Modern Dietetics

By DORIS JOHNSON

Edited by HAZEL E. MUNSELL

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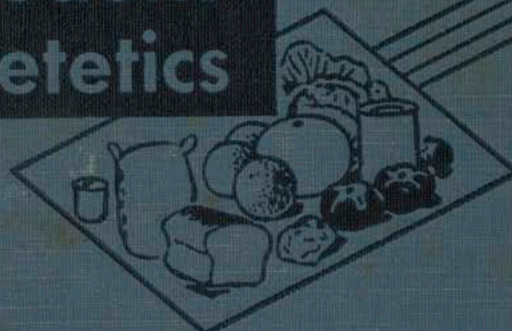

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MODERN DIETETICS

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Modern Dietetics

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PREFACE

DIETETICS, the practical application of the science of nutrition, has made much progress in the past two decades. The importance of adequate nutrition for individuals both in health and in illness has been recognized not only for its therapeutic but for its prophylactic value. With the ever-increasing scope of the knowledge of nutrition and its applications it becomes essential that this information be made available to as many individuals as possible. The nurse, through her contacts with people, is in a strategic position to disseminate these pertinent facts. It is the author's intention that the subject matter included in this textbook shall be a valuable asset to the nurse, and through her teachings a benefit to those with whom she comes in contact.

To present the subject of dietetics in a practical manner this book has been developed about the central theme of the normal diet.

Part I deals with normal nutritional requirements. As each one of the nutrients is studied its part in the Basic Daily Dietary Pattern is noted. By the time the student has covered the sections dealing with the individual nutrients she has acquired an understanding of those that are necessary for normal nutrition, their functions in the body and the kinds and amounts of food necessary each day to supply the recommended allowance. A section concerned with the variations of the normal dietary requirements throughout growth and in old age follows.

The application of the science of nutrition means that cognizance must be taken of economic and sociological factors

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influencing the practical aspects of nutrition. Chapters are therefore included on food economics, nutrition education and national and religious food customs.

Part II has to do with the treatment of disease by diet. All therapeutic diets are given as modifications of the normal diet in one or more constituents. Thus there are the modifications of the normal diet in selection of foods, consistency, protein, fat, carbohydrate, energy value and minerals. This is a somewhat unusual manner of presentation in line with the present trend of a few basic diets for the treatment of diseases rather than a diet for each disease.

The principle of modification of normal diet for the therapy of each disease is given. It is expected, however, that this part will be studied either concurrently with or following medical nursing courses so that the student will have an understanding of the pathology of each disease and will therefore be able to make the application of the diet therapy.

Part III deals with the selection, care, preparation and cookery of foods. If foods are to serve their function of nourishing the body, they must be so handled that the greatest nutritional value is obtained from them. It is essential that the nurse know how to handle foods properly herself and that she be able to teach others proper food preparation. This section is written to correlate with the author's *Laboratory Manual for Cookery* based on the meal-plan system.

Part IV is made up of various tables, including a table of food composition, necessary tools in the practice of dietetics.

The subject matter presented in the first three parts of the book is designed to meet the requirements of the three courses in nutrition, cookery and diet therapy, and the special services of pediatrics and obstetrics of the curriculum of schools of nursing. The *Manual for Teaching Dietetics to Student Nurses* prepared by the American Dietetic Association will prove a helpful guide in planning the class lessons.

Questions and problems for the student have been included at the end of each chapter throughout the book. References for the student and instructor are given. For the most part

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these are from journals and books available in the majority of hospitals and colleges.

The author wishes especially to express her deep appreciation to Dr. Munsell for her invaluable suggestions and criticisms in editing the manuscript and for the preparation of the Table of Food Composition. She wishes also to thank the publishers of books for permission to quote parts; those firms which permitted the reproduction of illustrative material; and Miss Nelda Ross, Director of the Nutrition Department of the Presbyterian Hospital in the City of New York, for permission to quote from the *Manual of Diets of Presbyterian Hospital*. Grateful acknowledgment is made of the many considerations of the publishers in the production of this book.

DORIS JOHNSON

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Chapter I

NUTRITION AND HEALTH

GOOD HEALTH is the basis of a happy and productive life. The health of the individual, of the community, of the nation and indeed of the world is a matter of considerable importance. The efforts of many people are concerned with the maintenance of good health.

What is good health? Good health means having plenty of vitality and energy for the daily activities of life, the proper weight for one's age and height, a clear skin and lustrous hair. It means good teeth and well-shaped bones, good posture and a well developed body. Good health means an alertness and an interest in one's work or, in other words, a worthwhileness to life.

The foundation stone of good health is good nutrition. No one single factor contributes more to health and well-being. This statement of Professor H. C. Sherman emphasizes the importance of good nutrition (1):

> "The evidence is impressive that on a world-wide scale the recent advances of the science of nutrition have spread a keen consciousness of its potentialities for the improvement of life. This has extended from the nutrition laboratories first to the world of medicine and public health, and now on into the world of affairs."

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Without the necessary materials for growth and maintenance of the body good health is impossible. It is our purpose then to study the nutritional needs of the body so as not only to benefit the individual's own nutritional state, but also to serve those with whom we come in contact by spreading the ever increasing knowledge of the science of nutrition.

The science of *nutrition* is concerned with the requirements of the living organisms for those essential materials needed for growth, maintenance and repair of its components and for the utilization of these materials.

Dietetics is the application of the science of nutrition in the feeding of individuals singly or in groups under different economic and health conditions.

Those who practice dietetics are called *dietitians* or *nutritionists.* They are highly trained specialists in the application of the science of nutrition.

Signs of Good Nutrition*

1. Body well developed.
2. Weight average for height.
3. Muscles well developed and firm.
4. Skin of healthy turgor and color.
5. Good layer of subcutaneous fat.
6. Mucous membranes of eyelids and mouth reddish-pink.
7. Hair smooth and glossy.
8. Eyes clear and without dark circles under them.
9. Facial expression alert but without strain.
10. Posture good: head erect, chest up, shoulders flat, abdomen in.
11. Attitude, good-natured, full of life, buoyant.
12. Sleep, sound.
13. Digestion and elimination good.
14. Appetite good.
15. Appearance of general well-being.

* Adapted from: *A Manual for Teaching Dietetics to Student Nurses,* American Dietetics Association. Philadelphia: W. B. Saunders Co., 1949.

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Importance of Scientific Information

It is important that the information that is taught about nutrition be sound. There are numerous fads and fallacies about food which influence the eating habits of many people. It is necessary that such misinformation be supplanted by true scientific knowledge. Claims made in advertisements of food products, vitamin preparations and the like should be carefully investigated before they are accepted. The press and radio are sources of accurate information, but they are also a medium of the pseudo-scientists. It is wise to weigh the claims of each statement and to judge its soundness before accepting it. Often just enough of the truth is included to make the claim seem plausible. Actually, the application of the information may even prove harmful in some cases. Accurate knowledge will tend to overcome much of this misinformation and lead to more adequate nutrition and better health for more people.

Functions of Food in the Body

Food is the principal source of the essential materials needed by the body for growth and normal functioning of its several parts. The specific materials required are called *nutrients*. In addition to its role as a source of essential nutrients food has other functions, and some of the nutrients may serve in more than one capacity. These include carbohydrates, fat and protein which serve as sources of energy; and minerals, vitamins, water and cellulose which with protein serve to build and repair tissue and to maintain and regulate body processes.

Nutritional Requirements

The results of many studies carried out by investigators in the United States and other countries have shown that the various essential nutrients are required in amounts that may be expressed as the daily requirement according to the age, sex and activity or physiological state of the individual. As

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TABLE 1

Recommended Daily Dietary Allowances[1]
Revised 1948

Food and Nutrition Board, National Research Council

	Calories[2]	Protein, gm.	Calcium, gm.	Iron, mg.	Vitamin A,[3] I.U.	Thiamine,[4] mg.	Riboflavin,[4] mg.	Niacin (Nicotinic acid),[4] mg.	Ascorbic acid, mg.	Vitamin D, I.U.
Man (154 lb., 70 kg.)										
Sedentary	2400	70	1.0	12[5]	5000	1.2	1.8	12	75	[6]
Physically active	3000	70	1.0	12[5]	5000	1.5	1.8	15	75	[6]
With heavy work	4500	70	1.0	12[5]	5000	1.8	1.8	18	75	[6]
Woman (123 lb., 56 kg.)										
Sedentary	2000	60	1.0	12	5000	1.0	1.5	10	70	[6]
Moderately active	2400	60	1.0	12	5000	1.2	1.5	12	70	[6]
Very active	3000	60	1.0	12	5000	1.5	1.5	15	70	[6]
Pregnancy (latter half)	2400[7]	85	1.5	15	6000	1.5	2.5	15	100	400
Lactation	3000	100	2.0	15	8000	1.5	3.0	15	150	400
Children up to 12 yrs.[8]										
Under 1 yr.[9]	110/2.2 lb. (1 kg.)	3.5/2.2 lb. (1 kg.)	1.0	6	1500	0.4	0.6	4	30	400
1–3 yrs. (27 lb., 12 kg.)	1200	40	1.0	7	2000	0.6	0.9	6	35	400
4–6 yrs. (42 lb., 19 kg.)	1600	50	1.0	8	2500	0.8	1.2	8	50	400
7–9 yrs. (58 lb., 26 kg.)	2000	60	1.0	10	3500	1.0	1.5	10	60	400
10–12 yrs. (78 lb., 35 kg.)	2500	70	1.2	12	4500	1.2	1.8	12	75	400
Children over 12 yrs.[8]										
Girls, 13–15 yrs. (108 lb., 49 kg.)	2600	80	1.3	15	5000	1.3	2.0	13	80	400
16–20 yrs. (122 lb., 55 kg.)	2400	75	1.0	15	5000	1.2	1.8	12	80	400

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Boys, 13–15 yrs. (108 lb., 49 kg.)	3200	85	1.4	15	5000	1.5	2.0	15	90	400
16–20 yrs. (141 lb., 64 kg.)	3800	100	1.4	15	6000	1.7	2.5	17	100	400

[1] Objectives toward which to aim in planning practical dietaries: The recommended allowances can be attained with a good variety of common foods which will also provide other minerals and vitamins for which requirements are less well known.

[2] Calorie allowances must be adjusted up or down to meet specific needs. The calorie values in the table are therefore not applicable to all individuals but rather represent group averages. The proper calorie allowance is that which over an extended period will maintain body weight or rate of growth at the level most conducive to well-being.

[3] The allowance depends on the relative amounts of vitamin A and carotene. The allowances of the table are based on the premise that approximately two-thirds of the vitamin A value of the average diet in this country is contributed by carotene and that carotene has half or less than half the value of vitamin A.

[4] For adults (except pregnant and lactating women) receiving diets supplying 2000 calories or less, such as reducing diets, the allowances of thiamine and niacin may be 1 mg. and 10 mg. respectively. The fact that figures are given for different calorie levels for thiamine and niacin does not imply that we can estimate the requirement of these factors within 500 calories, but they are added merely for simplicity of calculation. In the present revision, riboflavin allowances are based on body weight rather than caloric levels. Other members of the B complex also are required, though no values can be given. Foods supplying adequate thiamine, riboflavin, and niacin will tend to supply sufficient of the remaining B vitamins.

[5] There is evidence that the male adult needs relatively little iron. The need will usually be provided for if the diet is satisfactory in other respects.

[6] The need for supplemental vitamin D by vigorous adults leading a normal life seems to be minimum. For persons working at night and for nuns and others whose habits shield them from the sunlight, as well as for elderly persons, the ingestion of small amounts of vitamin D is desirable.

[7] During the latter part of pregnancy the calorie allowance should increase to approximately 20 percent above the preceding level. The value of 2400 calories represents the allowance for pregnant, sedentary women.

[8] Allowances for children are based on the needs for the middle year in each group (as 2, 5, 8, etc.) and are for moderate activity and for average weight at the middle year of the age group.

[9] Needs for infants increase from month to month with size and activity. The amounts given are for approximately 6 to 8 months. The dietary requirements for some of the nutrients such as protein and calcium are less if derived largely from human milk.

Further recommendations:

Fat. There is available little information concerning the human requirement for fat. Fat allowances must be based at present more on food habits than on physiological requirements. While a requirement for certain unsaturated fatty acids (the linoleic and arachidonic acids of natural fats) has been amply demonstrated with experimental animals, the human need for these fatty acids is not known. In spite of paucity of information on this subject there are several factors which make it desirable (1) that fat be included in the diet to the extent of at least 20 to 25 percent of the total calories and (2) that the fat intake include essential unsaturated fatty acids to the extent of at least 1 percent of the total calories. At higher levels of energy expenditure, e.g., for a very active person consuming 4500 calories and for children and for adolescent persons, it is desirable that 30 to 35 percent of the total calories be derived from fat. Since foodstuffs such as meat, milk, cheese, nuts, etc., contribute fat to the diet, it is necessary to use separated or "visible" fats such as butter, oleomargarine, lard, or shortenings to supply only one-third to one-half the amounts indicated.

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TABLE 1 (Continued)

Iodine. The requirement for iodine is small, probably about 0.002 to 0.004 mg. daily for each kilogram of body weight, or a total of 0.15 to 0.30 mg. daily for the adult. This need is met by the regular use of iodized salt; its use is especially important in *adolescence* and *pregnancy.*

Water. A suitable allowance of water for adults is 2.5 liters daily in most instances. An ordinary standard for diverse persons is one milliliter for each calorie of food. Most of this quantity is contained in prepared foods. At work or in hot weather, requirements may reach 5 to 13 liters daily. Water should be allowed *ad libitum,* since sensations of thirst usually serve as adequate guides to intake except for infants and sick persons.

Salt. The needs for salt and for water are closely interrelated. A liberal allowance of sodium chloride for the adult is 5 grams daily, except for some persons who sweat profusely. The average normal intake of salt is 10 to 15 grams daily, an amount which meets the salt requirements for a water intake up to 4 liters daily. When sweating is excessive, one additional gram of salt should be consumed for each liter of water in excess of 4 liters daily. With heavy work or in hot climates 20 to 30 grams daily may be consumed with meals and in drinking water. Even then, most persons do not need more salt than usually occurs in prepared foods. It has been shown that after acclimatization persons produce sweat that contains only about 0.5 gram to the liter in contrast with a content of 2 to 3 grams for sweat of the unacclimatized person. Consequently after acclimatization, need for increase of salt beyond that of ordinary food disappears.

Phosphorus. Available evidence indicates that the phosphorus allowances should be at least equal to those for calcium in the diets of children and of women during the latter part of pregnancy and during lactation. In the case of other adults the phosphorus allowances should be approximately 1.5 times those for calcium. In general it is safe to assume that if the calcium and protein needs are met through common foods, the phosphorus requirement also will be covered, because the common foods richest in calcium and protein are also the best sources of phosphorus.

Copper. The requirement for copper for adults is about 1 to 2 mg. daily. Infants and children require approximately 0.05 mg. for each kilogram of body weight. The requirement for copper is approximately one-tenth that for iron. A good diet normally will supply sufficient copper.

Vitamin K. The requirement for vitamin K usually is satisfied by any good diet except for the infant in utero and for the first few days after birth. Supplemental vitamin K is recommended during the last month of pregnancy. When it has not been given in this manner, it is recommended for the mother preceding delivery or for the baby immediately after birth.

Folic Acid. Evidence for recognizing folic acid (pteroylglutamic acid, vitamin B_c, L. casei factor or vitamin M) as an essential human nutrient is presented in the text. The quantitative requirement cannot be closely estimated from evidence now available.

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an aid to those who are concerned with supplying food for good nutrition or otherwise with the study of individuals or their food habits in relation to their nutritional state, the Food and Nutrition Board of the National Research Council has undertaken to set up tables of Recommended Daily Dietary Allowances which amply meet the nutritional needs of individuals according to their age and activity. As knowledge accumulates relative to the requirements of the essential nutrients this table is revised. This table (Table 1) is included here as an introduction to the discussion of the various essential nutrients and reference will be made to it from time to time as the subject is developed.

Food for Good Nutrition

No single food can furnish all the nutrients that are necessary for good nutrition. Some foods are more important sources of one nutrient than another and the proper combination of foods is necessary to obtain the essential supply of all nutrients. A combination of foods that together supply enough of all of the essential nutrients to meet the body's requirements each day is referred to as an adequate diet. It is

Basic Daily Dietary Pattern for an Adult

Food	*Amount*
Milk	3 cups
Meat*	3 ounces (raw)
Egg	1 (or 3 to 5 per week)
Additional protein†	1 serving
Vegetables (1 to be green or yellow)	2 servings
Potato	1 medium
Fruits (1 to be citrus or tomato)	2 servings
Whole grain or enriched cereal or bread	4 ounces
Butter or fortified margarine	3 teaspoons

* Includes all types of meat, fish, and poultry.

† Includes either 1 egg, 1 ounce cheese, meat, fish or poultry, or ½ cup legumes.

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important to learn what the best food sources of each of the nutrients are, in order to select those that will assure an adequate diet, for it is the practical application of the knowledge of nutrition that is necessary to good health.

For convenience in assuring an adequate diet it is now customary to suggest selecting foods according to basic food groups. A basic pattern suggested for an adult and designed to supply amounts of nutrients in accordance with the Recommended Daily Dietary Allowances is shown on page 6.

When these basic foods have been eaten any other type of food or more of these same foods may be taken to supply the energy needs of the individual.

What is the contribution of each of these basic foods? Why have they been selected? It will be the purpose of the next few chapters to discover what are the essential nutrients, what are their functions and what food group or groups may be depended upon for their supply.

Questions and Problems

1. What is meant by good health?
2. What is meant by the term nutrition? Dietetics?
3. Why should a nurse especially be interested in nutrition?
4. Note all the advertisements in a current women's magazine that are concerned with nutrition. Can you judge the accuracy of the claims made for each product?
5. What are the functions of food in the body?
6. Keep track of your complete food intake for 3 days. Do you include in your diet each day the foods in the Basic Daily Dietary Pattern in the recommended amounts?

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Chapter II

PROTEINS

PROTEIN is most important as a constituent of all living tissue, both plant and animal, and it is from this fact that the word protein, which means "that which is of first or prime importance" was derived. In addition to its function in growth and the maintenance and regulation of body functions protein either from food or from the body, may serve as a source of energy when fat and carbohydrate are in short supply.

Chemical Composition

Proteins are complex organic compounds made up of carbon, hydrogen, oxygen and nitrogen. Many contain sulphur and some contain iron and phosphorus. The nitrogen, however, is the distinguishing characteristic since it occurs in all and in specific combination with hydrogen.

Amino acids. Proteins are made up of simpler compounds called amino acids often referred to as building stones. An amino acid is an organic acid with an amino group attached to the carbon atom adjacent to the carboxyl group. Thus the type formula for an amino acid is

$$\begin{array}{c} \mathrm{H} \\ | \\ \mathrm{R{-}C{-}COOH} \\ | \\ \mathrm{NH_2} \end{array}$$

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in which R represents a great number of different atomic groupings. Some forty or more amino acids have been described.

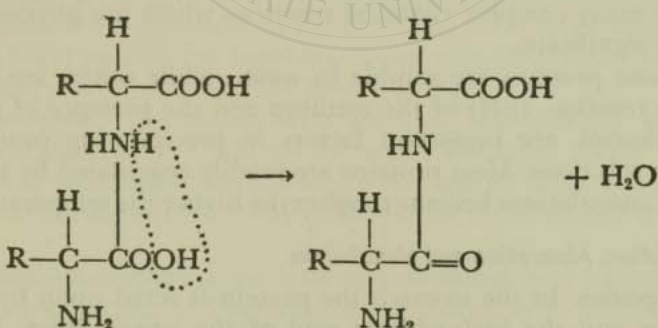
There are approximately twenty-two of these amino acids which have been found to be the necessary building stones of living tissue. Some of these the body can make while others must be supplied in the food that is eaten. The amino acids which the body cannot synthesize are called essential amino acids.

Essential Amino Acids

Arginine	Phenylalanine
Valine	Tryptophan
Leucine	Methionine
Isoleucine	Lysine
Threonine	Histidine

These amino acids are the ones which have been found essential for the rat, the animal most widely used for nutrition investigations. It is believed, however, that for man two of these, arginine and histidine, are not essential.

Amino acids are linked together in a chain-like manner from the amino group of one to the carboxyl group of the next with the removal of a molecule of water. This is called the peptide linkage.



Peptide linkage of two amino acids

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Proteins are composed of a large number of amino acids linked together in this fashion. It can easily be realized that an almost infinite variety of proteins could be possible. It is significant though that the same type of protein is always synthesized in each plant and animal tissue.

Classification

Proteins may be classified as complete, partially incomplete and totally incomplete.

A complete protein is one which has all the essential amino acids present in sufficient amounts so that it will maintain life and promote growth when it is the sole source of protein in the diet. Such proteins are those of milk, casein and lactalbumin, or those of eggs, ovalbumin and ovovitellin.

A partially incomplete protein is one which will maintain life but will not promote growth. Such a protein is the gliadin found in wheat.

A totally incomplete protein is one which is entirely lacking in one or more of the essential amino acids and will neither promote growth or maintain life. Such a protein is gelatin which lacks tryptophan and valine.

Properties

Proteins are colloidal materials of high molecular weight.

Amino acids, and therefore proteins, are amphoteric, that is they contain both acidic and basic groups. Thus they may have many complex chemical reactions which are physiologically significant.

Some proteins are soluble in water, while others are not. The reaction (pH) of the medium and the presence of salts or alcohol, are important factors in precipitating proteins from solutions. Most proteins are readily coagulated by heat. The coagulations become tougher the higher the temperature.

Digestion, Absorption and Metabolism

Digestion. In the stomach the protein is acted upon by enzymes and the hydrochloric acid of the gastric juice. The *hydrochloric acid* forms a complex with the protein, called

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metaprotein. This substance is then acted upon by the enzyme *pepsin.* This enzyme begins the process of breaking the protein up into smaller units by splitting the peptide linkages. Partially digested protein substances termed peptones and proteoses are formed. There is also present a special enzyme, *rennin,* which begins the digestion of the soluble casein of milk. Ionized calcium is necessary for this process. Casein is first changed into paracasein which becomes insoluble on combination with calcium forming a curd and a soluble portion, the whey protein. The calcium paracasein is then acted upon by pepsin. The softer and more flocculent the curd, the more readily is it attacked by pepsin.

In the small intestine the food is acted upon by enzymes of the pancreatic juice and of the intestinal juice. The peptones and proteoses are changed into still simpler units, the polypeptides, and finally into the basic building units, the amino acids.

The pancreatic juice contains two enzymes, *trypsinogen* and *chymotrypsinogen* which are made into the active forms, trypsin and chymotrypsin by another enzyme, *enterokinase.* Both of these enzymes are effective in furthering the digestion of proteins, but chymotrypsin is more specific for the casein of milk.

In the intestinal juice are *peptidases,* among them a group of enzymes, *erepsin,* which bring about completion of the digestion of the proteins into their constituent amino acids.

There are also present in the intestinal juice other enzymes which are specific for breaking down such substances as the nucleoproteins found in the nuclei of cells.

Absorption. The amino acids are absorbed into the blood stream through the villi in the small intestine. These villi contain capillaries which take up the amino acids and they are then transported by way of the portal blood stream to the liver.

Metabolism. Here at the liver several things may happen to the amino acids. 1. They may be sent directly to the tissues and used for the synthesis of new tissue or for the repair of old tissue. 2. They may go into the formation of antibodies, en-

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zymes, hormones and other such specialized materials as the proteins of the blood stream. 3. They may be deaminized, that is the — NH_2 group may be removed, and the residue may be used as carbohydrate or fat, or it may be used immediately for energy.

Protein as such is not stored in the body to any great extent, as is fat. There is, however, in all the tissues, to a greater extent in some than in others, a labile or deposit protein upon which the body may draw when there is the demand. It has been shown by the use of isotopic nitrogen incorporated into the amino acids that they are rapidly taken into the blood plasma, liver, kidney and intestinal tract proteins, but more slowly into the hemoglobin of the red blood cell. It is from these sources that the body first draws amino acids when the dietary intake is inadequate.

It has further been shown that breakdown and resynthesis of tissues proceed along together and the amino acids from one tissue may be used in the formation of another. Protein metabolism is thought of as being in a state of dynamic equilibrium. There is a continuous interchange in the amino acid content of the tissues as well as the replacement of tissue amino acids by dietary amino acids. It has been estimated that protein metabolism in the liver occurs at such a rate that about half of the liver is replaced within 10 days. Other tissues are replaced less rapidly.

Proteins have a stimulating effect upon metabolism which is called the *specific dynamic action*. All foods exert some effect but that of protein is the greatest. This results in a rise in body temperature and is one of the factors in maintaining the warmth of the body.

The *end-products of protein metabolism* are carbon dioxide, water, urea and energy. The carbon dioxide, water and energy come from the oxidation of the amino acid after it has been deaminized. Upon deaminization, about 58 per cent of the amino acids are converted into carbohydrate while about 46 per cent may be changed into fatty acids, and are used for energy by the body in these forms. The urea is formed from

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the amino groups removed in the process of deaminization. It is excreted by the kidney.

Functions

From the fates that await the amino acids in metabolism it can be realized that protein serves a variety of purposes in the body.

First there is the need for amino acids for the maintenance of the body tissues. There is a daily wear and tear of body tissue which requires a constant source of amino acids to replenish it.

There is also the need for essential amino acids for growth. Thus the growing child and the pregnant woman have additional need for protein. In lactation the production of milk also requires an added intake of protein of high biological value.

Besides the general body tissues the amino acids go into the construction of more specialized materials such as the antibodies, the hormones, the digestive and metabolic enzymes, and various secretions of the body. Amino acids are important constituents of the blood proteins, the hemoglobin of the red blood cell which carries the oxygen to the tissues, and the plasma proteins. The latter function in maintaining the osmotic pressure of the tissues and in helping to regulate the acid-base balance of the body. Finally amino acids may be used for energy. When all the other needs for protein are fulfilled, those amino acids remaining may be deaminized and used for energy. When the intake of other nutrients is not sufficient to meet the energy needs of the body protein is also used for this purpose. Protein is, however, an expensive source of energy both from a physiological and economical point of view. It is considered wasteful to use it as an energy source.

Requirements

In order to replace the essential amino acids used in the so-called wear and tear of body tissue an amount of protein

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sufficient to supply an amount of amino acids equal to that used must be taken into the body. When the food intake of nitrogen just equals the nitrogen excreted in the urine, feces and sweat, the body is said to be in *nitrogen equilibrium.* If the body excretes more nitrogen than is being taken in in the food a *negative nitrogen balance* results; the body is losing nitrogen. Such a state results when the diet is inadequate in protein. On the other hand when the body excretes less nitrogen than is taken in a *positive balance* occurs; the body is retaining nitrogen. Such a condition results during growth, pregnancy, lactation, in recovery from wasting diseases and in conditioning exercises. In all cases new tissues are being formed.

To supply the essential amino acids in amounts to maintain nitrogen equilibrium a certain amount of protein must be included in the diet. The daily protein allowance has been set at 1 gram of protein per kilogram or ½ to ⅔ gram per pound of ideal body weight of the individual. This amount was first proposed by Sherman (2) and has been adopted by the Committee on Foods and Nutrition of the National Research Council (1). Various factors influence the protein requirement and the Recommended Daily Dietary Allowance was selected with a margin of safety to allow for variations in individual needs, variations in the composition of foods and differences in the composition of the diet as it may influence the protein requirement.

In growth this daily amount is increased to 3 to 4 grams per kilogram of ideal body weight in children under 5 years of age, while during adolescence the amount is 1½ to 2 grams per kilogram of ideal weight. In pregnancy the daily allowance is 1¼ to 1½ grams per kilogram of ideal weight, while in lactation it is 2 grams per kilogram. The daily protein allowance for various individuals is given in Table 1.

Of this total amount of protein which is allowed it is important that some of it be from complete protein foods. In other words the quality of the protein as well as the quantity of the protein must be taken into consideration. For an adult it is considered that if ⅓ of the total protein is supplied by

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complete protein foods the needs for the essential amino acids will be met. For the child the amount is set at ½ to ⅔ of the total amount.

Food Sources of Protein

As sources of protein, foods vary both quantitatively and qualitatively. Some foods are excellent sources of complete proteins. These include meat, fish, poultry, cheese and eggs. Milk contains complete proteins, but the amount is not nearly as great on a percentage basis as in these other foods. Some foods are just fair sources of protein, such as soybeans and other legumes, nuts, whole wheat and green vegetables. Other foods are only poor sources of protein. These include fruits, other cereal grains and other vegetables.

It will be noticed that animal products furnish the best sources of protein both as to quality and quantity. It is from these protein containing foods that the necessary amounts of the essential amino acids are furnished. The rest of the protein may be supplied by the other food sources. Furthermore, the various proteins tend to supplement each other. Thus the cereals may be supplemented with milk to make a valuable contribution to the diet.

PROTEIN CONTENT OF THE FOODS OF THE BASIC DAILY DIETARY PATTERN

Food	*Amount*	*Protein gms.*
Milk*	3 cups	25.5
Meat, fish or fowl*	3 ounces (raw)	17.0
Egg*	1	6.5
Additional protein†	1 serving	7.0
Whole grain or enriched cereal or bread	4 ounces	10.0
Vegetables	3 servings	6.5
Fruit	2 servings	2
Butter or enriched margarine	½ ounce	0
	Total	74.5

* Sources of complete protein.

† Includes average of 1 ounce meat, 1 ounce cheese, 1 egg and ½ cup legumes.

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Supplying the Daily Protein Needs

In the Basic Daily Dietary Pattern given in the first chapter we can now observe that certain of the foods are included for their contribution of protein to the diet. Thus the milk, egg and meat or its equivalent are the sources of complete protein, supplying more than the minimum amount of essential amino acids.

For the increased protein needs of children the milk allowance is increased to 1 quart. Similar additions are made for pregnancy and lactation which will be discussed later. (Chapter XIII.)

Questions and Problems

1. What is a protein? An amino acid? An amino group? Peptide linkage?
2. What functions does protein serve in the body?
3. What is an essential amino acid? How many are there?
4. What is a complete protein? A partially incomplete protein? A totally incomplete protein? Give an example of each.
5. What property of protein must be considered when cooking foods of high protein content?
6. Trace the digestion of the proteins of milk.
7. After the amino acids have been absorbed into the body what various pathways may they follow?
8. Why is protein a poor source of energy?
9. What is the daily dietary protein allowance for an adult? Is this the least amount of protein which the individual needs? What is the daily dietary protein allowance for a growing child? For a pregnant woman?
10. What is meant by nitrogen equilibrium? When is a positive nitrogen balance shown? Why?
11. What foods are good sources of complete proteins? How much of the total protein requirement should be supplied by these foods?
12. Calculate your protein intake for 3 days. Have you met your daily allowance for protein?
13. Meat is listed in the Basic Daily Dietary Pattern. How much of the other complete protein foods will furnish an amount of protein equal to one ounce of meat?

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Chapter III

CARBOHYDRATES

CARBOHYDRATES ARE also indispensable materials of life. They are an important source of energy and serve as structural material for the formation of protoplasmic and intercellular substances.

Chemical Composition

A carbohydrate is a single sugar or a substance that can be converted into a single sugar by hydrolysis (splitting by the addition of water).

Carbohydrates are made up of carbon, hydrogen and oxygen. The hydrogen and oxygen in most of the carbohydrates are present in the amounts to form water, and hence the general name applied to this group of substances. The formula for a single carbohydrate is

$$\begin{array}{l}
\;\mathrm{H} \\
\;\mathrm{C{=}O} \\
\;\;| \\
\mathrm{HCOH} \\
\;\;| \\
\mathrm{HCOH} \\
\;\;| \\
\mathrm{HCOH} \\
\;\;| \\
\mathrm{HCOH} \\
\;\;| \\
\mathrm{HCOH} \\
\;\;\mathrm{H}
\end{array}$$

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Classification

Carbohydrates are classified according to the number of single sugar groups or saccharides contained in each molecule.

A. Monosaccharides or single sugars
   1. *Glucose* (dextrose or grape sugar) is found naturally in fruits, most vegetables and honey. It is the form in which carbohydrate is found in the blood stream.
   2. *Fructose* (levulose) is found along with glucose in the fruits, vegetables and honey.
   3. *Galactose* is not found free in nature but occurs as a result of the hydrolysis of lactose.

B. Disaccharides or double sugars
   1. *Sucrose* is found in sugar cane and sugar beets and is the ordinary table sugar. It is also obtained from maple sap and fruits and vegetables.
   2. *Lactose* is the sugar found in the milk of mammals. It is less sweet than sucrose.
   3. *Maltose* is found in germinating seeds and in the malting process. It also results from the hydrolysis of starch by the action of dilute acid or enzymes.

C. Polysaccharides or complex sugars
   1. *Starch* is the carbohydrate stored by plants. It is therefore found in grains, seeds, roots, tubers and bulbs.
   2. *Dextrin* is formed by the incomplete breakdown of starches by enzymes or heat.
   3. *Glycogen* is the carbohydrate stored in animal tissues. It is found mainly in the liver but it is deposited also to some extent in the other tissues, particularly in muscle.
   4. *Cellulose* and hemi-cellulose are the structural parts of plants. They are woody fibrous materials which are not digested in the human gastro-intestinal tract.

Properties

Carbohydrates differ in their solubilities. Starch is insoluble in water while most of the other sugars, with the excep-

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tion of lactose, are very soluble. Lactose is only sparingly soluble. Heating of starch as in cooking renders it more soluble by disrupting the cell walls and thus freeing the starch granules.

The carbohydrates also differ in their sweetening power. Lactose is the least sweet being 1/6 as sweet as sucrose, and fructose is the sweetest of all the natural sugars being twice as sweet as sucrose (3). Glucose is also somewhat less than sucrose. This fact is made use of when a higher caloric intake is desired. For the same amount of sweetness greater amounts of the less sweet sugars may be used thus supplying many more calories, without rendering the diet unpalatable.

Digestion, Absorption and Metabolism

Digestion. Besides mastication and moistening of the food digestion of the carbohydrate foods begins in the mouth. Saliva contains an enzyme, *ptyalin,* which will attack cooked starches breaking them down by stages, through various dextrins, into the disaccharide, maltose. There is present in the saliva another enzyme, *maltase,* which will hydrolyze maltose into two molecules of glucose.

In the stomach the digestion of starch is continued as long as the stomach contents are alkaline. As the gastric juice containing hydrochloric acid is mixed with the food the activity of the enzymes of the saliva is inhibited. The hydrochloric acid will form invert sugar, that is, one molecule of glucose and fructose from sucrose. Relatively little carbohydrate digestion occurs in the stomach, however.

The greatest part of the carbohydrate digestion takes place in the small intestine. The pancreatic juice contains an amylase called *amylopsin,* an enzyme which splits either starches or glycogen into dextrins and finally into the disaccharide, maltose. The pancreatic juice contains also the enzyme *maltase,* which forms glucose from the maltose produced from the digestion of the starches.

The intestinal juice contains the enzyme *lactase,* which splits lactose into one molecule each of glucose and galactose.

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Another enzyme *sucrase* hydrolyzes sucrose into one molecule each of fructose and glucose. *Maltase* is also found in the intestinal juice.

Absorption. Glucose and the other single sugars are absorbed by the same route as the amino acids. They therefore pass into the blood stream through the capillaries of the villi of the small intestines and are carried to the liver and other tissues of the body to be metabolized.

Metabolism. The normal body maintains a level of glucose in the blood of about 100 milligrams per cent (100 mgs. %) spoken of as the blood sugar level. Insulin, a hormone secreted by the pancreas, is necessary for the regulation of this blood sugar level.

Insulin also brings about the storage of glycogen in the liver by promoting the synthesis of the single sugars into the polysaccharide. The glycogen thus stored can later be broken down into glucose by a series of reactions catalyzed by certain enzymes and is available for energy purposes.

In order to be used for energy glucose then goes through another series of reactions whereby it is oxidized to carbon dioxide and water, with the release of heat and energy to do work. This is an intricate procedure carried on in the cells involving a whole group of enzymes with a large number of intermediary compounds formed before the final end products are derived. The heat formed from the oxidation serves to maintain the body temperature. The carbon dioxide and water formed are waste products and are excreted through the lungs and the kidney.

When the glycogen storage and the energy needs of the body are met any excess glucose will be converted into fat and stored in the adipose tissue to be used later for energy needs.

Functions

The main function of carbohydrate is to furnish energy to the body, either from the immediate source, the ingested food, or from the storage supply of glycogen. Glucose is one

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of the body's most readily available supplies of energy. It is often given by vein when there is an emergency need for energy and the individual cannot take food by mouth.

Carbohydrates also act as a protein sparer. That is, if there is a sufficient amount of carbohydrate in the diet the protein will not be called upon as a source of energy and is therefore spared to carry on its more important functions.

Carbohydrate is also necessary for the efficient functioning of the liver. A liver well stocked with glycogen functions much better than one in which there is little glycogen storage.

Daily Allowance

No definite daily allowance for carbohydrate is set as was done with protein. However, in the average mixed diet about ½ to ⅔ of the total calories is supplied by carbohydrate according to the caloric needs of the individual.

Food Sources of Carbohydrate

Plants are the main source of carbohydrate. It is found in roots, tubers, cereals or seeds and most fruits.

Starches

1. Cereals—wheat, oats, rice, corn, barley, rye
2. Flours—wheat, oats, rice, corn, barley, rye, arrowroot, cornmeal, tapioca, sago, foods made from these flours, noodles, bread, cake, puddings
3. Alimentary pastes—macaroni, spaghetti
4. Legumes, potatoes and root vegetables

Sugars

1. Cane, beet and maple sugars in all forms
2. Jellies, jams, candies, syrup, honey, preserves
3. Fruits, fresh (as grapes, bananas, dates, figs), canned with sugar, dried, stewed with sugar

Supplying the Daily Carbohydrate Needs

Since there is no definite allowance for carbohydrate in the daily diet the amount of carbohydrate to be included each

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day will vary according to the caloric needs of the individual.

Most of the carbohydrate of the diet is furnished by starch and to a lesser extent by sugar. Foods high in starch such as the cereal grains and potatoes form the main source of energy for most people. They are readily available and are relatively cheap food substances.

It is neither wise nor necessary to use carbohydrate in excessive amounts. First of all an excessive intake of carbohydrate will lead to obesity and the consequent damage that can result from overweight. It has also been observed that sugars in large amounts and in concentrated form are irritating to the gastro-intestinal tract. Carbohydrates in the form of sugars and candies, depress the appetite and for this reason may be harmful in that not enough of the necessary foods may be eaten to allow for adequate nutrition. Furthermore, such foods supply little else than calories. It is well to think of foods not only for their caloric value but for their content of other nutrients as well.

Questions and Problems

1. What is a carbohydrate? How are carbohydrates classified?
2. Which carbohydrates are the least sweet? How is this fact applied in feeding certain patients?
3. Trace the digestion of the carbohydrate of a slice of toast.
4. After the single sugars are absorbed into the body what pathways may they follow?
5. What is insulin? What is the normal blood sugar level?
6. What is meant by "protein sparer"?
7. What is the daily dietary carbohydrate allowance?
8. What foods are especially important as sources of carbohydrate?
9. Calculate the carbohydrate content of:
   - 1 slice of bread
   - 1 tablespoon of jelly
   - 1 medium size orange
   - 1 tablespoon of honey
   - 1 medium size potato
10. Why is it wise to avoid excessive amounts of carbohydrate in the diet?

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Chapter IV

FATS OR LIPIDS AND RELATED SUBSTANCES

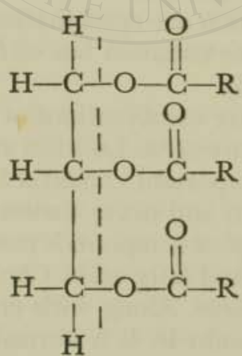
A SECOND GROUP of energy-producing nutrients is the fats. These and related fat-like substances belong to a group of compounds which are termed lipids.

Chemical Composition

Fats are made up of carbon, hydrogen and oxygen just as are carbohydrates. However, they contain in their molecule much less oxygen and much less in proportion to hydrogen than do carbohydrates.

The fat molecule, termed a glyceride, is made up of one molecule of glycerol (an alcohol) and three molecules of fatty acids. Thus the type formula is:

Glycerol residue



Fatty acid residues

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The R can stand for a large number of different fatty acid residues.

Fatty Acids

Fatty acids are made up of a carboxyl group (organic acid radical) and a chain of carbon atoms. There may be as few as two or as many as thirty in the molecule. One of the characteristics of these compounds is that they all contain an even number of carbon atoms.

Fatty acids are divided into two groups, saturated and unsaturated. The saturated fatty acids are those which have enough hydrogen in the molecule to combine with all the free carbon bonds, while the unsaturated do not. In these latter, the free bonds form double linkages or double bonds. These double bonds are easily broken in chemical reaction and compounds containing them are unstable and easily broken down into their constituent parts.

Two fatty acids are considered to be essential in that the body cannot synthesize them at all or not at a rapid enough rate to supply the body's needs. These are the unsaturated fatty acids arachidonic and linoleic. The exact requirement for these is not known but apparently it is small.

Classification

Fats may be classified in several ways. We are particularly concerned with three groups.

A. *Neutral fats* which are combinations of fatty acids and glycerol. These are the common fats of foods and of the adipose tissue of the body.

B. *Phospholipids* are combinations of fatty acids, glycerol, phosphoric acid and nitrogen. Lecithin and cephalin are such substances and are important constituents of the living cell, especially of the brain and nerve tissues.

C. *Sterols* are complex compounds made up of high molecular weight alcohols and fatty acids. Cholesterol is one of the most important of these. Along with ergosterol it is one of the precursors of vitamin D. It is normally present in all liv-

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ing tissue, including the blood and central nervous system. It may be synthesized by the body. In certain diseases the concentration of cholesterol in the blood may vary considerably.

Properties

Fats and the fat-like substances are insoluble in water but are soluble in such materials as chloroform and ether.

Fats vary in their consistency according to the type of fatty acids which make up the molecule. Fats which have long-chain fatty acids will be hard fats while those with short chains will be soft. Thus butter which contains a higher percentage of glycerides of shorter-chain fatty acids such as butyric acid (4 carbons) is a soft fat, while the body fat of animals such as the stearin of beef, contains a high percentage of glycerides of the 18 carbon acid, stearic acid, and is a hard fat. Fats made up largely of glycerides of unsaturated fatty acids are liquid at ordinary temperatures.

The flavor of fats and their melting points are also determined by their fatty acid content.

Digestion, Absorption and Metabolism

Digestion. Fat digestion begins in the stomach. Emulsified fats, such as occur in butter, cream and egg yolk, are acted upon to some extent by a *lipase,* or fat-splitting enzyme, and are broken down into glycerol and the fatty acid components.

In the small intestine *lipases* are present in both the pancreatic and intestinal juices. These act on the fats which were not digested in the stomach.

Bile salts, formed by the liver, are present in the small intestine and aid in the emulsification of fats so that the lipases may act upon them.

Absorption. Fatty acids, as phospholipids, cholesterol esters, or soaps, in the presence of the bile salts pass through the wall of the villi and are carried by way of the portal vein to the liver. Varying amounts of the fat are absorbed by this route, depending upon the amount of lipase present in the

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gastro-intestinal tract and the fat content of the diet. The fat which is not hydrolyzed by the fat-splitting enzymes, the neutral fat, is absorbed into the lymphatic system of the villi eventually reaching the systemic blood by which it is carried to the fat depots of the body.

Metabolism. The fatty acids carried to the liver are oxidized for energy. Since the fatty acid molecule has little oxygen in it, it furnishes considerably more energy than either carbohydrate or protein when it is metabolized. The fatty acids are broken down in the liver by the removal of 2 carbon atoms at a time. These 2 carbon fragments then recombine into 4 carbon compounds known as ketones which are sent to the tissues where they are used for energy. The complete combustion of the ketones ends in the formation of carbon dioxide, water and energy. When there is a disturbance in the metabolism of carbohydrate so that only a small proportion of the energy used is met by this constituent there may be a rapid increase in the breakdown of fat to such an extent that the body may not be able to oxidize all of the ketone bodies formed. The accumulation of these substances may then be sufficient to cause a state of ketosis and resultant acidosis.

Phospholipids are also manufactured by the liver and then sent to the body tissues as needed.

Fat not immediately needed as a source of energy is stored as body fat or adipose tissue.

Functions

Probably fat serves more varied purposes in the body than any other of the nutrients.

First it is the most concentrated source of energy, furnishing two and one-fourth times more energy for an equal weight than either carbohydrate or protein. It may be stored and serve as a reserve supply of energy as well.

The phospholipids are important in the proper functioning of the tissues, particularly the nerve tissues.

Fats act as carriers of the fat-soluble vitamins, A, D, E and K.

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Fats also function as a padding around vital organs and the layer of fat just beneath the skin serves as insulation against loss of body heat.

Fats act as lubricants in the gastro-intestinal tract, thus aiding elimination. Fats also decrease gastric motility and depress gastric secretion, thus delaying digestion in the stomach.

Since fats are such an important source of energy they are valuable as protein sparers.

Finally, fats add palatability to the diet.

Daily Allowance

No definite dietary allowance for fat is set. In the average mixed diet 20 to 25 per cent of the total calories may well come from fat and at high levels of energy expenditure, i.e., 4500 calories or more, this may be increased to 30 or 35 per cent. The essential fatty acids should be supplied to the extent of about 1 per cent of the total calories. These substances occur in such foods as eggs, butter and liver so that the requirement for them is easily met by the use of these basic foods.

Food Sources

Fats may be obtained from both plant and animal sources.

Plant Sources

1. Vegetable oils, such as cottonseed, peanut, corn, soybean and olive
2. Margarine and other butter substitutes made from vegetable oils
3. Chocolate
4. Avocados, olives, nuts, coconuts

Animal Sources

1. Dairy products: whole milk, cream, butter, cheese made from whole milk
2. Fat of meats: fatty meats and fish, poultry fats, fish liver oils, lard, drippings
3. Egg yolk

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Most liquid vegetable oils may be converted to solid or semisolid fat by the process of hydrogenation which changes the unsaturated fatty acid glycerides to saturated fatty acid glycerides. The fat used in margarine is manufactured by this process. Such butter substitutes when they are enriched with the fat soluble vitamins compare favorably with butter in nutritive value.

Supplying the Daily Fat Needs

The amount of fat included in the diet each day should be governed by the caloric needs of the individual and to some extent by the composition of the rest of the diet. The foods supplying the greater proportion of fat in the ordinary mixed diet are fat meats, fat fish, butter, eggs, milk and cream, and cooking fats and oils.

It is not wise to take an excessive amount of fat in the diet. Amounts of fat over and above the caloric needs lead to obesity. It is well also to remember that excessive amounts of fat, when the carbohydrate intake is low, can lead to ketosis.

Questions and Problems

1. What is a fat?
2. What is a fatty acid? What are the essential fatty acids?
3. How are fats classified? Name one example in each group.
4. Why are some fats soft while others are hard? What is an oil?
5. Trace the digestion of the fat of a glass of milk. What function does bile serve in fat digestion?
6. In what manner is fat absorbed from the digestive tract?
7. How are fats metabolized? What is ketosis?
8. What functions does fat serve in the body?
9. What is the daily dietary allowance for fat? How much of the total calories of the average mixed diet are supplied by fat?
10. Both plants and animals are sources of fats. What are the more common food fats obtained from each of these sources?
11. Why is it not wise to take excessive amounts of fat in the diet?

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Chapter V

ENERGY METABOLISM

Metabolism

Metabolism is the sum total of chemical processes taking place in the cells of the body by which materials are obtained and utilized for growth and for the various vital functions and through which energy is released for muscular work and cell activities. For convenience it is usually discussed from two aspects: anabolism, the synthesis or building up of body materials; and catabolism, the breakdown of body materials.

Energy Metabolism

Every movement of the body requires energy. The involuntary movements of breathing, the work of the heart and the circulatory system, and the tension or tone of the muscles all take energy. The voluntary movements of the body, such as are made in walking, exercise and work also require energy.

Basal metabolism is the energy necessary for the involuntary movements of the body. It may be considered as the amount of energy necessary just to maintain the body processes. In other words, it is the amount of energy necessary to live. The basal energy expenditure per unit of time is usually referred to as the basal metabolic rate.

Total energy metabolism includes the energy needed for

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basal metabolism plus the amount of energy required for the voluntary movements of the body and for the influence of the various foodstuffs on metabolism.

Measurement of Heat Production

In order to determine the caloric requirement of the body two methods may be used. The first method is by *direct measurement*. Thus the animal or individual is placed in an insulated chamber called a respiration calorimeter. This is provided with means for accurately measuring the amount of heat given off by the subject in a given period of time. This type of calorimetry is very laborious and expensive and there are only a few of these calorimeters in existence. It was by this method, however, that all the early work on energy metabolism was done.

A more practical method for measuring caloric expenditures is by an *indirect method*. Oxygen is the necessary constituent for the metabolic processes of the body. Measurement of the oxygen consumed by an individual in a given period of time can be used to calculate the energy expenditure since it has been determined that the combustion of one liter of oxygen by a person on a mixed diet is equivalent to 4.83 calories. This is the usual clinical procedure for measuring the basal metabolic rate. The individual lies down on a bed. He breathes from a measured supply of oxygen through a mouthpiece, his nose being closed off. He is thus in a closed circuit. The carbon dioxide produced is absorbed by soda lime. The standard conditions for determining basal metabolic rate are that the subject be awake but at complete rest and that 12 to 14 hours have elapsed since the last meal (post-absorptive state).

Factors Affecting Basal Metabolic Rate

There are a number of factors which account for the normal variations in basal metabolism. Variations within 10 per cent above or below the basal metabolic rate are accepted as within normal limits. The average basal caloric requirement for an average-size man is approximately 1700 calories per

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day and that for the average-size woman 1400 calories per day.

Sleep is one factor affecting the basal metabolic rate. Here the energy needs of the body are at their very minimum so that basal metabolism will be lowered.

The *surface area* of the body influences the basal heat production since the skin is the means by which the heat is continually radiated from the body. Thus the size and shape of an individual is a determining factor in basal metabolism. It has been found that a tall thin person has a greater surface area than a short fat person of the same weight and therefore has a proportionately greater basal metabolism.

The *composition of the body tissues* will cause a variation in basal metabolism. Since metabolism is carried on in actively functioning tissue the individual with the greater amount of muscular tissue for the same body weight will have the higher basal metabolism.

Age and growth are factors which bring about a normal variation in basal energy requirements. The highest metabolic rate is found to be between the ages of one and two years. It decreases somewhat after that, but remains relatively high during the entire growing period. During most of adult life there is only a slight change of basal metabolism with age, but with the onset of old age there is a marked decrease due probably to a general slowing down of the activities of the body.

Certain *hormones* are concerned with metabolism. Hormones from the adrenal gland and from the pituitary have marked effects on metabolism. The hormone from the thyroid gland, thyroxine, is especially important. Excessive amounts of thyroxine (hyperthyroidism) will result in a greatly accelerated metabolism, while insufficient amounts result in hypothyroidism or a decreased metabolic rate.

Total Energy Metabolism

Basal metabolism accounts for only a part of the energy expenditure of the body. There are several factors which add materially to the total energy needs.

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Apparatus used for basal metabolism test.

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Muscular activity, the most important of these, is brought about in the performance of the daily activities of life. The caloric needs of an individual are directly proportional to the extent of his muscular activity. The greater the activity the greater the caloric needs. Thus a person of sedentary occupation, such as an office worker, expends considerably less calories than does a person doing heavy manual labor.

A second factor in increasing the caloric needs of the individual is the effect of the foodstuffs themselves on metabolism, the so-called *"specific dynamic action"* of foods. Carbohydrates and fats, as well as proteins, have a stimulating effect on metabolism, causing an increase in metabolic rate when they are ingested. The effect of protein is the greatest, increasing the rate of metabolism by as much as 30 per cent. On the average mixed diet, however, an increase of only 6 per cent of the basal metabolism will result.

Other factors of more or less importance in varying metabolism are temperament of the individual and environmental factors such as climate, conditions of housing and kind and amount of clothing worn.

The problem of apparent variations in the caloric needs of two individuals under similar conditions may best be explained by differences in the disposition or emotional make-up of the two individuals. One may be a calm, efficiently acting person, while the other may be a very active, energetic person, with increased muscle tone, waste motions and an inability to relax. The former will require considerably less calories than the latter.

The heat produced by the metabolism of food in the body is used to maintain the body temperature. It is retained or given off from the body at such a rate that the body temperature is held within quite constant limits. Heat is eliminated from the body by radiation and to a less extent by conduction and convection, and by evaporation of moisture through the lungs and the perspiration of the skin. Heat is conserved to the body by wearing adequate clothing and by living in heated houses. The subcutaneous fat tissues conserve heat to

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TABLE 2

Energy Expenditure per Hour under Different Conditions of Muscular Activity*

	CALORIES PER HOUR			
	Man		Woman	
	Per kilogram	Per pound	Per kilogram	Per pound
Sleeping	0.93	0.43	0.87	0.40
Awake lying still	1.10	0.50	1.02	0.47
Sitting quietly	1.43	0.65	1.33	0.60
Reading aloud	1.50	0.69	1.39	0.63
Standing relaxed	1.50	0.69	1.39	0.63
Hand sewing	1.59	0.72	1.47	0.67
Standing at attention	1.63	0.74	1.53	0.69
Knitting (23 stitches per min. on sweater)	1.66	0.75	1.54	0.70
Dressing and undressing	1.69	0.77	1.57	0.71
Singing	1.74	0.79	1.62	0.74
Tailoring	1.93	0.88	1.79	0.81
Typewriting rapidly	2.00	0.91	1.86	0.85
Ironing (with 5 pound iron)	2.06	0.93	1.91	0.87
Dishwashing (plates, bowls, cups, saucers)	2.06	0.93	1.91	0.87
Sweeping bare floor (38 strokes per min.)	2.41	1.09	2.24	1.02
Bookbinding	2.43	1.10	2.26	1.02
"Light exercise"	2.43	1.10	2.26	1.02
Shoemaking	2.57	1.17	2.41	1.10
Laundry work (towels rubbed on a board without water, 35 times per min.)	2.60	1.18	2.42	1.10
Walking slowly (2.6 mph)	2.86	1.30	2.66	1.21
Carpentry, metal working, industrial printing	3.43	1.56	3.19	1.45
"Active exercise"	4.14	1.88	3.85	1.75
Walking moderately fast (3.75 mph)	4.28	1.95	3.99	1.81
Stoneworking	5.71	2.60	5.31	2.41
"Severe exercise"	6.43	2.92	5.98	2.72
Sawing wood	6.86	3.12	6.39	2.90
Swimming	7.14	3.25	6.64	3.02
Running (5.3 mph)	8.14	3.70	7.57	3.44
"Very severe exercise"	8.57	3.90	7.97	3.62
Walking very fast (5.3 mph)	9.28	4.22	8.63	3.92

* Taylor, C. M. and MacLeod, G., *Rose's Laboratory Handbook for Dietetics*, fifth ed. New York: The Macmillan Company 1949.

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the body also. The body can involuntarily increase heat production by increased muscular contraction, such as shivering. In cold weather it may be necessary to increase the caloric intake in order to meet the increased caloric need.

Energy balance. Under ideal conditions there would be a balance in the body between the energy intake and the energy output. However, if the food intake does not supply sufficient energy for the body's needs the body stores of energy materials (fat and glycogen) will be drawn upon; if the reverse is true, that is if energy intake exceeds the energy expenditure, the excess energy will be stored as a reserve in the form of adipose tissue.

Requirements

From the foregoing discussion it is apparent that the energy requirement of an individual may be assessed according to age, weight and activity.

From a great many determinations the average caloric needs of individuals of different occupations have been determined. The National Research Council tables (pages 6–8) gives the caloric needs of various individuals under varying amounts of activity. Thus the moderately active woman, weighing 56 kilograms, will require an average of 2500 calories per day, while the moderately active man, weighing 70 kilograms, will require 3000 calories. Figures for children and for pregnancy and lactation are also given.

The caloric needs of an individual may be calculated more directly by observing the activities of the person for a period of 24 hours. The caloric expenditures for various activities on a weight basis are given in Table 2. The individual's ideal weight must also be determined. This is obtained from weight for height tables (pages 492–503) which give the weight that an individual should weigh for his height and age. It is obvious that ideal rather than actual weight should be used in the calculations of the caloric needs of an individual. An example of such a calculation is given on page 42.

Such a determination and the value given for a moderately active woman in Table 1 are in quite close agreement. There-

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ENERGY REQUIREMENTS OF A NURSE FOR A DAY

Activity	*Amount of time*	*Calories per kilogram per hour*	*Total calories*
	hours		
Sleeping	8	0.87	6.96
Dressing	1	1.57	1.57
On duty			
Active work	3	3.85	11.55
Sitting quietly	1	1.33	1.33
Light work	4	2.26	9.04
Eating—sitting quietly	2	1.33	2.66
Classes—sitting quietly	3	1.33	3.99
Studying—sitting quietly	1	1.33	1.33
Recreation (swimming)	1	6.64	6.64
Total	24		45.07
	Multiplied by ideal weight—56 kilo.		56
			2523.92

fore for all practical purposes this table, The Recommended Daily Dietary Allowances of the National Research Council, may be consulted in determining caloric needs of normal individuals, and it is not necessary to make such a detailed calculation.

Food Sources

The energy value of foods has been referred to in the chapters on carbohydrates and fats. It will be recalled that carbohydrates are the most readily available and economical source of energy, while fat is the most concentrated source of energy.

Caloric Value of the Nutrients

We have already discussed metabolism to some extent in the preceding chapters on protein, carbohydrates and fats. It was pointed out that each one of these nutrients supplied heat and energy to the body with the formation of the end-products carbon dioxide and water. The unit of measurement used to express the fuel value of the nutrients is the large calorie. It is the amount of energy necessary to raise the temperature of one liter of water one degree centigrade.

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The caloric value of nutrients was determined by burning each in a bomb calorimeter in an atmosphere of oxygen.

From a large number of determinations the average fuel value of the three nutrients in the body has been given as:

1 gram of pure carbohydrate furnishes 4 calories
1 gram of pure fat furnishes 9 calories
1 gram of pure protein furnishes 4 calories

These are called the *physiological fuel values* of the nutrients. They are slightly lower than the results obtained for these foodstuffs by the bomb calorimeter. There are losses in digestion of the three nutrients and some loss in the metabolism of protein since it is not as completely oxidized as are fats and carbohydrates. Thus the energy values would be expected to be somewhat less in the body than in the bomb calorimeter where the material can be entirely oxidized. These physiological fuel values are used to determine the energy values of the various foods. If the chemical composition, i.e., the protein, fat and carbohydrate content of the food, is known the energy value of the food is readily calculated by multiplying each of the nutrients by the proper physiological fuel value. (See pages 401–05 for a more detailed discussion.)

Caloric Value of the Foods of the Basic Daily Dietary Pattern

Food	*Amount*	*Calories**
Milk	3 cups	480
Meat, fish, fowl	3 ounces	160
Egg	1	80
Additional protein	1 serving	100
Whole grain or enriched cereal or bread	4 ounces	320
Vegetables	3 servings	190
Fruits	2 servings	115
Butter or fortified margarine	½ ounce	105
	Total	1550

* Rounded off to the nearest 5.

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Supplying the Daily Energy Needs

The Basic Daily Dietary Pattern supplies approximately 1500 calories which is somewhat more than half of the caloric requirement of a moderately active woman. The remaining calories to 2500 can be supplied by more of these same foods and by other carbohydrate and fat foods.

Typical Additions to the Basic Daily Dietary Pattern to Furnish Approximately 2,500 Calories per Day

Food	*Amount*	*Calories**
Sugar	2 tablespoons	120
Shortening	1 ounce	210
Bread or cereal	2 ounces	160
Cream, coffee	1 tablespoon	30
Cream, whipping	1 tablespoon	45
Milk	½ pint	160
Dessert (pie, cake, pudding)	1 serving	350
	Total	1075

* Rounded off to the nearest 5.

As was pointed out in previous chapters the excessive intake of either carbohydrate or fat foods will lead to obesity and the many complications that may result from such malnutrition. The desirable procedure is to maintain the daily food intake at such a level that there is little variation in body weight from that accepted as the ideal weight for the individual.

Questions and Problems

1. What is meant by metabolism? Catabolism? Anabolism?
2. How is basal metabolism measured? What is meant by basal metabolism? Energy metabolism?
3. What are the physiological fuel values of the nutrients? How were they first determined?
4. A pint of milk contains 16 grams of protein, 20 grams of fat and 24 grams of carbohydrate. How many calories will it furnish?

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5. What two methods are used to measure the caloric requirement of an individual? How do they differ?
6. What factors increase basal metabolism? State why each one of these factors influences the energy requirement.
7. What influence does muscular activity have on the energy requirement of the body? What other factors influence the total energy requirement of the body?
8. What is meant by specific dynamic action? How does it influence the total energy requirement?
9. How is the temperature of the body regulated?
10. Why should the ideal weight of a person be used in determining his caloric needs?
11. What is the caloric requirement of a sedentary woman weighing 56 kilograms? A man of 70 kilograms doing heavy work? A high school girl?
12. Using the table on page 40, calculate your caloric expenditure for one day. How does this compare with your caloric requirement as determined from Table 1?
13. What types of foods are the main sources of calories in the diet?
14. Calculate the caloric value of the following foods:
    1 slice of bread
    1 medium-size potato
    1 teaspoon sugar
    1 orange
    1 teaspoon butter
    ½ cup tomatoes
15. What part of the caloric requirement of a moderately active woman is supplied by the foods listed in the Basic Daily Dietary Pattern?
16. Plan a day's diet for a nurse that will furnish 2600 calories.

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Chapter VI

MINERALS

THE NORMAL STRUCTURE and functions of the body are dependent on still other materials besides protein, fat and carbohydrate. Fundamental as these substances are they cannot function alone. Another necessary group of nutrients includes the minerals. These are the inorganic elements which may occur in the body as simple salts

ELEMENTARY COMPOSITION OF THE BODY (2)

Element	*Approximate per cent in body*
Oxygen	65
Carbon	18
Hydrogen	10
Nitrogen	3.0
Calcium	1.5
Phosphorus	1.0
Potassium	0.35
Sulfur	0.25
Sodium	0.15
Chlorine	0.15
Magnesium	0.05
Iron	0.004
Iodine	0.00004
Copper, silicon, fluorine, boron, zinc, aluminum	Very minute amounts

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or in combination with the complex organic material. They are left when the oxidizable part of the food has been burned.

Some fifteen minerals are normal constituents of the body and make up about 4 per cent of the body weight. The specific function of all of these minerals is not known.

There are certain functions which the minerals in general share. The first is *structural*. Minerals are the materials which give bones and teeth their firmness and rigidity. They are also found in the cells of the soft tissues of the body, such as the muscles, nerves and blood cells.

Minerals serve in a number of ways in the *regulatory processes* of the body. They are necessary for the contraction of muscle, the irritability of nerves, the maintenance of the acid-base balance and osmotic pressure of the body, and the formation of the digestive juices and other secretions of the body.

An adequate intake of minerals is necessary to replace those that are eliminated in the processess of metabolism. Just as protein is used up in the daily wear and tear of the body, so too some of the mineral-containing constituents undergo changes resulting in the loss of these substances. A balance must be maintained between the intake and output of minerals as well as of other materials if the body is to function properly. During growth, as in children and in pregnancy, as well as during lactation, it is especially important to maintain a positive balance for mineral intake to assure adequate amounts for the formation of new tissue.

Supplying the Daily Mineral Needs

Some of the minerals occur abundantly in foods and on a good diet there is little likelihood of an inadequate supply of these. Others, however, occur in fewer foods and in less concentration and a deficiency of certain of the minerals, such as calcium and iron, may occur unless attention is given to inclusion of foods in the diet to supply these constituents in adequate amounts.

In order to assure an adequate mineral supply several factors must be taken into consideration in the choice of foods

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that are to supply these nutrients to the body. The first of these has to do with the actual mineral content of the food itself and how well it is retained by the refining and cooking processes. Furthermore, a food may have a goodly quantity of a mineral and still not be of much value as a source of the mineral in the body. It has been shown that the form in which a mineral occurs is an important factor in its use by the body; minerals in the inorganic form are generally more available than those in the organic form. A final consideration is the amount of the food that is to be used. A food may be a source of a nutrient, but whether it can be eaten in sufficient quantities to make a real contribution to the total requirement of the nutrient will be governed by how much of the food one is able to eat.

Calcium

The mineral found in largest amount in the body is calcium. About 99 per cent of the calcium is found, combined with phosphorus, in the bones and teeth giving them firmness. In addition, calcium is necessary to aid in the clotting of blood, the normal response of nerves, heart and muscle tissues, and in the absorption of the end-products of digestion, particularly of iron.

An inadequate amount of calcium in the diet will lead to a proportionate impairment of these functions. Poor development of bones and teeth results, as well as disfunction of some of the vital processes of the body.

Daily Allowance. The daily allowance for calcium as set forth by the Committee on Foods and Nutrition of the National Research Council is given as 1 gram per day for the adult. The allowances given for children and during adolescence, pregnancy and lactation are designed to take care of growth. The range for children is from 1.0 to 1.4 grams per day, depending upon the age; for pregnancy it is 1.5 grams per day and for lactation it is 2.0 grams per day. These amounts are purposely greater than the average requirement in order to give a "margin of safety" and assure an adequate supply under all circumstances. (See Table 1.)

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Food Sources. Calcium is not found in foods in any great concentration. Milk, in any form, is by far the best source of calcium in the diet. There is no food, except the hard cheese made from milk, which can compare with it. Three cups of milk alone supplies about two-thirds of the calcium requirement of the adult. One quart of milk is necessary for the growing child and in pregnancy. The other foods which are fair sources of calcium and can supplement milk include greens—such as turnip tops, kale, collards, cabbage, broccoli and cauliflower—and clams. None of these can be eaten in the quantities or with the repetition that milk and cheese can be eaten. The importance of milk in the diet cannot be overemphasized.

Not all of the calcium that is ingested in the food may be available to the body. Calcium oxalate, which occurs in some foods, spinach for example, is insoluble, and calcium in this form is not available to the body. Furthermore, oxalic acid which is present in such foods as spinach, rhubarb and chocolate may render calcium of other foods unavailable through the formation of the insoluble calcium oxalate. The use of large quantities of chocolate milk for children is to be questioned on this score.

Supplying the Daily Calcium Needs

Calcium Content of the Foods of the Basic Daily Dietary Pattern

Food	*Amount*	*Calcium gm.*
Milk	3 cups	0.84
Meat, fish, poultry	3 ounces	0.01
Additional protein*	1 serving	0.06
Egg	1	0.03
Fruit	2 servings	0.04
Vegetables	3 servings	0.15
Whole grain or enriched cereals or bread	4 ounces	0.04
Butter or fortified margarine	½ ounce	—
	Total	1.17

* Includes average of 1 egg, 1 ounce of cheese or meat, or ½ cup legumes.

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Calcium is one of the minerals most apt to be inadequate in the American dietary. It will be noticed that the foods given in the basic dietary supply slightly more than the amounts indicated as the adult requirement. This again emphasizes the important contribution that milk makes in supplying the calcium needs of the body. When additions to the diet are made to meet the caloric needs of the body it is wise to choose foods which also will supply more calcium.

Phosphorus

Phosphorus is the most widely distributed in the body of all the minerals. Seventy per cent of it is associated with calcium as calcium phosphate in the bones and teeth and it is found in all the cells of the body. In addition phosphorus is necessary for the continuance of metabolic processes of the body, and in the form of its salts acts as one of the buffering systems of the blood in the maintenance of the acid-base balance of the body.

Daily Allowance. The daily allowance of phosphorus for the adult is given as 1.3 grams per day and that for the child as 1.5 grams per day. The requirement during pregnancy and lactation is somewhat higher than for the same individual prior to conception. (See Table 1.)

Food Sources. The main sources of phosphorus are meat, fish, poultry, cereal grains, nuts, milk, cheese, legumes and eggs.

Supplying the Daily Phosphorus Needs. The abundance of phosphorus in both plant and animal foods makes it relatively easy to meet the phosphorus requirement. If the protein and calcium requirements are met there is very little likelihood of an inadequacy.

Iron

Although the amount of iron in the body is very small, approximately 4.0 grams altogether, its function is of vital importance. As a part of the hemoglobin of the red blood cell it aids in the transportation of oxygen to the tissues of the body and the return of the carbon dioxide to the lungs.

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Iron is found in all the cells of the body as a part of certain enzymes, and as a part of chromatin, the pigment found in cells.

Iron is absorbed from the gastro-intestinal tract only as it is needed. The needs of the body are small under normal conditions since little iron is excreted. The body retains its iron supply tenaciously. The iron that is released at the breakdown of hemoglobin is retained and reused many times in the formation of new hemoglobin. An inadequate amount of iron results in a condition known as nutritional or secondary anemia (page 245). This condition is most apt to develop in periods of growth, such as in children, in pregnancy and during lactation where there is an increased need for iron.

Daily Allowance. The daily allowance for the adult is given as 12 milligrams per day (See Table 1) while in growth and pregnancy the allowances are proportionately higher to take care of the increased hemoglobin formation.

The normal adult male may not need much iron. If the diet is adequate in other respects the iron supply will be entirely adequate.

Food Sources. The most valuable source of iron is liver, all types, except fish liver. Other important sources are egg yolk; muscle and organ meats; molasses; fruits, such as peaches, apricots, prunes, apples, raisins and grapes; some green vegetables; and whole grain cereals.

The form in which iron occurs in the food is an important point in determining the value of the food as a source of iron. Of all the iron ingested very little is absorbed because much of it is not in a form available to the body. Iron is absorbed mainly in the duodenum where the intestinal contents are still acid. The ferrous iron is more available than the ferric iron, and the inorganic salts are more usable than the organic forms.

Supplying the Daily Iron Needs

Iron, like calcium, is one of the nutrients most frequently found to be inadequate in the diet. It will be observed that the iron allowance of the adult is barely met by the basic

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Iron Content of the Foods of the Basic Daily Dietary Pattern

Food	*Amount*	*Iron mg.*
Milk	3 cups	0.6
Meat (liver once a week)	3 ounces	2.7
Egg	1	1.4
Additional protein*	1 serving	1.0
Fruits	2 servings	1.0
Vegetables	3 servings	2.9
Whole grain or enriched cereal	4 ounces	2.4
Butter or fortified margarine	½ ounce	—
	Total	12.0

* Includes 1 egg, 1 ounce of cheese or meat or ½ cup legumes.

dietary pattern. It is advisable to use liver in some form at frequent intervals, preferably once a week, to insure an adequate iron intake. Emphasis should be laid on the daily inclusion of some of those foods listed as valuable sources of iron. In periods of stress, such as growth, it is essential that greater amounts of foods high in available iron be used regularly.

Iodine

Thyroxine, the hormone of the thyroid gland, contains iodine in its molecule. This hormone has already been mentioned as an essential factor in energy metabolism. The amount of iodine that must be furnished for thyroxine formation is very small, yet without this minute amount the thyroid gland cannot function and it eventually enlarges and a condition known as goiter results. Iodine is necessary for normal growth and development and throughout life for normal body function. If the mother's thyroid is not well supplied with iodine during pregnancy the child will be a cretin, a condition characterized by improper physical development and a specific type of idiocy (2).

Goiter has been associated with regions of the world where

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there is little iodine in the soil. Thus there are "goiter belts" through the midwest and the northwest of the United States and in Switzerland. Since iodine occurs in the sea water those soils along the coast contain abundant iodine, with the result that the foods produced in such areas are also high in iodine content and little goiter occurs among those living in these areas. The classic work of Marine and Kimball has led the way in the use of supplementary iodine in goitrous areas. These investigators studied school children in Akron, Ohio. In the group of children given supplements of sodium iodide practically no goiters occurred, while in the unsupplemented group there was a 21 per cent incidence of the disease.

Daily Allowance. The daily allowance of iodine is about 15 to 30 milligrams per day for the adult. (1)

Food Sources. Sea foods, the water and the vegetables from coastal areas are the main sources of iodine.

Supplying the Daily Iodine Needs. In the coastal areas adequate amounts of iodine are supplied by the food and water.

In the inland areas several methods of supplying supplementary iodine have been advocated. These include the addition of iodine to the water supply, giving of iodine tablets to the school children and the use of iodized salt. The latter is the method of choice since it reaches the largest number of people and is the least expensive. The education of people to the use of iodized salt is an important public health problem. Iodized salt should be used generally as a prophylactic measure and is especially necessary in growth and in pregnancy and lactation. (3)

Most iodized salt on the market contains 0.01 per cent potassium iodide. There is no conclusive evidence that the use of this salt can prove harmful.

Sodium

Sodium, in the form of sodium chloride, is found in the fluid tissues of the body and is an important factor in maintaining osmotic pressure or fluid balance. Sodium chloride is excreted through the perspiration and the urine. Increased

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losses will therefore result during heavy muscular work and exercise and in hot weather. Measures should be taken to see that these losses are replaced in order to prevent the disturbances which will result from an inadequate amount of sodium chloride in the body. The sodium chloride content of the body may also be disturbed in certain adrenal gland diseases and in gastro-intestinal disturbances such as vomiting and diarrhea.

Sodium, in the form of other salts, such as the carbonates and phosphates, act as buffers (page 57).

The average daily intake of sodium chloride is from 5 to 15 grams depending upon the tastes of the individual. The average need under normal conditions is about 2 grams per day. Thus under ordinary circumstances more than adequate salt intake is provided.

Potassium

Potassium is an important constituent of all cellular material. It is necessary in the maintenance of the acid-base balance, the osmotic pressure and for the irritability of nerves and muscles.

Magnesium

Magnesium is found in muscle tissue, in the body fluids and to the greatest extent in bones, associated with calcium. The specific function of magnesium is not well known but it is apparently necessary as an activator of certain enzymes vital to certain physiological processes.

Sulfur

Sulfur is a component of such structures of the body as the bone matrix, nails and hair. It is a part of certain metabolic materials, such as glutathione and the hormone, insulin. It is also present in the thiamine molecule. Since sulfur occurs in the amino acids, cystine and methionine, it will be adequately supplied in the diet if the protein needs are met.

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Trace Elements

Those elements which occur naturally in the body and are needed in amounts less than iron are considered to be trace elements (6). The human requirement and the function of some of these are not well known. Iron, copper, iodine, manganese, cobalt, zinc, fluorine, boron and aluminum are included among the trace elements. We have already considered iron and iodine.

Copper. Copper has been found to aid in the utilization of iron for hemoglobin formation.

Cobalt. Cobalt is also necessary for hemopoiesis and has recently been found to be a constituent of vitamin B_{12}, an important factor in blood formation.

Manganese. Manganese acts as an activator of certain enzymes, and is necessary for the normal reproduction and growth of some animals.

Zinc. Zinc is a constituent of the hormone insulin and of various metabolic enzymes.

Fluorine. Fluorine in large amounts is toxic. When ingested regularly over a prolonged period in subtoxic amounts it produces a condition in teeth known as "mottled enamel."

Recent studies have shown that in concentrations of a few parts per million in water fluorine may serve as a deterrent of dental caries. For this purpose the fluorine may be ingested as in drinking water or in somewhat higher concentration may be applied to the normal surface as a mouthwash.

The role of *boron* and *aluminum* in human nutrition is unknown.

The Selenium Problem. Selenium in various forms occurs in variable amounts in certain soils. The ingestion of selenium compounds over any extended period results in a condition of selenium poisoning evidenced by emaciation, stunted growth, profound changes in tissue structures especially the teeth and bones, damage to the digestive tract, cirrhosis of the liver, anemia and loss of reproductive power. Areas in the United States where there is sufficient selenium to render the vegetation toxic to man or animals are becoming better

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known and the disease is becoming of relatively rare occurrence.

Acid-Base Balance

In health the reaction of the body fluids in the tissues is slightly on the alkaline side of neutrality or within a narrow pH range of 7.3 to 7.45. This condition is maintained by a series of buffers circulated in the blood and present in the tissues. These substances are either weak acids or weak bases and are capable of combining with relatively large amounts of bases or acids without appreciable change in reaction. The proteins of the blood, both the hemoglobin and the plasma proteins, since they are amphoteric, i.e., have both basic and acidic properties, belong to one group of buffers. Sodium and potassium phosphates and the alkaline carbonates with carbonic acid form another group. As the acid products of metabolism, carbon dioxide, ketones, sulfates, chlorides and some organic acids are formed they are neutralized by the buffers. The carbon dioxide combines with the hemoglobin and is carried to the lungs where it is eliminated. The other metabolic products are eliminated through the kidney, combined with base, such as the sodium or potassium. The base thus used in the neutralization of these acids is lost to the body and if the body neutrality is to be maintained it must be replaced. This is accomplished by the mineral content of food. The buffer materials in the blood and tissues are termed the *alkaline reserve*. If for any reason the supply of these buffer substances is less than sufficient to neutralize the acid products of metabolism a condition of acidosis will result.

Reaction of Foods

Foods contain both basic and acidic elements. The mineral elements, sodium, potassium, magnesium and calcium, are base forming while phosphorus, sulfur and chlorine are acid forming. The mineral elements may occur in foods as salts of inorganic acids, phosphates, sulfates and chlorides or of organic acids. When foods are metabolized in the body they leave either an acid or an alkaline residue depending

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TABLE 3

Summary of the Mineral Elements

Mineral	Functions	Recommended daily allowance (1)	Food sources
Calcium	Building of bones and teeth Clotting of blood Response of nerves and muscle tissue Utilization of iron Maintenance of body neutrality	Adult 1.0 gms. Pregnancy 1.5 gms. Lactation 2.0 gms. Children 1.0 to 1.4 gms. depending on age	Milk Hard cheese Greens: Mustard Turnip Kale Collards Cabbage Clams Broccoli Cauliflower
Phosphorus	Building of bones and teeth Activation of enzymes Oxidation reactions Multiplication of cells Maintenance of body neutrality	Adult 1.3 gms. Children 1.5 gms.	Meat Fish Poultry Cereal grains Nuts Milk Cheese Legumes Eggs
Iron	Formation of hemoglobin, oxidative enzymes and pigments	Adult 12 mgs. Pregnancy 15 mgs. Lactation 15 mgs. Children 6.0 to 15 mgs. depending on age	Liver Egg yolk Muscle and organ meats Molasses Apricots Prunes Grapes Some vegetables Whole grain and enriched cereals
Iodine	Formation of thyroxine	Adult 0.15 to 0.30 mg.	Iodized salt Sea foods Foods grown in coastal areas
Sodium	Maintenance of body neutrality	2 grams	Table salt Milk

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TABLE 3 (Continued)

Mineral	Functions	Recommended daily allowance (1)	Food sources
	Regulation of osmotic pressure Irritability of muscle and nerve Regulation of water balance		Meat
Potassium	Maintenance of body neutrality Regulation of osmotic pressure Irritability of muscle and nerve	*	Vegetables Fruits
Magnesium	Constituent of: muscle tissue body fluids bones and teeth Activation of enzymes	*	Meat Cereals
Sulfur	Constituent of: bone matrix nails hair glutathione insulin thiamine	*	Meat Fish Poultry Cheese Legumes Nuts
Copper	Catalyst of iron in hemoglobin formation	Adults 1.0–2.0 mg. Children 0.05 mg. per kg. of body weight	Liver Meat Nuts Whole grain cereals Legumes
Cobalt	Formation of normal hemoglobin	*	Liver
Manganese	Activation of enzymes Reproduction and growth in some animals	*	Meat Cereals
Zinc	Constituent of insulin and some enzymes	*	

* The exact requirement of these minerals is not known. If the diet meets the allowances for protein, calcium and iron these minerals are presumed to be supplied in adequate amounts.

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upon whether the alkaline-forming or acid-forming elements in the food predominate. For convenience, foods may be grouped according to their predominately acid or alkaline residue.

Reaction of Foods

Acid ash	*Alkaline ash*	*Neutral*
Meat, fish, poultry	Fruits (except those already listed)	Butter
Eggs		Cream
Cheese	Milk	Cooking fats
Corn	Vegetables	Sugars
Cereal grains	Some nuts	Starches
Some nuts		
Prunes, plums, cranberries		

The taste of a food is no indication of its potential source of acidic or basic elements in the body. The sour taste of the citrus fruits is due to organic acids which are completely oxidized in the body, and these fruits actually have a high alkaline ash. Other fruits, such as prunes, plums and cranberries, contain benzoic acid which the body cannot metabolize and they therefore give an acid reaction on metabolism. The acid or base values of foods are given above.

Excess amounts of acid or base material not neutralized in the body are excreted by the kidneys so that the reaction of the urine serves as an indication of the type of diet eaten. Thus a diet high in base, a so-called alkaline-ash diet, will cause an alkaline urine, and the reverse, of course, is true of an acid-ash diet.

Questions and Problems

1. Approximately what proportion of the body is made up of minerals? About how many different minerals are found in the body?
2. What functions do the minerals in general perform in the body?
3. What factors determine whether a food is a good source of a mineral or not?

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4. For what purposes does the body need calcium? What foods are the best sources of calcium in the diet?
5. What functions does phosphorus serve in the body? How can we be sure that the phosphorus needs of the body are being met?
6. How does iron function in the body processes? What is nutritional anemia? When can it occur?
7. Plan a day's diet that supplies sufficient iron to meet the requirement for a young woman.
8. What is meant by available iron? What determines availability?
9. What is goiter? Why is it not as prevalent now as it was 25 years ago?
10. In what ways does sodium function in the body?
11. What functions do the following elements serve in the body: potassium, magnesium, sulfur? How are the requirements for these minerals met?
12. What is a trace element? Give the trace elements and their specific functions in the body.
13. What is the normal reaction of the body? How is it maintained?
14. What foods give an acid-ash in the body? An alkaline-ash? What does this mean?
15. What minerals, if any, are furnished by each of the food groups in the basic dietary pattern?
16. A patient has asked you why she should drink milk. How many reasons can you give her for drinking milk? In what ways may she use milk in her diet? Are there any foods that can be substituted for milk in nutritive value?

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Chapter VII

VITAMINS

THERE ARE still other nutrients that the body needs. Sufficient protein, calories and minerals are not enough for maintenance and growth of the body. Another group of nutrients, the vitamins, are also necessary for adequate nutrition.

These are extremely potent organic compounds other than protein, fat and carbohydrate, which occur in natural foodstuffs and must be available to the body in order that metabolic processes may proceed normally. There are some 40 or more substances included in this group. They vary decidedly in chemical composition, function and distribution in food. Not all of them have been shown to be necessary for human nutrition and the requirements of many are not known at the present time.

The term "vitamine" was first used by a Polish chemist, Funk, when he thought he had found a nitrogen-containing substance that was necessary for life, hence the derivation of the word from two words "vital" and "amine." The final e was dropped when the term was finally adopted to refer to the group of compounds newly discovered as functioning in life processes in very minute amounts and none was shown to contain an amino group implied by the spelling, "vitamine." The vitamins as first discovered were known through the deficiency disease that resulted when they were not pres-

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ent in the diet in adequate amounts; hence the terms, anti-beriberi, antiscorbutic, etc. At first their presence in foods could be indicated only qualitatively. As information on the occurrence in foods accumulated an attempt was made to select stable substances as standards of reference in terms of which the potency of other substances could be expressed. This work was undertaken by the Health Organization of the League of Nations when Standards of Reference for vitamin A, vitamin B, vitamin C and vitamin D were established. The substances accepted for comparison were called International Standards and the amounts used as basis for comparison International Units. As more and more vitamins have been discovered chemical identification has become more efficient and the older designations have been replaced by names more indicative of chemical configuration. At the present time concentrations are expressed in terms of micrograms or milligrams for all except vitamin A and vitamin D.

There has probably been no more dramatic period in the science of nutrition than that during the early discovery of the vitamins. The stories of these events are well told in several texts (2, 5, 6, 7) to which the interested student is referred. The first indications of these potent biological materials centered the interest of many people on nutrition. From the scientific point of view it led to a great surge of investigation, which is still proceeding, with resultant benefits to mankind. From the lay point of view it has led to a keener interest in good nutrition. This has in most instances been good since better nutrition for many people has been the result. On the other hand it has also resulted in a very great overemphasis on the vitamins and their exploitation commercially. There has been much false interpretation and inaccurate information given. Much has yet to be done to bring about accurate and adequate information concerning the vitamins so that their true role in nutrition will attain greater significance.

Vitamin A

Vitamin A was the first of the so-called fat soluble vitamins to be discovered. Observations made by two groups of work-

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ers, independently and at about the same time, indicated that there was something in butterfat and some other animal fats necessary for growth and life of animals. This substance was first called fat-soluble A and later vitamin A, the name by which it is still known. Subsequently, it was further observed that certain yellow pigments of plants, carotenes, served as sources of vitamin A in the animal body. They are referred to as precursors of vitamin A or provitamin A compounds. In plants, carotenes are closely associated with chlorophyll, the green pigment active in photosynthesis. Two forms of vitamin A are known; vitamin A_1, more commonly known simply as vitamin A, the form of significance in mammalian nutrition, and vitamin A_2 present in the liver oil of fresh water fish. An isomer of vitamin A_1, neo-vitamin A, occurs with vitamin A in fish liver oil.

Function. Vitamin A serves several functions in the body. One is that of maintaining the integrity of the epithelial tissues. By keeping such tissues as the skin and mucous membranes in healthy condition the body is able to avoid many types of infections.

A second function of vitamin A is in the regeneration of visual purple or rhodopsin, a substance necessary for vision in dim light. Vision in dim light is dependent on the rods in the retina. Their function requires the photosensitive pigment rhodopsin. This material is bleached by light and restored in darkness. Vitamin A is necessary for this cycle to continue. The bleached material or visual yellow as it is called and a protein are formed when the visual purple is exposed to light. The protein then combines with vitamin A to reform visual purple and the cycle continues. When there is an inadequate amount of vitamin A the cycle is broken and the condition known as night blindness results. This is one of the earliest signs of a vitamin A deficiency.

Vitamin A is essential for normal skeletal growth and for normal tooth formation. It is necessary for proper enamel and dentine formation. Normal reproduction and lactation in some animals will not take place when there is an inadequate vitamin A intake.

Physiology. Vitamin A and carotene are absorbed from the

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small intestine. The presence of fat seems to facilitate absorption of both, while in addition, carotene requires bile salts. At the present time it is not known whether the conversion of carotene to vitamin A occurs in the intestinal wall or in the liver as was at first believed. In any event, excess vitamin A, whether it is derived as such from food or through the conversion of carotenes, is stored in the liver. The body has the ability to store quite large amounts of the vitamin which may be used in times of extra need or when a temporary shortage occurs. The ability of the body to store the vitamin varies and is influenced by the presence of other substances, especially vitamin E. Any condition that affects the digestion and absorption of fat affects the absorption of vitamin A. Storage in the infant is small but there is a gradual increase with age.

The absorption of vitamin A may be interfered with by other substances in the gastrointestinal tract. Of particular importance is mineral oil, which markedly affects vitamin A absorption and should not be used without the advice of a physician. The fat-soluble vitamin A goes into solution in the mineral oil and since this oil is not absorbed but rapidly excreted the vitamin A is simply removed with it.

Deficiency State. Night blindness or nyctalopia, a loss of visual acuity in dim light, is a result of a mild vitamin A deficiency. It is more common in the general population than is usually appreciated. In this state the individual is unable to regenerate visual purple as has been explained previously. A test of the person's ability to adjust to dim light has been used as a means of testing for vitamin A deficiency.

Other signs of vitamin A deficiency which show up somewhat later than night blindness are the skin changes. There are two types of eruptions, one an exaggerated goosepimple-like papule and the other an acneform lesion. Both of these are preceded by a rough dry skin. The thighs and arms are the usual places where the goosepimple-like condition occurs while the back and arms are the usual site of the acneform lesions. Changes are seen also in other epithelial tissues of the body such as the trachea and bronchi, the urinary tract

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Night blindness, or nyctalopia, a loss of visual acuity in dim light resulting from a mild vitamin A deficiency.

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and the bladder in the more severe stages of vitamin A deficiency.

The specific effect of vitamin A deficiency is called xerophthalmia and occurs late in the deficiency. In fact it is seen infrequently in man since death usually results before this manifestation occurs. In this condition the epithelium of the cornea and conjuctiva of the eye undergo changes which result from impairment of the lachrymal or tear glands. When the fluid from these glands is absent dryness and finally ulceration of the cornea occur. If these changes are not stopped they become irreversible and result in blindness.

Measurement. Since pure vitamin A was not available at the time of establishment of the International Units, a preparation of pure β-carotene was used as the Standard of Reference. The International Unit was defined as the vitamin A activity of 0.6 micrograms (0.0006 milligrams) of this standard. With the production of compounds of vitamin A the unit has been redefined as the activity of 0.3 micrograms of vitamin A (alcohol form) and a stable salt of vitamin A has been adopted as the Reference Standard.

Daily Allowance. The Recommended Daily Dietary Allowance of vitamin A for the average adult is 5000 I.U. There is an increased need during growth, pregnancy and lactation (Table 1).

In expressing the value for the Recommended Daily Dietary Allowance of vitamin A, it was necessary to give consideration to the fact of efficiency of utilization of the provitamin A compounds, carotene and cryptoxanthin. These substances are in no case 100 per cent utilized and the efficiency of utilization decreases as the relative proportion of these substances to vitamin A in the diet increases. The recommended daily allowance is assumed for an average mixed diet and the margin of safety allowed is presumed to take care of normal dietary variations in the relative amounts of vitamin A and provitamin A compounds ingested.

Food Sources. Liver, since it is the site of storage of vitamin A in the body, is the most potent food source. Egg yolk, milk, butter and whole milk cheeses are the next most valuable

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sources. These foods contain the vitamin mainly as the preformed vitamin itself.

Plants contain the vitamin in the form of its provitamin, the carotenes. These are associated with those plant foods which are high in green or yellow color. The green color of the chlorophyll often masks a very high carotene content. Thus such green leafy vegetables as spinach, chard, beet and turnip tops, green leaves of lettuce, cabbage and celery, and asparagus and broccoli are excellent sources of carotene as well as are the yellow vegetables and fruits such as carrots, sweet potatoes, yellow corn, yellow peaches and apricots.

Fish liver oils are excellent sources of the preformed vitamin and serve as the means of supplying extra amounts of the vitamin when a supplement to the diet is indicated.

Hydrogenated vegetable fats may be fortified with vitamin A so that they have the same nutritive value as butter.

Supplying the Daily Vitamin A Needs

It is observed now that the green leafy or yellow vegetable is included in the basic dietary pattern to insure a large supply of carotene.

VITAMIN A VALUE OF THE FOODS OF THE BASIC DAILY DIETARY PATTERN

Food	*Amount*	*Vitamin A I.U.*
Milk	3 cups	1,230
Vegetables		
Potato	1 medium	52
Green leafy, yellow	1 serving	4,870
Other	1 serving	270
Meat, fish, or poultry*	3 ounces	2,105
Additional protein†	1 serving	500
Fruit	2 servings	241
Egg	1	495
Whole grain or enriched cereals	4 ounces	—
Butter or fortified margarine	3 teaspoons	480
	Total	10,243

* Includes liver once a week.
† Includes either 1 egg, 1 ounce cheese or meat or ½ cup legumes.

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The inclusion of liver in the diet at frequent intervals of about once a week is indicated since it is such a superior source of the vitamin as such. The daily inclusion of milk, butter and eggs in the diet insures a regular supply of the vitamin.

Vitamin A may be destroyed by oxidation. Thus although the food may have originally been a good source of the vitamin, its value may be lost in the cooking process. Long slow cooking of food at low temperatures with frequent stirring is more destructive of the vitamin than is the rapid short cooking at higher temperatures. The cooking of foods with the least possible exposure to air and in the shortest time is the procedure of choice.

Losses of carotene in vegetables and fruit occur on wilting and drying. It is advisable to procure fresh crisp vegetables and to keep them so. There is little if any loss of vitamin A during canning or freezing but there may be loss on prolonged storage of canned products. The subsequent defrosting of the foods may lead to losses, however. Rancidity in fats may cause appreciable losses.

Vitamin D

Besides vitamin A another substance was found in some fats which had an entirely different function in the body. This fat-soluble substance was found to be effective in the prevention of the deficiency state, rickets, through its control over the absorption and utilization of calcium and phosphorus. This substance has been termed vitamin D. It belongs to the class of compounds known as sterols (Chapter IV) and of the several forms that have been found two are of interest to us, D_2 or calciferol, derived from ergosterol, and D_3 or activated 7-dehydrocholesterol. Plants do not contain any active form of vitamin D. The sterol of plants, ergosterol, or some substance occurring with this sterol, on exposure to ultraviolet light acquires vitamin D properties. This is vitamin D_2 or calciferol. The sterol of animal tissue, cholesterol, contains a substance 7-dehydrocholesterol, which on exposure to ultraviolet light acquires properties of vitamin D. This is vitamin

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D_3 usually designated simply as vitamin D. This is the natural vitamin D of fish liver oils.

The term activated is used to denote the fact that the sterol has been exposed to ultraviolet light. This has resulted in a rearrangement of the molecule which makes it a potent antirachitic substance. This fact was discovered when it was found that certain foods had vitamin D activity after exposure to ultraviolet light. There is present in the skin of the body the sterol which is activated by the ultraviolet of the sun's rays. This activated substance is then carried to the tissues by the blood where it functions as vitamin D. Exposure of the skin to sunlight is an important factor in the prevention of rickets. During the winter months in northern climates when the amount and intensity of the sunlight is less it has become customary to supply children with an assured source of vitamin D in the form of fish liver oil or other reliable substance. The effectiveness of sunlight is decreased during passage through glass or air laden with smoke or fog and children living in cities should be given vitamin D from some source the year around.

Function. Vitamin D has been shown to be essential to the absorption of calcium from the gastro-intestinal tract and necessary to the utilization of both calcium and phosphorus in the body. Its principal action is that of promoting calcium and phosphorus deposition in the bones and teeth. Indirectly it would also influence the other functions of calcium in the body, such as the preservation of nervous stability, normal heart action and blood clotting. (Chapter VI.)

Physiology. Vitamin D, in its active form, is absorbed from the skin and gastro-intestinal tract into the blood stream. It is stored mainly in the liver where the body conserves its supply carefully.

Deficiency States

Rickets

Rickets, a disease occurring during growth, is most common in infancy and early childhood. In this disease there is imperfect calcification of the skeletal structures of the body,

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Rickets with bony deformity results from vitamin D deficiency.

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the bones and teeth. The main defect in rickets is in the growing parts of the bones. The calcium phosphate is not laid down in the cartilaginous matrix with the result that this tissue remains soft. These defects are particularly pronounced in the epiphyses of the long bones.

Three factors are involved in the prevention of rickets—calcium, phosphorus and vitamin D. If calcium and phosphorus are supplied in adequate amounts only small amounts of vitamin D are needed. However, if calcium and phosphorus are supplied in minimum amounts osteomalacia may result. If there is a lack of phosphorus but an adequate amount of calcium in the diet, one type of rickets results, while if the reverse is true another form of rickets results. The amount of vitamin D supplied will influence the severity of the disease in either case.

In rickets the skeletal changes occur first but may not be detected immediately, particularly if the infant continues to gain weight. However, sweating, irritability and muscular weakness are among the early symptoms of a severe deficiency. The skeletal defects occur as soft fragile bones, enlargement of the skull due to delayed closure of the skull bones, deformity of the chest, and enlargement of the joints at the knees, wrists and ankles. Poor teeth and caries may result also. The bony deformities may persist throughout life if the deficiency is not treated soon enough. Thus bowlegs, knock knees, flat feet, scoliosis and other skeletal deformities may indicate that rickets was present in early childhood.

Osteomalacia

This deficiency state occurs mainly in adults. In fact it is often called adult rickets. The disease is due to the fact that calcification of the bones is retarded in relation to the rest of the body process, due to a lack of vitamin D or available calcium. In this disease there is general weakness, accompanied by rheumatic pains. The bones become soft and deformities of various types result. This state occurs most often in pregnant women and during severe malnutrition.

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Tetany

Tetany may accompany either rickets or osteomalacia. It is due to the low blood calcium levels that may occur in either of these diseases (page 49). It is characterized by sharp flexion of the joints of the wrists and ankles, muscular twitching, convulsions, and cramps.

Dental Caries

A variety of causes for dental caries have been put forth by various investigators. Among the factors which have been shown to have an influence on tooth formation and integrity are ascorbic acid, vitamin A, the acid formation from carbohydrate by the microorganisms in the mouth, fluorine, vitamin D, calcium, and phosphorus. The exact way in which all of these factors influence dental caries is not known at the present time. Much research is being carried out to elucidate this problem and eventually this costly disease may be brought under control.

Measurement. The unit of measurement, I.U. or U.S.P. unit, for vitamin D is defined as the vitamin D activity of 0.025 microgram of calciferol (crystalline vitamin D_2).

Daily Allowance. It is difficult to evaluate the allowance of vitamin D for human nutrition. Under ordinary circumstances the requirement for adults is small and is met by the supply in the diet and by the sunshine. Because of the many factors influencing the amount of vitamin D available it is felt that in growth and in pregnancy and lactation a known amount of vitamin D should be taken. The recommended daily allowance is given as 400 I.U. (Table 1).

Food Sources. Natural food sources of vitamin D are few. It is found in small amounts in egg yolk, liver, cream and butter, and in such fish as salmon, tuna and herring.

Foods may be fortified either by irradiation or by the addition of some type of concentrate. Milk is one of the best foods for this purpose. The standard vitamin D milk contains 400 I.U. per quart. Some other foods, such as cereals, have been irradiated, but milk is the most acceptable food for this fortification.

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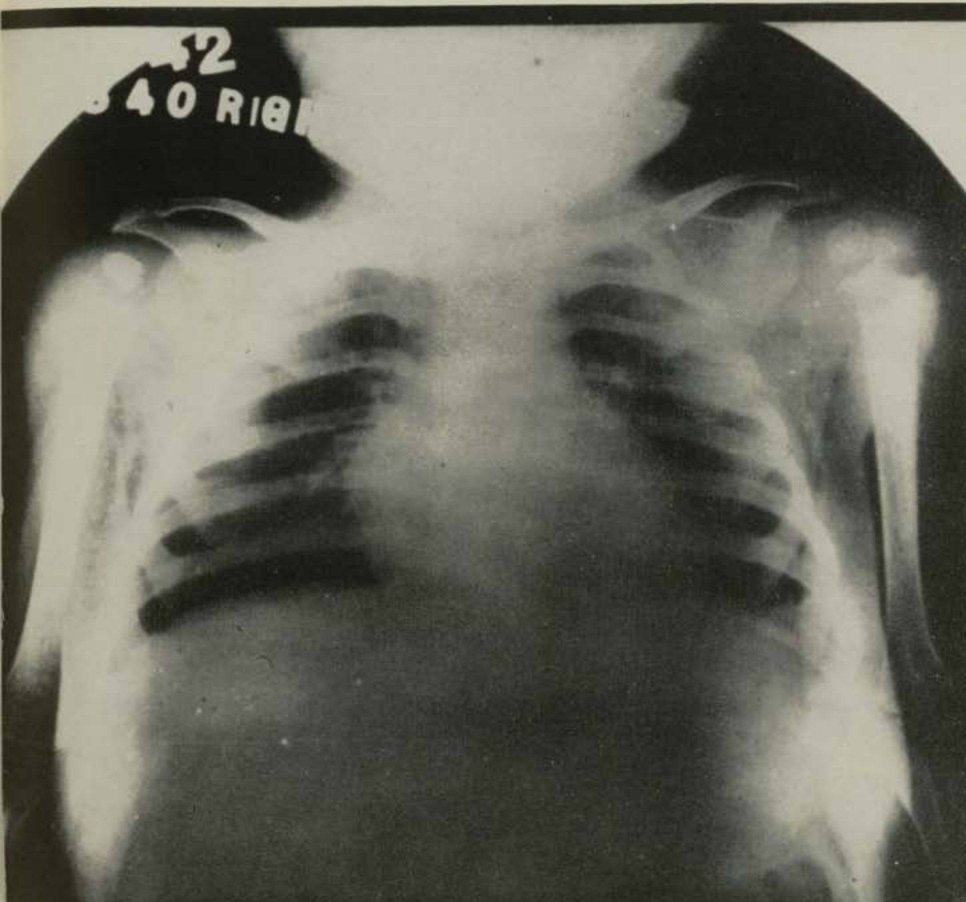

The roentgenogram shows the typical enlargement of the costochondral junctions. This enlargement is similar to that seen in rickets with the distinguishing exception that tenderness is present.

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Fish liver oils are the most concentrated source of the vitamin and are the form in which the vitamin is usually supplied when a supplement is indicated, such as for growing children and in pregnancy and lactation. The potency of the preparation and the amount per dose should be noted so that the proper amount will be administered.

Supplying the Daily Vitamin D Needs. When it is possible, sunshine is the obvious means of supplying vitamin D. Foods are a relatively unimportant source, except for vitamin D milk. When these sources do not meet the needs as already pointed out, one of the supplements is indicated.

The vitamin D that does occur in foods and in the fish liver oils is stable to a very high degree to heat, oxidation and storage.

The Vitamin B Complex

A large number of substances have been identified as belonging to this group of vitamins since the first observation of a factor that would prevent beriberi or polyneuritis was made years ago in the Orient. Continued investigations led to the discovery of many other factors described as belonging in this group through similarity in occurrence, some properties including the common one of solubility in water. More than 12 of these have been isolated and identified chemically.

Thiamine

Thiamine, the original B vitamin, has also been known as the antiberiberi or antineuritic vitamin. Its present name is more descriptive of its chemical nature since it contains both nitrogen and sulfur, as well as carbon, hydrogen and oxygen in its molecule.

Function. Thiamine is essential in one of the latter stages of carbohydrate metabolism, the breakdown of pyruvic acid. If there is an inadequate amount of thiamine in the diet pyruvic acid will accumulate in the body. The characteristic symptoms of severe thiamine deficiency are lack of appetite, edema, neuritic pains and abnormal reactions of the nervous systems.

Since thiamine in its role as an enzyme constituent is concerned with the metabolism of carbohydrate it is therefore

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indirectly concerned with the energy requirement of the body; its need by the body is proportional to the caloric intake, particularly the nonfat calories.

Thiamine is necessary for normal growth, normal structure and function of nervous tissue, normal tone and motility of the gastrointestinal tract, as an aid to normal digestive function and for normal heart action.

Physiology. Thiamine is absorbed into the body, through the small intestine and is immediately available for use. It is not stored to any appreciable extent. Excretion occurs in the urine, in perspiration and in the feces. Thiamine can be synthesized in the gastrointestinal tract of man and animals by bacterial action.

Deficiency State

Mild Deficiency

Early chronic mild thiamine deficiency is manifested by disturbances in sensations of the feet, legs and finger tips and by muscular fatigue. These conditions are associated with irritability, mental depression and lack of appetite and seem to be due to the metabolic changes resulting from a lack of thiamine.

As the deficiency proceeds the nervous system and the heart become involved, which results in the deficiency state, characteristic of a thiamine deficiency, called beriberi or polyneuritis.

Beriberi

There are two types of this disease, the dry and the wet forms. In the dry type there is extreme emaciation, while edema characterizes the wet type. Both types have other manifestations in common. There are circulatory changes which include enlargement of the heart, exaggerated heart sounds, a rapid heart beat and finally cardiac failure.

Nerve degeneration occurs, resulting in many sensory and motor changes in all parts of the body depending upon the degree of deficiency. The lower limbs are affected first. Gastrointestinal disturbances seen in thiamine deficiency are a result of nerve degeneration also.

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Measurement. Now that the chemical composition of thiamine is known and the pure chemical compound is available as a standard of reference, values are expressed in terms of weight, usually micrograms or milligrams.

Daily Allowance. The requirement for thiamine varies with the energy expenditure particularly in relation to energy derived from the metabolism of carbohydrate. The requirement is also increased during periods of growth, pregnancy and lactation. The allowance for the moderately active adult is given as between 1.2 and 1.5 milligrams or approximately 0.048 milligram per 100 calories of the diet (Table 1).

Food Sources. Important food sources of thiamine include: lean meats, especially lean pork and liver; whole grain cereals; legumes; glandular meats; nuts; egg yolk; milk; and some fruits. Thiamine does not occur in large proportion in any of these foods, except pork, and to a lesser extent liver. The contribution of each food therefore is important to meet the total daily needs.

In the milling process much of the thiamine of the grain is lost since it is present in the germ and bran and these are the parts discarded. With bread and other products made from this "refined" flour making up a large part of the diet it is difficult to make a daily selection of foods that will insure an adequate intake of thiamine. Dietary studies show that the average mixed diet tends to be low in thiamine. These and similar findings relative to other nutrients lead to the promulgation of an enrichment program whereby certain nutrients, thiamine, riboflavin, niacin and iron in specified amounts may be added to flour or products made with flour such as bread. The carrying out of this program is now compulsory by law in many states.

Dry yeast and wheat germ, although potent sources of thiamine are not eaten extensively. Dry yeast may be incorporated in a number of foods, however, and may therefore be used as a more concentrated source of the vitamin. Baker's yeast is not a good source of the vitamin: first, because its content is low, and second, the live yeast makes what supply of thiamine is present less available to the body (10).

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Supplying the Daily Thiamine Needs

It will be observed that the thiamine value of the foods of the Basic Daily Dietary Pattern barely meets the thiamine needs of the moderately active adult and each food makes an important contribution to the total. The foods selected to make up the remaining caloric needs of the basic dietary pattern should contain sufficient thiamine to insure an entirely adequate intake.

THIAMINE VALUE OF THE FOODS OF THE BASIC DAILY DIETARY PATTERN

Food	*Amount*	*Thiamine mg.*
Milk	3 cups	0.30
Meat, fish or poultry	3 ounces	0.21
Additional protein*	1 serving	0.07
Egg	1	0.07
Fruit	2 servings	0.12
Vegetables	3 servings	0.21
Whole grain or enriched cereals	4 ounces	0.24
Butter or fortified margarine	3 teaspoons	—
	Total	1.22

* Includes either 1 egg, 1 ounce cheese or meat or ½ cup legumes.

Thiamine, since it is water soluble, is lost in cooking, if the cooking water is discarded. Alkali destroys thiamine readily, as does prolonged heating. Cooked cereals retain their thiamine content well, since cooking is at a lower temperature and the water is not discarded. Baking destroys about 15 per cent of the thiamine while the losses in roasting meat may be 40 per cent or more. Sulfite rapidly destroys thiamine, so that dried fruits become a very poor source of this vitamin.

Riboflavin

Riboflavin or vitamin B_2 is the second member of the B complex. The name "riboflavin" indicates its chemical configuration since it is a combination of the sugar ribose with a substance belonging to the group of compounds known as

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flavins. When it is dissolved in water it gives a characteristic yellow-green fluorescence.

Function. Riboflavin, like thiamine, is concerned with energy metabolism. Riboflavin is a component in enzyme systems that function as hydrogen carriers and therefore is important in tissue respiration.

Riboflavin is necessary for normal growth and development, for normal digestion, normal skin and for proper vision.

Physiology. The body does not store very large amounts of riboflavin, and excess amounts are excreted in the urine. What riboflavin is stored is retained tenaciously, however.

Deficiency State. The deficiency disease due to a lack of riboflavin has been called ariboflavinosis and is believed to be one of the more common of the deficiency states. It is characterized by a number of symptoms all of which, however, may be found in other vitamin deficiencies or in entirely unrelated conditions. Treatment with riboflavin and resultant cure of the manifestations is the best indication of whether the symptoms were due to a lack of riboflavin.

The symptoms which are usually attributed to a deficiency of riboflavin include cheilosis, a characteristic cracking and fissuring at the corners of the mouth; a glossitis or inflamed tongue which is magenta colored; a scaly rough skin around the nose and ears; and various eye changes. The eye changes include swelling of the lids and increase in corneal vascularization with accompanying burning, roughness, itching, and sensitivity to light.

Measurement. Riboflavin values are expressed as micrograms or milligrams.

Daily Allowance. The numerical value of the Recommended Daily Dietary Allowances for riboflavin is somewhat larger than for thiamine. The amounts given are 1.8 mg. for the adult man and 1.5 mg. for the adult woman. The need is greater during growth, pregnancy and lactation. (Table 1.)

Food Sources. The richest food sources of riboflavin are meats, especially liver; cheese; eggs; milk. Some nuts, several species of fish, green leafy vegetables and some fruits also contain significant amounts. The relative richness of milk in

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content of riboflavin is another reason for the daily use of this food. Riboflavin is also one of the ingredients added to flour and bread under the enrichment program.

Supplying the Daily Riboflavin Needs

Riboflavin is soluble in water but considerably less so than is thiamine. Precautions taken to protect against loss of thiamine will also help conserve riboflavin. Riboflavin is also destroyed in an alkaline medium but it is more resistant to

RIBOFLAVIN CONTENT OF THE FOODS OF BASIC DAILY DIETARY PATTERN

Food	*Amount*	*Riboflavin mg.*
Milk	3 cups	1.29
Meat, fish or poultry*	3 ounces	0.28
Additional protein †	1 serving	0.28
Egg	1	0.18
Vegetables	3 servings	0.25
Fruits	2 servings	0.08
Whole grain or enriched cereal or bread	4 ounces	0.16
Butter or fortified margarine	½ ounce	—
	Total	2.52

* Includes liver once a week.
† Includes either 1 egg, 1 ounce cheese or meat or ½ cup legumes.

heat and oxidation than is thiamine. The losses in meat preparation are negligible.

Riboflavin is readily destroyed by light and the losses by this means are much greater than in the cooking processes. Since milk is such a valuable source of riboflavin it is important that the losses from exposure to light, such as can occur by allowing the milk to stand out on the porch after it is delivered, are to be avoided.

Niacin

Niacin, or nicotinic acid, has been shown to be one of the important factors in the prevention of pellagra, a deficiency disease not uncommon in the southern part of this country.

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Vitamin A Malnutrition
Xerosis and Folliculosis of Skin

Riboflavin and Vitamin A Malnutrition
Circumcorneal Injection

Riboflavin and Other B-Complex Deficiencies
Angular Stomatitis

Riboflavin and Vitamin A Malnutrition
Conjunctival Follicular Hypertrophy

Thiamine Deficiency
Advanced Polyneuropathy

Riboflavin Malnutrition
Advanced Dyssebacia of Naso-labial Folds

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Vitamin C Deficiency
Increased Capillary Fragility

Skin Lesions of Pellagra
Erythematous Dermatitis

Vitamin C Deficiency
Moderately Advanced Acute Scorbutic Gums

Skin Lesions of Pellagra
Hyperkeratotic Dermatitis

Vitamin C Deficiency
Advanced Chronic Gingivitis

Skin Lesions of Pellagra
Scarlet Glossitis and Angular Fissures in a Pellagrin

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Nicotinic acid has been known for some time but its role in nutrition is a comparatively recent discovery.

Function. Niacin functions in a manner similar to thiamine and riboflavin as a constituent of respiratory enzymes in energy release from carbohydrates.

Physiology. The manner and the amount of niacin stored in the body is not well known, although it is probably stored in the liver. The amino acid tryptophan has recently been found to be necessary for the formation of niacin by the body. Niacin is excreted in the urine through a variety of metabolic end products. Bacterial synthesis of the vitamin may occur in the gastrointestinal tract.

Deficiency State. An inadequate intake of niacin results in fatigue, a dermatitis or skin lesions, loss of muscular efficiency, and various gastrointestinal and nervous disturbances. Pellagra is the term for severe manifestations of these effects.

Pellagra

Although this disease at one time was ascribed to the use of a diet low in niacin recent evidence seems to indicate that more than one factor may be involved.

The characteristic symptoms are due to changes in the epidermis leading to dilation of the capillaries. The resulting dermatitis is most noticeable on exposed surfaces such as the backs of the hands and tops of the feet which first become rough and red and finally the skin may erode. Similar changes occur in the other epidermal surfaces such as in the mouth, the tongue and digestive tract. The tongue may become smooth and shiny and vary in hue from fiery red to magenta.

The nervous symptoms of pellagra include depression, loss of memory, clouding of consciousness, disorientation and delusions. Degeneration of the peripheral nerves and of the spinal cord occurs in late stages of the deficiency.

An anemia, similar to that in pernicious anemia, is present. Nausea, vomiting, and severe diarrhea are other common symptoms of this disease.

Measurement. Niacin values are usually expressed in milligrams.

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Daily Allowance. Because of the many factors that are involved in the metabolism of niacin its requirement is not accurately known at the present time. Since it is concerned with energy metabolism as is thiamine, the requirement will increase with energy expenditure. The daily allowance for the moderately active woman has been set at 12 milligrams per day or 0.48 milligram per 100 calories of the diet. The requirement is greater during pregnancy, lactation and growth (Table 1).

Food Sources. The important sources of niacin are meats, fish, cereals, nuts and legumes. Peanuts are exceptionally rich and some fruits and vegetables contain large amounts. Milk and eggs supply small amounts.

Supplying the Daily Niacin Needs

In selecting foods to meet the requirement for niacin it is well to include some that are also high energy foods since

NIACIN CONTENT OF THE FOODS OF THE BASIC DAILY DIETARY PATTERN

Food	*Amount*	*Niacin mg.*
Milk	3 cups	0.9
Meat, fish or poultry	3 ounces	4.7
Additional protein*	1 serving	0.6
Egg	1	—
Vegetables	3 servings	2.4
Fruits	2 servings	0.6
Whole grain or enriched cereals	4 ounces	2.4
Butter or fortified margarine	½ ounce	—
	Total	11.6†

* Includes either 1 egg, 1 ounce of cheese or meat or ½ cup legumes.

† The tryptophan content of the diet plus the niacin content will meet the niacin allowance.

this helps give the needed balance between niacin intake and caloric intake.

Niacin is water soluble so that the same precautions in this respect should be observed in the preservation of this nutrient in foods as was suggested for thiamine and riboflavin. Niacin

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is quite resistant to heat and oxidation so that little loss is incurred by this means.

Ascorbic Acid

The importance of this vitamin in nutrition was known long before the vitamin itself was discovered. It was shown that such fruits as limes and other citrus fruits and certain vegetables contained some substance that would prevent the disease of scurvy. The substance in these foods responsible for this effect was designated as vitamin C. After isolation and identification it was given the name ascorbic acid.

Function. The primary function of ascorbic acid is to aid in the formation and maintenance of an intercellular cement-like substance necessary for holding the cells of the body together. It is therefore an important factor in the normal development and maintenance of the tissues of the body, particularly of the blood vessels, bones, cartilage and other connective tissues, teeth and gums.

Ascorbic acid appears also to function in certain metabolic processes. It is necessary for normal growth. It is believed to function in preventing bacterial infections. A number of diseases such as tuberculosis, rheumatic fever and pneumonia seem to give rise to an increased need for this vitamin. Healing of wounds is hastened by vitamin C therapy.

Physiology. The body apparently has the ability to store only small amounts of vitamin C. It is found mostly in the glandular tissues. The body is said to be "saturated" when these and the other tissues which hold lesser amounts have their full quota. This is probably the desirable state in which the body should be maintained for good health. Excesses of ascorbic acid are readily excreted in the urine, but it is as readily retained when needed.

Deficiency State

Mild Deficiency

The symptoms of a mild ascorbic acid deficiency consist of spongy gums, vague pains in the extremities and pallor and weakness. This mild chronic deficiency state is more common

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than is generally appreciated. Often a determination of the amount of ascorbic acid in the blood, or load tests, are used to diagnose the hypovitaminosis, especially when the symptoms are mild.

Scurvy

The severe manifestations of ascorbic acid deficiency are denoted by the term scurvy. This is one of the oldest known of the deficiency diseases. Frank scurvy is relatively rare now but it is sometimes found in infants and secondary to certain diseases.

The prolonged use of a diet low in ascorbic acid results in scurvy as manifested by weakness, fragility and poor formation of bones, teeth and the capillaries. There is a ready tendency to hemorrhage in gums and joints and in the subcutaneous tissues from even slight bruising. An anemia develops due to the effects on the blood forming cells of the bone marrow. There is a retarded growth and a lowered resistance to infections.

Measurement. Chemically pure ascorbic acid is readily available for purposes of comparison in making quantitative measurements of the vitamin. Values are usually expressed in milligrams.

Daily Allowance. The requirement for ascorbic acid is proportional to the amount of the body tissue and therefore increases with an increase in size, with growth, pregnancy and lactation. The Recommended Daily Dietary Allowance for the adult man is given as 75 mg. and for the adult woman as 70 mg.

Food Sources. Vitamin C occurs in highest concentration in fresh foods. This vitamin is easily destroyed by oxidation and immediately a food is taken from the plant or animal that produced it the vitamin C content begins to decrease. Preservation is best in those foods, such as fruits, having a natural protective coating. Food sources of vitamin C considered the most reliable are the citrus fruits—oranges, grapefruit and lemons. Most berries are good sources and many of these are available when the citrus fruits are not so plentiful. Tomatoes

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Infant in scorbutic position. This position with semiflexion of thighs and legs and outward rotation of the hip is typical of scurvy in infants. The position is assumed because of pain which is the most frequent symptom in infants.

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and the green leafy vegetables such as beet greens and the Brassicas—mustard greens, turnip greens, cabbage, collards, kale and broccoli—are all excellent sources when prepared so as to conserve the vitamin. Fresh green peppers are an excellent source. Potatoes may supply significant amounts when they are properly cooked and make up a substantial part of the daily diet. Tomatoes and the citrus fruits, because of their high acidity, retain vitamin C well during canning and subsequent storage so that the vitamin C content of these foods canned is only slightly less than that of the fresh foods.

Supplying the Daily Ascorbic Acid Needs

The importance of the citrus fruits and the raw, green vegetables in the Basic Daily Dietary Pattern is obvious. The other foods contribute little if any vitamin C.

ASCORBIC ACID CONTENT OF THE FOODS OF THE BASIC DAILY DIETARY PATTERN

Food	*Amount*	*Ascorbic acid mg.*
Milk	3 cups	6
Meat, fish or poultry	3 ounces	2
Additional protein*	1 serving	—
Egg	1	—
Fruit		
1 citrus	1 serving	42
1 other	1 serving	5
Vegetables		
1 green or yellow	1 serving	23
1 other	1 serving	5
1 potato		12
Whole grain cereal	4 ounces	—
Butter or fortified margarine	½ ounce	—
	Total	95

* Includes either 1 egg, 1 ounce cheese or meat or ½ cup legumes.

Ascorbic acid is water soluble and losses during preparation of foods by boiling or steaming are largely due to solubility of the vitamin in the water.

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Ascorbic acid is readily oxidized and losses in foods from oxidation may be large unless precautions are taken. Foods counted on for vitamin C should not be exposed to air any longer than is absolutely necessary. Foods should be cooked only long enough to render them edible and should be served as soon as possible after they are cooked.

Vitamin C is more stable, that is less easily destroyed, in an acid medium than in one that is neutral or alkaline. This accounts for the greater stability of the vitamin in the citrus fruits and tomatoes. Orange juice may be kept in an open container in the refrigerator several days without appreciable loss of vitamin C content.

Exposure to room temperatures, drying and wilting of fruits and vegetables are all factors which increase the loss of the vitamin. None is lost in freezing and little on canning when the procedure is properly performed.

Other Vitamins

The vitamins which have been discussed so far are those for which Recommended Daily Dietary Allowances have been set by the Food and Nutrition Committee of the National Research Council. There are other vitamins which are necessary for the proper growth and functioning of the body. It is generally considered that if the diet is adequate in other respects the need for these nutrients will be adequately met as far as the present knowledge of these vitamins is concerned. For some, their nutritional significance and requirement is not yet known and further investigations will be necessary before their proper place in the diet can be evaluated.

The function and characteristics of some of these vitamins as well as those already discussed are given in Table 4.

Interrelationship of the Vitamins

One of the striking things that has been observed as the investigation of the vitamins has proceeded is their very great interdependence upon one another and upon other nutrients of the diet. Thus we have observed that each of the three members of the B complex is related to stages of carbohydrate and protein metabolism; that a precursor of niacin is the

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amino acid tryptophan; and that vitamin D, calcium and phosphorus function together. There are many other such relationships. For example, vitamin A and ascorbic acid have been shown to be interdependent, and various members of the B complex, such as pyridoxine, are essential in protein metabolism.

The science of nutrition is indeed a complex and growing science. There is much yet to be learned about the functions and interrelationships of the various nutrients as well as the amounts needed for good nutrition and optimum health. The functions of many of these factors already recognized are not well understood and there may be still other vitamins yet to be discovered. Further information is needed also on the occurrence of these factors in food and on the changes that take place during food preparation. This is still a very fertile field of investigation.

Treatment of the Vitamin Deficiency Diseases

In treating the vitamin deficiencies the cause of the deficiency must first be determined. Thus if the deficiency is due to an inadequate diet, this must be corrected by making adequate foods available and by teaching the patient the foods essential for good nutrition. If the deficiency is secondary to some other disease, this disease will have to be treated as well. Thus colitis and other diseases interfering with absorption in the gastrointestinal tract, hyperthyroidism, fever, surgical procedures and other conditions of stress or injury may precipitate a deficiency state, especially if the previous state of nutrition of the individual has been poor.

The essential treatment in such instances is to give therapeutic amounts of the vitamins concerned. This will be determined by the physician.

An entirely adequate diet should accompany the vitamin therapy. The practice of using a so-called high-vitamin diet is not warranted in treating a person with a deficiency state. It is difficult and often impractical to get such people to eat enough of the foods concerned to furnish therapeutic amounts of the necessary vitamins. Once the deficiency state is overcome, the normal diet should continue to serve as a

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TABLE 4

Summary of the Vitamins

Name	Characteristics	Function	Result of a deficiency in the diet: Symptoms	Result of a deficiency in the diet: Pathological state	Food source	Recommended daily allowance by National Research Council
Vitamin A	Fat-soluble Stable to heat Gradually destroyed by oxidation and drying Stored in liver Absorption interfered with by mineral oil	Normal growth Maintains normal epithelial tissues Functions in regeneration of visual purple	Rough, dry skin Decreased resistance to infection Stunted growth Night blindness Lack of visual acuity Defective dentine formation	Xerophthalmia	Fish liver oils Liver Egg yolk Milk Butter Whole milk cheese Fortified margarine Provitamin: Green and yellow vegetables Yellow fruits Tomatoes	Adult 5000 I.U. Pregnancy 6000 I.U. Lactation 8000 I.U. Childhood 1500–6000 I.U. according to age and size
Vitamin D or calciferol	Fat-soluble Stable to heat and oxidation Stored in liver	Regulates absorption and utilization of calcium and phosphorus	Soft bones Bowed legs and skeletal deformities Poor teeth Poor posture	Rickets	Fish liver oils Irradiated foods Activated sterols Butter Egg yolk Liver Some fish	Children and adolescents 400–800 I.U. Pregnancy and lactation 400–800 I.U.

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Ascorbic acid or Vitamin C	Water-soluble Oxidized easily More stable in acid than in neutral or alkaline medium	Formation and maintenance of intracellular cementing material	Subcutaneous hemorrhage Sore and bleeding gums Sore mouth Stiff joints Anemia Improper bone and cartilage development Susceptibility to infections	Scurvy	Citrus fruits Berries and other fresh fruits Tomatoes Green leafy vegetables raw or lightly cooked Potatoes	Adult male 75 mg. Adult female 70 mg. Pregnancy 100 mg. Lactation 150 mg. Children 30–100 mg. according to age
Thiamine	Water-soluble Unstable to heat, oxidation and in presence of sulfites Stable in dry form	Carbohydrate metabolism Normal growth Nerve stability Normal gastro-intestinal tone and motility	Poor appetite Fatigue Constipation Nervous irritability Edema Poor gastro-intestinal tone	Beriberi or Polyneuritis	Pork Brewer's yeast Wheat germ Liver and other organ meats Peanuts Legumes Whole grain and enriched cereals	Moderately active adult Male 1.5 mg. Female 1.2 mg.
Riboflavin	Water-soluble Destroyed by light Stable to heat, oxidation and acid	Carbohydrate metabolism Normal skin and eyes	Fissures at corner of mouth Glossitis Scaly skin Ocular changes	Ariboflavinosis	Milk Liver Brewer's yeast Eggs Enriched cereal grains Meats Cheddar cheese Legumes	Moderately active adult Male 1.8 mg. Female 1.5 mg. Pregnancy 2.5 mg. Lactation 3.0 mg. Children 0.6–2.5 mg. according to age

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TABLE 4 (Continued)

Name	Characteristics	Function	Result of a deficiency in the diet		Food source	Recommended daily allowance by National Research Council
			Symptoms	Pathological state		
Niacin	Water-soluble Stable to heat and oxidation	Carbohydrate and protein metabolism	Fatigue Dermatitis Sore mouth Gastro-intestinal disturbances Nervous disturbances	Pellagra	Liver Meat Fish Brewer's yeast Peanuts Legumes Enriched cereal grains Some fruits	Moderately active adult Male 15 mg. Female 12 mg. Pregnancy 15 mg. Lactation 15 mg. Children 4–17 mg. according to age
Vitamin E or alpha tocopherol	Fat-soluble Stable to heat and light Destroyed by rancidity	Normal reproduction in animals	Sterility in male rats Resorption of fetus in females Muscular dystrophy in rats	Sterility in animals	Wheat germ oil Some vegetable oils Green leafy vegetables Egg yolk	Not given

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Vitamin K or menadione	Fat-soluble Easily destroyed by alkali and light	Formation of prothrombin	Delayed clotting time of blood Hemorrhagic disease in newborn	Hypoprothrombinemia	Green leafy vegetables Pork liver	Not given
Pantothenic acid	Water-soluble Unstable to heat and in alkaline medium	Cell metabolism	Chick: dermatitis around eyes, beak and toes Rough feathers Nervous lesions Rats: Stunted growth Gray fur	Dermatitis Achromotrichia (rats)	Liver Brewer's yeast Molasses Egg yolk Milk Widespread in all foods in small amounts	Not given
Pyridoxine	Water-soluble Relatively stable to heat, oxidation, in alkaline and acid medium Destroyed by light	Probably in cell metabolism, particularly fat and protein metabolism	Rats: Failure of growth Edema Skin lesions of paws, mouth, tail, ears and nose Muscle and nerve degeneration	Acrodynia in rats Microcytic anemia in dogs	Brewer's yeast Meat Fish Legumes Milk Seeds, grains Molasses	None given

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TABLE 4 (Continued)

Name	Characteristics	Function	Result of a deficiency in the diet		Food source	Recommended daily allowance by National Research Council
			Symptoms	Pathological state		
Biotin	Water-soluble Stable to heat, and in acid and alkaline medium Destroyed by oxidation Not destroyed by light	Cell metabolism	Loss of weight Emaciation Pallor Scaly skin Fatigue Anorexia Cardiac disturbances	Dermatitis in rats	Liver Milk Kidney Meats Brewer's yeast Egg yolk Nuts Vegetables	None given
Choline	Water-soluble Hygroscopic Destroyed by alkali	Production of phospholipids and formation of methionine Utilization of fatty acids	Excess fat deposit in liver Abnormal fat metabolism Kidney hemorrhage	Fatty liver Perosis (chick)	Meats Eggs Milk Cereals	None given

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Folic acid (Folacin)	Sparingly water-soluble Destroyed by light, oxidation, acids, alkali and heat	Production of red blood cells		Liver Kidney Yeast Fresh green leafy vegetables Dry wheat cereals Beef, veal Salmon	None given
Inositol	Stable in acid and alkaline solutions	Enhances lipotropic action of choline	Rats: Lack of growth Spectacled eyes Poor lactation	Muscle meat Liver Brain	None given
Para-amino benzoic acid	Slightly soluble in water and alcohol	Unknown	Animals: Loss of color of hair Minimizes lack of growth	Liver Yeast	None given
Vitamin B_{12}	Contains cobalt	Blood regeneration "Extrinsic factor"		Liver Kidney Eggs Meat Milk	None given

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source of all the necessary nutrients. It is essential that the patient understand the need for maintaining adequate nutrition and know the foods that should be eaten in order to prevent any recurrence of such a deficiency. Education will be an important part of the patient's treatment.

Questions and Problems

1. What is a vitamin? Approximately how many are there? Of these which ones are listed in the Recommended Daily Dietary Allowances? Why are not all of them included?
2. What functions does vitamin A serve in the body? What will occur if there is a lack of vitamin A in the diet of humans?
3. What is a precursor or provitamin? What is the precursor of vitamin A?
4. Where is vitamin A stored in the body?
5. What is rickets? When does it occur? How may it be prevented?
6. What is meant by the term activated? Fortification?
7. How is the vitamin D requirement best met? What is the recommendation for meeting the vitamin D requirement in growth and pregnancy and lactation?
8. For which members of the vitamin B complex have dietary standards been set in the Recommended Daily Dietary Allowances?
9. In what way does thiamine function in the body? What happens when there is an insufficient amount of thiamine in the diet?
10. What properties of thiamine are important factors to be considered in the preparation of foods that contain this vitamin? Riboflavin?
11. What is ariboflavinosis? What are the characteristics of this condition?
12. What is the function of riboflavin in the body?
13. What results if there is an inadequate niacin intake in the diet of humans? How does niacin function in the body?
14. How is ascorbic acid effective in the prevention of scurvy?
15. What are the functions of vitamin E? Vitamin K? Folic acid? Pyridoxine? Biotin?
16. A patient has asked you what foods she should eat to be sure she is getting enough vitamins. List at least 5 good food

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sources for each of the vitamins that you could suggest to her.

17. Broiled liver has been served on the menu. What are all the specific nutrients supplied by this food?
18. What vitamins, if any, are furnished by each of the food groups in the Basic Daily Dietary Pattern?

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Chapter VIII

WATER AND CELLULOSE

Water

The substance occurring in largest amount in the body is water which makes up over two-thirds of the total body weight. It is divided between the blood (5 per cent), the intracellular, or within the cell, water (50 per cent) and interstitial, or around the cell, water (15 per cent). The latter is the most variable of the three in quantity, and it is by changes in its amount that the other two are kept fairly constant.

Water serves a number of purposes in the body. A fluid medium is necessary for carrying on the chemical processes of the body. Beginning with digestion and ending with excretion a fluid medium is necessary. The digestive secretions provide for the solution and chemical breakdown of foods and for their transportation to the different organs and tissues. Water is then the means by which materials are carried throughout the tissues and by which the interchange of these materials takes place. The waste materials are held in solution and are then excreted through a fluid medium, the urine. The waste materials of the gastrointestinal tract require water for their proper elimination from the colon.

Water is necessary for the prevention of friction between the various moving parts of the body such as the joints, and

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the various organs, especially those of the abdominal cavity. Water is necessary for the control of body temperature for through its evaporation from the body surfaces cooling takes place.

Water is therefore the second most important nutrient to the body, oxygen being the first. Life will not proceed for a very long period of time if water is not provided. In a matter of three or four days death will result.

Water is provided to the body by three routes: (1) water as such, (2) the water contained in foods, (3) the water that results from the metabolism of food in the body.

The water contained in foods is a variable factor but all foods contain some water. Fruits and vegetables have the highest content, some having as much as 90 to 95 per cent. Milk is 87 per cent water, meats 40 to 75 per cent, and flour, crackers and cereals are from 5 to 15 per cent.

The water that results from metabolism depends upon the metabolic mixture. For the average mixed diet it will furnish 300 ml. daily. The amount of water formed on oxidation of the foodstuffs is (2):

100 grams of fat yield	107.1 grams water
100 grams of starch yield	55.1 grams water
100 grams of protein yield	41.3 grams water

Water Losses from the Body

Water is lost from the body by three routes: through the urine, the feces and evaporation from the surfaces of the body, the lungs and the skin. From 500 to 2000 milliliters are lost through the urine, 100 to 300 milliliters through the feces and approximately 1000 milliliters through evaporation daily.

Water Balance

As with most of the other nutrients there must be a balance of water intake and output if good health is to be maintained. A loss of 10 per cent of fluid from the body causes serious consequences, such as disturbances of the acid-base balance,

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a rise in body temperature and impairment of renal and cardiac function. Abnormal losses of water may occur from vomiting, as in pregnancy; from prolonged gastrointestinal disturbances; post-operatively; from diarrhea; from burns; from hemorrhage; from prolonged fevers; from excessive perspiration; from uncontrolled diabetes mellitus. It must also be remembered that salt is being lost when fluid is lost from the body and it must be replaced along with the fluid.

Supplying the Daily Fluid Needs

In order to insure an adequate water intake it is generally accepted that from 6 to 8 glasses should be taken each day either as water itself or as other beverages.

When there has been excessive loss of fluid the amount of intake must be increased accordingly. It may be necessary in the case of severe losses to resort to intravenous or subcutaneous routes in order to supply sufficient fluid. Normal saline or saline and glucose are used in such instances.

Cellulose

Cellulose belongs to the carbohydrate class of nutrients (Chapter III). Unlike most of the other members of this group it does not furnish energy to the body. It is a woody fibrous material which cannot be digested in the gastrointestinal tract. A small amount of disintegration of the cellulose may occur due to bacterial action in the intestinal tract but the digestive enzymes have no effect.

Cellulose is the structural part of all vegetables, fruits and grains. Indeed, it is the framework of all vegetable matter and is responsible for the characteristic shape and structure of all plants.

Function

A certain amount of bulk or residue is necessary for the proper functioning of the gastrointestinal tract. Peristalsis is brought about mainly by the presence of materials in the gastrointestinal tract. Since cellulose is not digested it will act as a stimulus to peristaltic movement. Thus it will aid in the

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movement of waste materials along the intestinal tract until they reach the colon and can be eliminated in a normal manner.

Besides the fact that cellulose cannot be digested and acts as a mechanical stimulus to peristalsis it has another property which is valuable in the elimination of waste. Cellulose absorbs water readily. Raw cellulose holds water more tenaciously than does cooked cellulose but in either case a considerable amount is retained. This hygroscopic effect of cellulose increases the bulk of the fecal mass and also keeps it moist so that it is more easily eliminated.

Supplying the Daily Cellulose Needs

Approximately 5 to 6 grams of cellulose are needed in the daily diet by most people for normal elimination. The Basic Dietary Pattern supplies approximately this amount.

Cellulose Content of the Foods of the Basic Daily Dietary Pattern

Food	*Amount*	*Cellulose gms.*
Milk	3 cups	—
Meat	3 ounces	—
Additional protein	1	—
Vegetable		
1 green or yellow	1 serving	1.0
1 other	1 serving	1.0
1 potato	1 serving	1.0
Fruit	2 servings	2.0
Whole grain cereal	1 ounce	0.5
Whole grain bread	3 ounces	0.9
Butter or fortified margarine	½ ounce	—
	Total	6.4

When there is not enough cellulose in the diet the gastrointestinal tract may become sluggish and atonic constipation results. If this continues for any length of time the health of an individual may be impaired. An added amount of cellulose

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in the diet in the form of fruits and vegetables and whole grain cereals may prove very helpful in such instances (page 220). On the other hand, the overuse of cellulose, such as is found in bran and other coarse foods, may prove equally harmful and cause undue irritation of the lower gastrointestinal tract, resulting in spastic constipation (page 214).

Questions and Problems

1. What functions does water serve in the body?
2. By what means does the body obtain water? By what routes is it lost from the body?
3. What is considered to be the average daily fluid intake for a normal adult?
4. What is cellulose? What is its function in the body?
5. What properties of cellulose are responsible for its value in the diet?
6. A doctor has ordered a high-cellulose diet for a patient? What foods will be used in the diet to increase the cellulose content?

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Chapter IX

PLANNING THE ADEQUATE DIET

IN THE PRECEDING CHAPTERS we have discussed the various food nutrients that must be included in the daily diet in order that the body be properly nourished. We have seen that there is a need for protein, fat, carbohydrate, minerals, vitamins, cellulose and water if there is to be good health.

Furthermore, it was observed that it takes a variety of foods to supply all of these nutrients. A Basic Daily Dietary Pattern outlined a varied selection of foods that provide all the essential nutrients in at least minimum amounts. Table 5 shows an overall basic daily dietary pattern for the selection of foods to give adequate amounts of all nutrients.

It is important to note the contribution that each of the food groups makes to the diet. For example, milk supplies protein, calcium, thiamine, riboflavin, vitamin A and phosphorus; vegetables supply mainly minerals, vitamins and cellulose. Table 6 shows the chief contribution other than calories made by each of the food groups of the Basic Dietary Pattern. All foods supply some calories. However, the value of a food is measured not by calories alone but by as many other nutrients besides calories as it supplies. In selecting foods it is important to keep this fact always in mind.

The Basic Daily Dietary Pattern is divided into the three meals for the day and such other foods should be added as

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TABLE 5

Nutritional Evaluation of Basic Daily Dietary Pattern*

Daily food intake	Quantity		Minerals		Vitamins					Foodstuffs			
	Wt.	App. measure	Ca	Fe	A	Ascorbic acid	Thiamine	Riboflavin	Niacin	Carbohydrate	Protein	Fat	Calories*
	gm.		gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.	gm.	gm.	
Milk[a]	720	3 cups	0.84	0.6	1230	6	0.30	1.29	0.9	36	25.5	28	480
Egg	50	1 medium	0.03	1.4	495	—	0.07	0.18	—	—	6.5	6	80
Meat, poultry or fish, cooked[c]	75[d]	3 oz. raw wt. E.P.	0.01	2.7	2105	2	0.21	0.28	4.7	1	17.0	11	160
Additional protein		1 serving[e]	0.06	1.0	500	—	0.07	0.28	0.6	3	7.0	5	100
Bread, whole-grain or enriched	90	3 slices	0.03	1.8	—	—	0.18	0.12	1.8	45	7.5	3	240
Cereal, whole-grain or enriched	20	½ cup	0.01	0.6	—	—	0.06	0.04	0.6	15	2.5	1	80
Potato, cooked	150	1 medium	0.02	1.1	52	12	0.12	0.05	1.5	29	3.0	—	130
Vegetable, green or yellow[f]	100	1 serving	0.10	1.4	4870	23	0.05	0.17	0.6	6	2.0	—	30
Vegetable, other[g]	100	1 serving	0.03	0.4	270	5	0.04	0.03	0.3	6	1.5	—	30
Fruit, citrus	100		0.02	0.4	180	42	0.07	0.03	0.2	11	1.0	—	50
Fruit, other[h]	100	1 serving	0.02	0.6	161	5	0.05	0.05	0.4	15	1.0	—	65
Butter, or fortified margarine	15	3 teas.	—	—	480	—	—	—	—	—	—	12	105
Total			1.17	12.0	10,243	95	1.22	2.52	11.7[i]	167	74.5	66	1550

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[a]Milk may be used as a beverage or combined with other foods, as in soups, cream sauces or desserts. Dry milk may be used as a dry ingredient in food preparation.

[b]Caloric values have been rounded off to the nearest 5.

[c]This evaluation is based on the use of 100 gm. liver, 250 gm. pork or ham, 150 gm. fish and 500 gm. beef, veal, lamb or fowl per 10-day period.

[d]Weight after cooking.

[e]1 serving additional protein average of 1 ounce of meat, 1 ounce of cheese, 1 egg. Calculations from "Food Composition Tables Revised," Donelson, E. G. and Leichsenring, J. M.: A Short Method for Dietary Analysis J. Am. Dietet. A. 21:440, 1945.

[f]The vegetables included in this group are asparagus, broccoli, carrots, green beans, peas, kale, yellow squash, pumpkin, spinach, turnip greens and other greens.

[g]The vegetables included in this group are tomato-fresh, canned or juice; vegetables commonly served raw, as celery, cucumber, lettuce and cabbage; and other cooked vegetables, as beets, eggplant, onions, rutabagas and cauliflower.

[h]All fruits except citrus have been included in this average.

[i]The tryptophan content of the diet plus the niacin content will meet the niacin allowance.

* Adapted from Turner, D. Handbook of Diet Therapy, University of Chicago Press, Chicago, 1946.

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are necessary to furnish the required number of calories. A sample daily diet pattern and a typical menu adaptation is illustrative of how the Basic Dietary Pattern may be used in planning the day's meals.

DAILY DIET PATTERN	MENU ADAPTATION
Breakfast	*Breakfast*
*Fruit (citrus), 1 serving	Grapefruit juice
*Whole grain cereal, 1 serving with milk and sugar	Oatmeal with milk and sugar
*Egg, 1	Soft cooked egg
*Whole wheat or enriched bread, 1 serving	Whole wheat toast
*Butter or fortified margarine, 1 teaspoon	Margarine
Beverage	Coffee with cream and sugar
Luncheon	*Luncheon*
*Cheese, eggs, peanut butter, meat, fish or fowl, 1 serving	Peanut butter sandwich: whole wheat bread, margarine, peanut butter
*Vegetable (green or yellow) raw, 1 serving	Carrot sticks
*Fruit, 1 serving	Baked apple with milk
*Whole wheat or enriched bread, 1 serving	Milk
*Butter or fortified margarine, 1 teaspoon	
*Milk, 1 cup	
Dinner	*Dinner*
*Meat, fish or fowl, 4 ounces	Meat loaf
*Potato, 1 serving	Baked potatoes
*Vegetables, 1 serving	String beans
Dessert or fruit	Peach Betty with milk
*Whole wheat or enriched bread, 1 slice	Whole wheat bread
*Butter or fortified margarine, 1 teaspoon	Margarine
*Milk, 1 cup	Milk

* Foods included in the Basic Daily Dietary Pattern.

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TABLE 6

Chief Nutrients Contributed by Each of the Food Groups of the Basic Daily Dietary Pattern

Food group	Examples	Chief nutrients contributed
Milk	Whole milk Evaporated milk Buttermilk Dried milk powder Skimmed milk	Protein, calcium, riboflavin, thiamine, vitamin A, phosphorus (No vitamin A in skimmed milk)
Meat, fish or fowl	Beef, veal, pork, lamb, fowl, fish, liver, kidney, sweetbreads	Protein, iron, phosphorus, thiamine, riboflavin, niacin
Other protein foods	Cheese, eggs, milk	See milk and eggs
Eggs		Protein, iron, vitamin A, thiamine, riboflavin, phosphorus
Vegetables		Vitamins, minerals and cellulose in general
Green and yellow	Peas, asparagus, green beans, carrots, squash, pumpkins	Vitamin A
Green leafy	Spinach, kale, leaf lettuce, greens of turnips, beets, etc.	Vitamin A, ascorbic acid, riboflavin, iron
Potato	White and sweet	Thiamine, riboflavin, ascorbic acid, iron
Legumes	Navy beans, lima beans, split peas, lentils	Protein, thiamine, riboflavin, niacin, iron, calcium
Others	Celery, cauliflower, corn, beets, onions	Small amounts of minerals and vitamins
Fruits		Vitamins, minerals and cellulose in general
Citrus and tomato	Oranges, grapefruit, tangerines, lemons, limes, tomatoes	Ascorbic acid
Melons and berries	Honeydew, cantaloupe, strawberries, raspberries	Ascorbic acid
Dried	Prunes, apricots, raisins, peaches	Iron
Yellow	Apricots, peaches, cantaloupe	Vitamin A
Others	Apples, bananas, grapes, plums, pears, pineapple	Small amounts of minerals and vitamins

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TABLE 6 (Continued)

Food group	Examples	Chief nutrients contributed
Cereals Whole grain or enriched cereal	Whole wheat flour and breads, oatmeal, whole wheat cereals, rye breads, enriched breads and cereals, brown rice	Thiamine, riboflavin, niacin, iron, protein
Fats Butter or fortified margarine		Vitamin A

It should be apparent that many variations of the Basic Daily Dietary Pattern are possible. It may be altered to fit the eating habits of the family, which may be influenced by the hours of work of the members of the family, religious and national food customs, and other similar factors. The important point to be remembered is that each of the food groups should be represented in the proper amounts each day.

Questions and Problems

1. Keep track of your food intake for one day. Note all the nutrients supplied by each of the foods you have eaten. Have you included all the foods recommended in the Basic Daily Dietary Pattern for adequate nutrition?
2. Plan a day's menu for a family of four consisting of a mother age 30, a father age 32 and two children, a girl age 8 and a boy age 3. The father carries his lunch to work.
3. A person asks you to determine his caloric intake for one day. Does this show a nutritionally adequate diet or not? Why?
4. Make a table which includes the food groups of the Basic Dietary Pattern, the specific nutrients furnished by each food group, and the function of each of these nutrients in the body.

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Chapter X

FOOD ECONOMICS

THE IMPORTANCE of an adequate diet has been stressed repeatedly in the foregoing chapters. It is necessary to realize, however, that the cost of these foods is one of the most salient factors in determining whether or not an adequate diet is actually obtained.

Many families find that the expense for food for an adequate diet makes up such a large proportion of their budget that it is out of the question to have such a diet. It is essential to know therefore the most economical foods in the various food groups of the Basic Daily Dietary Pattern so that an adequate diet may be planned within the family budget.

Budgeting of Income

The first factor to be considered in planning food expenditures is the total family budget. It is wise to allot a specific amount, on the basis of total income, for the purchase of food and see to it that this amount is spent for that purpose. The proportion of income allotted will range from a very small percentage for families with large incomes to as much as 50 to 60 per cent or more for low income families, especially if the family is large. Too often the allotment for food, which makes up the largest part of the budget of the low-income family, is used for other purposes, with the result that pur-

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chases of food are inadequate. The family budget should be so planned that there is a reasonable distribution among food, clothing, shelter and other necessary expenses. When a family has difficulty in making these plans and is not able to meet adequately the family needs the advice of a nutritionist or home economist in a public health or welfare agency should be sought.

The Food Budget

After the amount of the total income to be spent for food has been determined then a plan of purchase should be made on the basis of the Basic Daily Dietary Pattern in order to give reasonable assurance of obtaining foods that will supply an adequate diet. These basic foods should be the first to be purchased and then as the family income allows other foods may be added or more expensive forms of the foods may be purchased.

This means that first of all the amounts of each of the basic groups of foods must be estimated. This will be determined by the size of the family. Table 7 shows the amounts of foods suggested to be purchased for one week for each member of the family at four different levels of income. From this table the total amounts of foods to be purchased may be figured for any family group.

Food Buying Within the Food Budget

After the total amount of foods needed has been determined it is important to make a wise use of the family money in buying these foods. Many factors may be listed which will influence the cost of the food purchases and the wise buyer will consider each in relationship to her particular situation.

1. Plan the menu for the family for several days at a time. This should allow for the use of left-overs and foods purchased so that there will be no waste.
2. Prepare a market list from this menu before going to market. The quantities of the foods needed should be given. Thus no item will be omitted and the proper quantities of

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TABLE 7

Weekly Quantities of Food (as Purchased) for 19 Age, Sex, and Activity Groups

A.—Master Food Plan at Low Cost.

Family members	Leafy, green and yellow vegetables	Citrus fruit, tomatoes	Potatoes, sweet-potatoes	Other vegetables and fruit	Milk[1]	Meat, poultry, fish	Eggs	Dry beans and peas, nuts	Flour, cereals[2]	Fats and oils[3]	Sugar, sirups, preserves
	Lb. Oz.	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Qt.*	*Lb. Oz.*	*No.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*
Children through 12 years:											
9–12 months	1 — 8	1 —12	0 — 8	1 — 0	6	0 — 4	5	0 — 1	0 —10	0 — 1	0 — 1
1–3 years	1 —12	1 —12	1 — 0	1 — 0	5½	[4]0 — 8	5	0 — 1	1 — 4	0 — 2	0 — 2
4–6 years	1 —12	1 —12	1 — 8	1 — 4	5½	1 — 0	5	0 — 2	1 —12	0 — 6	0 — 6
7–9 years	2 — 0	2 — 0	2 — 8	1 — 8	5½	1 — 8	5	0 — 4	2 — 4	0 — 8	0 —10
10–12 years	2 — 4	2 — 4	3 — 0	1 —12	6	1 —12	5	0 — 4	3 — 4	0 —12	0 —12
Girls:											
13–15 years	2 — 4	2 — 4	3 — 4	1 —12	6½	[4]2 — 0	5	0 — 4	3 — 8	0 —12	0 —12
16–20 years	2 — 4	2 — 4	3 — 0	1 —12	5	[4]2 — 0	5	0 — 4	3 — 4	0 —12	0 —10
Boys:											
13–15 years	2 — 8	2 — 8	4 — 0	2 — 4	6½	2 — 0	5	0 — 8	4 — 8	1 — 0	0 —14
16–20 years	2 —12	2 — 8	5 — 0	2 — 8	6½	2 — 0	5	0 — 8	5 —12	1 — 6	1 — 0
Women:											
Sedentary	2 — 4	2 — 0	2 — 4	1 —12	5	2 — 0	5	0 — 4	2 — 0	0 —10	0 —10
Moderately active	2 — 4	2 — 0	3 — 0	1 —12	5	2 — 0	5	0 — 4	3 — 4	0 —12	0 —12
Very active	2 — 8	2 — 8	4 — 0	2 — 0	5	2 — 0	5	0 — 6	4 — 4	1 — 0	1 — 0
Pregnant	3 — 0	2 — 8	2 — 8	2 — 0	7½	[4]2 — 4	7	0 — 4	2 — 8	0 —10	0 — 8
Nursing	3 — 8	3 —12	4 — 0	2 — 4	10½	[4]2 — 8	7	0 — 4	3 — 0	0 —10	0 — 8
60 years or over[4]	2 — 8	2 — 4	2 — 8	1 —12	5	2 — 0	4	0 — 2	2 — 4	0 — 8	0 — 8
Men:											
Sedentary	2 — 4	2 — 0	3 — 0	1 —12	5	2 — 0	5	0 — 4	3 — 4	0 —12	0 —12
Physically active	2 — 8	2 — 8	4 — 0	2 — 0	5	2 — 0	5	0 — 6	4 — 4	1 — 0	1 — 0
With heavy work	2 — 8	2 — 8	6 — 0	2 — 8	5	2 — 0	5	0 —10	7 —12	1 —14	1 — 0
60 years or over[4]	2 — 8	2 — 4	3 — 4	1 —12	5	2 — 0	4	0 — 2	3 — 4	0 —10	0 —10

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TABLE 7 (Continued)

B.—Master Food Plan at Moderate Cost.

Family members	Leafy, green and yellow vegetables	Citrus fruit, tomatoes	Potatoes, sweet-potatoes	Other vegetables and fruit	Milk[1]	Meat, poultry, fish	Eggs	Dry beans and peas, nuts	Flour, cereals[2]	Fats and oils[3]	Sugar, sirups, preserves
Children through 12 years:	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Qt.*	*Lb. Oz.*	*No.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*
9–12 months	1 — 8	1 —12	0 — 8	1 — 0	6	0 — 4	5	0 — 1	0 —10	0 — 0	1 — 1
1–3 years	2 — 0	2 — 0	0 — 8	1 —12	6	[4]0 —12	6	0 — 1	1 — 4	0 — 2	0 — 2
4–6 years	2 — 4	2 — 4	1 — 0	2 — 4	6	1 — 4	7	0 — 1	1 — 8	0 — 6	0 — 8
7–9 years	2 — 8	2 — 8	1 —12	2 — 8	6½	1 —12	7	0 — 2	2 — 0	0 — 8	0 —12
10–12 years	3 — 0	2 —12	2 — 4	2 — 8	7	2 — 4	7	0 — 2	2 —12	0 —12	0 —14
Girls:											
13–15 years	3 — 8	2 —12	2 — 8	3 — 8	7	[4]2 —12	7	0 — 2	2 —12	0 —14	0 —14
16–20 years	3 — 8	2 —12	2 — 8	3 — 8	6	[4]2 —12	7	0 — 2	2 — 8	0 —12	0 —14
Boys:											
13–15 years	3 — 8	3 — 0	3 — 8	3 — 8	7	3 — 0	7	0 — 4	4 — 0	1 — 2	1 — 2
16–20 years	4 — 0	3 — 8	4 — 8	3 — 8	7	3 — 4	7	0 — 6	5 — 4	1 — 6	1 — 4
Women:											
Sedentary	3 — 4	2 — 8	1 —12	3 — 4	5	2 — 8	7	0 — 1	1 —12	0 —10	0 —12
Moderately active	3 — 8	2 — 8	2 — 8	3 — 8	5	2 —12	7	0 — 2	2 — 8	0 —14	0 —14
Very active	3 —12	3 — 0	3 — 4	4 — 0	5	3 — 0	7	0 — 4	3 —12	1 — 2	1 — 2
Pregnant	4 — 0	3 — 8	2 — 4	3 — 0	7½	[4]3 — 0	7	0 — 2	2 — 4	0 —10	0 —10
Nursing	4 — 0	4 — 8	3 — 0	3 — 8	10½	[4]3 — 0	7	0 — 2	2 — 8	0 —12	0 —12
60 years or over[5]	3 — 8	2 —12	2 — 0	3 — 0	5½	2 — 8	6	0 — 1	1 —12	0 — 8	0 —10
Men:											
Sedentary	3 — 8	2 — 8	2 — 8	3 — 8	5	2 —12	7	0 — 2	2 — 8	0 —14	0 —14
Physically active	3 —12	3 — 0	3 — 4	4 — 0	5	3 — 0	7	0 — 4	3 —12	1 — 2	1 — 2
With heavy work	4 — 0	3 — 8	5 — 0	4 — 4	5	3 — 8	7	0 — 6	7 — 0	2 — 0	1 — 4
60 years or over[5]	3 — 8	2 —12	2 —12	3 — 0	5½	2 —12	6	0 — 2	2 — 8	0 —12	0 —12

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C.—Another Low-cost Food Plan (at Lower Cost than Plan A).

Family members	Leafy, green and yellow vegetables	Citrus fruit, tomatoes	Potatoes, sweet-potatoes	Other vegetables and fruit	Milk[1]	Meat, poultry, fish	Eggs	Dry beans and peas, nuts	Flour, cereals[2]	Fats and oils[3]	Sugar, sirups, preserves
Children through 12 years:	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Qt.*	*Lb. Oz.*	*No.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*	*Lb. Oz.*
9–12 months	1 — 8	1 —12	0 — 8	1 — 0	6	0 — 4	5	0 — 1	0 —10	0 — 1	0 — 1
1–3 years	1 — 8	1 — 4	1 — 8	0 — 8	5½	[4]0 — 6	4	0 — 1	1 — 8	0 — 2	0 — 2
4–6 years	1 — 8	1 — 8	2 — 0	0 —12	5½	0 — 8	3	0 — 4	2 — 4	0 — 6	0 — 4
7–9 years	1 —12	1 — 8	3 — 0	0 —12	5½	0 —12	3	0 — 6	3 — 0	0 — 8	0 — 8
10–12 years	2 — 0	1 — 8	3 — 8	1 — 4	6	1 — 0	3	0 — 8	3 — 8	0 —12	0 —12
Girls:											
13–15 years	2 — 0	1 —12	4 — 0	1 — 8	6½	[4]1 — 0	4	0 — 8	3 —12	0 —12	0 —12
16–20 years	2 — 0	1 —12	3 — 8	1 — 8	4½	[4]1 — 0	4	0 — 8	3 —12	0 —12	0 —12
Boys:											
13–15 years	2 — 0	2 — 0	4 — 4	1 — 8	6½	1 — 4	4	0 —12	4 —12	1 — 2	0 —14
16–20 years	2 — 4	2 — 0	5 — 8	1 — 8	6½	1 — 4	5	0 —14	6 — 0	1 — 6	1 — 0
Women:											
Sedentary	2 — 0	1 — 8	3 — 0	1 — 4	5	1 — 0	4	0 — 4	3 — 0	0 — 8	0 — 8
Moderately active	2 — 0	1 — 8	3 — 8	1 — 8	4½	1 — 0	4	0 — 8	3 —12	0 —12	0 —12
Very active	2 — 0	1 — 8	4 — 8	1 — 8	4½	1 — 0	4	0 —12	4 —12	1 — 0	0 —14
Pregnant	2 —12	2 — 0	3 — 0	1 — 8	7½	[4]1 — 4	5	0 — 6	3 — 0	0 — 8	0 — 8
Nursing	3 — 0	3 —12	4 — 4	1 — 8	10½	[4]1 — 8	5	0 — 6	3 — 8	0 —12	0 — 8
60 years or over[5]	2 — 0	1 —12	3 — 4	1 — 0	5	1 — 0	4	0 — 4	3 — 0	0 — 8	0 — 8
Men:											
Sedentary	2 — 0	1 — 8	3 — 8	1 — 8	4½	1 — 0	4	0 — 8	3 —12	0 —12	0 —12
Physically active	2 — 0	1 — 8	4 — 8	1 — 8	4½	1 — 4	4	0 —12	4 —12	1 — 0	0 —14
With heavy work	2 — 0	1 — 8	7 — 0	1 — 8	4½	1 — 4	5	1 — 0	7 —12	1 —14	1 — 4
60 years or over[5]	2 — 0	1 —12	4 — 0	1 — 4	5	1 — 0	4	0 — 6	3 —12	0 —10	0 —10

[1] Or its equivalent in cheese, evaporated milk, or dry milk.

[2] Count 1⅓ pounds of bread as 1 pound of flour. Use as much as possible in the form of whole-grain, enriched, or restored products.

[3] For small children and pregnant and nursing women, cod-liver oil or some other source of vitamin D is also needed. For elderly persons and for persons who have no opportunity for exposure to clear sunshine, a small amount of vitamin D is also desirable.

[4] To meet iron allowance, 1 large or 2 small servings of liver or other organ meats should be served each week.

[5] The nutritive content of the weekly food quantities for a man and woman 60 years or over were based on the National Research Council's recommended daily allowances for the sedentary man and woman.

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foods will be purchased. Unnecessary or too expensive foods will not be obtained inadvertently.

3. Select the market where the most economical purchases may be made. The cash and carry market is usually the best, since the operational expenses are the least in such a store.
4. Foods should be purchased on the basis of total food value per serving in relation to cost. This should always be estimated in making the decision of which food is the best buy. It means the careful reading of labels for the actual contents of the food package or can. Some economies in respect to specific food groups are listed below.
   a. Evaporated and dried milks are usually cheaper than fresh milk and may be substituted, at least in part, for fresh milk. Bottled milk is usually less expensive than container milk.
   b. Fresh vegetables, in season, are usually least expensive. Canned vegetables may be used when fresh vegetables are more expensive. The grade of canned vegetables should be considered in relationship to their use. Fresh vegetables which are wilted or have been stored for some time have lost much of their vitamin values.
   c. Meats should be selected carefully. The cost per serving of actual edible meat should be considered. Bony or fat meat is not necessarily a good purchase although it may be cheap. The food value of meat that takes a long time to cook is the same as that which takes a short time to cook, such as steaks or chops. The ready-cooked meats are usually expensive. Some fresh fish and frozen fish are quite inexpensive. Poultry is usually expensive.
   d. Cheese and eggs are inexpensive substitutes for meat and may be used frequently, especially on low-income budgets. Processed and imported cheeses are more expensive than the domestic varieties. The cost of eggs from a nutritional point of view is not determined by grade or the color of the shell. The eggs to be purchased should be determined by their use. Less expensive ones may be used in cooking than those used as such for eat-

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ing. High price "fresh" eggs are often less fresh than lower priced eggs where the turn-over is more rapid.

e. Fruits, like vegetables, are usually cheapest in season. Canned fruits at other times may be cheaper. The most economical sources of ascorbic acid are canned grapefruit juice, canned tomatoes and fresh tomatoes in season. Frozen fruits are usually expensive. The grade of canned fruit should be chosen to serve the purpose for which it is to be used. The standard grade of canned fruits is usually the most economical.

f. Whole grain cereals and enriched cereals have more food value than refined cereals. Prepared cereals are more expensive than home-cooked cereals. Day-old bread is cheaper than fresh bread. Fancy breads and rolls are usually considerably more expensive than their food value warrants. The same is true of cakes, cookies, doughnuts and other pastries.

g. Butter may be an expensive food; it is less expensive in tub or roll than as print butter. Fortified margarine is equal to butter nutritionally and costs less. Cream, bacon and olive oil are expensive food fats. Peanut butter is inexpensive and is also high in protein, fat and niacin.

5. Foods purchased in bulk are less expensive generally than packaged or container foods. Packaging and labeling greatly increase the cost.
6. Foods bought in quantities are less expensive, if there is adequate storage space and they are used before any spoilage can occur.

Care and Preparation of Food

After a food is purchased the full money value is obtained only if the food is stored and prepared so that the maximum nutritive value is retained. There is no point in spending time in buying foods unless care is given to the retention of nutritive value. The major properties of the vitamin content may be lost from foods if they are not properly stored. Cooking affects the content of nitrogen, soluble carbohydrate,

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minerals and vitamins. In the section on cookery these effects are discussed in detail as to quality, methods of storage and preparation so as to obtain the most nutrients from the foods.

The wise use then of the family food dollar is an important factor in adequate nutrition. The advice given to patients should emphasize economical food expenditures in order to obtain the best nutrition for the least cost.

Questions and Problems

1. What are the main divisions of expenditure in the family budget? What proportion of the total family budget is allotted to food expenditure?
2. From Table 7 determine the amount of milk, meat, vegetables and cereals that should be purchased each week by a family of four, mother age 35, father age 36 and two boys ages 8 and 14.
3. Determine the cost per unit of measure, i.e., ounces, pounds, pints, etc., of the following list of foods as obtained in a supermarket type of grocery and in a privately owned grocery or market. Make a table comparing the costs of the foods from the two different types of stores.

Fresh tomatoes	Whole wheat bread
Canned tomatoes	Pecan rolls
Dried peas	Evaporated milk
Frozen peas	Homogenized milk
Canned peas	Dried milk
Canned peaches	Ground beef
Frozen peaches	Sirloin steak
Oatmeal	Grade A medium eggs
Cornflakes	Grade B medium eggs

4. Mrs. White has been told she must have a high-protein diet. What would be the most economical means for her to increase the protein intake of her diet?
5. What are some general suggestions that can be given to a housewife so that she may decrease food expenditures?
6. Plan two dinner menus to supply equal nutritive value: one to be low cost and one to be expensive.

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7. If you were marketing for the following foods in what forms would you buy them in order to make the most economical purchases? Eggs, navy beans, milk, tomatoes, cereal, citrus fruit, cheese, beef.
8. What measures should be taken to retain the most nutrients in vegetables? Fruits?

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Chapter XI

NUTRITION EDUCATION

IN THE PRECEDING CHAPTERS the foundations of normal nutrition have been discussed. A Basic Dietary Pattern has been developed which shows foods for the day that will furnish the essential nutrients in amounts considered adequate for good nutrition. The influence of economic factors on securing such an adequate diet has been noted and suggestions have been made for the most economical buying of foods. In the section on cookery the means whereby the foods may be prepared so as to retain as much of their nutritive value as possible is discussed. Still another point must be considered and that is the dissemination of this valuable information to the people. It must be passed on so that as many as possible will benefit from better nutrition.

The importance of good nutrition to the health and welfare of the peoples of the world cannot be given too much emphasis. The world significance of nutrition is exemplified by the fact that the United Nations established the Food and Agriculture Organization known as FAO. FAO became an active body in 1945. It is the object of this organization to study the food situation in the various countries of the world and to make recommendations of what should be done to bring about better nutrition not only in individual countries but in the world in general. This is a large order but it cer-

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tainly indicates the importance of good nutrition and the need to see that the means for attaining it are made available to all.

In order to know what the nutrition situation is in various parts of the world surveys must be made. In these surveys a representative group, or groups, of the population is selected for study. Parallel determinations are made of food intake and of physical status as determined by certain body measurements and clinical manifestations. The information on physical status is intended to show what percentage of the group deviate from the considered norm and the extent of deviation. The data on food intake are studied to determine if possible wherein the dietary pattern may have been at fault. Surveys of this type are now much in vogue. However faulty such studies may be from their very nature those carried out in this country where food is presumed to be plentiful indicate that certain types of malnutrition may be widespread even after granting that some conclusions drawn from such studies have been a little extravagant (1,2).

It has been shown in numerous well-controlled experiments with animals as well as by observations on human subjects that increase in the intake of certain nutrients results in improvement in nutritional status as judged from increase in body stature, extension of the prime of life and delay in the onset of signs of old age. The long term feeding trials with rats made under the direction of Dr. H. C. Sherman at Columbia University have shown that an increase in the intake of one nutrient over and above that already determined to be adequate for normal good health has resulted in even better health and performance. This has led to the conception that our goal should be "optimum nutrition" and not merely "adequate nutrition." To further this aim the National Research Council Committee on Food and Nutrition set up the Recommended Daily Dietary Allowances (Table 1).

These Recommended Daily Dietary Allowances which have been used as a basis for the Basic Daily Dietary Pattern for adequate nutrition are designed to supply sufficient amounts of all the nutrients to meet the needs of the greatest numbers

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of our population. It is known that individuals vary in their requirements for the nutrients, so a margin of safety has been allowed for each nutrient in order to insure that the individuals with a high requirement will have adequate nutrition. These recommendations then are designed for large groups of the population. In some instances, when an individual's needs are measured in relationship to the Recommended Daily Dietary Allowances the allowances may appear too liberal or not liberal enough depending upon the individual and his metabolic needs, which in turn are influenced by many factors. It may be argued by some that it is wasteful to have too liberal allowances. Groups have been shown to subsist on food intakes considerably less than the Recommended Daily Dietary Allowances with apparently little or no dietary deficiencies, as for example England during World War II. On the other hand information from dietary surveys referred to above indicates that malnutrition may be more prevalent than is at present believed. In the light of our present knowledge and until much more is known about the nutritional requirements of people and the many factors involved it seems advisable to allow for a margin of safety and to aim for optimum nutrition.

This means that there is a great educational program to be carried out. Many people do not yet know the essentials of an adequate diet or how to obtain them. The benefits of nutrition education and other public health measures which have been attempted to date should encourage the expansion of these programs. Although the effect of these measures is difficult to evaluate some credit must be given to improved eating habits for the increased life span of the present generation and the generally improved health of large groups of people, particularly the school children and pregnant and lactating women.

Public health and welfare agencies have as one of their main programs nutrition education. Great impetus was given to these educational programs during World War II with the result that there was increased consumption of those foods considered most essential for good nutrition, as reported by

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the United States Department of Agriculture (3). However, these programs must be continuous if they are to be enduringly effective. Everyone interested in good health must continue to teach the importance of an adequate diet.

In connection with the spread of nutritional information a number of measures have been undertaken by the federal and local governments to aid in the improvement of the nutrition of large groups of people. One of the most important is the enrichment program which includes enrichment of margarine with vitamin A and enrichment of cereals and flours, including wheat, corn and rice, with thiamine, niacin, riboflavin and iron. The enrichment of these food products which are used so universally will aid materially in improving the nutritional status of many people. All states should be encouraged to adopt the use of these enriched products.

School lunch programs are another means of improving the nutrition of a large segment of our population. The serving to school children of a noon meal designed to supplement the home diet has been shown to be an effective measure in improving their health. This is especially true, of course, in low-income groups where the home diet is often quite inadequate. It is not without benefit to all school children, however, and this program must be expanded so that its benefits will extend to all children.

Role of the Nurse in Nutrition Education

The education of large groups of people in the fundamentals of an adequate diet is one of the essential phases of the work of the nurse. It is particularly important in the work of the public health nurse as she comes in contact with the families in the home. This offers her an opportunity not only to teach the fundamentals of an adequate diet but to aid the family in planning and in securing such a diet. She has an opportunity to teach mothers better nutrition during pregnancy and lactation which will mean healthier and stronger babies; she has an opportunity to teach children how to be better nourished and to remain strong and healthy; the adults

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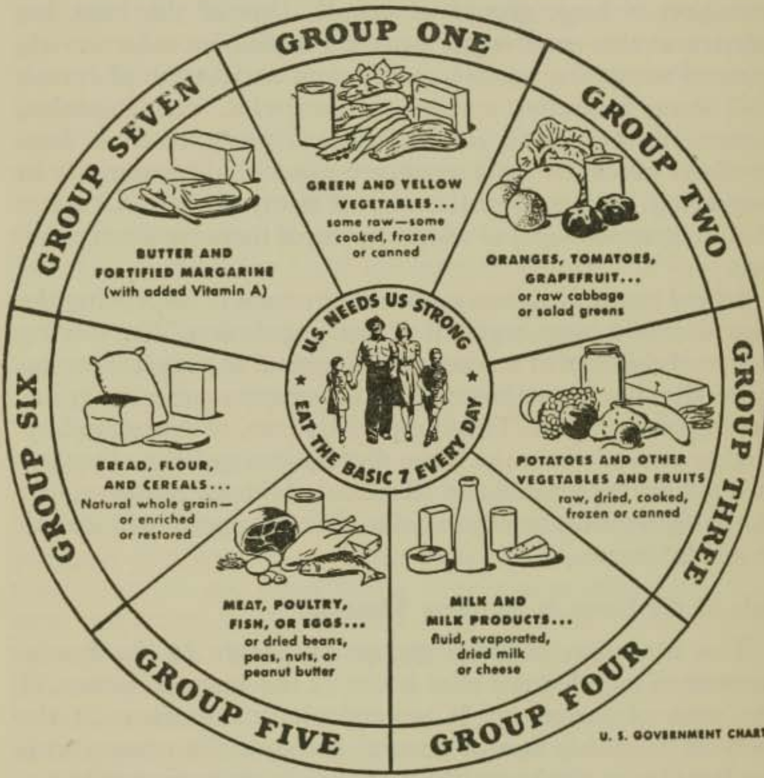
THE BASIC 7 FOODS PLAN

FOR HEALTH EAT SOME FOOD
FROM EACH GROUP EVERY DAY



U. S. GOVERNMENT CHART

IN ADDITION TO THE BASIC 7
EAT ANY OTHER FOODS YOU WANT

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of all ages can be influenced by her teachings, and all will benefit from better health. Optimum nutrition for as many as possible should be the objective of her teachings.

Tools for Teaching Nutrition

There are a number of tools that may be used to teach nutrition. The most essential of these is the nurse's own knowledge and her beliefs in the importance of this subject. She must have a fundamental knowledge of nutrition so that she can teach facts that are based on scientific information, and she must have a conviction of the importance of good nutrition so that her teachings will be put into practice. She must practice these teachings herself, thus setting the example.

A second tool that the nurse may use to teach nutrition is the Basic Daily Dietary Pattern which has been used throughout these chapters as the foundation of the adequate diet. This dietary pattern has been planned on the Basic Food Groups used by the Bureau of Human Nutrition and Home Economics of the United States Department of Agriculture. This Basic Dietary Pattern can serve as a guide not only for normal diets but for therapeutic diets as well.

Other tools available to the nurse are posters which she may make herself or secure from the food clinic or from commercial sources. Illustrative material is always an effective means of teaching, particularly with people with limited backgrounds or language difficulties. Such posters can show the nutritive value of each of the basic food groups; or the best sources of certain nutrients; or the nutritive value of certain food combinations, such as a good or a poor breakfast.

Films are effective means of teaching and may be used in schools for teaching children or for parent organizations and clubs. There are a number of excellent ones available.

Changing Food Habits

If there is to be better nutrition, food habits must be changed in many cases. One of the functions of nutrition

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education is to make the need for an adequate diet seem so important that food habits will be changed for the better. It is not an easy matter to change habits of long standing and it may take much patience on the part of the teacher to accomplish even a small change.

It is usually advisable to try to accomplish only one change at a time. Although there may be several practices that need correcting, it is better to concentrate on just one. Often the rest comes more easily after the first change has been accomplished. Since milk is such an important food its adequate intake should be the first goal. It is a great satisfaction when one finally obtains the co-operation of the family and the consumption of the essential foods becomes adequate.

It is by improving the nutrition of each individual that the eventual goal of optimum nutrition for all will finally be accomplished.

Questions and Problems

1. What is FAO? What is its function?
2. What is the purpose of the Recommended Daily Dietary Allowances which have been established by the National Research Council?
3. What is a nutrition survey? What information may be gained from such surveys?
4. What measures have been taken by the federal and local governments to improve the nutritive value of some foods?
5. What other measures may be taken to improve the nutrition of various groups in our population?
6. Make a poster that can be used to illustrate to a group of mothers the contribution to good nutrition of one of the Food Groups of the Basic Daily Dietary Pattern.
7. In what ways may the public health nurse teach groups of people the essentials of an adequate diet?
8. As a school nurse you have been asked to speak to a group of mothers about nutrition. Outline a talk that you might give to such a group.
9. Johnny, aged 4 years, does not want to drink milk. What suggestions can you give his mother to help her to improve his intake of milk?

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10. As a visiting nurse what illustrative materials should you have at hand to teach the essentials of an adequate diet to the patients with whom you may come in contact in the home?

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Chapter XII

FOOD HABITS AND CUSTOMS OF VARIOUS NATIONALITY GROUPS

THE FOOD HABITS and customs of the many nationalities and various religious groups within the United States are important factors to be considered in the nutrition of these peoples. It is one thing to establish a basic dietary pattern but it is another thing to expect that it will be used as such by every nationality group. It is essential to know the food habits and customs of all special groups so that modification of the Basic Daily Dietary Pattern can be made which will include the requirements of a normal diet and still follow the dictates and customs of the particular group concerned.

It is one of the important functions of the nurse, particularly the nurse in public health work, to guide families with foreign backgrounds in the selection of an adequate diet. She will find it of great advantage therefore to have an appreciation and understanding of the various food habits and customs with which she may come in contact. Furthermore, she will find that this appreciation of the customs of a foreign group will prove helpful in her contacts with the families with such backgrounds. If these people realize that the nurse has an appreciation and sympathetic understanding of their

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customs and habits they will be much more apt to accept her suggestions and feel that she is indeed interested in them.

The person recently arrived in our country has many adjustments to make, and probably one of the greatest is to the foods that are available. The food customs of the foreign born have been determined to a large extent by the geographic location of the country and the foods that may be produced in the area. The facilities for the preservation of the foods are also an important determining factor in what foods can be used. Furthermore, the foods that the foreign born are accustomed to using in their own countries and, which are relatively inexpensive there, are often unusual in this country and are therefore expensive. Thus the Italian uses his olive oil and native cheeses and the Puerto Rican his tropical fruits, despite the cost. Often this results in an unbalanced diet since the cost of these few foods prohibits securing the other foods necessary to an adequate diet. Many of the immigrants who have come to this country are from the peasant or rural groups, while others are from the crowded poorer areas of the cities. The first group is accustomed to producing their own foods and thus find adjustment to city living and dependence entirely upon purchased foods an especially difficult adaptation to make.

Although the food customs of the foreign born may seem not to furnish an adequate diet, in his own country these food habits in most instances give an adequate diet for compensations are made which in the end supply all the essentials for normal nutrition. We must not be overcritical of the food customs of foreign groups and think, because they are not the same as ours, that they necessarily result in inadequate nutrition. Much analysis of the composition of foreign foods must take place before accurate evaluation of the diets in many countries can be made. Furthermore, some of the customs of the foreign groups reveal sources of nutrients which are not ordinarily thought of in this country. Thus the Mexican may get his calcium from the lime used in the preparation of the corn for tortillas, rather than from milk. However, the native diet of some foreign groups is probably inadequate for opti-

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mum health as demonstrated by the fact that the children in this country are much taller than their relatives at home. This has been shown to be true especially of Japanese children who have been brought up in this country.

The religious and social customs of various groups must also be respected. Probably the most important from a nutritional point of view are the Jewish food laws which specify the foods that may be used and how they may be prepared. It is essential that these laws be understood and appreciated when one is working with orthodox Jewish people.

The following descriptions* of the food habits of some of the nationality groups are offered to help those who should know the various national and religious customs of the peoples of our country. By keeping in mind the fundamental facts for each group helpful advice may be given which will aid the foreign born not only to have an adequate diet but to incorporate in it as many of his native foods as possible, and to keep the cost of the diet within the budget allowance of the family income. Often advice on the best methods for the preparation of foods will be helpful in making diets of higher nutritive value. It will be observed from the following descriptions that one of the foods most apt to be lacking in the diets of the various foreign groups in this country is milk, and its use in some form should be emphasized. However, one of the important facts to be kept in mind is that as many as feasible of the foods typical of the family's national or religious food customs should be incorporated in its menus. There are many good points in the diets of each national group and these should be encouraged, along with the use of the available foods in this country which are essential to an adequate diet. By sympathetic understanding and patient teaching the foreign born may be helped to make the neces-

* The material for these descriptions is taken from the following sources: Raymond, Charlotte, *Food Customs from Abroad*, Massachusetts Department of Public Health; Reports from the Committee on Food Habits, National Research Council Committee on Food Habits, 1942-45; *Eating Around the World*, Community Education Section of the New York State Dietetic Association, 1944; Gillett, Lucy, *Nutrition in Public Health*, Philadelphia: W. B. Saunders Company, 1946.

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sary adjustments to living in this country which will result in their continued good health.

Italian Food Customs

The Italian is devoted to his food customs and even though he may have been born in this country still eats many of the native dishes. The food customs of the Italian vary with the section of the country from which he comes, northern Italy having somewhat different customs from the southern part of the country.

In his native land the Italian uses large amounts of milk and cheese. These are usually from goat products and are quite cheap. Cream and butter are not used, however. Green leafy vegetables are easily available, as are legumes and most fruits. Eggs and poultry are used freely. In the southern part of Italy fish is eaten almost to the exclusion of meat, while in northern Italy some meat is included in the diet. The Italian is of course noted for his use of olive oil and such alimentary pastes as spaghetti and macaroni; cornmeal is used in the form of polenta, a main dish. The flour used for breads and cereal pastes is usually whole grain. The Italian eats few sweets and pastries, fruit forming the main type of dessert. From the variety of native foods the Italian can easily plan an adequate diet.

In this country, however, the Italian finds it more difficult to meet the requirements of normal nutrition. Milk and cheese, particularly the imported cheese which he prefers, are quite expensive, as are the fruits and vegetables which he has been accustomed to growing himself. Thus the Italian may find it difficult to meet his calcium needs, particularly as he does not care for American cheese or milk. He may be taught ways of using our milk in cooking and of appreciating American forms of the Italian types of cheese which are much cheaper than the imported types. The use of other than the green leafy vegetables, which may be quite expensive, should be encouraged; the use of root vegetables and potatoes especially should be emphasized. Some of the Italian methods of cooking may be improved also, particularly the preparation

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of vegetables so that more of the minerals and vitamins are retained. The Italians have a tendency to use a considerable amount of fat in the form of oil in their food preparation and this might be discouraged, as well as the use of so many fried foods. Olive oil is expensive in this country. It may be made to go further if it is mixed with less expensive oils, thus retaining the flavor of the olive oil at a considerably lower cost. The use of whole grain or enriched grains in breads and as breakfast foods is to be encouraged.

Jewish Food Customs

It is essential to understand the basic Old Testament injunctions of the Jewish food laws if one is to seek the co-operation of Jewish people, especially the orthodox. From Genesis comes the basis for the rule that only the forequarters of animals that chew the cud and have cleft hooves may be eaten. Only such animals are considered clean, or Kosher. This eliminates the pig and any of its products, including lard. Kosher meat means that the meat has been prepared so that as much of the blood as possible is removed. This meat must be killed by a special official and according to prescribed procedures. The meat must not touch any unkoshered food. All such meat is sold immediately and is not kept in cold storage. At home this meat is further treated by soaking and by treating with salt so that as much as possible of the remaining blood is removed. From the fact that Jacob had his thigh injured when wrestling with the angels has come the injunction that the hindquarters of animals cannot be eaten. Only fish which have fins and scales may be used, which eliminates all shell fish. From the statement in the Old Testament, "Must not seethe the kid in its mother's milk!", comes the law that milk and meat cannot be served in the same meal, and in the orthodox Jewish home separate cooking utensils are necessary for preparing and serving meals containing milk or meat. No milk or dairy product can be eaten for from 3 to 6 hours after meat has been eaten. The bread used at the two different meals must also be suitable. There is a neutral bread (Parvah) which may be used at

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either type of meal, since it contains neither milk nor animal fat. Other neutral foods are cereals, fruits and vegetables.

There are a number of Jewish holidays for which food customs are prescribed. On the Jewish Sabbath which is from sundown on Friday to sundown on Saturday no food may be cooked.

Yom Kipper, or Day of Atonement, is a fast day occurring in the fall. Passover occurs in the spring and marks the time of exodus of the Jews from Egypt. Unleavened bread, Matzoh, is the only type of bread allowed at this time. This custom arose from the fact that the Jews as they fled from Egypt could not wait for the bread to rise and so ate unleavened bread. Other foods used during Passover are quite rich and prepared with the fat of fowl, especially that of chickens. Special sets of cooking utensils and serving dishes are used only for these particular holidays. The Jewish New Year is marked as a time for feasting.

The restrictions in the use of milk may lead to a deficiency of calcium and riboflavin in the diet of the orthodox Jewish people and especially the children. Although considerable cheese is eaten much of it is cottage or pot cheese which contains only small amounts of calcium.

The protein of the Jewish diet is entirely adequate. Fowl, fish and the cheaper cuts of meat are used extensively, as are liver and other internal organs. Fowl is used on the Sabbath especially. Meat soups and meat and vegetable dishes are also well liked.

One of the commendable points of the Jewish food customs is the preference for whole grain cereals both in breads and as breakfast cereals. On the other hand seasonings, relishes and pickles, and considerable amounts of fats are used in the preparation of the foods, adding little to the nutritive value of the diet and may even make it less digestible.

Many of the basic food customs of the Jewish people have been further modified in the countries from which they have come, such as Russia, Poland and Germany.

The buying habits of the Jewish people have a tendency to make their meals more expensive than necessary. Because

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of their beliefs about fresh foods, small quantities of foods, often obtained at the delicatessen, are purchased, increasing the cost considerably. Sour cream is quite expensive, and for low income groups evaporated milk coagulated with lemon juice may be suggested as a substitute. Pickles, relishes and ready prepared foods as available in the delicatessen are expensive.

Near East Food Customs Including Armenia, Syria, Greece and Turkey

The people from this area of the world have crude cooking methods and equipment and few facilities for keeping fresh foods, particularly milk. This food is usually used in the fermented form both plain and for cooking. It is known as matzoon in Armenia, yaourti in Greece, yogart in Turkey and yaghourt in Syria. This form of milk in America is relatively expensive and these people will go without milk entirely if they cannot afford to buy it or if they do buy it will sacrifice some other essential foods. Little butter or cream is used by these people.

Cracked wheat and rice are used with meat and vegetables or nuts for main dishes and with nuts or fruits for desserts. Some fine whole grain breads are used, but much of the bread is made of refined flour and baked on griddles in round flat loaves, as it has been done for centuries.

These people use vegetables stuffed with wheat, rice, nuts or meats, especially lamb, and cooked with oil and lamb broth. They eat salads dressed with olive oil and vinegar, but do not serve green leafy vegetables in the cooked form. Few potatoes are used. Although many of the subtropical fruits, including oranges, are available in their native lands these are little used here because of their high cost, and dried fruits are the usual type bought. Because the diets of these people are apt to be low in ascorbic acid, the use of more foods high in this vitamin must be encouraged.

Lamb is the only meat eaten to any extent. It is barbecued over an open flame or is combined with cracked wheat or rice and stuffed into vegetables, usually cabbage. Nuts are used

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quite commonly and dried beans, peas and lentils are used somewhat less. Fish, eggs and chicken are the other sources of protein in their diets. The protein content of the diets of these people can be quite adequate.

Ripe olives, lamb fat, seed oils and olive oil are the fats commonly used. In this country most of these fats are expensive and substitutes must be found. Peanut butter is often acceptable as a spread, and olive oil mixed with other less expensive oils may also be used as a substitute.

Grapevine leaves are important to the Greek, especially, for preparation of many dishes. A substitute for this expensive imported item must be found here in the United States.

Sweets are used mainly on special occasions. Pastry with nuts and honey, called paklava, is used as are fruit candies and Turkish pastes. Honey is the usual sweetening agent but molasses made from grapes is common also.

Czechoslovakian Food Customs

Although there are many variations in food customs in this country depending upon the location, only those customs characteristic of the country as a whole will be discussed here. One of the outstanding characteristics of the Czechs in this country is their great loyalty to their national food customs even to the second and third generation.

Milk is not drunk as a beverage, but it is used extensively in cooking and as cottage cheese, buttermilk and clabber.

Legumes, eggs, pickled herring, sausage and the organs of all animals form the main sources of protein for these people. They use mostly the less expensive cuts of meats.

A great variety of vegetables is eaten, but usually in cooked form. The long cooking of these vegetables leads to a loss of much of the mineral and vitamin content and is to be discouraged. Fruits are not used very extensively so that ascorbic acid intake may be low, although tomatoes are eaten quite generally by these people.

Many types of cereal grains are used, including rice, barley and farina. Rye bread is the most common form of bread. Formerly oatmeal was used more extensively than it is now.

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White flour is used for pastries and dumplings, one of the most popular of their dishes which can be prepared in a variety of ways.

Butter, bacon and goose fat are the common agents for shortening. Sweets are used sparingly, honey and dried fruits being the preferred ones.

Seasoning with spices and caraway, poppy and sesame seeds are the main flavorings for the foods.

Polish Food Customs

The Polish people as a group are accustomed to producing their own foods and storing for winter use those which are not consumed immediately. Thus if they settle in the cities of America they find it very difficult to make adjustments.

Milk and cheese are used abundantly by the Polish people. The milk is preferred as buttermilk, clabber or sour cream. The cost of these foods in America may mean that they are not used and the diets may be inadequate, particularly in calcium.

Potatoes and root vegetables in the form of soups or one-dish meals are the common vegetables used. Other vegetables are used to a lesser extent; green vegetables especially are not used as much as they should be. Fruits are found quite commonly in the diets of these people in their home land, but are relatively expensive in this country. Vegetables are the greater source of ascorbic acid in their diets.

The Poles use small amounts of meat which consists mainly of the more inexpensive forms. Goose, duck, pork in various forms, and such organs as heart, kidney, tongue and tripe are the meats most used. Legumes, eggs and fish in all forms, along with cheese, complete their main sources of protein.

In their native land the Poles use only whole grain cereals. Buckwheat, rye, millet and barley are the most common of the grains. In America their diets may be inadequate if they use too much of the refined cereals available here.

Butter is not used. The common fats are lard, bacon fat, poultry fat, suet and oils from seeds such as flax or hemp.

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Sweets are mainly in the form of honey and jams. Characteristic seasonings include various seeds, dill, saffron and mace.

Puerto Rican Food Customs

Because of the lack of refrigeration Puerto Ricans are not accustomed to many of the foods common to this country. Most of the Puerto Ricans coming to this country are from the low-income groups. They find our foods not only strange but expensive and they therefore encounter difficulties in making adjustments to living here.

Little milk is available in their native island since it cannot be refrigerated. Cheese, butter and meat are scarce also. When available they must be used soon after they are prepared. Thus the Puerto Rican has the habit of buying from meal to meal which he still carries over into this country, often making the food more expensive than necessary.

Rice and beans are the mainstay of the Puerto Rican diet. These dishes may be prepared with small amounts of meat, usually salted meat. Oils are added to enhance the palatability of these dishes.

The vegetables used most commonly by the Puerto Rican include tubers and roots such as chayote, cassava, yams, yautias and malangas, which are similar to our sweet and white potatoes. Although citrus fruits are grown on the island the low-income families cannot afford them. The common fruit is the plantain, which is similar to the banana, and is often prepared as a vegetable.

In the cities where they have been introduced cereal grains other than rice are little used. Molasses is the main sweetening agent. Good black coffee is consumed in large quantities at each meal. *Cafe con leche* or coffee with milk is prepared by those who can get the milk.

The Puerto Rican who comes to the United States has more adjustments to make to our foods and customs than almost any other group. To begin with, their own diet appears to be inadequate. The foods they are accustomed to are expensive in this country. As a result until they learn to eat more of

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our own foods, particularly milk, green leafy vegetables, potatoes and canned tomatoes and citrus juices the diet of the Puerto Ricans will continue to be quite inadequate. They need advice on buying and food preparation as well as on food selection if they are to be better nourished.

Chinese Food Customs

The Chinese have many characteristic dishes made up of combinations of foods, particularly vegetables often unfamiliar in America. Many of these dishes are delicious, with interesting flavorings and seasonings. The Chinese coming to this country cling to these typical foods and do not change their food customs readily, but they will adapt to some extent depending upon the available food supply.

The vegetables used most by the Chinese are radish leaves, shepherd's purse, bamboo sprouts, bean sprouts, Chinese cabbage, celery cabbage, leeks, onions, lettuce, mustard root, bitter gourd, vegetable sponge, watercress and green peas in the pod. The Chinese cook their vegetables lightly so as to preserve their delicate flavors. This is a commendable practice for it preserves much of the nutritive value.

Meat is eaten in small quantities. Pork is the chief type of meat while lamb is used in lesser amounts. Nearly all parts of the animal are used, including the blood and skin. The meats are always cut into small pieces. Fresh fish and shell fish are eaten quite regularly particularly along the coastal areas. Chicken is bought by those who can afford it. This is also true of all meat and fish for many of the Chinese. Soybeans are used abundantly and provide one of the main sources of protein in the diet.

Eggs are used extensively. They are prepared in a number of different ways characteristic of China, such as fermented eggs.

Milk is not taken at all in China as little is produced. Neither is cheese a common food. It may appear that the calcium content of the Chinese diet is low, but the custom of using a mild acid, such as vinegar, in the preparation of meat containing bones is believed to aid materially in making con-

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siderable quantities of calcium available. Soybeans, which are eaten in large quantities, are also a source of calcium.

Fruits used most commonly in China are melons, oranges, tangerines, kumquats, pummelos and persimmons.

Butter and cream are not used at all, the main source of fat being lard or sesame oil. Sweets are served seldom, but one of the characteristic and favorite sweets is almond cookies.

Malnutrition is common among the poorer classes of China which comprise the greater part of the native population. Among the small wealthy class food is adequate in both kind and amount.

Mexican Food Customs

Beans hold a prominent place in the Mexican diet as they do in that of the Puerto Rican. Many varieties of beans are used and they are prepared in various ways. Other vegetables commonly eaten are potatoes, tomatoes, peas, onions, garlic, cabbage and turnips. Chili, a variety of pepper, is used extensively as flavoring and is an important and characteristic part of the Mexican diet.

Milk is not used to any extent. The amount produced is small and available refrigeration is not adequate to take care of even this small amount. Cheese is uncommon also.

Meat is used in small amounts. Beef and chicken are the most common forms, with some pork available. Chili con carne, made of beef, and tamales made of cornmeal and pork are characteristic Mexican dishes. Eggs are not eaten to any extent. In some coastal areas fish forms an appreciable part of the diet.

Fruits, especially bananas, citrus fruits and other semitropical fruits are eaten frequently, particularly by the higher-income groups. Some of the citrus fruits are unusually high in ascorbic acid.

Corn is the common cereal grain, but appreciable amounts of rice and wheat are served also. Large amounts are used for tortillas. The corn is prepared by placing the whole kernel in a lime solution which is heated for about a half hour at a

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simmering temperature. It is then allowed to soak overnight after which it is well-washed and then ground immediately. Tortillas are a considerable source of calcium in the diet of these people, making up to a large extent for the lack of milk.

Questions and Problems

1. What are some of the problems of the person recently arrived in this country in relation to foods? How can the public health nurse help these people?
2. Make a table which shows for each nationality or religious group the typical foods used and note the nutrients in which the typical diet may be lacking in each case.
3. As a public health nurse you are visiting an Italian family which has recently immigrated to this country. What suggestions can you make to this family to secure an adequate diet with a limited budget and still satisfy its desire for its native foods? Do the same for the other nationality and religious groups discussed.

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Chapter XIII

PREGNANCY AND LACTATION

THE INCREASED NEED for the various nutrients during growth has been pointed out repeatedly in many of the preceding chapters. Pregnancy and lactation are normal states in which the requirements of growth of the fetus and infant place an increased demand on the maternal body. It is important therefore to know how much the requirements of the various nutrients are increased by growth and how they may be supplied by certain additions to the Basic Daily Dietary Pattern in order to insure that both the mother and offspring will benefit from adequate nutrition.

Both surveys and research studies repeatedly have shown the necessity of an entirely adequate food intake during pregnancy and lactation both for the health of the mother and for the normal development of the infant.

Pregnancy

Calories

The metabolism rises about 23 per cent during pregnancy, the greatest increase occurring during the latter half of pregnancy as the fetal tissue increases in amount. It is to be remembered that during this period the activities of the pregnant woman are somewhat curtailed and her caloric needs will therefore be somewhat lessened in this respect.

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The final outcome then is that the caloric needs of the pregnant woman remain about the same throughout pregnancy, the greater needs of an increased metabolism is offset by a lessened activity during the latter part of the pregnancy.

The total weight gain during pregnancy averages about 20 pounds if the maternal weight is normal at the beginning. The weight gain of the fetus is approximately 1 gram per day at first, but by the third trimester it is about 10 grams per day. The greatest gain in weight of the fetus is during the last 8 weeks. The gain in weight of the mother should average 2 pounds per month. Her food intake should be so adjusted that this rate of gain is maintained. If overweight or underweight is a complicating factor the food intake should be adjusted accordingly, still maintaining adequate protein, mineral and vitamin intake.

During the first part of the pregnancy the appetite is often diminished and it is more difficult to keep the food intake where it should be. On the other hand, during the latter part of pregnancy the appetite may be increased and it may be necessary to restrict the food intake at this time without sacrificing adequate nutrition.

Protein

Since pregnancy represents a period of growth it is extremely important that the protein intake be adequate. This means that it must be somewhat higher than for the normal adult; from the usual level of 1 gram per kilogram of ideal body weight per day the amount is raised to 1.5 grams per kilogram. This will result in a total intake during the latter part of pregnancy of approximately 85 grams of protein per day, the allowance suggested by the National Research Council in the Table of Recommended Daily Dietary Allowances (Table 1).

The quality of the protein should be maintained at a high level also, so that sufficient amounts of the essential amino acids will be furnished for the growth of new tissue.

An inadequate intake of protein during pregnancy is believed to result not only in poor development of the fetus,

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but may also result in poor lactation. And further, it may lead to edema and possibly toxemia. It is imperative then that sufficient protein be eaten to insure the health of both the infant and the mother.

Minerals

Calcium and Phosphorus. Calcium and phosphorus, forming the main part of the bones and teeth, are also necessary in greater amounts in pregnancy to supply the needs of both the mother and the fetus. The maternal organism will suffer most if there is an inadequate intake of either of these two minerals. The teeth begin forming early in prenatal life and it is essential that the calcium intake be adequate from the beginning of pregnancy. It is suggested that the intake of both calcium and phosphorus should be increased approximately 50 per cent during pregnancy (Table 1) to meet all the demands of the maternal organism and the developing fetus. Not only will the bones and the teeth be affected but also the other functions ascribed to these minerals will be impaired if there is an inadequate intake (Chapter VI).

Iron. The demands of the growing organism require an increased intake of iron. Anemia in the mother, due to inadequate intake of iron, is not an uncommon accompaniment of pregnancy. It may be necessary to use iron salts as well as increased food iron in order to supply a sufficiently large amount of iron to meet the entire needs for blood formation and storage of iron in the fetus. Inadequate iron intake of the mother also may result in anemia in the infant during the first year due to inadequate storage of iron during fetal life. The iron allowance therefore is increased during pregnancy to 15 mg. per day (Table 1).

Iodine and the other Minerals. The increased needs for iodine during pregnancy have already been noted in Chapter VI. It was observed that cretenism of the young and goiter in the mother occurs when the intake of iodine is not adequate to meet the needs of both the mother and the developing infant.

The needs for the other minerals, besides those already

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TABLE 8

Summary of Nutritive Content of Basic Daily Dietary Pattern and Additions for Pregnancy

	Quantity		Minerals		Vitamins					Foodstuffs			
DAILY FOOD INTAKE	Wt. gm.	App. measure	Ca gm.	Fe mg.	A I.U.	Ascorbic acid mg.	Thia-mine mg.	Ribo-flavin mg.	Niacin mg.	Carbo-hydrate gm.	Protein gm.	Fat gm.	Calories
Additions to Basic Daily Dietary Pattern													
Milk	240	1 cup	0.28	0.2	410	2	0.10	0.43	0.3	12	8.5	9	160
Meat or equivalent*		1 serving	0.13	0.8	500	—	0.07	0.28	0.6	45	7.5	3	240
Whole wheat or enriched cereal	90	3 servings	0.03	1.8	—	—	0.18	0.12	1.8	45	7.5	3	240
Citrus fruit	100	1 serving	0.02	0.4	180	42	0.07	0.03	0.2	11	1.0	—	50
Vegetables	100	1 serving	0.10	1.4	4870	23	0.05	0.17	0.6	6	2.0	—	30
Total			0.56	4.6	5960	67	0.47	1.03	3.5	119	26.5	15	720
Total of Basic Daily Dietary Pattern			1.17	12.0	10243	95	1.22	2.52	11.7	167	74.5	66	1550
Grand Total			1.73	16.6	16203	162	1.69	3.55	15.2	286	101.0	81	2270
National Research Council Recommendations			1.50	15.0	6000	100	1.50	2.5	15.0		85		2400

* 1 serving additional protein average of 1 ounce of meat, 1 ounce of cheese, 1 egg. Calculations from "Food Composition Tables Revised," Donelson, E. G. and Leichsenring, J. M.: A Short Method for Dietary Analysis, J. Am. Dietet. A. 21: 440, 1945.

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mentioned, are also increased during pregnancy. However, as with the normal diet, if the protein, calcium and iron needs are met, the needs for other nutrients are presumed to be met.

Vitamins

Vitamin needs in general are greater during pregnancy. Extra vitamin D is necessary for the utilization of the extra calcium and phosphorus. Increased vitamin A is also necessary. It is recommended that additional amounts of these two vitamins over that in the diet be taken, especially during the latter part of pregnancy. The increased amounts of vitamins needed are indicated in Table 1.

Supply the Daily Dietary Needs during Pregnancy

The Basic Dietary Pattern will still serve as the foundation for the dietary plan in pregnancy. The following additional foods should be used to insure the increased amounts of nutrients needed:

Milk	1 cup
Meat or equivalent	1 ounce
Whole grain or enriched cereal or bread	3 servings
Fruit—citrus or tomato	1 serving
Vegetable	1 serving

The high iron, vitamin A and vitamin B-complex content of liver makes it a food to be emphasized in the diet. It should be included at least once a week. Dried brewer's yeast is also a valuable addition to the diet for its vitamin B complex content.

Lactation

It is generally agreed that it is most desirable to breast feed the infant if it is at all possible. It has already been pointed out that the prenatal diet of the mother appears to be an important factor in determining the ability of the mother to nurse her child. The adequacy of the diet during this period

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has also been stressed. The demands made on the maternal organism by lactation are even greater than those made during pregnancy.

Calories

The energy needs of the infant must be met by the nursing mother. The requirement for calories of the lactating woman has been set at 3000 calories per day depending upon her activity (Table 1). From 500 to 700 of these calories are used in the formation of the milk necessary to the infant. The remaining calories meet the energy needs of the mother in her daily activities.

Protein

For the elaboration of the milk for feeding the infant there is an increased need for protein. Human milk is 1.25 per cent protein. In order that this much protein be made, over twice as much must be eaten by the mother. In other words, the human body is only about 50 per cent efficient in converting food protein into milk protein. To meet the needs of the infant the protein intake of the mother should be at least 100 grams per day. This should be protein of high biological value as well.

Minerals

The developing infant requires a sufficient amount of minerals to allow for the rapid growth of the tissues of the body, especially the bones, teeth and blood. Increased amounts of calcium, phosphorus and iron are therefore needed. It is essential that these be furnished to the lactating woman in larger amounts in order that the needs of nursing the infant may be met without undue strain on the mother. Table 1 gives the requirements of calcium and iron for the lactating woman. If these and the protein requirement are met all the other minerals will be presumed to be supplied in adequate amounts.

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TABLE 9

Summary of Nutritive Content of Basic Dietary Pattern and Additions for Lactation

	Quantity		Minerals		Vitamins					Foodstuffs			
DAILY FOOD INTAKE	Wt. gm.	App. measure	Ca gm.	Fe mg.	A I.U.	Ascorbic acid mg.	Thia-mine mg.	Ribo-flavin mg.	Niacin mg.	Carbo-hydrate gm.	Protein gm.	Fat gm.	Calories
Diet during pregnancy	—	—	1.73	16.6	16203	162	1.69	3.55	15.2	286	101.0	81	2270
Milk	480	2 cups	0.56	1.0	820	4	0.20	0.86	0.6	24	17.0	18	320
Total			2.29	17.6	17023	166	1.89	4.41	15.8	310	118.0	99	2590
National Research Council Recommendations			2.0	15	8000	150	1.5	3.0	15.0		100		3000

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Vitamins

It is apparent also that the need for the vitamins as well as for the other nutrients will be increased for the lactating woman in order to supply the necessary amounts to the growing infant. Table 1 gives the requirements for the vitamins during lactation.

Meeting the Daily Dietary Needs of the Lactating Woman

Further additions must be made to the Basic Daily Dietary Pattern to supplement those already suggested for pregnancy in order to meet the increased requirements noted (Table 9). Thus the following addition will be made:

Milk 1 pint

Complications of Pregnancy

There are several conditions which can result as a complication of pregnancy which may be treated by a modification of the normal diet for pregnancy.

Nausea and Vomiting. In the early part of pregnancy morning nausea and vomiting are quite common. The condition is often alleviated by eating some type of high carbohydrate food before arising. Crackers, toast, zwieback or hard candy have been found helpful in most instances.

A more severe type of nausea and vomiting may occur. It may become so serious as to interfere with the food intake of the pregnant woman. For this condition a high-carbohydrate diet in small frequent feedings has been found beneficial. If this does not help, intravenous administration of glucose, protein hydrolysates, minerals and vitamins must be resorted to in order to insure as much nutriment as possible. As soon as the patient can tolerate it she should be returned to the normal diet for pregnancy.

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High-Carbohydrate Diet—Frequent Small Meals (9)

First to Third Day

SUGGESTED DIETARY PATTERN	MENU ADAPTATION
6 A.M. or on Awakening	
Saltines, 2 Jelly, 2 teaspoons Hard candy or loaf sugar	Saltines with jelly Lemon balls
Breakfast	
Cereal, ½ cup with sugar Milk for cereal if desired or Dry toast and jelly	Oatmeal with milk and sugar
Mid-morning	
Crackers, 2 Jelly, 2 teaspoons Hard candy or loaf sugar	Soda crackers with jelly Loaf sugar
Luncheon	
Salty broth, ½ cup or tomato juice, ½ cup Toast, 1 slice Gelatin or fruit dessert	Chicken broth Toasted whole wheat bread Sliced bananas with sugar
Mid-afternoon	
Crackers, 2 Jelly, 2 teaspoons Baked potato, 1 serving or Cereal, ½ cup with sugar Milk—if desired or Dry toast with jelly	Baked potato, 1 serving Soda crackers, 2 Jelly, 2 teaspoons
Dinner	
Same as at luncheon	Tomato juice, ½ cup Soda crackers, 2 Fruit gelatin

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8:00 P.M.

Same as at mid-afternoon | Corn flakes with milk and sugar

10:00 P.M.

Same as at mid-afternoon | Dry toast with jelly

During the night

If the patient is awake give nourishments as at mid-afternoon

Fourth Day or When Vomiting Stops and Nausea Has Subsided

Progress gradually to the regular diet for pregnancy, as tolerated. As long as the patient is troubled with any feeling of nausea particular attention should be given to the early morning and bedtime feedings.

All additions to the previous day's diet should be made with discretion, depending upon the condition of the patient. The diet should be progressed slowly and only as the patient can tolerate it.

Appeal to the appetite by giving the patient what she feels she can take. It is usually advisable to consult the patient before each meal. If the diet must be followed for more than 2 or 3 days vitamin concentrates, especially the vitamin B complex, should be prescribed.

Overweight. If the weight gain is out of all proportion to what it should be, a diet of 1500 to 1800 calories may be advisable. The adequacy of a 1500 calorie diet for pregnancy can be observed from the evaluation of the diet for pregnancy, Table 8. It will be noted that 2320 calories are available from the foods suggested to supply protein, minerals and vitamins in adequate amounts. If a lower caloric diet is indicated, supplements will be needed. See Chapter XXI on the low caloric diet for the principles of such a diet. It is essential that the protein, mineral and vitamin intake should not be sacrificed when the caloric value is lowered.

Constipation. This is not an uncommon complication of pregnancy. It may be treated by increasing the amount of cellulose in the normal diet for pregnancy through the addition of more fruits and vegetables. An adequate fluid intake is also important. See page 220 for the modification of the normal diet in cellulose content.

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Toxemias of Pregnancy. The cause of the toxemias of pregnancy is not well understood. Inadequate nutrition, particularly of protein, may be a factor. It has been observed that an adequate diet during pregnancy is an important factor in avoiding toxemia (2, 4). Hypertension, edema and albuminuria and other kidney complications may occur. The diet is often modified to increase the protein intake while keeping the sodium intake low. This is not easily accomplished, however, since protein-containing foods are generally high in sodium. It is essential to make every effort to maintain the nutrition of the pregnant woman during these periods. Mineral and vitamin supplements are usually indicated. See Chapter XXV on the low-sodium diet for the general principles involved in the modification of the normal diet to make it lower in sodium and Chapter XXI for the principles of the low-caloric diet.

Salt-Poor Moderately Low-Caloric Diet for Pregnancy (9)
(Approximately 1500 calories)

All food is prepared without salt and soda and no salt is served on the tray

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit—fresh or unsweetened (1 serving equal to 10 grams carbohydrate; 2 servings during each day to be orange or grapefruit)	Orange, 1
Whole grain or enriched cereal with milk, ½ cup or unsalted bread, 1 slice	Unsalted bread, 1 slice
Egg, 1	Poached egg, 1
Butter, 1 teaspoon	Sweet butter, 1 teaspoon
Coffee or tea with milk and saccharin	Coffee with milk and saccharin, 1 cup
Mid-morning	
Milk, 1 cup	Milk, 1 cup

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Luncheon	
Lean meat or unsalted cottage cheese, 1 serving	Sliced chicken, 1 serving
Vegetable—green or yellow, 1 serving	Diced carrots, 1 serving
Salad with lemon or vinegar	Lettuce hearts with lemon wedge
Fruit—fresh or unsweetened (1 serving equal to 10 grams carbohydrate)	Peach, 1
Enriched unsalted bread, 1 slice	Enriched unsalted bread, 1 slice
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Milk, 1 cup	Milk, 1 cup
Mid-afternoon	
Milk, 1 cup	Milk, 1 cup
Dinner	
Lean meat, fish or fowl, 1 serving	Roast beef, 1 serving
Potato, 1 small serving	Small baked potato, 1
Vegetables, 2 servings	Asparagus Sliced tomatoes
Fruit—fresh or unsweetened (1 serving equal to 10 grams carbohydrate)	Grapefruit, ½ small
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Tea with milk and saccharin	Tea with milk and saccharin
Bedtime	
Milk, 1 cup	Milk, 1 cup

Supplemented with vitamins A, D and B-complex

Questions and Problems

1. What is the caloric requirement of the pregnant woman as given in the Recommended Daily Dietary Allowances? How does this compare with the caloric requirement of the moderately active non-pregnant woman?
2. Make a table showing how much each one of the nutrients

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is increased in pregnancy above that for the moderately active woman and note why each of these nutrients must be increased.
3. Mrs. Smith has come to the prenatal clinic for the first time. She has asked you what she should do about her diet. Outline how you would go about instructing her and the suggestions you would give her.
4. Mrs. Jones, who is pregnant, does not care for milk to drink. Plan a day's menu for her to show her how she can include the recommended quart of milk.
5. In what respects does the diet for the lactating woman differ from that for the pregnant woman? Why?
6. What are some of the common complications of pregnancy? What part does diet play in the treatment of each of these complications?
7. The doctor has ordered a low-caloric salt-poor diet for a patient with a diagnosis of toxemia of pregnancy. Plan a day's menu for the patient. How does this diet differ from a low-sodium (250 milligrams) diet? Why?

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Chapter XIV

INFANT FEEDING

THE FEEDING of the infant is one of the most important phases of human nutrition for it is during these first weeks and months of life that the basis for good health in later life is laid. It is intended that the mother shall nourish the infant for the first few months of post-natal life. It is generally agreed that human milk is the best food for the young infant. Breast-fed babies are conceded to have a better chance for good health than are artificially fed infants and every effort should be made to breast feed the child. This begins with a good prenatal diet of the mother and continues on through the period of lactation (Chapter XIII). It is not to be construed, however, that the artificially fed infant will not do well. Modern information on infant feeding has done much to improve the lot of the infant who must be fed by formula.

Breast Feeding

Human milk begins as a secretion known as colostrum. This lasts for several days when the regular milk supply begins. The colostrum is of a somewhat different composition from the true milk. It is sometimes sparse and to prevent undue weight loss in the infant it may be necessary to give supplementary formula feedings until the supply of milk be-

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comes adequate. The value of colostrum as a source of nourishment is not well understood, but it is probably of some special nutritional significance.

Human milk is presumed to supply all the necessary nutrients for the infant except vitamin D and iron. Table 10 gives the composition of human milk and of cow's milk. As a matter of precaution human milk may need to be supplemented with ascorbic acid and the vitamin B complex, while vitamin D and iron must of necessity be supplied.

TABLE 10

PERCENTAGE COMPOSITION OF HUMAN AND COW'S MILK (2)

	Fat	*Sugar*	*Total protein*	*Lactalbumin*		*Casein*	*Total ash*	*Ca*
Human milk	3.5	7.5	1.25	0.75		0.50	0.20	0.034
Cow's milk	3.4	4.7	3.4	0.50		3.4	0.75	0.122
	Mg	K	Na	P	S	Cl	Fe	Cu
Human milk	0.005	0.048	0.011	0.015	0.036	0.036	0.0001	0.00003
Cow's milk	0.013	0.154	0.060	0.090	0.031	0.116	0.00004	0.00002

Protein Needs

On the basis of the composition of human milk and the amount usually required to support an acceptable rate of gain in weight by the normal healthy infant it has been estimated that the growing infant requires 2 to 2.5 grams of protein per day per kilogram of body weight.

Energy Needs

The energy needs of the infant begin at approximately 100 calories per kilogram of body weight per day for the first four months and decrease to 80 to 90 calories per kilogram of body weight per day by the 12th month. The infant should gain at a rate of 5 to 8 ounces a week during the first 6 months of life. An infant should double his birth weight in 5 or 6 months and should triple it by the end of the first year. There

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should be a proportional gain in height along with the gain in weight as the infant becomes older. By weighing the infant before and after a feeding and calculating the amount of milk taken at a value of 20 calories per ounce it can be determined whether or not the infant is securing enough energy. If the proper gain in weight and height does not occur when the caloric intake of the feedings appears adequate the advice of a pediatrician should be sought.

Additions to the Breast Feedings

Additions to the breast feedings should be made at regular intervals throughout the first year. The first addition is some form of vitamins A and D. This is begun within the first week or two of life. Cod liver oil or other fish liver oil containing the two vitamins may be used. It is usually started in small amounts and increased until the infant is receiving approximately 600 to 800 International Units of vitamin D per day by the time he is one month old.

The next addition is orange juice or tomato juice. This supplement is usually given within the first month. Orange juice may be diluted at first and given in teaspoon amounts, then given undiluted in increasing amounts until about 2 ounces are being taken per day by the end of the second month. Tomato juice is about half as potent as orange juice in ascorbic acid. It need not be diluted at first and as the infant grows older the amounts given should be twice those specified for orange juice.

The next addition to the infant's diet is usually egg yolk. It is a valuable source of iron and may be added as early as the second or third month. It is usually begun in very small amounts and gradually increased in amount until a whole yolk is given.

At about the same time cereals may be added. These are usually specially prepared infant cereals which are precooked and fortified with the vitamin B complex, or they may be the regular cooked cereals which must be strained if they are coarse. Small amounts mixed with some milk are given at first and then gradually increased amounts until the infant is

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receiving approximately 4 or 5 tablespoons twice a day by the seventh month.

At about the fourth month strained vegetables may be added to one of the feedings. One teaspoon is given at first and increases made until the child is receiving as much as 4 tablespoons per day by the eighth month. Potato is added later than some of the other vegetables, usually at the sixth or seventh month.

TABLE 11

Feeding Schedule for Infants Under Six Months Age (3)

The ages at which additions may be made to the milk feedings are given in parentheses.

6:00 A.M.	Breast milk or formula feeding
8:00 A.M.	Orange or tomato juice (4 to 5 days)
10:00 A.M.	Enriched cereal (2½ to 3 months) Breast milk or formula feeding
2:00 P.M.	Strained vegetable (3 to 4 months) Breast milk or formula feeding Egg yolk (2½ to 3 months) Ground meat (alternate with egg yolk after 5 months) Strained fruit or ripe banana (3 to 4 months)
6:00 P.M.	Enriched cereal (2½ to 3 months) Strained fruit (3 to 4 months) Breast milk or formula feeding
10:00 P.M.	Breast milk or formula feeding

Vitamins A and D to be added (7 to 10 days)

Strained cooked or canned fruits and mashed banana may be begun at about the same time as the strained vegetables. At first a small amount is usually given with one of the feedings. Gradually two feedings per day are introduced.

Scraped lean beef or liver or specially prepared infant meats can be introduced at about the fifth month. They may be alternated with the egg yolk.

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Dried bread, dry toast or zwieback are given to the child at about 8 months of age or when his first teeth are appearing.

It is important that the infant receive sufficient water at all times in order to prevent dehydration. It may be given by bottle as glucose and water at first and then as plain water.

Feeding Schedule

Feeding of the infant is usually done on a schedule, which, however, should be sufficiently flexible to meet the individual needs of the individual infant. The schedule may be set at approximate four-hour intervals at first, such as 6 A.M., 10 A.M., 2 P.M., 6 P.M., 10 P.M. and 2 A.M. The 2 A.M. feeding is omitted very soon if the infant is progressing satisfactorily, and the 10 P.M. feeding is usually omitted by the fourth month. As the number of feedings decreases the amount per feeding should be increased.

Some pediatricians have found a so-called "demand" schedule, feeding the infant whenever he is hungry, a satisfactory procedure. It seems to be particularly valuable for early breast feeding when the amounts of milk may be small. The final evaluation of this method of feeding awaits continued trial.

By the time the child is 8 months of age he should be having 5 feedings daily. These will be three regular meals with two between-meal feedings of milk.

Psychological Aspects of Breast Feeding

It is generally considered that besides the nutritional advantages of breast feeding to the infant he also benefits from a psychological point of view. The fact that he must be held and that the mother is with him throughout the feeding period gives the child a feeling of security and establishes a feeling of closeness between the mother and child. These may be important factors to the child later in life.

Weaning

The child is weaned from breast feeding by the substitution of either a bottle feeding or cup and spoon feeding for some of the breast feedings, depending upon the age when weaning

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is begun. If the infant is being weaned early, at the fifth month or earlier, the former procedure will be used. If the weaning takes place at a later time, the second procedure will be employed. Most infants are weaned by the ninth month.

As the breast feedings become less in number in the weaning process the amount of milk formed will also become less and gradually will not be sufficient for the infant and may then be discontinued entirely. The entire process of weaning may take as long as a month.

Artificial Feeding

There are circumstances under which it becomes necessary to feed the infant by formula. Certain chronic illnesses of the mother, such as cancer, cardiac or renal complications or severe infections such as typhoid fever or tuberculosis, or another pregnancy are instances in which it is undesirable for the mother to breast feed the infant and artificial feeding should be used. If the mother's milk is insufficient in amount it may be necessary to give some feedings of formula to replace some of the breast feedings or to add some formula feeding to each breast feeding to insure adequate nutrition for the infant.

When a formula is used it is important to consider the infant's total nutritional needs. He must receive an adequate source of calories, protein, minerals, vitamins and fluid for maintenance and support of growth and to meet other nutritional needs. The Recommended Daily Dietary Allowance of the infant under 1 year of age is given in Table 1. A formula and supplementary feedings may be so calculated as to meet these needs. It will be noticed that the protein allowance of 3 to 4 grams per kilogram of body weight per day allows for a considerable margin of safety. It is usually at the higher level when cow's milk is used in place of human milk. The biological value of human milk appears to be higher than cow's milk for the infant. The fluid intake for infants is between 1.5 and 2.5 ounces per pound of body weight per day.

Cow's milk is usually used in the preparation of the formula. Under some circumstances goat's milk may be used,

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especially when the infant is allergic to cow's milk. It will be observed from Table 10 which shows the composition of cow's milk and human milk that cow's milk is considerably higher in protein content and that there are variations in the type of protein present. It is much higher in casein, and therefore forms a tougher and larger curd than does human milk. The protein of human milk is made up mostly of lactalbumin which forms a fine flocculent curd and is more easily digested. In order more nearly to approximate human milk the cow's milk is diluted. It may be heated, acidified or homogenized to develop a finer curd and thus render it more easily taken by the infant's digestive tract.

Various forms of cow's milk may be used. It may be fresh pasteurized, evaporated or dried milk. These milks may be fortified with vitamin D. The type of milk used will depend upon various circumstances such as cost, refrigeration, facilities for preparation, availability and the needs of the individual infant. Fresh whole pasteurized milk may be preferred. It is usually used as homogenized milk in which the fat particles are finely dispersed. Fresh milk must be boiled. This not only sterilizes it but reduces the size of the curd.

Evaporated milk is widely used since it is easily stored. It does not require refrigeration until after the container has been opened and it does not need to be heated as does fresh milk.

Dried milk is diluted, according to the directions on the container, to approximate whole milk. It must be heated to sterilize it and to make a smaller curd. It is especially valuable where fresh milk cannot be procured or kept easily. It is easily used and comes in several forms such as whole milk, skimmed milk or as protein milk.

The Formula

Ingredients. The majority of the formulae used at the present time are relatively simple. They are usually made of milk, either fresh or evaporated, a simple carbohydrate and water. The exact prescription is determined by the doctor but it is

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based upon the nutritional needs of the infant for a 24-hour period. The average infant takes from 1.5 to 2 ounces of milk per pound of body weight per 24 hours. The carbohydrate is added to make up the total calories. It should be in an easily digested form. Cane sugar, corn sirup, lactose or dextrimaltose are the most common sugars used. As the carbohydrate of the diet from supplementary foods such as cereal increases, the sugar of the formula should be decreased. Water is added to the formula to dilute the protein of the milk so that it is approximately the same percentage as human milk. Standard formulae which have approximately the same caloric value as human milk are:

Evaporated Milk Formula		*Whole Fresh Milk Formula*	
Evaporated milk	⅓	Whole milk	⅔
Water	⅔	Water	⅓
Cane sugar	5%	Cane sugar	5%

Preparation. Two procedures are in practice for the preparation of the formula. In one an aseptic technic is used, while in the other a clean technic is used. In the former all utensils and the formula are sterilized and the formula then put in the bottles. In the latter the sterilization procedure occurs after the formula has been placed in the bottles. In either case cleanliness and care in the preparation of the formula cannot be overemphasized. Either procedure is satisfactory for producing a bacteriologically safe formula, but the latter procedure is simpler to perform.

For either procedure first prepare the formula by measuring the exact amount of sugar, water and milk into a saucepan. If fresh milk is used it should be well mixed first by inverting the bottle several times before measuring it. If evaporated milk is used a similar procedure is followed. It is important to see that the openings of the bottles or cans are entirely clean before pouring the milk. A dried milk formula requires that the measured amount of dried milk and water be thoroughly mixed by beating with an egg beater, and then adding the specified amount of sugar.

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Aseptic Technic Procedure

Utensils

Large kettle; with cover and rack, for sterilizing
Saucepan
Funnel
Sieve
Measuring cup
Measuring tablespoon
Measuring teaspoon
Knife
Long-handled spoon
Long-handled brush
Tongs
Bottles
Nipples
Caps

Method

1. Wash hands with hot soapy water.
2. Wash bottle caps, nipples and bottles in hot soapy water and then rinse well with clear water. Place nipples and caps in jar with perforated top.
3. Put about 2 inches of water in kettle containing rack, cover and bring to a boil.
4. Place bottles, jar of nipples and caps and utensils in the kettle and let boil for 5 minutes.
5. Remove jar of nipples and caps and allow to drain. Remove rack with bottles and allow to drain.
6. Boil measured formula mixture for 5 minutes.
7. Remove the sterile sieve and funnel to one of the sterile bottles.
8. Strain formula through the sterile sieve and funnel directly into the sterile bottles.
9. Cover with sterile nipples and caps.
10. Cool under running water and place in refrigerator.

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Clean Technic Procedure

Utensils

The same utensils will be needed for the clean technic procedure as for the aseptic technic procedure.

Method

1. Wash bottle caps, nipples and bottles as for the previous technic.
2. Pour measured formula mixture directly into clean bottles. Cover with nipples and caps.
3. Place in kettle containing the rack and filled with 4 inches of water. Cover and boil for 30 minutes.
4. Cool the bottles under running water and refrigerate.

Other types of formulae may be required for some infants. These may be thickened with cereal or flour, be high in protein, acidified or have added banana powder. The procedures for the preparation of such formulae will depend upon the ingredients. The details for such special formulae may be obtained from any good pediatrics book.

Number of Feedings. The number of feedings per day for an artificially fed infant is similar to the number for the breast-fed baby. Usually a schedule of approximate 4 hour intervals is established. It should have sufficient flexibility to satisfy the infant, as was suggested for the schedule of the breast-fed baby. Feedings should not be too frequent, however, since the protein of cow's milk remains in the stomach longer than does the protein of human milk.

Feeding the Infant. When the formula is given to the baby it should be warmed to body temperature. This is done by placing the bottle in a pan of warm water. It is allowed to warm to such a temperature that a few drops shaken on the wrist cannot be felt. It should take an infant about 15 minutes to take the amount of formula he needs if the hole of the nipple is of the proper size. If the hole is too small it will take the

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child too long, whereas if the formula is taken too rapidly undue swallowing of air can occur with subsequent general discomfort.

Additions to the Formula Feedings. The foods added to the diet of the artificially fed infant are similar to those given the breast-fed baby and the same general plan of additions may be used (page 151).

Weaning. The weaning of the artificially fed infant will occur at the eighth to tenth month. Substitution of cup and spoon feedings are made for some of the formula feedings until the child is taking all of his food by this means. The process should be completed within a month.

Feeding Premature Infants. The premature infant begins life at a disadvantage. His digestive system is underdeveloped and he is generally smaller and weaker than is the infant who has the advantage of the full term of prenatal nutrition. The premature infant, then, requires special considerations, particularly from the feeding point of view. Each premature infant is fairly much of an individual problem in himself, depending upon his age and physical condition when he is born.

Generally the premature infant is unable to nurse and must be fed by some type of special feeder, usually a medicine dropper with soft rubber tubing on the end will suffice. Breast milk is used if it is possible to secure it, otherwise a formula will be prescribed. In most cases an evaporated milk formula may be used, similar to the one given on page 155, diluted by one half at first.

The nutritional requirement of the premature infant is higher than that of the full term infant of the same weight. From 120 to 200 calories per kilogram of body weight per day are generally needed. The protein requirement is approximately 4 grams per kilogram of body weight per day. There is increased need for the minerals and the vitamins. Supplements of vitamins A and D and ascorbic acid are added within the first week or two. Iron is usually given within the first month.

The premature infant can take only small amounts at first. Depending upon his weight he is given ½ to 1 teaspoon

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TABLE 12

Outline for Feeding Normal Infants with Evaporated Milk Mixtures (2)

Age	Weight		Evaporated milk		Water		Sugar		Feedings		
mo.	kg.	lbs.	ml.	oz.	ml.	oz.	gms.	oz.	no.	ml.	oz.
½	3.2	7	150	5	390	13	30	1	6–7	75–90	2½–3
1	3.6	8	200	6½	520	17½	30	1	6–7	100–210	3½–4
2	4.5	10	240	8	660	22	35	1¼	5–6	150–180	5 –6
3	5.5	12	300	10	600	20	45	1½	5–6	150–180	5 –6
4	6.3	14	360	12	700	23	50	1¾	5–6	210	6 –7
6	7.3–7.7	16–17	390	13	660	22	60	2	5	210	7
8	8.2–9	18–20	450	15	600	20	45	1½	5	210	7
12	10	22	450	15	510	17	—	—	4	240	8

glucose water (5 per cent) for the first day. By the second day the glucose water feedings are alternated with either breast milk or formula feedings. A very small baby will get only about ½ teaspoon a feeding. There is usually a 3 hour interval between feedings of the breast milk or formula. Gradual increases are made in the amounts of the feedings as the infant is able to take them and as his weight indicates a need for increased food intake. When the premature infant

TABLE 13

Outline for Feeding Normal Infants with Fresh Milk Mixtures (2)

Age	Weight		Fresh milk		Water		Sugar		Feedings		
mo.	kg.	lbs.	ml.	oz.	ml.	oz.	gms.	oz.	no.	ml.	oz.
½	3.2	7	330	11	210	7	30	1	6–7	75–90	2½–3
1	3.6	8	420	14	300	10	30	1	6–7	105–120	3½–4
2	4.5	10	540	18	360	12	35	1¼	5–6	150–180	5 –6
3	5.5	12	630	21	270	9	45	1½	5–6	150–180	5 –6
4	6.4	14	750	25	300	10	50	1¾	5–6	180–210	6 –7
6	7.3–7.7	16–17	840	28	210	7	60	2	5	210	7
8	8.2–9.1	18–20	960	32	90	3	45	1½	5	210	7
12	10	22	960	32	—	—	—	—	4	240	8

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TABLE 14

Approximate Percentage Composition of Some of the Foods Used in Infant Feeding (3)

Ingredient	Carbohydrate	Protein	Fat	Caloric value*			Measure	
							Tbsp.	Grams
	%	%	%	per oz.	per ml.	per gm.	per oz.	per Tbsp.
FLUID MILK								
Breast milk	7.5	1	4	20	0.7	—	—	—
Whole milk	5	3.5	4	20	0.7	—	—	—
Evaporated milk	10	7	8	44	1.4	—	—	—
Formulae	9	7	8	44	1.4	—	—	—
Skimmed milk	5	3.5	0.5	10	0.4	—	—	—
Half skimmed milk	5	3.5	2.0	15	0.5	—	—	—
Buttermilk	5	3.5	0.5	10	0.4	—	—	—
S. M. A. (liquid)	15	3	7.5	20	0.7	—	—	—
DRIED MILK								
Dryco	47	32	12	119	—	4.2	3.8	7.5
Hi-Pro	35	41	14	121	—	4.0	3.0	10.0
Klim	38	27	28	145	—	4.8	3.5	8.6
Lactogen	53	16	25	156	—	5.0	4.0	8.6
Olac	53	23	19	134	—	4.5	3.5	8.6
Protein milk	26	37	27	144	—	4.8	3.5	8.6
Similac	54	12	27	153	—	5.0	4.0	7.5
S. M. A. (powdered)	55	10	28	151	—	5.3	3.5	8.5
Alacta	47	33	12	121	—	4.3	3.5	8.6
SUGARS								
Cane sugar	100	—	—	120	—	4.0	2.0	15.0
Dexin	99	—	—	115	—	3.8	6.0	5.0
Dextri-Maltose 1-2-3	97	—	—	110	—	3.9	4.0	7.5
Honey	80	—	—	96	—	3.2	1.5	20.0
Glucose	90	—	—	108	—	3.6	3.0	10.0
Karo	74	—	—	85	—	2.8	2.0	15.0
Lactose	100	—	—	114	—	4.0	3.0	10.0
CEREALS								
Barley flour	77	10	2	109	—	3.7	3.5	8.5
Farina	76	12	1	108	—	3.6	3.0	10.0
Pablum	70	15	3	106	—	3.5	12 0	2.5
ALLERGY								
Goat's milk (fresh)	5	3	4	20	0.7	—	—	—
Goat's milk (evaporated)	8	8	7	37	1.3	—	—	—
Mull-Soy (liquid)	9	6	8	40	1.3	—	—	—
Sobee (powder)	37	32	19	128	—	4.5	6.0	5.0
Nutramigen	55	15	18	132	—	4.7	3.5	8.0
MISCELLANEOUS								
Banana powder	85	5	2	105	—	3.7	3.5	8.5
Casec	—	88	2	105	—	3.7	6.0	5.0
Amigen	—	90.5	—	105	—	3.7	3.0	8.0

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weighs up to 7 to 8 pounds he will be fed similarly to the infant born at term and will develop quite normally.

Questions and Problems

1. Why is it usually considered advisable for the mother to nurse the infant? When might it not be advisable?
2. Make a table showing the additions that are made to the infant's feedings, when they are made, and the nutrients that are supplied to the diet by each of the additions.
3. In what respects does human milk differ from cow's milk?
4. When is the infant weaned? How is weaning brought about if an infant is 8 months old?
5. Calculate an evaporated milk formula for an infant 6 months of age who weighs 14 pounds.
6. Why is sugar in some form added to the formula for the artificial feeding of infants?
7. How does the feeding of a premature infant compare with the feeding of a full-term infant?
8. Outline the instructions about formula preparation you would give a mother who must prepare an evaporated milk formula by the clean technic procedure.
9. What are the advantages of each of the procedures given for the preparation of a formula?
10. What are some factors that will influence the choice of milk to be used in feeding an infant?

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* (*See* Table 14.) Calculations are based on 30 grams equals 1 ounce except when manufacturers have stated figures based on 28.35 grams per ounce.

Analyses are taken from Accepted Foods by the Council on Foods of the American Medical Association, or from the manufacturer or from United States Department of Agriculture circular #549—Proximate Composition of American Food Products.

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Chapter XV

FEEDING OF CHILDREN

IT IS ESSENTIAL that food adequate for normal growth and development be furnished the child during his entire growth period if he is to benefit from good health then and in later life. The foundations of good health through good food practices are laid in prenatal life and early infancy but these will fail if good eating habits do not continue throughout the entire period of growth to maturity. This means that the principles of adequate nutrition must be emphasized just as much during this period as at any other time. Certainly there is no more interesting or stimulating group to which to teach good nutrition than the preschool children or the school children up through adolescence. In the home, in the school and in the clinic and hospital opportunities are offered to bring about better nutrition in the growing child. These opportunities should not be neglected.

Recommended Daily Dietary Allowances for children of various age groups are suggested by the Committee on Foods and Nutrition of the National Research Council (Table 1). These allowances should meet the needs of the average child for growth as indicated by rate of gain in weight (Table 15). They were worked out with consideration for size in relation to age of children, their activities and the differences in

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nutritional requirements of boys and girls, especially during adolescence.

TABLE 15

NORMAL YEARLY GAIN IN WEIGHT OF CHILDREN FROM BIRTH TO MATURITY*

Age	*Boys* Pounds	*Girls* Pounds
First year	11 to 13	11 to 13
Second year	8 to 9¾	8 to 9¾
Third year	4¾ to 6½	5⅔ to 6½
Fourth to eighth (inclusive)	4 to 5	4 to 5
Ninth to eleventh (inclusive)	5⅔ to 6½	
Twelfth to thirteenth (inclusive)	9 to 9¾	
Fourteenth to sixteenth (inclusive)	9¾ to 13	
Ninth to twelfth (inclusive)		5¾ to 7
Thirteenth to fifteenth (inclusive)		9 to 10½
Sixteenth to seventeenth (inclusive)		3¼ to 6½

* Adapted from material prepared by Lucy Gillett for New York Association for Improving the Condition of the Poor.

Energy

It will be observed that the total energy needs of children increases from 1200 calories for the preschool child until at 10 to 12 years the amounts are equal to those for the moderately active adult. During adolescence the amounts become even greater than those for the adult. The adolescent's nutritional needs are generally greater than those for any other single group. Thus, in proportion to the energy needs of the adult, the energy needs of children are considerably higher per unit of body weight.

Protein

Protein in the diet must be not only sufficient in amount but of good quality as well so that growth processes may proceed at the normal rate. The requirement of the growing child for protein is considerably higher in proportion to his

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weight than the requirement of the normal adult. Children require from 3 to 4 grams per kilogram of ideal body weight during the preschool age after which the requirement gradually decreases until at adolescence it is from 1½ to 2 grams per kilogram of ideal body weight.

One of the best sources of protein for children of all ages is milk. The child 2 to 3 years of age should be receiving from 1½ pints to 1 quart of milk per day. Older children should have a full quart each day. As the total protein requirement increases with growth, additions of such valuable protein foods as eggs, meat and fish may be made. These protein foods may be supplemented with the proteins of legumes and cereals after the need for complete protein has been met.

Minerals

Calcium and iron are the two minerals needing the most attention in the child's diet, as well as in the adult's diet. If foods are included to supply these two minerals in sufficient quantities to meet the needs of growth it is reasonably safe to assume, on the basis of the average mixed diet, that other essential minerals also will be supplied in the required amounts.

It is obvious that the mineral requirements will increase during growth as there is increase in the structural tissues of the body and in the amount of hemoglobin formed.

The calcium needs are best met by the daily inclusion of the quart of milk which also supplies valuable protein. Hard cheeses are another important source of this mineral.

The iron needs of children increase with age until the same amount is needed by adolescent boys and girls as by adults. The iron-containing foods listed on page 53 should be used regularly in the diets of children as well as adults.

Vitamins

The increase in vitamin requirements of children parallels the increases in requirements for other nutrients. It is important to include daily some of those foods that are listed in Chapter VII as valuable sources of each of the vitamins.

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Since foods are not a good source of vitamin D it is essential that all growing children receive some daily supplementary source of this vitamin such as cod liver oil or other vitamin D containing fish liver oil, a proprietary product like activated ergosterol or some fortified food product.

Supplying the Daily Nutritional Needs of Children

The Basic Daily Dietary Pattern may be used in planning the diet for children as well as for adults. It should be modified to include a quart of milk per day, and the size of the servings should be governed by the age of the child and his needs. The total caloric needs for the various age groups will be met by the addition of more of the same foods or of other foods.

DAILY BASIC DIETARY PATTERN FOR CHILDREN

Food	*Amount*
Milk	1 quart
Egg	1 (cheese, meat, milk, nuts or legumes may be substituted 3 times a week)
Meat, fish, poultry	1 serving
Additional protein*	1 serving
Vegetables (1 to be green or yellow)	2 servings
Potato	1 serving
Fruit (1 to be citrus or tomato)	2 servings
Whole grain or enriched cereal or bread	4 servings
Butter or enriched margarine	1 tablespoon or more

* Additional protein is 1 ounce of cheese, 1 egg, 1 glass milk or 1 ounce meat.

Suggested dietary patterns for three age groups are given. The amounts of the foods included should be increased with the increase in age of the child. The foods should be changed to finely chopped and then to whole foods as soon as the child is able to masticate foods sufficiently well.

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Regular Diet for Children (2)

12 months to 18 months of age

Breakfast

Orange or tomato juice
Enriched cereal or whole egg
Whole wheat toast or graham cracker or zwieback
Milk

Dinner

Ground meat
Potato
Strained or chopped vegetable
Soft pudding or junket or gelatin dessert or custard
Milk

Supper

Milk toast or egg or cottage cheese or bacon
Potato or spaghetti or macaroni or rice (if desired)
Strained or chopped vegetable
Whole wheat toast or graham cracker or zwieback
Strained fruit
Milk

Vitamins A and D to be added

Regular Diet for Children (2)

18 months to 3 years of age

Breakfast

Fruit—citrus or tomato
Whole grain or enriched cereal
Egg
Whole wheat toast or bread with butter
Milk

Dinner

Ground meat, fowl or fish (without bones)
Potato
Chopped vegetable
Dessert—pudding, plain cake or ice cream
Milk

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Supper

Main dish (combination of protein and carbohydrate)
Chopped vegetable (if desired)
Whole wheat bread or toast with butter
Chopped fruit
Milk

Vitamins A and D to be added

Regular Diet for Children (2)

THREE TO TWELVE YEARS OF AGE

Breakfast

Fruit—citrus or tomato
Whole grain or enriched cereal
Egg
Whole wheat toast or roll with butter
Milk

Dinner

Meat, fowl or fish (without bones)
Potato
Cooked vegetable
Raw vegetable
Dessert—pudding, cake or ice cream
Milk
Whole wheat bread and butter

Supper

Main dish (combination of protein and carbohydrate)
Vegetable or salad
Whole wheat bread and butter
Fruit
Milk

Vitamins A and D to be added

Eating Habits of Children

The formation of good eating habits is one of the most important phases of child training. Studies have been made of the many factors involved in the establishment of good eating

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habits so that adequate nutrition will be maintained during the period of growth and in adult life as well. One of the important factors in encouraging the child to eat well is the example set by his elders. If the father and mother eat all the foods that are considered essential for adequate nutrition and do not show strong dislikes for certain foods, the child is not apt to develop the permanent aversion to foods which might result in an inadequate intake of some of the nutrients.

The attitude of the parents toward the child while he is eating is one of the most influential factors in the training of the child in the proper ways of eating. Due to the use of artificial feeding methods and the great emphasis that has been placed on adequate nutrition in the past few years parents have a tendency to be overanxious about the eating habits of their child. In their efforts to be sure that the child receives an adequate diet they tend to force him to eat. This forcing may go all the way from physical force to much more subtle types of forcing, such as remarks that are made about foods or the rules that are made about eating. There is too much emphasis laid on food and poor eating, and the child soon learns to use his willingness or unwillingness to eat as a tool against his parents.

The following practices of parents must be eliminated if overattention for poor eating is to be avoided (5):

1. Forcing the child to sit at the table until the plate is emptied.
2. A promise of a dessert only if the plate is emptied.
3. Bringing back left-over food on the same plate for another meal.
4. Setting an alarm clock to time the child.
5. Eating for grandma, grandpa, etc.
6. Talking during mealtime about vitamins and other nutrients that are good for you.
7. Saying, "It's good for you" or "It will make you grow," etc.
8. Comparison with another brother or sister who eats more and is younger or bigger.

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9. Remarks after a meal about how the child ate, and other recognition of poor eating.

In other words attention must not be given for not eating. All emphasis on eating and food must be avoided. If the child does not eat a food or even a whole meal he will not develop a deficiency. Furthermore, if he does not touch his food at one meal he will be more apt to eat at the next one if no attention is given to the fact that he missed the previous one.

It should be remembered that the essential point is to serve foods to the child that are nutritionally important so that he can have an adequate diet. Experience has shown that children will eat adequately if an optimum diet is supplied them and a proper attitude is assumed by the parents. They must be an example to the child by their own eating habits; avoid giving overattention for poor eating; and not become unduly alarmed or worried if the child does not eat or if he dawdles, especially when he is using this behavior as a means of obtaining attention. It may be difficult for parents to detach themselves sufficiently from the child to obtain an objective point of view but it is necessary if they are to do a good job of training him. A positive approach to the formation of good eating habits should be taken by the parents. After making sure that they have provided an adequate amount of food for the child they should direct his eating habits so that he will learn to eat the foods presented to him.

The appetite of children has been shown to follow certain patterns with change in age (6). Thus at 1 year of age a child tends to have a small appetite. At about 21 months he will show decided preferences and has a very discerning appetite; at 2 years he shows decided preferences for such foods as carrots, butter and cheese. Food jags and food strikes are common from 2 to 4 years of age. At 5 years the child is usually willing to take what is offered and is more easily influenced in his eating habits. At 6 years the child again may show strong preferences. From this time on through adolescence he is more cooperative in his eating until by the time

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he is 10 or 11 years of age he is engrossed with eating and could eat all the time if he were allowed to do so.

It is important to remember that there are these variations in a child's appetite and not to become so concerned over changes that occur that a feeding problem will result.

There are other factors which enter into the matter of whether children will accept certain foods or not. The preparation of the food, its temperature, consistency and flavor are all factors in the child's likes and dislikes (7, 8). One of the important points brought out in this connection is the texture of foods. Careful consideration should be given to this factor. Stringy vegetables, gummy puddings, mixed dishes, such as casseroles, gummy potatoes and tough foods are not liked by children and are often refused. Children like foods that they can handle themselves, so-called "finger-foods" and foods that are not mixed with other foods. For example, they prefer their toast by itself rather than under a creamed dish. It has also been pointed out that children prefer mild flavored foods and foods that are lukewarm.

The child should be supplied with utensils which can be handled easily, of the proper shape and weight. He should be seated at a table so that he is comfortable and the time of eating should be a pleasant one so that he will enjoy his food and thus form good eating habits.

Although the emphasis has been on the well child these factors in the establishment of good eating habits apply to the hospitalized child as well. The nurse in her contacts with the child will do well to bear them in mind as she serves him his food (9).

Questions and Problems

1. Plan a day's menu for a child 8 years of age who must carry his lunch to school. Calculate the protein and calcium content of the diet.
2. You have been asked to speak to a group of third grade children about nutrition. Outline a 10 minute talk that you might give to them.
3. What are some of the important factors in establishing good food habits in young children?

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4. Mrs. Smith has difficulty in getting Jane, age 4, to drink milk. What are some suggestions you could give her so that Jane will be getting an adequate amount of milk?
5. Mrs. Anderson has said that Jimmy, age 3, is a "feeding problem." What are some of the reasons why he might be a feeding problem, and what suggestions could you give her about how to manage the situation?
6. A patient 6 years of age is in the pediatrics ward with a broken leg. He continually refuses to eat his fruit and milk. How will you go about handling the situation?

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Chapter XVI

NUTRITION IN ADOLESCENCE

ATTENTION to the diet during adolescence is more important, perhaps, than at any other period.

For both the boy and the girl this is a period of very rapid growth accompanied by great physical activity and a voracious appetite. Today the average adolescent is interested in good health as concomitant with a good physical appearance. Some teen-age girls may strive to curb their appetites in order to maintain that so-desirable thin appearance, but extreme tendencies in this direction should be discouraged.

Adolescence is an age when nutrition education can do much to influence not only present eating habits but future ones as well, and may be the most important factor in the continued good health of the adult. Much can be done in the schools through education and the school lunch program to teach the principles of adequate nutrition. An appeal to the youth's desire for an attractive physical appearance is one of the strongest means of emphasizing adequate nutrition to this group.

The nutritional requirements of the adolescent are higher than for any other age group as shown by Recommended Daily Dietary Allowances of the National Research Council (Table 1).

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Energy

The total energy needs of the adolescent range from 2400 calories per day for the older adolescent girl to 3800 calories per day for the older adolescent boy. Thus the adolescent boy often requires a considerably greater food intake than does his father. If we assume the same age range for the adolescent boy and the adolescent girl, then since girls tend to mature at an earlier age than boys, within this range the energy requirement of an older girl may be less than of a younger one while the reverse will be more generally true for boys.

This high caloric requirement in adolescence is due to an increased basal metabolism as well as to the great physical activity of this group. Normal weight for height and age (Tables 40–41) should be maintained throughout adolescence by adjustment of the food intake. It is not wise to let the weight of the adolescent vary much either way from the normal. Underweight is predisposing to many infectious diseases, while overweight is equally harmful and often of psychological importance as well (Chapter XXI).

Protein

Protein requirements on a weight basis are very high in early adolescence, then become lower ranging from 1½ to 2 grams per kilogram of ideal body weight for the older adolescent and finally as complete growth is attained tapering off to that for the adult.

It goes without saying that the protein for the adolescent should be of the highest biological value, and milk should be emphasized as much for this age group as for the young child. The other sources of complete protein, eggs, cheese and meats, will necessarily complete the protein needs.

Minerals

The requirement for calcium is especially high during adolescence because of the great skeletal growth which is occurring. A boy of 16 to 20 years of age requires 1.4 grams per day while a girl of the same age requires 1.0 grams per day.

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It is essential that adequate amounts of milk be taken to meet these needs. At least 1 quart of milk per day should be consumed by each adolescent.

Iron needs are also great in adolescence; the allowance for both boys and girls is 15 milligrams per day. If anemia is to be avoided there must be adequate intake of available iron.

Vitamins

The requirements for all the vitamins are increased proportionately in accordance with the needs for growth in adolescence. It is advisable to continue the use of some source of vitamin D such as cod liver oil to assure an adequate intake of this vitamin. Adequate amounts of fruits, vegetables and whole grain cereals and breads must also be emphasized for adequate vitamin intake.

Supplying the Nutritional Needs of the Adolescent

The Basic Daily Dietary Pattern is used in planning the diet for adolescents as well as for adults. It is modified to include at least a quart of milk a day and the size of the servings will be increased to meet the greatly increased nutritional needs.

DAILY BASIC DIETARY PATTERN FOR ADOLESCENTS*

Food	*Amount*
Milk	1 quart
Eggs	1 or 2
Meat, fish or poultry	1 serving of 4 to 5 ounces
Additional protein†	1 serving
Vegetables (1 to be green or yellow)	2 servings
Potato	1 serving
Fruit (1 to be citrus or tomato)	2 servings
Whole grain or enriched cereal or bread	4 to 6 servings
Butter or fortified margarine	1 tablespoon or more

* Additional foods from this list or other foods must be added to meet the caloric needs of the individual.

† Additional protein is 1 ounce of cheese, 1 egg, 1 glass milk or 1 ounce meat.

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Between-meal Eating

The large amounts of foods that must be consumed at various periods during adolescence permit some eating between meals. This fourth or fifth meal, as the case may be, should be made up of nutritious foods and should not become a time for taking cakes and other sweets or carbonated beverages which have little to offer in the way of minerals, vitamins, protein or anything else of value.

Questions and Problems

1. Plan a day's menu for a boy 16 years old. Calculate the calorie, protein and iron content of the diet.
2. How would you change this menu for a girl 16 years of age? Why?
3. You are a school nurse in a Junior High School. What are some things you could do to promote nutrition education in this school?
4. Make a table comparing the nutritional requirements of a boy 17 years of age, a moderately active man and a pregnant woman.
5. What type of between-meal snacks should the adolescent be encouraged to take? Why?

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Chapter XVII

NUTRITION FOR THE AGED

THROUGH our increased scientific knowledge during the last few decades the life span of man has been lengthened considerably. The newer knowledge of nutrition has been one factor in this increase in the years of enjoyment that man may experience. Not only has the total life span been lengthened but the useful years of man's existence or "prime of life" have been extended as well.

In our discussion of the nutrients and foods of the Basic Daily Dietary Pattern we have for the most part considered these factors in terms of the moderately active younger adult. The question arises as to whether the nutritional needs of the adult after 60 years of age are the same as of the younger person.

Undoubtedly there are changes occurring with age which will influence the nutritional requirements of older people. Not as much is known about these changes as should be known, however, in order properly to establish the dietary needs of the elderly.

It is of course agreed that the object of the diet should be to keep the elderly person in a state of good health so that he may have an interest and experience enjoyment in these final years of life. It seems apparent then that the same general principles will apply to the diet for the person past 60 years

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of age as for the earlier age group, taking into consideration certain physiological changes which have occurred.

Calories

It is known that there is a general decrease in metabolism with age although there may be considerable individual variation in this matter. Generally, therefore, with the decreased activity and the lowered metabolism, the total caloric value of the diet of the aged may be reduced somewhat from that of the younger adult. It is well to maintain a normal weight in the older person. His food intake should be so adjusted that there is little change in weight from that accepted as average for the majority of people of that height and weight (Tables 42–43). This usually results in a reduction of 10 to 15 per cent in the caloric value of the diet for the individual after he is 60 years of age.

It is important to bear in mind the results of overintake of certain of the nutrients. The complications of obesity are pointed out in Chapter XXI and are as applicable to the older person as to the younger one. On the other hand, the elderly person should not restrict his food intake to such an extent that there is undernutrition. There may be factors which will influence the elderly person's ability to eat, such as lack of teeth, which will in turn affect his dietary intake. Measures should be taken to correct any conditions which might interfere with adequate nutrition.

Protein

The protein intake of the elderly person must be maintained at the level of one gram per kilogram or from ½ to ⅔ grams per pound of ideal body weight. There is still the need for protein to carry out its many functions in the body (Chapter II). Bodily wear and tear continues in old age as it has throughout life. Protein must be supplied daily for this purpose as well as for the formation of enzymes, hormones, antibodies and the other materials for the regulation of normal body processes.

It is known that there is a reduction in certain of the diges-

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tive enzymes with age. Pepsin and acid of the gastric juice are lessened but trypsin of the pancreatic secretion is maintained at its usual level. Whether the amount of trypsin present is able to compensate for the lowered concentration of pepsin in the digestion of proteins is not definitely known. It seems wise therefore to keep the protein intake for the elderly at adequate but not high levels. It should be protein of high biological value.

Carbohydrate and Fat

There is a decrease in the digestive enzymes ptyalin of the saliva and lipase of the pancreatic juice. The amylase content of the pancreatic juice remains at normal levels, however. The decrease in lipase of the pancreatic juice may in turn affect the digestion of the fats. It is generally agreed that the decrease in calories for the aged should be mainly through a decrease in fat intake. The digestion of carbohydrate appears to remain normal.

Little is known about the changes in the absorption of the nutrients that may occur with age with resultant effect on the nutritional state of the individual.

Minerals

Minerals for the maintenance of body tissues and body functions are as necessary for the older person as for the younger. There is no evidence to show that it is advisable to decrease the intake of any of the minerals with age. It is essential that calcium and phosphorus be supplied in the diet in the amounts recommended for the moderately active adult as discussed in the chapter on minerals (page 47). It will be recalled that if these two minerals are supplied in adequate amounts, along with iodine in certain areas of the country, the requirements for all the other minerals essential to health may be presumed to be met.

Vitamins

The vitamin intake of elderly people should be maintained at normal or even higher levels than that of early adult life.

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If there is decreased absorption in the gastrointestinal tract with age, as it is assumed there may be, it is wise to have adequate amounts of the vitamins available so that the necessary amounts may be absorbed. Emphasis on the vitamin B complex intake seems to be of especial importance, since border-line deficiencies of this group of vitamins are apparently not uncommon in older people.

Water and Cellulose

The intake of fluids and cellulose should be kept at the normal level. The value of water and cellulose in the proper elimination of waste materials from the gastrointestinal tract has been discussed in Chapter VIII and applies to people of all age groups.

Planning the Diet

The same Basic Daily Dietary Pattern may be used for the planning of diets for elderly persons as for all other people (Chapter IX).

Feeding the Aged

The problem of feeding the aged is a considerable one. Except for a slight decrease in calories it has been pointed out that there is a normal need for all the nutrients as far as our present knowledge indicates. There is often a decrease in the appetite of the elderly, sometimes complicated by the lack of teeth, which influences considerably the desire of older people to eat. There is therefore a tendency for many older people to restrict their food intake unduly with resulting malnutrition. Furthermore, many elderly people live alone and will not or cannot prepare adequate meals for themselves.

There are a number of considerations that should be given to the feeding of older people which will aid them in eating an adequate diet. First to take into account are previous eating habits, especially those of a national or religious nature. In fact, it is wise to encourage these habits for they are of long standing and are important to the individual. Poor eat-

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ing habits due to ignorance or inability to obtain an adequate diet should be taken care of through proper education and adequate facilities for securing and preparing food. Even elderly people may be taught about adequate nutrition and be influenced to eat properly. The matter of the inability to obtain proper food may be due to financial or physical disability. Measures must be taken to correct such situations when they exist.

The preparation and choice of foods for the elderly person should also have consideration. The food should be prepared in such a way that it may be eaten easily. This is especially true when teeth are lacking. Thus it may be necessary to use chopped or even pureed foods and to avoid raw fruits and vegetables and whole meats. The size of servings should be governed by the amount the person can eat. Thus smaller meals and more frequent ones may be advisable. Four or five smaller meals instead of three large meals may prove to be the solution.

The use of foods to stimulate the appetite is also found to be of value for some people in order to bring about a greater food intake. Thus meat soups, such as consomme or clear broth, seasonings and relishes may prove helpful. The cost of such foods should be kept in mind. They are relatively expensive and furnish little of nutritive value. Coffee and tea which are cheaper are usually just as satisfactory. Elderly people, too, prefer at least one warm food at each meal. (1)

The feeding of the elderly person who lives alone on a limited income presents many problems. The securing of an adequate inexpensive diet is often difficult. A suggested weekly food order for one person is given on page 182 (1).

The cooking facilities of the single elderly person may consist of a one burner gas-plate. Storage space and refrigeration are usually inadequate also. In such situations suggestions to help the person make the best use of the facilities available are essential if he is to have an adequate diet.

There is much to be learned yet about the exact nutritional needs of elderly people. The problem has become of considerable importance because of the increased number of people

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A Low-Cost Weekly Food Order for One Person

Milk	3½ to 7 quarts; fresh, evaporated or dried
Cheese	¼ pound American or ½ pound cottage
Eggs	½ dozen or more
Vegetables	5 to 8 pounds, including potatoes, green leafy and others; fresh or canned
Fruit and tomatoes	4 pounds or more, fresh or canned
Bread and cereals	3 to 4 pounds; whole grain or enriched
Meat, fish	1½ pounds; liver, kidneys, chopped meat, lamb shoulder chops, stewing meat and inexpensive fish in season
Fats	½ pound; butter, enriched margarine, peanut butter
Sweets	½ pound; sugar, molasses, other sweetening
Tea	
Coffee	
Seasoning	

living to beyond 60 years of age. Certainly they should have the benefit of adequate nutrition which from our present knowledge means that their intake must be similar to that of the younger adult with only slight caloric modifications. If there has been adequate nutrition from infancy through childhood and early adult life the elderly should profit from this abundant health and have a useful and enjoyable old age.

Questions and Problems

1. What is the caloric requirement of the person past 60 years of age? How does this compare with the requirement of the younger adult?
2. Why is it important for older people to avoid obesity?
3. What is the daily protein need of the older adult?
4. What are the changes in mineral and vitamin needs of the older adult? Why?
5. What are some of the factors that enter into the feeding of aged people?
6. What are some considerations that should be given to planning diets for elderly people to assure more nearly adequate diets for them?

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7. Mr. Jones, a widower, age 70 years, has just been discharged from the hospital. He lives by himself in a single room, where he has a hot plate on which to prepare his food. As a visiting nurse you have observed that he seems to be neglecting his meals. What are some things you might do in order to see that he obtains an adequate diet?

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PART II

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Chapter XVIII

DIET THERAPY

Introduction

Diet therapy may be defined as the science of modifying the normal diet to meet the physiological requirements of the body in various pathological conditions (1).

In previous chapters we have discussed the nutrients which are necessary for good health at all ages, for growth and for reproduction and lactation. We shall consider now the modifications that are made in the normal dietary pattern for the treatment of various diseases. Cognizance should always be taken of the modification being made and its effect upon the nutritional adequacy of the diet. In most cases it is possible to make adjustments to insure an adequate dietary intake and still maintain the objective of the therapeutic treatment. In fact the therapeutic value of the diet may be lost if it does not also supply essential nutrients adequate for good nutrition. The nutritional needs of the body are essentially the same in illness as in health and there may be even an increased need for certain of the nutrients.

In the feeding of the patient, either in the hospital or in the home, there are a number of factors which must be taken into consideration if the value of the modification of the normal diet for therapeutic purposes is to be realized.

Of primary importance is food that the patient will eat. If

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the diet is not eaten it does not serve its purpose either for good nutrition or for therapeutic treatment. The food must therefore be properly prepared and palatable. The selection of foods must be such that an attractive meal is presented to the patient. His surroundings should be pleasant so as to encourage him to eat. Such factors as making his position comfortable and placing the tray where it can be reached easily are important. Another consideration in enticing the patient to eat is the menu plan. The plan should fit into his previous eating habits as far as this is compatible with the requirements of the therapeutic diet and of good nutrition. Thus nationality or religious customs relative to selection or preparation of foods should be observed whenever it is feasible. However, poor eating habits should not be condoned under any circumstances. The role of the nurse in her daily contact with the patient is an invaluable factor in the education of the patient to good eating habits.

Still another consideration in the feeding of the patient is the cost of the food. In both the home and the hospital food economics usually must be considered. When the money available for food is limited the object is to get the most in food value for the money spent. Many considerations important in this connection have been pointed out already in Chapter X. Food waste should be eliminated and wise buying of food should be practiced. The patient in the home especially should be advised against selecting expensive foods when less expensive ones will supply the same food values. The normal diet may be modified for use as a therapeutic agent in a number of diverse pathological conditions. For example the diet may be modified to bring about changes in body weight, to rest a certain organ or part of the body, to fit the digestive or metabolic abilities of the body or to overcome a deficiency in nutrition.

In order to accomplish one or more of these objectives specifications in regard to the diet may relate to:

1. Foods allowed and not allowed
2. Consistency

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3. Total caloric value
4. Amount of protein
5. Amount of fat
6. Amount of carbohydrate
7. Minerals contraindicated
8. Specific foods to be included for certain nutrients

Regular Hospital Diet

The regular hospital diet means that any food may be used. This is entirely true, but it is not always practiced. Many food prejudices have developed which have led to undue restrictions in the regular diet of the hospital. Some people do not tolerate well such foods as pastries, pies, fried foods and other so-called less easily digested foods. Studies on the digestibility of foods do not substantiate the belief that these foods are generally indigestible (2). For example, pies and puddings leave the stomach at about the same time and induce the secretion of approximately the same amount of hydrochloric acid. For those people who for one reason or another cannot tolerate certain foods, substitution of other foods is advisable. This should be done on an individual basis, and certain foods need not be continually omitted from the regular hospital diet because a few people do not choose to eat them. Thus the simplest modification of the normal diet is that of selection of food. When a food is omitted from the

REGULAR DIET

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit	Orange juice
Egg	Soft cooked egg
Whole grain cereal	Oatmeal
Whole wheat bread	Whole wheat toast
Butter	Butter
Cream	Cream
Sugar	Sugar
Beverage	Coffee

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Luncheon	
Protein food	Macaroni and cheese
Vegetable	Buttered string beans
Salad	Chef's salad
Fruit or dessert	Sliced peaches
Whole wheat bread	Whole wheat rolls
Butter	Butter
Milk	Milk
Beverage (if desired)	Beverage (if desired)
Dinner	
Meat, fish or fowl	Pot roast of beef
Potato	Mashed potatoes
Vegetable	Creamed carrots
Dessert or fruit	Vanilla ice cream with strawberries
Whole wheat bread	Whole wheat bread
Butter	Butter
Milk	Milk
Beverage (if desired)	Beverage (if desired)

diet regularly, another food from the same food group should be substituted so that the nutritive value of the diet is maintained.

The regular hospital diet should be planned according to the Basic Daily Dietary Pattern. The caloric value is maintained at a level adequate for bedridden people. The selection of foods, their preparation and service, should be such as to appeal to the often jaded appetite of the ill.

Questions and Problems

1. What is diet therapy?
2. What are the factors which influence the acceptability of a therapeutic diet by a patient?
3. What purposes may a therapeutic diet serve? How may the normal diet be modified so as to accomplish one or more of these purposes?
4. What is meant by a regular hospital diet?

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5. Plan a regular hospital diet for 3 days. Calculate the protein and caloric content of the diet you have planned for one day.
6. List the various factors which you have noticed that have influenced adversely the eating of the patients for whom you have cared. Suggest what should be done in each instance to remedy the condition.

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Chapter XIX

MODIFICATIONS OF THE NORMAL DIET IN SELECTION OF FOOD

Allergy

Foods are one of the most important agents in the etiology of allergic manifestations. All types of allergic responses may be brought about by foods, including asthma, coryza, urticaria, migraine, acne, eczema and gastrointestinal disturbances. It is necessary to determine which food or foods are the offending agents and then to eliminate them from the diet. To accomplish this, elimination diets have been devised which are used as diagnostic aids. These are diets limited to foods least likely to cause allergic reactions.

Planning the Diet

Adequacy of the Diet. Since elimination diets are diagnostic measures and therefore are used for only a short period of time it is not necessary to see that they are nutritionally adequate. However, once the offending food has been found, the diet must then be planned to supply an adequate intake of the essential nutrients. This is often not an easy matter since many of the foods which are the most common allergens are

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essential parts of the Basic Daily Dietary Pattern. Milk, eggs and wheat are at the top of the list, while citrus fruits are not far behind.

MOST COMMON FOOD ALLERGENS IN ORDER OF FREQUENCY (1)

Eggs	Tomato
Milk	Cod
Wheat	Chocolate
Oranges	Potato
Grapefruit	Spinach
	Oatmeal

When one of these essential foods is the allergenic agent it is usually necessary to supplement the diet with the minerals and vitamins which will be lacking if this food is not included in the diet. For example, if milk is the allergen, calcium must be supplied by some type of calcium salts. The other nutrients supplied by milk, such as protein and vitamins A and the B complex may be included by the wise choice of other foods high in these nutrients.

Selection of Foods

Two sets of diets are given as representative of the choice of foods that may be used on elimination diets. These are foods which have been found to be least likely to cause an allergic reaction for a large number of people.

ELIMINATION DIETS (1)

	Diet #1	*Diet #2*
Beverage	Tea	Milk
	Pineapple juice	Coffee
	Apricot juice	Prune juice
	Lemonade	Grape juice
Cereal	Corn	Rice
	Hominy grits	
Meat	Lamb—any cut	Beef—any cut
	Pork—any cut	Veal—any cut
		Chicken—any cut

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	Diet #1	*Diet #2*
Vegetables	Cabbage	Carrots
	Escarole	Beets
	Sweet potato	Turnips
	Corn	Lettuce
	Beans, all kinds	Squash
	Asparagus	Kale
Fruit	Pineapple	Grapes
	Banana	Raisins
	Apricots	Apple
	Pears	Prunes
	Lemon	Plums
Bread	Corn pone	Ry-krisp
		100% whole rye bread
Fat	Mazola oil	Butter
	Bacon fat	Chicken fat
Miscellaneous	Molasses	Cheese
	Karo	Sugar
	Sugar	Salt
	Salt	Apple jelly or apple butter
	Apricot jam	Plum jelly
	Synthetic vinegar	Grape jelly
	Gelatin	Cider vinegar
		Gelatin

Notes:

In cases of urticaria or gastrointestinal allergy pork should be eliminated. (Diet #1)

The inclusion of milk in diet #2 may be of diagnostic value since it is a common allergen.

On diet #1, where milk is not allowed, meat should be given twice a day to insure adequate protein intake. Calcium may be added.

If a food is allowed on the diet it may be used in any form. Thus if corn is allowed, it may be used as such, as corn meal, as cornstarch or as corn oil. It is important to remember that if a food is eliminated from the diet all forms of the food must be eliminated also. If eggs must be eliminated then cakes, cookies or candies in which eggs are used must also be eliminated.

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Foods that are related botanically very often cause a reaction if one member of the group is found to be an allergen. Thus if oranges cause an allergic reaction other members of the citrus fruit family as well are quite likely to cause a reaction.

In some instances *desensitization* of the person to the food causing the allergy may be attempted. It has been found successful in a fair number of cases and is particularly worth attempting for children who have an allergy to such foods as milk and eggs. Extremely small amounts of the foods, diluted considerably, are given regularly each day. The amount given is gradually increased until the patient is able to take the whole food in normal quantities. This procedure covers a considerable period of time for accomplishing final desensitization.

Procedure for Administration of an Elimination Diet

The patient is placed on one of the elimination diets. The choice of diet will depend much upon that patient's past history. Previous food records of the patient or diagnostic tests, such as skin or patch tests, may give an indication of the foods which are likely allergens to the individual.

The patient is allowed to stay on the diet for approximately two weeks, unless a severe reaction results. In such case the other elimination diet must be used. It is necessary to have the patient remain on a diet for approximately two weeks so that the allergic reaction present may subside entirely, and also to allow sufficient time to insure that no reaction, no matter how mild, will result from the foods in the diet. When it is certain that the patient is not allergic to any of the foods included in the diet, the patient will be put on the other elimination diet for a similar period of time. If the patient is not allergic to the foods on the second diet he may then have the foods listed on both diets. To these foods are then added single foods at 3 to 4 day intervals. If a reaction occurs on the addition of a food to the basic diet it is a good indication that it is an allergen. This food should be tested again after a week. If a reaction is repeated this food is

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then included as one to be omitted from the diet. This procedure is continued until as many foods as necessary have been tested and the offending foods identified. If no improvement whatsoever is shown by the patient through diet therapy the allergic substance must not be of food origin.

Food Preparation

Once the offending foods have been determined and the foods which the patient may eat have been identified the preparation of the foods is the next most important factor to which attention must be given. It is absolutely necessary to make sure that the foods which are allergenic are omitted entirely. The inadvertent inclusion of the smallest amount of the offending food in the diet may cause a severe reaction. It is important that no food be eaten if its composition is not exactly known. It may be necessary to use substitutions for some food substances in order to have more variety in the diet. For example, if wheat must be omitted from the diet cornstarch may be used as a thickening agent, and rice and oatmeal may be used for cereal products. With thought and ingenuity many interesting menus may be prepared for the patient who must consistently omit certain foods from his diet.

The following lists indicate the common preparations which contain eggs, milk or wheat respectively. If any one of these foods is found to be the allergen then all of the preparations listed as containing this food must be omitted as well.

COMMON PREPARATIONS CONTAINING EGG

Eggs in any form
Cakes, candy as chocolate cream, nougat or fondant
Cookies
Cocomalt
Custard
Eggnogs or other egg drinks
Ice cream
Mayonnaise or hollandaise sauce
Marshmallows
Meringue
Meat prepared with egg as meat loaf, breaded meat
Milk puddings containing eggs
Muffins
Noodles
Ovaltine
Pies, as lemon, custard, pumpkin, cocoanut etc.
Pretzels
Soft rolls as Parker House

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Common Preparations Containing Milk

Bread—except rye
Butter
Buttermilk
Cakes or cookies made with milk
Caramels
Chocolate candies
Cocomalt
Cream soups
Cream sauces
Cream
Cheese
Custard
Evaporated milk
Gravies made with milk, cream or butter
Milk
Ice cream, sherbets
Malted milk
Mashed potatoes
Ovaltine
Pie crust made with butter
Pies—cream or soft pies
Puddings made with milk
Vegetables seasoned with butter or creamed
Zwieback

Common Preparations Containing Wheat

Beverages
- Malted milk
- Postum
- Mellin's food
- Nestles's food

Bread
- All breads including ordinary rye bread and oatmeal
- Hot breads and muffins
  - Cornbread
  - Baking powder biscuits
- Zwieback
- Pretzels
- Gluten bread

Cereals

All-bran	Kix	Pettijohns	Wheatena
Bran flakes	Krumbles	Puffed wheat	Wheat flakes
Crackels	Meads	Ralstons	Wheaties
Cream of wheat	Mellowwheat	Shredded wheat	Wheatsworth
Farina	Muffets	Shredded ralstons	Whole bran
Grapenuts	New oats	Super-farina	
Grapenuts flakes	Pep		
	Pablum		

Crackers
- All crackers and cookies

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Desserts
  Cakes
  Cookies
  Doughnuts
  Ice cream cones
  Pies
Griddle cakes, waffles, pancakes, either homemade or commercially prepared
Gravies or sauces thickened with flour
Macaroni, spaghetti, noodles or vermicelli
Meat
  Prepared with flour, bread or cracker crumbs, as croquettes and meat loaf, or stews thickened with flour or made with dumplings
  All commercially prepared meats as frankfurters, sausages or meat loaf where wheat may be used as a filler
  Canned broth or consomme
Salad dressing
  All cooked or boiled salad dressings where flour is used for thickening
Flour
  In any form, including graham, white or whole wheat

Questions and Problems

1. What is the purpose of an elimination diet?
2. What are the most common food allergens?
3. Mrs. Brown has been found to have an allergy to eggs. She has asked you what foods contain eggs. List them for her.
4. What is desensitization? How is it accomplished?
5. If a patient is allergic to milk what foods would you tell him he cannot eat? What suggestions could you give him in order to supply the same nutrients to the diet which milk supplies?

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Chapter XX

MODIFICATIONS OF THE NORMAL DIET IN CONSISTENCY

THE FIRST major modification in the normal diet is that of consistency. Many patients are not able to take a regular diet. It may require too much effort to chew it; it may be too bulky; or the patient may not have teeth and has difficulty in chewing. In these and other instances where a patient cannot tolerate a regular diet the soft diet may be indicated.

Soft Diet

Planning the Diet. To modify the regular diet in consistency plant foods high in indigestible carbohydrates, such as cellulose, hemicellulose, lignins, gums and related substances, and cuts of meat high in connective tissue are avoided. Thus no raw fruits or vegetables or other coarse foods are allowed, and tough meats are not used. The fruits and vegetables are cooked as this brings about disintegration of the cellulose and related materials. Very coarse cereals and fruits and vegetables may be strained to reduce further the amount of cellulose. However, the trend is to use whole cooked fruits and vegetables low in cellulose, since they are more acceptable to most people than pureed food. Likewise the tendency is not

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to use ground meat but rather to select meat that is tender and then prepare it so as to avoid making it tough or hard.

Adequacy of Diet. The soft diet is nutritionally adequate when properly planned. It is essential that a serving of citrus fruit juice, tomato juice or other adequate and acceptable source of ascorbic acid be included in the diet each day.

Soft Diet

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit	Orange juice
Egg	Soft cooked egg
Whole grain cereal	Strained oatmeal
Fine whole wheat bread	Fine whole wheat toast
Butter	Butter
Cream	Cream
Sugar	Sugar
Beverage	Beverage
Luncheon	
Protein food	Macaroni and cheese
Vegetable	Strained string beans
Fruit or dessert	Sliced peaches (canned)
Fine whole wheat or enriched bread	Enriched bread
Butter	Butter
Milk	Milk
Citrus or tomato juice	Tomato juice
Beverage (if desired)	Beverage (if desired)
Dinner	
Meat, fish or fowl	Pot roast of beef
Potato	Mashed potatoes
Vegetable	Creamed carrots
Dessert or fruit	Vanilla ice cream
Fine whole wheat or enriched bread	Fine whole wheat bread
Butter	Butter
Milk	Milk
Beverage (if desired)	Beverage

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Foods Allowed

Beverages

All beverages

Breads, crackers and cereals

Enriched white, fine whole wheat and rye bread without seeds

White crackers

Prepared cereals such as corn flakes, rice cereals and infant prepared cereals

Fine cooked cereals such as enriched farina, cornmeal, hominy grits, rice, noodles, spaghetti and macaroni

Strained coarse cereals such as oatmeal and whole wheat cereals

Cheese

Mild, soft cheese such as cream, cottage and grated American cheese in sauce

Desserts

Custard, cornstarch, tapioca, rice and bread puddings, cake, cookies, frozen and gelatin desserts—all without nuts and whole fruit with seeds and skins

Eggs

Prepared in any form

Fruits

Cooked or canned fruits without seeds or skins, fruit juices, banana

Meats

Any ground meat, fish, shellfish and fowl, without bones or gristle. If the meat is very tender it need not be ground

Milk

Fresh whole milk, skimmed milk, evaporated milk, dried milk, buttermilk

Vegetables

Strained cooked vegetables, except strongly flavored ones unless tolerated

Tender vegetables, low in cellulose, need not be strained.

Sweet potato—no skin

White potato—no skin—served any way except fried

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Foods to Avoid

Breads, crackers and cereals

Coarse dark bread
Whole grain crackers
Coarse dark cereals unless strained

Desserts

Rich pastries, gingerbread and any dessert containing nuts, raisins or fruit not allowed

Fruits

Raw fruit except juice and ripe banana; fruits with seeds or skins or high in cellulose unless strained

Meats

Tough meats with gristle, bone or excess fat
Salted or smoked meat and fish

Vegetables

Raw and coarse vegetables
Strongly flavored vegetables, if not tolerated, such as Brussels sprouts, broccoli, cabbage, cauliflower, cucumber, onion, turnips, radishes

Excessive seasonings and fried foods

Fluid Diets

A further modification in consistency in the normal diet is made in the fluid diets. Some patients may not be able to tolerate even a soft diet. This is true in some instances postoperatively, in febrile states and in other conditions of extreme prostration.

Clear-Fluid Diet

Two stages of fluid diet are generally used in most hospitals. The simplest is the *clear-fluid diet*. This consists, as a rule, of tea, sugar, broth and gingerale. In some instances fruit juices are allowed. Such a diet is obviously an inadequate diet, sup-

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plying only fluid and a few calories. It should be considered a temporary measure, not to be allowed any longer than absolutely necessary.

Clear-Fluid Diet

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit juice (if tolerated)	Orange juice
Tea	Tea
Sugar	Sugar
Mid-morning	
Gingerale	Gingerale
Luncheon	
Broth	Chicken broth
Tea	Tea
Sugar	Sugar
Mid-afternoon	
Fruit juice	Lemonade
Dinner	
Broth	Beef broth
Tea	Tea
Sugar	Sugar
Bedtime	
Tea with lemon and sugar	Tea with lemon and sugar

Full-Fluid Diet

The second of the fluid diets is the *full-fluid diet,* which is used in the progression from the clear-fluid diet to the soft diet. To the clear-fluid diet additions of fruit juices, vegetable juices, milk, refined and strained cereals, gelatin, eggs, coffee and flavors such as malt, chocolate and vanilla are made. Such a diet may be planned to meet adequately the normal nutritional requirements of an individual.

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Full-Fluid Diet

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit juice (citrus)	Orange juice
Strained cereal	Strained oatmeal
Soft cooked egg (if tolerated)	Softed cooked egg
Cream	Cream
Sugar	Sugar
Beverage	Coffee
Mid-morning	
Eggnog or	Eggnog
Malted milk	
Luncheon	
Cream soup	Cream of tomato soup
Simple pudding	Baked custard
Fruit or vegetable juice	Grapefruit juice
Beverage (if desired)	Milk
	Tea
Cream	Cream
Sugar	Sugar
Mid-afternoon	
Citrus juice with glucose	Orange juice with glucose
Dinner	
Same as luncheon	Cream of potato soup
	Chocolate pudding
	Pineapple juice
	Milk
	Tea
	Cream
	Sugar
Bedtime	
Milk	Malted milk

Foods Allowed

Any food in liquid form is allowed and in addition, custard, junket, gelatin, plain ice cream, fruit ice or sherbet, plain

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puddings such as cornstarch and tapioca puddings, soft cooked eggs, strained cooked cereals.

Specific Modification of the Normal Diet in Consistency

There are a number of diets that are based on the soft diet and are thus essentially modifications in consistency of the normal diet. They are used for the treatment of diseases of the gastrointestinal tract and are varied slightly according to which part of the gastrointestinal tract is being treated.

Bland Diet

The most used of these diets is the bland diet which is indicated for the treatment of peptic ulcers.

A peptic ulcer is an erosion of the gastrointestinal mucosa which occurs for the most part either on the lesser curvature of the stomach or in the first few centimeters of the duodenum. The exact cause of ulcers is not known. They are characterized by a high gastric acidity and pain which occurs at regular intervals in definite relation to the previous meal.

Planning the Diet. The objective of the diet to treat peptic ulcer is two-fold.

1. Rest of the irritated area by
   a. prevention of mechanical irritation of the ulcer
   b. reduction of gastric acidity by lessened stimulation to gastric secretion and by neutralization and dilution
2. Adequate intake of essential nutrients

The prevention of mechanical irritation of the ulcerated area is accomplished by the application of the principles already outlined for the soft diet (page 200). Thus cellulose and other indigestible carbohydrates and connective tissue are reduced.

The next objective, the reduction of gastric acidity, is accomplished in various ways. Neutralization of the acid is brought about by alkaline medication and by protein foods. The latter, because of their amphoteric properties, are quite effective antacids. It is necessary that feedings be given at

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frequent and regular intervals in order to have a constant source of materials to neutralize and dilute the gastric acidity. Thus the bland diet consists of at least six feedings a day. The between-meal feedings are made up primarily of milk or some food prepared from milk.

Foods that stimulate gastric secretion include meat extractives, spices and condiments, coffee, tea and other substances containing caffeine and related compounds, the so-called highly flavored vegetables and extremely hot or extremely cold foods. It is recommended that none of these be included in the diet used for the treatment of peptic ulcer. The use of emulsified fats such as occur in butter, cream, milk and eggs in the bland diet is also beneficial through the formation of enterogastrone, the hormone which inhibits gastric secretion and motility.

Adequacy of the Diet. The final objective, an adequate intake of essential nutrients, is entirely possible with the bland diet. The caloric value of the diet should be normal if the patient's weight is normal. It may, however, be necessary to use a high-caloric bland diet as underweight often accompanies an ulcer.

The protein intake should be normal, that is 1 gram per kilogram of the patient's ideal body weight. Often a higher protein intake may be indicated in order to bring about tissue repair and as an increased source of antacid for neutralization of the gastric acidity.

The carbohydrate and fat are used in amounts necessary to supply the desired caloric intake. Concentrated sweets and fried food, however, are usually avoided.

In order to insure adequate ascorbic acid intake citrus fruit juice or tomato juice should be included each day as was indicated for the soft diet. It is advisable to use enriched cereals and breads, since whole grain ones are interdicted. Iron and thiamine intake may be interfered with by continued alkalinization of the gastrointestinal tract. In such cases appropriate measures should be taken to supplement the diet in order to compensate for any such possible inadequacies.

Administration of the Diet. In some cases of peptic ulcer it may be advisable to have a preliminary period of feeding before

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the bland diet is used, in order to build up the patient's ability to take the bland diet. This period may extend from a few days to several weeks, depending upon the individual patient. Thus a progressive diet, beginning with small frequent (hourly) feedings of milk and cream is gradually increased in amounts and types of foods until all the foods allowed on the bland diet have been added and the patient is taking six feedings. This principle of the small frequent feedings progressing to a bland diet for the treatment of peptic ulcer was begun by Dr. Sippy (4) and some modification of his regimen is used in nearly every hospital at the present time.

Progressive Diet Regimen (2)

The regimen consists of four stages and progression from one stage to the next is made by order of the physician. The fourth stage of the regimen is the bland diet with six meals.

Bland Diet I

Ninety (90) ml. (⅓ cup) half milk and half cream is given every hour from 6:00 or 7:00 A.M. to 9:00 or 10:00 P.M. It is continued through the night if the patient is awake.

Bland Diet II

One hundred eighty (180) ml. (⅔ cup) half milk and half cream is given every 4 hours during the day and night. In addition foods are chosen from the following list in any combination not to exceed 180 ml. to be given at alternate times with the milk and cream feedings.

FOODS TO USE

Strained cereal gruel	Soft cooked eggs
Junket	White toast
Jello	Eggnog
Baked or soft custard	Rice
Strained cream soup	Half milk and half cream
Plain cornstarch puddings	Saltines or soda crackers
White potato—no skin	Sugar—in small amounts

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Butter
Milk toast
Salt—enough to make food palatable

SUGGESTED DIETARY PLAN

6 A.M.
180 ml. milk and cream

Breakfast (8:00 A.M.)
180 ml. strained cereal gruel with sugar and milk

10 A.M.
180 ml. milk and cream

Luncheon (Noon)
100 ml. strained cream soup
Soda crackers

2 P.M.
180 ml. half milk and half cream

Dinner (4 P.M.)
1 soft cooked egg
100 ml. Junket

6 P.M.
180 ml. half milk and half cream

8 P.M.
180 ml. eggnog

Bland Diet III

Increase the amounts of the feedings from 180 ml. to 300 ml; give 6 feedings daily. In addition allow the following foods:

- Cream cheese
- Cottage cheese
- Plainly prepared noodles, macaroni or spaghetti
- Fruits:
  - Strained orange, grapefruit and tomato juice
  - Strained cooked pears, apples, peaches, plums, prunes and apricots

Avoid: All other foods including coffee, tea, carbonated beverages, meat broths, spices and condiments

SUGGESTED DIETARY PLAN	MENU ADAPTATION
	Breakfast
Strained cereal, 2/3 cup	Strained oatmeal, 2/3 cup
Egg, 1	Soft cooked egg, 1
Enriched white toast, 1 slice	Enriched white toast, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Milk, 2/3 cup	Milk, 2/3 cup

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Mid-morning	
Milk, 1 cup	Milk, 1 cup
Soda crackers, 2	Soda crackers, 2
Butter, 2 teaspoons	Butter, 2 teaspoons
Luncheon	
Cream soup, ⅔ cup	Cream of tomato soup, ⅔ cup
Potato or cheese, 2 to 3 ounces	Cottage cheese, 3 ounces
Strained fruit, ½ cup	Strained peaches, ½ cup
Mid-afternoon	
Milk, ½ cup	Milk, ½ cup
Soda crackers, 2	Soda crackers, 2
Butter, 2 teaspoons	Butter, 2 teaspoons
Custard, ½ cup	Custard, ½ cup
Dinner	
Cheese, 2 ounces or	
Egg, 1	Poached egg, 1
Potato or substitute, 3 ounces	Mashed potato, 3 ounces
Citrus or tomato juice, ½ cup	Orange juice, ½ cup
Dessert, 1 to 2 ounces	Cornstarch pudding, ¼ cup
Bedtime	
Milk, 1 glass	Milk, 1 glass
Soda crackers, 2	Soda crackers, 2
Butter, 2 teaspoons	Butter, 2 teaspoons

Bland Diet with Six Meals

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit juice, ripe banana, strained fruit	Sliced banana
Strained whole grain or enriched cereal	Enriched cream of wheat with milk and sugar
Milk	
Sugar	
Egg	Poached egg
Enriched white toast	Enriched white toast
Butter	Butter
Coffee, one half milk	Coffee, half hot milk

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Mid-morning	
Milk, 1 cup	Chocolate milk, 1 cup
Soda crackers, 2	Soda crackers, 2
Butter, 2 teaspoons	Butter, 2 teaspoons
Luncheon	
Strained cream soup (no stock)	Strained cream of celery soup
Egg, mild soft cheese or tender meat, fowl or fish (ground unless very tender)	Cottage cheese
White potato (without skin), rice, noodles, spaghetti or macaroni	Mashed potatoes
Strained fruit	Strained apricots
Enriched white bread	Enriched white bread
Butter	Butter
Milk	Milk
Citrus fruit juice, ½ cup	Orange juice, ½ cup
Mid-afternoon	
Same as mid-morning	Milk, 1 cup Soda crackers, 2 Butter, 2 teaspoons
Dinner	
Citrus or tomato juice, ½ cup	Tomato juice, ½ cup
Tender meat, fish or fowl (ground unless very tender)	Creamed chicken
White potato—without skin	Riced potatoes
Strained vegetable	Strained peas
Dessert	Baked rice custard
Enriched white bread	Enriched white bread
Butter	Butter
Milk	Milk
Bedtime	
Same as mid-morning	Milk, 1 cup Soda crackers, 2 Butter, 2 teaspoons

Foods Allowed

Beverages

Coffee or tea, ½ cup with ½ hot milk, not more than once a day

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Soups

Cream soups made without stock

Breads, crackers and cereals

Enriched white, fine whole wheat or rye bread without seeds
White crackers
Prepared cereals such as corn flakes, rice krispies and puffed rice
Cooked fine cereals such as enriched farina, cream of wheat, cornmeal, hominy grits, rice, noodles, spaghetti, and macaroni and infant cereals
Strained coarse cereals such as oatmeal, pettijohns and whole wheat cereal

Desserts

Custard, cornstarch, tapioca, rice or bread pudding, plain cake, cookies, frozen and gelatin desserts—all prepared without nuts or raw fruits

Fruits

Strained cooked apples, pears, peaches, prunes, plums, apricots
Ripe banana
Strained orange, grapefruit, pineapple, apple, prune or tomato juice

Vegetables

Strained cooked:

Chard	Carrots	Dried peas or lima beans
Beets	Lima beans	String beans
Sweet potato	Peas	Celery
Corn	Pumpkin	Lentils
Squash	Asparagus	
Spinach		

White potatoes—any way except fried—served without the skin

Meat

Beef, veal, lamb, liver, fowl, fish, oysters, canned salmon and tuna, all without bones, gristle and excessive fat—ground unless very tender

Milk

Fresh, pasteurized, dried or evaporated

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Cheese

Mild soft cheese, such as cream, cottage and grated American cheese in sauce

Miscellaneous—in moderate amounts if well tolerated

Jelly	Honey	Molasses
Sirup	Plain candy	Sugar

Salt to make food palatable

Foods to Avoid

Beverages

Coffee or tea—except in amounts allowed, chocolate, carbonated drinks, cereal beverages, cola drinks

Breads, crackers and cereals

Coarse dark cereals unless strained
Whole grain crackers
Coarse dark breads
Fresh or hot breads

Desserts

Rich pastries and any desserts containing nuts or whole fruits

Cheese

Strongly flavored types

Fruit

Raw fruits except juices and ripe banana
Any with seeds or skins
Any not listed on foods allowed

Meat

Salted and smoked meat and fish
Pork
Gristle, bones and excess fat

Soups

Any soups prepared with meat stock including chicken broth

Vegetables

Raw and coarse
Strongly flavored (if not tolerated) such as cabbage, cauliflower, broccoli, Brussels sprouts, green peppers, onion, turnip

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Miscellaneous

Seasonings, spices, condiments as mustard, catsup, chili sauce, horseradish, Worcestershire sauce, vinegar, olives, pickles, pepper, garlic
Fried foods, rich gravies and sauces
Nuts

Hemorrhaging Ulcers

In some cases of peptic ulcer severe hemorrhage may occur when the ulcer erodes one of the larger blood vessels of the stomach. The trend in the treatment of such cases is to feed the patient as soon as possible after the hemorrhage as he will take food (5). The buffering effect of the food in the stomach as well as the nutrient content has proved beneficial in many such cases. Some clinicians feel that the patient should be given whatever he will take, while others, including Dr. Meulengracht who first advocated the principle of feeding a hemorrhaging ulcer, use a bland diet such as is used for the non-hemorrhaging ulcer (page 208).

Psychological Aspects of Ulcer Therapy

Probably as important as the food itself for the ulcer patient are the circumstances under which he eats his meals. It is important that the patient eat at regular times, in a pleasant environment, with sufficient time to relax and chew his food well. It is important, too, that the patient be given help with his emotional problems, whether they be social or economic, if he is to derive full benefit from the diet therapy measures which have been instituted.

Surgery for Peptic Ulcer

In some intractable cases of ulcer it is found necessary to resort to surgery. The post-operative dietary procedure in such cases is one of progression from frequent small feedings to a bland diet within a period of approximately two weeks.

Post-Operative Gastric Routine (2)

The prevention of nausea is of paramount importance in any surgery of the stomach, therefore begin with very small

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amounts of food (30 ml. or less) and gradually increase the amounts giving special attention to the phrase "as tolerated." Begin with weak tea and water.

1st Day

Give feedings every 2 hours as tolerated. Begin with 30 ml. and increase to 60 ml. Alternate weak tea served with lemon and glucose with water.

2nd and 3rd Days

Give feedings every 2 hours as tolerated. Begin with 90 ml. and increase to 180 ml. Alternate tea served with lemon and glucose, with farina or strained oatmeal diluted with an equal amount of hot milk and seasoned with salt and glucose.

4th Day

Proceed through the bland diet regimen (pages 207–08) as prescribed by the surgeon. In many cases the progression may be quite rapid to parallel the rapidity with which the patient is made ambulatory after surgery.

Other Uses for the Bland Diet

The bland diet may be indicated in such gastrointestinal diseases, other than peptic ulcer, as gastritis, hyperchlorhydria, gastric atony, carcinoma of any part of the gastrointestinal tract.

Low-Residue Diet

The soft diet may be modified slightly for use in the treatment of diseases of the large intestine such as colitis, diarrhea, dysentery, spastic constipation and other disorders of the large intestine and after surgery. In such conditions a low-residue diet is indicated. Thus a minimum of irritating residue reaches the large intestine. The soft diet is modified still further in consistency by elimination of whole grain breads and the use of ground meats and strained fruits and vegetables.

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Such a diet can be planned to supply adequate amounts of the essential nutrients. Enriched breads and cereals must be emphasized, and a serving of citrus juice or tomato juice included daily. It should be realized, however, that in many of the diseases for which this diet is used the food material passes along the gastrointestinal tract so rapidly that much of its nutritive value is lost to the body, and nutritional deficiencies can result unless adequate measures are taken. In some instances increased amounts of protein, minerals and vitamins may need to be given by parenteral routes to insure the adequate intake of essential nutrients until the gastrointestinal tract is functioning normally.

Low-Residue Diet (2)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit juice, ripe banana, strained fruit	Strained pears
Strained whole grain or enriched cereal	Strained oatmeal
Egg	Scrambled eggs
Milk	Milk
Sugar	Sugar
Enriched white toast	Enriched white toast
Butter	Butter
Beverage	Coffee with cream and sugar
Luncheon	
Strained soup	Strained vegetable soup
Egg, mild soft cheese or ground tender meat, fowl or fish	Meat loaf
White potato (without skin), rice, noodles, spaghetti or macaroni	Creamed potatoes
Strained fruit	Ripe banana
Enriched white bread	Enriched white bread
Butter	Butter
Milk	Milk
Citrus fruit juice, ½ cup	Orange juice, ½ cup

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Dinner	
Citrus or tomato juice, ½ cup	Tomato juice, ½ cup
Ground tender meat, fish or fowl	Ground beef pattie
White potato (without skin)	Mashed potato
Strained vegetable	Strained string beans
Dessert	Cottage pudding
Enriched white bread	Enriched white bread
Butter	Butter
Milk	Milk
Beverage (if desired)	Tea with sugar and lemon

Foods Allowed

Those foods listed on the soft diet (page 200) are allowed with the following exceptions: only white enriched bread is to be used, all meat must be ground and all fruits and vegetables strained with the exception of ripe banana.

Foods to Avoid

All the foods listed as to be avoided on the soft diet (page 202) plus those previously noted above.

If the diet is to be a high-caloric diet also, between meal feedings of allowed foods will be necessary.

Strict Low-Residue Diet

In some instances a diet even lower in residue than the one just described may be indicated. In conditions such as severe diarrhea, dysentery, partial intestinal obstruction and following certain rectal and intestinal operations the so-called "strict low-residue" diet may be instituted. The cellulose is restricted to a minimum so that the diet is approximately cellulose free. This will help to decrease the stimulation of peristalsis and will avoid distention. All whole grain cereals and whole grain breads, fruits and vegetables except white potato are omitted from the soft diet. This diet is inadequate in minerals and the vitamin B complex and ascorbic acid. Supplements of iron and the various vitamins should be made if the diet is continued for more than a few days.

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Strict Low-Residue Diet (2)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Enriched fine white cereal	Enriched farina
Egg	Soft cooked egg
Enriched white toast	Enriched white toast
Butter	Butter
Milk	Milk
Cream	Cream
Sugar	Sugar
Beverage	Coffee
Luncheon	
Mild cheese, egg, ground tender meat, fish or fowl	Cheese fondue
White potato (no skin), rice, noodles, spaghetti, macaroni	Buttered noodles
Dessert	Cottage pudding
Enriched white bread	Enriched white bread
Butter	Butter
Milk	Milk
Beverage (if desired)	Tea with sugar and lemon
Dinner	
Ground tender meat, fish or fowl	Creamed chicken
White potato—no skin	Baked potato—no skin
Dessert	Chocolate ice cream
Enriched white bread	Enriched white bread
Butter	Butter
Milk	Milk
Beverage (if desired)	Coffee with cream and sugar

Foods Allowed

Beverages

Milk, cocoa, tea, coffee

Cereals

Fine white cereals, including rice, noodles, macaroni and spaghetti, white crackers, enriched white bread

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Desserts

Plain baked or soft custard, cornstarch, tapioca and rice puddings
Plain ice cream, cookies and cake—all without fruit or nuts

Eggs and mild cheese

Meats, fish or fowl (ground)

Beef, veal, lamb, fish, chicken, liver, sweetbreads

Soups

Broths
Strained cream or stock soups

Vegetables

White potato—no skin

Miscellaneous

Butter	Salt	Sirup
Sugar	Jelly	

FOODS TO AVOID

Whole grain cereals and whole grain breads
Fruit and fruit juices
Vegetables—except potatoes
Tough meats, gristle, bone, excess fat
Fried foods
Spices and condiments
Nuts
Excess of sugar and sweets

Tube Feedings

There are occasions when food cannot be taken by mouth. Such may be the case, for example, in an obstruction of the upper part of the gastrointestinal tract; in surgery of the upper part of the tract, in cases of severe prostration or other instances in which the patient is unable to masticate or swallow food.

Gastrostomy Feeding. When inability to take food is due to some impairment of the upper gastrointestinal tract a tube may be introduced directly into the stomach and feeding of the patient carried out in this manner. It is essential that all

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the nutrients be supplied to the patient each day, since it is often necessary to use such feedings for extended periods of time. The following formula is more than adequate in all the nutrients with the exception of iron. Parenteral iron medication must be used along with the feeding.

Formula for Gastrostomy Feeding (2)

Calories = 1825
Protein = 75 grams

Food	*Measure*	*Weight gms.*
Milk	1½ qts.	1500
Glucose or sugar	½ cup	120
Enriched farina or strained cereal	⅔ cup, cooked	120 (20 raw)
Eggs	3	150
NaCl	½ tsp.	2

Vitamin concentrates to meet vitamin A, B complex and ascorbic acid requirement added before administration of feeding

Directions

Beat the eggs slightly. Add all other ingredients and mix thoroughly. Strain the mixture through a fine sieve, pour in bottles, cover, label and place in the refrigerator. The feeding should be warmed to body temperature in a double boiler before giving.

Jejunostomy Tube Feeding. After a jejunostomy is performed feeding of the patient will take place through a tube into the jejunum. It is advisable in such a case to have a partially digested feeding. Two types of feeding are possible. The eggs and milk of the gastrostomy feeding may be peptonized for three hours and then put into the formula. The cereal is omitted. A feeding using protein hydrolysates is much easier

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to prepare. The following formula is more than adequate in all the nutrients except iron. Parenteral iron therapy must be used along with the feeding.

Formula for Jejunostomy Tube Feeding

Calories = 1770
Protein = 90 grams

Food	*Measure*	*Weight gms.*
Protein hydrolysate	6 T.	60
Cream, 20%	1 pint	480
Homogenized milk	1 pint	480
Glucose	4 T.	40
NaCl	½ tsp.	2

Vitamin concentrates to meet vitamin A, B-complex and ascorbic acid requirement added before administration of feeding.

Directions

Mix protein hydrolysate and glucose together in a bowl. To this mixture add the homogenized milk to form a paste, gradually adding the rest of the homogenized milk and then the cream. Beat this mixture with an egg beater; place in covered bottles and sterilize. Cool and store in the refrigerator. The feeding should be warmed to body temperature before giving. Care should be exercised in administering the feeding so that as little contamination as possible results. Undue fermentation and putrefaction in the gastrointestinal tract will cause distress to the patient.

High-Cellulose Diet

Atonic Constipation. A diet which contains more cellulose than the amount furnished by the foods in the Basic Daily Dietary Pattern (Chapter IX) is indicated in atonic constipation or sluggish colon. In this condition an increase of 100

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per cent in the cellulose content of the diet is often beneficial in correcting the stalsis which develops. It will be recalled that cellulose acts as a stimulant to peristalsis and due to its affinity for water softens the fecal mass and thus aids in elimination.

Planning the Diet. The Basic Daily Dietary Pattern is used as a basis for the high-cellulose diet. This supplies approximately 5 to 6 grams of cellulose (page 97). The cellulose content may be doubled by including two more servings each of fruits, vegetables and whole grain cereal or bread. Raw fruits and vegetables are preferable.

Since the tone of the gastrointestinal tract is dependent in part upon thiamine an increased intake of this and other members of the vitamin B complex may be indicated. For amounts greater than that supplied by the high-cellulose diet dried brewer's yeast, wheat germ or some other concentrated source of these vitamins may be used.

There are several other factors in connection with a high-cellulose diet which have been found helpful. Increased amounts of simple carbohydrates stimulate peristalsis and also increase the bulk of the stool. Sugars, jam, jelly and marmalade are often added to the high-cellulose diet. Fruits are valuable due to their organic acid content as well as to their cellulose content because the organic acids also stimulate peristalsis. Certain fruits, such as prunes, figs, raisins, dates, apples and grapes, are important from this standpoint.

Sufficient liquids must be taken (Chapter IX). The daily intake should be at least 8 to 10 glasses. This may include water and fruit juices. If increased amounts of lubrication are necessary and mineral oil is prescribed by the physician, it should be taken at bedtime. It should not be taken with meals since it interferes with the absorption of fat soluble vitamins (page 66). Of very great importance in the treatment of this type of constipation is good health habits, along with the high-cellulose diet. Regularity in elimination, exercise and time for meals must be established.

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High-Cellulose Diet (2)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit, 1 serving	Grapefruit, ½
Whole grain cereal, 1 serving	Whole wheat cereal, 1 serving
Egg, 1	Soft cooked egg, 1
Whole wheat bread, 2 servings	Whole wheat toast, 2 slices
Milk, ½ cup	Milk and sugar
Sugar	
Jam, 1 tablespoon	Jam, 1 tablespoon
Butter, 2 teaspoons	Butter
Hot beverage with cream and sugar	Coffee with cream and sugar
Luncheon	
Protein dish, 1 serving	Cheese souffle, 1 serving
Potato, rice, noodles, macaroni, spaghetti, 1 serving	Baked potato, 1
Vegetable, 1 serving	String beans, 1 serving
Salad, 1 serving	Tomato salad, 1 serving
Fruit, 1 serving	Raw apple, 1
Whole wheat bread, 2 slices	Whole wheat bread, 2 slices
Butter, 2 teaspoons	Butter, 2 teaspoons
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Milk or buttermilk, 1 cup	Milk, 1 cup
Dinner	
Meat, fish or fowl, 1 serving	Veal chop, 1 serving
Potato, 1 serving	Mashed potatoes, 1 serving
Vegetable, 2 servings	Buttered beets, 1 serving Asparagus, 1 serving
Fruit, 1 serving	Royal Anne cherries, 1 serving
Whole wheat bread, 1 slice	Whole wheat bread, 1 slice
Butter, 2 teaspoons	Butter, 2 teaspoons
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Milk or buttermilk, 1 cup	Milk or buttermilk, 1 cup
Beverage	Tea with sugar and lemon
Bedtime	
Fruit or fruit juice, 1 serving	Orange juice, 1 cup

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Questions and Problems

1. When may the use of a soft diet be indicated?
2. What modifications of the regular diet are made for a soft diet? Why?
3. When is a clear-fluid diet indicated? A full-fluid diet?
4. Plan a full-fluid diet for 3 days for a woman whose ideal weight is 60 kg.
5. Mr. Jones must have a soft diet since he has no teeth. He does not like pureed foods. Plan a day's diet for him.
6. What are the objectives of the diet for the treatment of peptic ulcer? How is each one of these objectives attained?
7. A patient who has been diagnosed as having a peptic ulcer has been placed on the progressive bland diet regimen, to be progressed every other day. Plan a week's menu for him.
8. What is the present generally accepted practice in treating hemorrhaging ulcer?
9. When else, besides for ulcer therapy, may the bland diet be used?
10. What is the dietary regimen generally used following gastric surgery?
11. Mr. Smith, a clerk, has been discharged from the hospital where he has been on a bland diet for peptic ulcer. He must buy his lunch in a restaurant. Plan a day's diet for him.
12. In what ways does the low-residue diet differ from the bland-diet? Why?
13. When is a strict low-residue diet indicated? In what respects does this diet differ from a low-residue diet?
14. Calculate the calcium, iron and thiamine content of the gastrostomy tube feeding.
15. How does a jejunostomy feeding differ from a gastrostomy feeding? Why?
16. What is meant by a high-cellulose diet? How is the normal diet modified to make a high-cellulose diet?
17. Mrs. Anderson has been placed on a high-caloric bland diet. What modifications in the bland diet can you suggest to her to make the diet high-caloric? Plan a day's diet and calculate the caloric value of the diet.

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Chapter XXI

MODIFICATIONS OF THE NORMAL DIET IN ENERGY VALUE

ONE OF THE SIMPLEST, yet most often used, variations of the normal diet is that of a change in calorie value from the normal requirement. In Chapter V the energy needs of the body were discussed and the energy value of different foods explained. It would be well for the student to review that section at the present time.

High-Caloric Diet

There are a number of conditions in which the body requires a greater source of calories than the normal diet supplies. A high-caloric diet is indicated in malnutrition or underweight, in fevers and infections and in hyperthyroidism.

In malnutrition or underweight the individual has not been getting sufficient calories, has drawn upon his body tissues for energy and as a result has lost body weight. This condition can result from ignorance on the part of the individual of what should be eaten for adequate nutrition, or it may be due to inability to buy sufficient food for adequate nutrition. Malnutrition and underweight may also be a secondary complication of some diseases, especially those which

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interfere with the absorption of the food nutrients, as for example colitis, dysentery or diarrhea.

In fevers and infections the metabolic requirement of the body has been increased. It has been shown that for each degree rise in body temperature above normal the caloric requirement is increased 7 per cent. Thus a few degrees rise in temperature soon increases the caloric needs of an individual considerably. In addition the caloric needs of a patient with fever are increased by his restlessness and the toxic destruction of the tissues by the invading organism.

In hyperthyroidism there is an excess of secretion of the thyroid hormone, thyroxine, which regulates metabolic processes (Chapter V). This increase in thyroxine output may increase the daily energy expenditure of the body by a few hundred to one or two thousand calories above normal, depending upon the condition of the patient. Such patients are nervous and restless which accounts for the increased expenditure of energy. There is often considerable loss of weight, and prolonged feeding of an exceptionally high-caloric diet may be necessary in some cases to bring about a gain in weight.

Planning the Diet. The high-caloric diet is planned to meet the needs of the individual patient by the addition of any of the following foods to the normal diet:

Bread and cereals	Cream
Butter, cooking fats and oils	Jam, jelly, marmalade
Sugar, glucose, beta-lactose	High-caloric desserts

In planning the diet the patient's ability to take the food must be borne in mind. Except for the hyperthyroid, lack of appetite is a common accompaniment of underweight. It may be necessary to use only concentrated foods in small feedings, avoiding the more bulky foods, or to use between-meal feedings, or a combination of these may prove most effective in securing the desired caloric value. Here again the importance of attractively prepared and served food to increase the total food intake cannot be overemphasized.

The regular diet of the hospital is planned to furnish ap-

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proximately 2000 calories per day, the amount of energy necessary for the average bedridden individual. Simple additions to the regular diet will increase the caloric value without increasing the bulk of the diet materially. Table 16 gives examples of additions which illustrate how the energy value of the diet may be increased by 250 calorie amounts. For further increases above 1000 calories, cream may be substituted for half of the milk; jam, jelly and marmalade may be added or high-caloric desserts may be used. Between-meal feeding is indicated so that it will not be necessary to take too large amounts at any one time.

TABLE 16

Suggested Additions to the Regular Diet to Increase It by Approximately:

250 *Calories*	500 *Calories*	750 *Calories*	1000 *Calories*
Bread, 1 slice	Bread, 2 slices	Bread, 3 slices	Bread, 5 slices
Butter, 1 tsp.	Butter, 2 tsp.	Butter, 3 tsp.	Butter, 4 tsp.
Milk, 1 cup	Milk, 2 cups	Citrus juice, 1 cup	Citrus juice, 1 cup
		Glucose, 2 tbsp.	Glucose, 2 tbsp.
		Milk, 2 cups	Milk, 2 cups
			Egg, 1

3000 Calorie Diet

SUGGESTED DIETARY PLAN	MENU ADAPTATION
	Breakfast
Citrus fruit, 1 serving	Grapefruit, ½
Egg, 1	Soft cooked egg, 1
Cereal, 1 serving	Oatmeal with milk and sugar
Bread, 2 slices	Whole wheat toast, 2 slices
Butter, 2 teaspoons	Butter, 2 teaspoons
Cream, 1 tablespoon	Coffee with cream and sugar
Milk, ½ cup	
Sugar, 2 teaspoons	
Beverage	

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Mid-morning	
Eggnog	Eggnog
Luncheon	
Protein dish, 1 serving	Cheese souffle
Potato, noodles, rice, spaghetti, macaroni, 1 serving	Baked potato, 1
Salad, 1 serving	Tomato salad with mayonnaise
Fruit, 1 serving	Sliced pineapple
Bread, 2 slices	Whole wheat bread, 2 slices
Butter, 2 teaspoons	Butter, 2 teaspoons
Milk, 1 cup	Milk, 1 cup
Mid-afternoon	
Citrus juice, 1 cup	Orange juice, 1 cup
Glucose, 2 tablespoons	Glucose, 2 tablespoons
Dinner	
Meat, fish or fowl, 3 ounces	Baked ham, 3 ounces
Potato, 1 serving	Candied sweet potato, 1 serving
Vegetable, 1 serving	Buttered peas
Dessert	Peach upside-down cake
Bread, 1 slice	Bread, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Milk, 1 cup	Milk, 1 cup
Bedtime	
Milk, 1 cup	Milk, 1 cup
Bread, 2 slices	Bread, 2 slices
Butter, 1 teaspoon	Butter, 1 teaspoon

Modification of the High-Caloric Diet. The regular high-caloric diet may need to be modified into a soft or fluid diet for some patients when they are extremely ill. For example, the patient with typhoid fever, during the acute stages of the disease particularly, needs a high-caloric diet, but his ability to take regular food is considerably impaired. Furthermore, in this particular disease the irritation to the gastrointestinal tract is such that a low-residue diet is indicated if further damage

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is to be avoided. A semi-soft high-caloric diet or an entirely fluid high-caloric diet may be used, depending upon the ability of the patient to take the diet. In the acute stages of other diseases where there is fever, such as pneumonia and rheumatic fever, the same diet may be used.

High-Caloric Fluid and Soft Diet for Patients with Fever (1)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Citrus juice, 1 cup	Orange juice, 1 cup
Glucose, 2 tablespoons	Glucose, 2 tablespoons
Cereal, strained, ½ cup	Strained oatmeal, ½ cup
Cream, 20%, ½ cup	Cream, 20%, ½ cup
Glucose, 1 tablespoon	Glucose, 1 tablespoon
Egg, soft cooked or poached	Poached egg, 1
Enriched white bread, 1 slice	Enriched white toast, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Beverage	Coffee with 2 tablespoons 20% cream and 1 tablespoon glucose
Cream, 20%, 2 tablespoons	
Glucose, 1 tablespoon	
Mid-morning	
Eggnog made with cream and glucose, 1 cup	High-caloric eggnog, 1 cup
Luncheon	
Cream soup, strained, 1 cup	Cream of tomato soup, 1 cup
Egg or mild cheese, 1 serving	Cream cheese, 1 ounce
Saltines, 2	Saltines, 2
Potato, 1 serving	Mashed potatoes, 1 serving
Enriched white bread, 1 slice	Enriched white bread, 1 slice
Butter, 3 teaspoons	Butter, 3 teaspoons
Milk, half cream, 1 cup	Milk, half cream, 1 cup
Mid-afternoon	
Citrus or tomato juice, 1 cup	Tomato juice, 1 cup
Custard or plain pudding, 1 serving	Soft custard, 1 serving

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Dinner	
Broth or strained soup, 1 cup	Strained vegetable soup, 1 cup
Gelatin, 2 tablespoons	Gelatin, 2 tablespoons
Egg or cheese, 1 serving	Poached egg, 1 on enriched buttered white toast, 1 slice
Potato, noodles, spaghetti, rice or macaroni, 1 serving	Buttered noodles, 1 serving
Dessert, 1 serving	Vanilla ice cream, 1 serving
Enriched white bread, 1 slice	
Butter, 2 teaspoons	
Milk, half cream, 1 cup	Milk, half cream, 1 cup
Bedtime	
Chocolate malted milk, 1 cup	Chocolate malted milk, 1 cup
Saltines, 2	Saltines, 2

Foods Allowed

Beverages

Coffee, tea, cocoa and gingerale

Breads, crackers and cereals

Enriched white bread, plain or toasted, any plain white crackers, any cooked cereal allowed on soft diet (for typhoid fever use only white cereals), prepared cereals such as rice cereals and corn flakes

Cheese

Cream or cottage

Desserts

Custard, cornstarch, bread, junket, rice and tapioca puddings, plain gelatin desserts, plain ice cream or fruit juice ices without nuts or pieces of fruit

Eggs

Soft cooked, poached, scrambled or eggnog

Fruit

Fruit juice, sweetened with glucose, ripe banana

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Milk

Fresh whole milk, evaporated milk, dried milk, malted milk, any flavored milk drinks

Soups

Meat broths and bouillon
Strained cream soups
Strained meat stock soups

Vegetables

Mashed or baked potato (without skin), strained peas, asparagus, celery, corn, carrot, tomato or spinach in cream soup

Foods to Avoid

Coarse dark cereals
Coarse dark breads
Rich desserts as pie and pastry
All fruits and vegetables except those listed
All meats and fish
Strongly flavored and rich cheese
All fried foods
Nuts

High-Caloric Fluid Diet

A high-caloric fluid diet may be made by using the full fluid diet as a basis (page 204). To this the following foods are added in amounts sufficient to supply the needed calories and yet not exceed the individual patient's ability to take the fluids.

Cream, 20%
Glucose
Eggs
Butter in cereal and soup

Low-Caloric Diet

In discussing the energy needs of the body (Chapter V) it was pointed out that when the caloric value of the food eaten is greater than the energy expenditure of the body the excess material is deposited as fatty tissue, resulting in overweight of the individual.

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In order to correct this condition it is necessary to reduce the food intake of the person to a level below his normal requirement so that the deposited fat will be drawn upon to supply a part of the calories needed. This will result in loss of fat and resultant reduction in body weight. Thus another simple modification of the normal diet is made, that of fewer calories. Reduction in overweight is indicated in such diseases as arthritis, rheumatism, gout (page 257), diabetes (page 270) and cardiac insufficiency (page 297) when overweight is a complicating factor.

Planning the Diet. A safe rate of weight loss is considered to be between 1½ and 2 pounds of body weight per week. Too rapid loss of weight is considered to be harmful since it is a strain on the metabolic processes of the body and leaves a loose flabby skin. To accomplish a safe rate of weight loss a reduction of 50 per cent in the normal caloric requirement is usually necessary. Thus the normal caloric requirement of the average moderately active woman of 56 kilograms ideal weight is 2400 calories per day (2). A 50 per cent reduction would mean that the diet would contain approximately 1200 calories per day. The normal protein requirement of 1 gram per kilogram of ideal body weight must be maintained despite the reduction of calories. The diet therefore will contain approximately 56 grams of protein. The calories remaining after the protein calories are subtracted will be divided about equally between the carbohydrate and fat. The carbohydrate is taken mainly in the form of bulky low-carbohydrate foods such as fruits and vegetables. The fat is necessary for adequate vitamin intake and palatability.

Adequacy of the Diet. The 1200 calorie diet may be planned to be adequate in all the nutritional requirements. Re-examination of the Basic Daily Dietary Pattern (page 100) recalls that this selection of foods supplies approximately 1550 calories and adequate amounts of protein, minerals and vitamins to meet the needs of the average adult. By selecting only lean meats, fish or fowl, and omitting two servings of whole grain or enriched cereal, 2 teaspoons butter, and potato, it is possible to reduce the caloric value of the Basic Daily Dietary

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TABLE 17

1200 Calorie Diet

FOOD	Measure	Weight gm.	Protein gm.	Calories*	Minerals		Vitamins				
					Calcium gm.	Iron mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic acid mg.
Milk	1 pint	480	17	320	0.56	0.4	820	0.20	0.86	0.6	4
Lean meat (liver once a week)	4 ounces	120	23	160	0.01	3.3	2807	0.16	0.65	5.9	2
Additional protein**	1 serving	—	7	100	0.13	0.8	300	0.07	0.28	0.6	—
Egg	1	50	7	80	0.03	1.4	495	0.07	0.18	—	—
Fruit (1 citrus)	3 portions	300	3	165	0.06	1.5	500	0.17	0.18	1.0	52
Vegetables	4 servings	400	8	130	0.24	2.2	10280	0.18	0.44	1.8	56
Potato	1 small serving	85	2	70	0.01	0.6	16	0.09	0.03	1.0	14
Whole wheat bread	2 servings	60	5	150	0.02	1.2	—	0.12	0.08	1.2	—
Butter or enriched margarine	1 tsp.	5		35	—	—	160	—	—	—	—
Total			72	1210	1.06	11.4	15378	1.06	2.65	12.1	128

* Calories have been rounded off to the nearest 5 calories.

** Average of 1 egg, 1 ounce of cheese, 1 cup milk or 1 ounce meat or fish. (1 cup milk preferable.) Calculations from "Food Composition Tables Revised" Donelson, E. G. and Leichsenring, J. M.: A Short Method for Dietary Analysis, J. Am. Dietet. A. 21: 440, 1945.

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Pattern sufficiently so that extra portions of fruits and vegetables may be added to supply bulk (Table 17). This still gives a diet adequate in all respects except calories.

It is to be noted, however, that iron and thiamine are borderline in meeting the nutritional requirements. If the person who is on a 1200 calorie diet is not in a good nutritional state it may be advisable to supplement the diet with these two nutrients especially.

Approximate 1200 Calorie Diet

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit, 1 portion	Orange juice, ½ cup, scant
Egg, 1	Soft cooked egg, 1
Whole wheat bread, 1 slice	Whole wheat toast, 1 slice
Butter, ½ teaspoon	Butter, ½ teaspoon
Tea or coffee with milk and saccharin—if desired	Coffee with milk and saccharin
Milk, 1 cup	Milk, 1 cup
Luncheon	
	Chicken broth
Lean meat, fish, fowl or cottage cheese, 1 ounce	Cottage cheese, 2 tbsp.
Vegetables, 2 servings	Tomato salad, ½ cup
	Swiss chard, ½ cup
	Lemon wedge
Fruit, 1 portion	Fresh pear, 1 small
Whole wheat bread, 1 slice	Whole wheat bread, 1 slice
Butter, ½ teaspoon	Butter, ½ teaspoon
Milk, 1 cup	Milk, 1 cup
Dinner	
Lean meat, fowl or fish, 3 ounces	Roast beef, 3 ounces
Vegetables, 2 servings	Carrots, ½ cup
	String beans, ½ cup
Fruit, 1 portion	Apple, ½ medium, 3″ diameter
Milk, 1 cup	Milk, 1 cup
Beverage—if desired	Black coffee

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Between-Meal Nourishment

Saccharin lemonade, tea with lemon, black coffee or bouillon may be taken as desired. Milk or fruit from the meals may be saved to be used as a between-meal nourishment.

Modification of 1200 Calorie Diet. Modification of the basic 1200 calorie diet may need to be made for some patients. It may be necessary to have less than a 1200 calorie diet to have effective weight loss. This may be especially true if the individual is leading a quite sedentary life, when a 1000 calorie or even an 800 calorie diet may be indicated. In other cases too rapid weight loss may result on the 1200 calorie diet. In such instances a 1500 calorie diet may be desired. It should be apparent that dietary inadequacies may result on diets of less than 1200 calories and their use is not advised except under the careful supervision of a physician.

For 800 Calorie Diet

Using the 1200 calorie diet as a basis omit:
- Bread, 2 slices
- Butter, 1 teaspoon
- Skimmed milk substituted for whole milk

For 1000 Calorie Diet

Using the 1200 calorie diet as a basis:
- Skimmed milk substituted for whole milk

For 1500 Calorie Diet

Using the 1200 calorie diet as a basis add:
- Cereal, 1 serving or
- Bread, 1 slice
- Butter, 2 teaspoons
- Potato, 1 small

The 800 calorie diet is inadequate in iron, vitamin A, thiamine and riboflavin. The 1000 calorie diet is also inadequate in thiamine and iron. Concentrates should be prescribed if the diet is

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used for 2 weeks or longer. Such diets should be used only under careful supervision.

TABLE 18

Summary of Variations of Low-Caloric Diets

	1200 *Calories*	1000 *Calories*	800 *Calories*	1500 *Calories*
Fruit, 1 portion	3	3	3	3
Egg	1	1	1	1
Whole wheat bread	2 slices	2 slices	none	2 slices
Butter	1 tsp.	1 tsp.	none	3 tsp.
Milk	3 cups	3 cups skim	3 cups skim	3 cups
Vegetable	4 servings	4 servings	4 servings	4 servings
Potato, white	none	none	none	1 small
Meat, lean	4 ounces	4 ounces	4 ounces	4 ounces
Cereal	none	none	none	1 cup or 1 slice bread

Foods Allowed

Beverages

Coffee, tea, milk in allowed amounts

Breads, cereals and crackers

Whole wheat bread, enriched white bread, rye bread in given amounts, as allowed on the diet

The following may be substituted for 1 slice of bread:

- Plain muffin, 1
- Plain roll, 1
- Cooked cereal, ½ cup cooked
- Prepared cereal, flakes and puffed varieties, ¾ cup scant; shredded wheat, ⅔ biscuit
- Rice, macaroni, noodles, spaghetti, ½ cup cooked
- Crackers
  - Graham, 2 (2½ x 2¾″)
  - Oyster, 20 (½ cup)
  - Saltines, 5 (2″ sq.)

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Soda, 3 (2½ x 2¾)
Round, thin varieties, 6 to 8 (1½″ diam.)
Vegetables
Beans, peas, dried (cooked), ½ cup scant
Includes: lima, navy, kidney beans, blackeyed, cowpeas and split peas, etc.
Corn, ½ cup or one small ear
Parsnips, ½ cup, scant
Peas, fresh, ½ cup
Potatoes, white
Baked, 2″ diam.
Boiled, mashed, ½ cup, scant
Sweet potatoes or yams, ¼ cup

Eggs

Soft cooked, poached, scrambled, fried in allowed fat

Fruits—(fresh or unsweetened cooked or canned)

1 portion equals 10 grams carbohydrate

Fruit	*Approximate measure*
Apple	1 small, 2″ diam.
Applesauce	½ cup, scant
Apricots, fresh	2 medium
Apricots, dry	4 halves
Banana	½ small
Berries	1 cup
Cantaloupe	¼, 6″ diam.
Cherries	10 large or 15 small
Cranberries	1 cup
Dates	2
Figs, dried	1 small
Figs, fresh	2 large
Grapefruit	½ small
Grapefruit juice	½ cup
Grapes	12
Grape juice	¼ cup
Honeydew melon	¼ 6″ diam.
Mango	½ small
Nectarine	1 medium
Orange	1 small
Orange juice	½ cup scant

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Fruit	*Approximate measure*
Papaya	⅓ medium
Peach	1 medium
Pear	1 small
Pineapple	½ cup, cubed
Pineapple juice	⅓ cup
Plums	2 medium
Prunes, dried	2 small
Raisins	2 tablespoons
Strawberries	1 cup, 12 large
Tangerine	1 large
Watermelon	1 cup diced or 1 slice 3″ x 1½″

Vegetables

The following vegetables may be used as desired:

Asparagus	Greens:	Mushrooms
Broccoli	Beet	Okra
Cabbage	Chard	Parsley
Cauliflower	Collards	Pepper, green
Celery	Dandelion	Radish
Chicory	Kale	Romaine
Cucumber	Mustard	Rhubarb
Escarole	Poke	Sauerkraut
Eggplant	Spinach	Summer squash
Lettuce	Turnip	Tomatoes
		Watercress

One of the following vegetables may be used once daily:

Beans, string	Carrots	Pumpkin
Beets	Onions	Rutabagas
Brussels sprouts	Peas, canned	Squash, winter
		Turnip

Meat, fish or fowl

Beef, fowl, lamb, veal (medium fat), liver

Fish—cod, haddock, halibut, herring, etc.

crab meat and lobster, ¼ cup equal to 1 ounce meat

shrimps, clams, oysters (medium), 5 equal to 1 ounce meat

Cheese

Cottage cheese, 3 tablespoons level equal to 1 ounce meat

Cheddar cheese, 1 ounce equal to 1 ounce meat

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Fats

Butter or margarine

The following may be substituted for 1 teaspoon butter:

Bacon, crisp	1 slice
Cream, 20%, sweet or sour	2 tablespoons, level
Cream, 40%	1 tablespoon, level
Cream cheese	1 tablespoon, level
French dressing	1 tablespoon, level
Mayonnaise	1 teaspoon, level
Oil or cooking fat	1 teaspoon, level
Olives	5 small

Miscellaneous

The following foods may be used as desired:

Clear broth	Mustard, dry
Bouillon (fat free)	Pickle, dill or sour
Gelatin, unsweetened	Saccharin
Rennet tablets	Pepper and other spices
Lemon	Vinegar
Salt	

Foods to Avoid

The following foods are avoided or used only in the amounts specified by the dietary pattern:

Beverages and soups made with cream, butter, whole milk, cereals or sugar

Breads including sweet rolls, waffles, pancakes, cereals, etc.

Rich and sweet desserts as cake, cookies, pudding, pastry and ice cream

Sweetened, canned or stewed fruit

Vegetables high in carbohydrate unless used as a substitute for bread or potato

Fat meat and fish as fresh pork, ham, bacon, sausage, sardine or other fish canned in oil

Cream—sweet or sour

Chocolate

Sauces and gravies

Fried foods including potato chips, doughnuts, etc.

Oil and salad dressings including mineral oil

Sweets as sugar, candy, jelly, jam, marmalade, sirup, honey and molasses

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Nuts

Bottled beverages as gingerale, pop, cola beverages, beer, wines and other alcoholic beverages

Food Preparation. The foods used on the low-caloric diet should be simply prepared. For example, the meat, fish and poultry should be broiled, baked or roasted or boiled; the fruits should be either fresh or canned or cooked unsweetened; the vegetables and potatoes should be prepared either by boiling, steaming or baking. The only additions allowed are such seasonings as salt and pepper, spices and vinegar. The butter allowance may be used on the potato or vegetable.

One of the important factors in the use of the low-caloric diet is to satisfy the desire of the individual for food. This is done by using bulky low-caloric foods and foods with no food value. These are listed on the foods allowed. Another helpful practice is to save some of the fruit or milk from the meal for a between-meal snack. In order to make the low-caloric diet as acceptable as possible it may be adapted to fit into the eating habits of those who must carry a lunch or who must eat regularly in a restaurant. It can be so planned as to follow the patterns of eating of various nationalities and religious groups.

Psychological Aspects of Weight Reduction. Overweight is due almost entirely to one cause—overeating. The factor of the disturbance of one or more of the endocrine glands as a cause of overweight has been found to be a very slight one and applies to only a few of those who are obese. There are many reasons why people overeat, and they can all be traced back to some emotional basis. As is true with other diseases which are primarily of emotional origin it is important that the patient be helped with his underlying problem if he is to follow his diet and eventually benefit from it.

Weight Reduction in Children. Weight reduction in the child may be carried out by a procedure similar to the one used for the adult. The low-caloric diet used for the obese child should, nevertheless, be nutritionally adequate. The requirement of the child for the various nutrients is considerably

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higher than those of the adult (Table 1), since the child's growth requirements must be met as well. The low-caloric diet therefore becomes an individual matter with each child, depending upon his age and height. It is not always necessary to put the child on an extremely low-caloric diet. He may be placed on a maintenance diet for his ideal weight which will supply him with just enough calories without inviting weight gain; then as he grows he will eventually reach his desired weight for his age and height. Adequate nutrition will also have been maintained.

Questions and Problems

1. In what instances may a high-caloric diet be prescribed by the doctor? What is the reason for an increased caloric requirement in each instance?
2. Plan a day's diet that will furnish 3500 calories and 100 grams of protein for a hyperthyroid patient.
3. How would this diet be modified for a patient having typhoid fever?
4. What type of foods are emphasized for a high-caloric diet? What foods are avoided?
5. Plan a tube feeding to supply 3000 calories and 120 grams of protein.
6. Mrs. White is 30 pounds overweight. Approximately how long should it take to lose this excess weight at a safe rate of weight loss? Why?
7. The doctor has prescribed a 1200 calorie diet for Mrs. White. Plan a day's diet for her.
8. Mrs. White has asked you if there are any foods that she can have whenever she wishes. What would you tell her?
9. What suggestions can you give to Mrs. White about the preparation of her diet along with the rest of the family's meals?
10. What modifications are made in the 1200 calorie diet for a 1000 calorie diet? 800 calorie diet?
11. Does each of these diets supply all the nutrients except calories for an adequate diet?
12. Mr. Jones is to be discharged from the hospital on a 1500 calorie diet. Outline the dietary instructions that should be given to Mr. Jones before he leaves the hospital.

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Chapter XXII

MODIFICATIONS OF THE NORMAL DIET IN PROTEIN CONTENT

High-Protein Diets

One of the more recent and most used modifications of the normal diet is the high-protein diet. In the discussion of the part that protein plays in normal nutrition (Chapter II) it was pointed out that protein was needed primarily for growth and repair of body tissues and for various regulatory functions and secondarily for energy. In a great variety of diseases there is damage and destruction or loss of various of the body tissues, such as the muscle tissue, blood proteins or the parenchyma of such organs as the liver, with consequent impairment of body function. An increased intake of protein is necessary to restore these to their normal state.

Hypoproteinemia. Hypoproteinemia, or low blood serum proteins, may be due to a variety of causes. For example, it can occur in malnutrition which is usually more than a simple lack of calories and may include a lack of protein, minerals and vitamins as well. When there has been a deficient protein intake for a considerable period of time the body reserves are used up and the blood serum proteins are drawn upon, result-

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ing in hypoproteinemia. When this occurs a generalized edema usually results, due to the upset in the osmotic balance between the blood and interstitial fluid. This edema which is the result of inadequate protein nutrition is often spoken of as nutritional edema. It may be amenable to a high protein intake with sufficient calories, minerals and vitamins included to insure adequate nutrition. However, the elaboration of serum protein occurs slowly and extended periods of feeding are often necessary before noticeable increases are made.

Diseases of the Liver. In *cirrhosis of the liver* the damage to the liver cells is such that there is interference with the formation of serum proteins. A hypoproteinemia and accompanying ascites will result. Again a high protein intake is indicated. Diets containing as much as 130 to 200 grams or more of protein per day have been used effectively in the treatment of cirrhosis, affording regeneration of liver tissues and eventually elaboration of serum proteins (1). The high protein intake also supplies the body with larger amounts of lipotropic substances, such as choline and methionine which are effective in preventing fatty liver.

In *infectious hepatitis* damage has been done to the functional cells and to the parenchyma of the liver by infection, probably of virus origin. The disease is accompanied by jaundice. It responds well to a diet similar in protein content to that used in cirrhosis.

Nephritis. In the acute stages of glomerulonephritis there is loss of protein in the urine as well as toxic destruction of tissue due to infection. As a result of this loss of protein plus the usual wear and tear of the body tissues, hypoproteinemia with the accompanying edema results. Again an intake of protein above the normal is indicated to maintain the normal body functions of protein and to replace that which has been lost. These increased amounts of protein above the normal requirements are not harmful to the kidneys and do not place an extra burden upon them, but rather help to insure a better state of nutrition for the patient and thus a better chance of recovery.

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Nephrosis. In nephrosis, edema and proteinuria are more extensive than in nephritis. There is more serious hypoproteinemia, and an even higher protein diet is usually necessary. Two to three grams of protein per kilogram of ideal body weight per day may be necessary to compensate for that lost in the urine, to replace the damaged tissues and blood proteins, as well as to provide the protein necessary for normal body maintenance.

Secondary Anemias. In anemia which may have occurred as a result of an inadequate diet (page 52), inadequate absorption or some type of blood loss or destruction, increased protein intake will be necessary not only to build up the hemoglobin of the blood but to replace the serum proteins as well. Blood donors should increase their protein intake above their normal requirement in order to aid blood regeneration.

Pernicious Anemia. Pernicious anemia is a condition in which an inadequate number of mature red blood cells is formed. It results from a deficiency in the gastric juice of a substance known as the "intrinsic factor." This factor is necessary to make available an extrinsic substance found in foods which is the essential nutrient for red blood cell formation. Recent research has led to the conclusion that this essential material is vitamin B_{12} (page 91). The treatment of pernicious anemia has gone through several stages. Daily oral administration of large amounts of liver has been generally supplanted by parenteral injection of crude liver extract. With the discovery of the important role of vitamin B_{12} the treatment of pernicious anemia has come into a new phase. However, little of this material is yet available for general use. When it is available in sufficient amounts and at a reasonable cost the treatment of pernicious anemia will be greatly simplified. In the meantime the diet in the treatment of pernicious anemia should be an adequate diet, high in protein, supplemented with whole liver extract injections or other anti-pernicious anemia factors.

Surgery and Burns. Pre- and post-operatively and in burns a high-protein diet has been found to be imperative for the

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satisfactory recovery of the patient (2). One of the functions of protein, it will be recalled, is the repair and growth of body tissues. It is obvious that in burns and surgery sufficient protein must be furnished if the proper healing of the surgical wound or burn is to occur. Furthermore, additional protein in surgery is beneficial because of its protective action to the liver against damage due to anesthesia and its prevention of infections through antibody formation, and by the elaboration of hemoglobin and serum proteins. The prevention of hypoproteinemia and resultant edema is imperative if proper wound healing is to occur.

Pregnancy, Lactation, Growth. The importance of higher protein intakes in pregnancy, lactation and in all stages of growth is emphasized in Chapters XIII, XIV, XV and XVI.

Planning the Diet. In planning the high-protein diet for the various diseases mentioned two general principles are involved.

1. Maintenance of adequate nutrition
2. Increase in protein intake sufficiently above the normal requirement to
   a. elaborate serum proteins
   b. replace damaged tissue
   c. synthesize new tissue

Adequate Nutrition

The high protein diet may be planned to be nutritionally adequate by using the Basic Daily Dietary Pattern as the basis for the diet plan and making a few simple additions to it.

Protein

The protein content of the diet is usually increased above the normal requirement by at least 50 per cent. In many instances, depending upon the degree of depletion of the patient, even greater increases may be necessary. The diet

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will therefore contain at least 100 grams or more of protein per day.

The protein foods that are added to the regular diet should be of high biological value. Emphasis should therefore be placed on milk and eggs particularly.

SUGGESTED ADDITIONS TO INCREASE THE DIET BY APPROXIMATELY 50 GRAMS PROTEIN

Food	*Amount*	*Protein gms.*
Milk	1 pint	16
Eggs	2	12
Cream soup	1 cup	8
Meat or equivalent	3 ounces	18

If a still higher protein intake is desired egg white or whole egg may be added to soups and beverages; dried whole milk or dried skim milk solids may be added to fresh milk and may be used in cooking. In some instances protein hydrolysate preparations may be added to beverages and soups. They are not too palatable, however, and the use of natural foods is preferable.

Calories

The diet must be adequate in caloric value, and in instances in which there is underweight it will be advisable to have the diet high in calories as well as in protein.

Sufficient carbohydrate and fat must be supplied for energy purposes so that the protein is spared for its essential functions of tissue repair and synthesis and for its various regulatory functions.

Bulky low-caloric foods should be avoided since they may interfere with the total food intake and therefore result in an inadequate protein and calorie intake. Otherwise any foods which the patient will take may be used, emphasis being placed on those foods which contain protein of high biological value.

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High-Protein Diet (3)
(Approximately 120 Grams Protein)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit, 1 serving	Grapefruit juice, ½ cup
Cereal, 1 serving	Whole wheat cereal with cream and sugar
Eggs, 2	Scrambled eggs, 2
Bread, 1 to 2 slices	Whole wheat toast, 2 slices
Butter, 1 to 2 teaspoons	Butter, 2 teaspoons
Cream	Coffee with cream and sugar
Sugar	
Beverage (if desired)	
Mid-morning	
Milk, 1 cup	Milk, 1 cup
Luncheon	
Cream soup, 1 cup	Cream of asparagus soup, 1 cup
Meat, fish, fowl or equivalent, 3 to 4 ounces	Broiled fish, 3 ounces
Potatoes, rice, noodles etc., 1 serving	Creamed potatoes, 1 serving
Salad or vegetable, 1 serving	Mixed vegetable salad, 1 serving
Fruit, 1 serving	Pears, 1 serving
Bread, 1 to 2 slices	Whole wheat bread, 2 slices
Butter, 1 to 2 teaspoons	Butter, 2 teaspoons
Milk, 1 cup	Milk, 1 cup
Dinner	
Meat, fish or fowl, 3 to 4 ounces	Sliced chicken, 3 ounces
Potato, 1 serving	Potatoes au gratin, 1 serving
Vegetable, 1 serving	Buttered carrots, 1 serving
Dessert, 1 serving	Apple cobbler, 1 serving
Bread, 1 to 2 slices	Whole wheat bread, 2 slices
Butter, 1 to 2 teaspoons	Butter, 2 teaspoons
Milk, 1 cup	Milk, 1 cup
Bedtime	
Eggnog, 1 cup	Eggnog, 1 cup

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Modification of the High-Protein Diet

Soft High-Protein Diet. The high-protein diet may be modified into a soft high-protein diet by applying the principles just laid down for the high-protein diet and for the soft diet (Chapter XX).

Fluid High-Protein Diets. A high-protein intake is often necessary immediately post-operatively and in other instances in which the patient may not be able to take a regular or soft diet. In such cases liquid diets as high in protein as possible will be indicated. High-protein full fluid diets and clear fluid diets with added protein may be planned according to the following suggested pattern. Individualization of the diet to fit the needs of the patient is an important factor in insuring the desired protein intake.

FULL FLUID HIGH-PROTEIN DIET (3)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit juice with egg white (35 grams)	Grapefruit juice with egg white
Strained enriched or whole wheat cereal with milk and sugar, 1 serving	Strained oatmeal with milk and sugar, 1 serving
Soft cooked egg, 1	Soft cooked egg, 1
Beverage with cream and sugar	Coffee with cream and sugar
Mid-morning	
Fruit juice with 1 whole egg and 2 teaspoons glucose, 1 cup	Fresh strained orange juice with 1 egg and 2 teaspoons glucose, 1 cup
Luncheon	
Strained cream soup with 2 teaspoons gelatin, 1 cup	Strained cream of asparagus soup with 2 tsp. gelatin, 1 cup
Fruit juice with egg white, 1 cup	Pineapple juice with egg white, 1 cup
Gelatin dessert, 1 serving	Orange gelatin, 1 serving
Milk with added dried milk and egg white (35 grams), 1 cup	High protein milk, 1 cup

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Mid-afternoon	
Eggnog, 1 cup	Eggnog, 1 cup
Dinner	
Tomato juice with egg white (35 grams), 1 cup	Tomato juice with egg white, 1 cup
Strained cream soup or broth with 2 teaspoons gelatin, 1 cup	Strained cream of corn soup with 2 teaspoons gelatin, 1 cup
Custard or plain pudding, 1 serving	Baked custard, 1 serving
Hot cocoa with added dried milk (30 grams), 1 cup	Hot cocoa with added dried milk (30 grams), 1 cup
Bedtime	
Eggnog with added dried milk solids, 1 cup	High protein eggnog, 1 cup

Clear Fluid Diet with Added Protein (3)

SUGGESTED DIETARY PATTERN

Breakfast

Tea with 2 teaspoons gelatin and 2 teaspoons glucose

Mid-morning

Fruit juice with egg white (35 grams), 1 cup

Luncheon

Grape juice with gingerale and egg white (35 grams), 1 cup
Tea with 2 teaspoons gelatin and glucose

Mid-afternoon

Tomato juice with egg white (35 grams), 1 cup

Dinner

Broth with 1 whole egg and 2 teaspoons gelatin, 1 cup
Tea with 2 teaspoons gelatin and 2 teaspoons glucose

Bedtime

Fruit juice with egg white (35 grams), 1 cup

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Tube Feedings and Parenteral Feedings. The gastrostomy feeding given on page 219 may be increased in protein content by the use of dried skim milk solids, dried eggs or additional whole fresh eggs, or by the inclusion of protein hydrolysates.

The jejunostomy feeding given on page 220 may be increased in protein content by the use of increased amounts of protein hydrolysate. Unduly large amounts of the protein hydrolysate may be irritating to the gastrointestinal tract, however, and discretion should be observed in the amount used.

When the oral means of introducing protein into the body is impossible, the parenteral use of protein hydrolysate has been found successful when used with care and discretion. It helps to maintain the protein nutrition of the patient until such time as sufficient amount of food may be taken by mouth.

Celiac Syndrome. Two conditions are represented in the celiac syndrome, true celiac disease and cystic fibrosis of the pancreas. In these diseases which occur in children from 6 months to 10 years of age, there is intolerance of fats and starches, which leads to characteristic symptoms. Fats are not absorbed and the carbohydrate ferments in the gastrointestinal tract. There is defective absorption generally and extreme malnutrition results. The diet found most effective in the treatment of the celiac syndrome is a high-protein, high-caloric, low-fat and starch-free diet.

Planning the Diet

Adequate Nutrition

It is not easy to plan an adequate diet for the child with either of these diseases. The modifications of the normal diet required to meet the conditions of the diseases result in a diet inadequate in minerals and vitamins, and supplementation is necessary.

Protein

The diet in the celiac syndrome is made up primarily of protein foods. The protein is maintained at from 6 to 8 grams per kilogram of ideal body weight. Such foods as cottage

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cheese, skimmed milk, lean beef, chicken, lean lamb, veal and liver are emphasized.

Carbohydrate

The carbohydrate of the diet is supplied by simple sugars. All forms of starch must be strictly avoided. Such foods as fruits, fruit juices, vegetables, jelly and hard candy are used. Banana is particularly well tolerated. After a year or so on the diet some starches may be added with caution.

Fats

Fats are strictly limited until the steatorrhea has disappeared. Depending upon the child's tolerance small amounts of fat may be added with caution after a considerable period of time.

Calories

The diet is high-caloric; approximately 150 calories per kilogram of ideal body weight should be maintained. This will be supplied by the protein and simple sugars.

Vitamins and Minerals

Supplementation of the diet is recommended as follows (4):

Oleum percomorphum 20-40 drops
Vitamin B complex 2-4 teaspoons
Ascorbic acid 50-100 milligrams
50% ferric ammonium citrate 0.6 ml. per kilogram ideal body weight

Formula. A formula is used to complete the diet. In the infant it may be the entire source of calories while as the child becomes older solid foods are included as well. The formula is computed calorically as follows:

⅔ to ¾ from Protein milk or Hi-Pro
¼ to ⅓ from Banana Powder or glucose
Water to make total volume 24-32 ounces

Administration of Diet. The child is kept strictly to the basic diet for a matter of months to years. When the symptoms

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have subsided and there is a gain in weight some starches are gradually introduced. Bread, potato, rice, zwieback, melba toast, cornstarch and flour are added with considerable caution. Fats are also introduced after some period of time and with great care.

For patients with the pancreatic deficiency, pancreatin which furnishes the digestive enzymes of the pancreatic juice is given along with the formula or at mealtime.

High-Protein—Low-Fat—No-Starch Diet (4)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Egg, any way but fried, 1	Poached egg, 1
Ripe banana, 1 or 2	Ripe banana, 1 or 2
Uncreamed cottage cheese (if hungry)	Uncreamed cottage cheese
6 to 8 ounces of formula	6 to 8 ounces formula
Luncheon	
Finely ground meat, 2 to 3 tablespoons or more	Ground beef, 3 tablespoons
Vegetable puree, 1 to 2 tablespoons or more	Pureed string beans, 2 tablespoons
Fruit puree, 2 to 3 tablespoons or more	Applesauce, 3 tablespoons
6 to 8 ounces formula	6 to 8 ounces formula
Dinner	
Uncreamed cottage cheese, 2 to 3 tablespoons or more	Uncreamed cottage cheese, 2 tablespoons
Vegetable puree, 1 to 2 tablespoons or more	Strained carrots, 1 tablespoon
Fruit puree or gelatin dessert or junket or custard, 2 to 3 tablespoons or more	Banana gelatin, 3 tablespoons
6 to 8 ounces formula	6 to 8 ounces formula
Evening (optional)	
6 to 8 ounces formula	6 to 8 ounces formula
Vitamin supplements as indicated	

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Allow Only the Following Foods

Meats	*Vegetables*
Beef	Asparagus
Chicken	String beans
Lean lamb	Beets
Fresh fish	Carrots
Liver	Squash
Turkey	Spinach
Veal	Peas
	Tomato juice

Fruits	*Miscellaneous*
Applesauce	Cow's milk skimmed
Raw apple, peeled	Egg
Apple juice	Cottage cheese, no cream
Apricots, cooked or canned	Gelatin
Apricot juice	All sugars, corn sirup, honey
Banana	Salt, pepper
Grapefruit juice	Jelly, no seeds
Grape juice	Lollypops or hard candy
Lemon juice	Vanilla, almond extract
Peaches, cooked or canned	Junket or custard made with skim milk
Pears, cooked or canned	
Pineapple juice	
Orange juice, strained	
Pears, peeled raw	

Sprue. This disease which is of a nutritional deficiency origin, is characterized by a macrocytic hyperchromic anemia and gastrointestinal disturbances, including copious foul-smelling stools. There is an intolerance to fats and starches similar to that noted in the celiac syndrome of children. The condition responds to a high-protein, low-fat, low-carbohydrate diet plus the B complex vitamins, especially folic acid and vitamin B_{12}, or crude liver extract. The latter is more effective than the folic acid alone.

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Planning the Diet

Adequate Nutrition

It is difficult to plan an adequate diet with the restrictions imposed for the therapeutic treatment of this condition. Supplementing the diet in iron and vitamins is necessary.

Protein

The protein intake should be at least 2 grams per kilogram of ideal body weight or more per day. Only that of high biological value should be used.

Carbohydrate

The carbohydrate is limited to that found as simple sugars in fruits and vegetables. The carbohydrate of banana is well tolerated.

Fat

The fat intake is restricted to that naturally occurring in the protein foods allowed. All meats should be lean and the visible fat removed. The fat will therefore be 25 grams or less per day.

Minerals and Vitamins

Iron and the B-complex vitamins must be given. Folic acid is necessary for treatment of the macrocytic anemia. Crude liver extract injections are often substituted since the liver extract is a source not only of folic acid but of many other nutrients. Adequate amounts of liver given orally is also another means of furnishing a sufficient intake of these nutrients and must be used when it is not feasible to give injections.

Consistency

In severe cases it may be necessary to make the diet low in cellulose until the gastrointestinal symptoms have improved. The principles of this diet are given on page 214.

Limited Protein Intake

Nitrogen Retention or Uremia. The protein intake of the diet may be limited to the minimum in diseases of the kidney in

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which there is nitrogen retention or uremia. When there is such a degree of impairment of kidney function that the nitrogen waste products cannot be eliminated it is unwise to make the injured kidney do any more work than necessary. However, it must be remembered that the wear and tear of body protein will continue and there will be a certain minimum amount of nitrogen waste products formed continually. It is therefore needless to have a protein intake below the minimum needs of the body in an effort to spare the kidneys. There always will be the minimum of nitrogen waste products to be excreted and if the protein used in body maintenance is not replaced there can be serious complications. The protein, however, should be limited to the bare essentials for adequate nutrition. Only those protein foods included in the Basic Daily Dietary Pattern should be used and the amounts definitely limited. The total intake may be limited to about 50 grams of protein per day. The diet may be made calorically adequate by the addition of sufficient amounts of carbohydrate and fat.

Limited-Protein Diet (3)
(Approximately 50 grams)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit, 1 serving	Sliced peaches, 1 serving
Whole grain or enriched cereal with milk and sugar, 1 serving	Oatmeal with milk and sugar, 1 serving
Egg, 1	Soft cooked egg, 1
Whole wheat or enriched bread, 1 slice	Whole wheat toast, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Beverage with cream and sugar	Coffee with cream and sugar
Luncheon	
Potatoes, rice, noodles, spaghetti or macaroni, 1 serving	Steamed rice with brown sugar and butter, 1 serving
Vegetable, 1 serving	Buttered asparagus, 1 serving
Salad, 1 serving	Tomato salad, 1 serving
Fruit, 1 serving	Grapefruit, ½

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Luncheon (continued)	
Whole wheat or enriched bread, 1 slice	Whole wheat bread, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Milk, 1 cup	Milk, 1 cup
Dinner	
Meat, fish or fowl, 1 small serving (2 ounces)	Roast beef, 2 ounces
Potato, 1 serving	Mashed potatoes, 1 serving
Vegetable, 1 serving	String beans, 1 serving
Fruit, 1 serving	Sliced pineapple, 1 serving
Whole wheat or enriched bread, 1 slice	Whole wheat bread, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Milk, 1 cup	Milk, 1 cup

Foods to Avoid

Peas	Nuts
Beans, dried	Cheese
Lentils	Gelatin

Desserts or soups containing milk or egg unless they are substituted for part of the protein allowance.

The milk, egg, meat or equivalent, and bread or cereals must be used only in the amounts specified.

The diet may be ordered low in sodium and fluids may be limited. If a low-sodium diet is ordered the principles outlined in Chapter XXV should be observed also.

Modification of the Normal Diet in Purine Content

Low-Purine Diet

Gout. In the metabolism of purines, which are present in the nucleo-proteins of the cells, uric acid is formed. Normally this is excreted through the kidneys. In gout there is an impairment of either metabolism or excretion so that an increased amount of uric acid is present in the body. This may be deposited in the various joints as sodium salt resulting in

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considerable pain to the individual. A low-purine diet has been found of value in treating gout in many patients.

Besides purines derived from food, exogenous source, the body has another source of these substances through its ability to synthesize them, endogenous source. The latter obviously cannot be controlled and will be a constant source of purines to the body. The exogenous source can, however, be limited.

Planning the Diet

Purine Content

Purines are found mainly in animal proteins, although they are also present in vegetables to a limited extent. Meats are a considerable source: glandular meats, sweetbreads, liver and kidney being quite potent. These must be eliminated from the diet entirely along with such other high purine foods as meat extractives, sardines and anchovies. The purine content of foods is given in Table 19. On a very low-purine diet only those foods listed in Group I may be used. Such a diet will contain approximately 35 milligrams of purines per day (10). An ordinary diet contains from 300 to 1000 milligrams or more of purines per day. When a moderately low-purine diet is indicated a 2 ounce serving of meat, fish or fowl, other than those listed in Group III, may be used twice weekly.

TABLE 19

PURINE CONTENT OF FOODS PER 100 GRAMS (1)

Group I (0-15 mg.)	*Group II* (50-150 mg.)	*Group III* (150-800 mg.)
Vegetables	Meats	Sweetbreads
Fruits	Fish	Anchovies
Milk	Sea foods	Sardines
Cheese	Beans, dry	Liver
Eggs	Peas, dry	Kidney
Cereals	Lentils	Meat extracts
	Spinach	Brains

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Adequacy of the Diet

The Basic Daily Dietary Pattern will be used as a basis for planning the low-purine diet. Since this diet must be limited in the amount of meat, fish and poultry, it is necessary to supply the required amounts of protein through increased amounts of milk, cheese and eggs. This is the only modification of the Basic Daily Dietary Pattern that will be needed.

Calories

The diet may be limited in caloric value to bring about weight reduction since this is often a complicating factor in gout.

Fat

Fat should be limited to the amount in the foods shown in the Basic Daily Dietary Pattern since fat interferes with urate excretion.

Carbohydrate

Unless the diet is limited in caloric value it should be high in carbohydrate since it is of value in aiding in urate excretion.

Low-Purine Diet (2)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
	Breakfast
Fruit, 1 serving	Orange juice, ½ cup
Cereal, 1 serving	Enriched cream of wheat, 1 serving
Egg, 1	Soft cooked egg, 1
Enriched white bread, 1 slice	Enriched white toast, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Decaffeinated coffee or cereal coffee	Decaffeinated coffee, 1 cup
Milk, ½ cup	Milk, ½ cup
Sugar, 2 teaspoons	Sugar, 2 teaspoons

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Luncheon	
Egg or cheese, 1 serving	Cottage cheese, 1 serving
Potato, rice, noodles, spaghetti or macaroni, 1 serving	Baked potato, 1 serving
Salad without dressing, 1 serving	Tomato salad, 1 serving
Fruit, 1 serving	Peaches, 1 serving
Enriched white bread, 1 slice	Enriched white bread, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Milk, 1 cup	Milk, 1 cup
Dinner	
Egg or cheese, 1 serving	Mushroom omelet, 1 serving
Potato, 1 serving	Baked potato, 1 serving
Vegetable, 1 serving	Asparagus, 1 serving
Dessert or fruit, 1 serving	Lemon sherbet, 1 serving
Enriched white bread, 1 slice	Enriched white bread, 1 slice
Butter, 1 teaspoon	Butter, 1 teaspoon
Milk, 1 cup	Milk, 1 cup

Foods to Avoid

Sweetbreads, brains, liver, kidney, meats
Meat extracts, broths, gravies
Dried beans, lentils, dried peas, spinach
Oatmeal
Fried foods
Cream, salad oils, cooking fats
Alcoholic beverages
Coffee, tea, chocolate, cocoa*
Anchovies, sardines, sea food, fish

* There is some question as to whether caffeine can be converted into uric acid in the body (1).

Questions and Problems

1. What is meant by a high-protein diet? What additions may be made to the regular diet to make a high-protein diet?
2. List all the types of conditions in which a high-protein diet might be indicated. In each case note the reasons for the high-protein intake.
3. When might it be necessary to limit the protein intake in the diet? Why? What is meant by a limited-protein diet?
4. Mrs. Jones is being discharged on a high-protein (160 grams) soft diet which she is to progress to a regular high-protein

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diet in a week's time. Plan a day's menu for her for each of the diets as an illustration of what she should eat when she returns home.

5. A mother whose child has celiac disease has asked you what foods her child may have on the high-protein, low-fat, starch-free diet the doctor has ordered. List the foods that may be used. What instructions about food preparation would you give her?
6. A high-protein (180 grams) full-fluid diet, supplying 3000 calories has been ordered for a patient. Plan a menu for 2 days to meet the requirements of this diet order.
7. Mrs. Smith must prepare a diet containing 150 grams of protein per day for her husband. They have a limited food budget. What suggestions can you give her about foods to use that are high in protein but inexpensive. Plan a day's menu for her as an example.
8. What is the metabolic disorder which occurs in gout? What type of diet may be indicated?
9. What are the sources of purines to the body?
10. What other limitations besides low-purine content may be made in the diet for the treatment of gout? Why?
11. Plan a day's menu for a patient on a low-purine, 1500 calorie diet to contain 70 grams of protein.

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Chapter XXIII

MODIFICATIONS OF THE NORMAL DIET IN FAT CONTENT

Limited-Fat Diets

A diet lower in fat content than the normal diet is used mainly in conditions in which an impairment of an organ associated with fat digestion is involved. Thus, in diseases of the gall bladder such as gallstones or cholelithiasis, and in infections of the gall bladder or cholecystitis, a limited-fat diet is usually used. It is sometimes employed in the treatment of some diseases of the liver in which there is interference with the flow of bile.

Cholecystitis. Infections of the gall bladder cause an inflamed state which is further aggravated by the stimulation of the gall bladder to contract when fat is introduced into the gastrointestinal tract. In order to allow the gall bladder to rest until the inflammation has subsided it is found advisable to reduce the fat content of the diet to a minimum, compatible with requirements for an adequate and palatable diet. There is, however, considerable variation in individuals with cholecystitis in the amount of fat that may be tolerated, and the diet should be adjusted accordingly.

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Cholelithiasis. Gallstones, made up mainly of cholesterol (Chapter IV), may act as an obstruction and an irritant to the gall bladder. Thus, a limited-fat diet is indicated in this condition. The value of a low-cholesterol diet in addition is questionable. The food cholesterol intake may have little bearing on the blood cholesterol and bile content. However, low-cholesterol diets may be prescribed in some rare instances, in an attempt to alleviate the condition. A table of the cholesterol content of foods is given on page 479 which may be used when a low-cholesterol diet is indicated. It will be observed that such foods as liver, egg yolk, brain, kidney, sweetbreads, caviar and roe are especially high. The fat of meat, butter and whole milk cheese also have appreciable amounts. Most of these foods are already restricted in a limited-fat diet. Many people with cholelithiasis are overweight and benefit greatly from a low-caloric diet (Chapter XXI) which will be limited both in fat and in cholesterol.

Diseases of the Liver. In *cirrhosis of the liver* it has been the custom for some time to restrict the fat of the diet quite rigidly. The trend in recent years, however, has been toward a more liberal fat intake. This has been particularly true as the benefits of a high-protein intake in the treatment of this disease have been realized (Chapter XXII). Protein-containing foods are generally fat-containing foods as well. The amount of the fat in the diet therefore will depend largely upon the amount of protein to be included plus that in the other foods necessary for adequacy. The importance of an adequate diet for the patient with cirrhosis of the liver cannot be overemphasized. It is one of the most essential features of the dietary treatment of this disease.

In *infectious hepatitis* the fat intake will be limited in the same manner as has just been stated for cirrhosis of the liver.

Planning the Diet

Adequacy of the Diet

The first principle in the planning of the limited-fat diet is to supply adequate amounts of the essential nutrients. Thus the Basic Daily Dietary Pattern will be used as the basis. The

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calories necessary to meet the energy needs of the individual will be supplied by carbohydrate foods.

Fat

The next principle of the diet is to keep the fat content as low as possible, compatible with the requirements for adequacy. The amount of fat allowed, therefore, cannot be lower than approximately 65 grams and still supply all the essentials for good nutrition.

FAT CONTENT OF FOODS IN BASIC DIETARY PATTERN

Food	*Amount*	*Fat gms.*
Milk	3 cups	28
Lean meat or equivalent	3 ounces	11
One other protein	1 serving	5
Egg	1	6
Vegetables including potato	3 servings	—
Fruits	2 servings	—
Whole grain cereals	4 servings	4
Butter	1 tablespoon	12
		66

Protein

The protein of the diet must meet the basic requirement of 1 gram per kilogram of ideal body weight for a day. It may be much higher than this depending upon the use to which the diet is being put. Since the protein-containing foods are fat-containing as well, the amount of fat is largely controlled by the protein foods necessary for an adequate protein intake.

Calories

The total caloric requirement will of necessity be made up mainly of high-carbohydrate low-fat foods such as honey, jelly, jams, marmalade, bread, cereals, sugar and glucose.

Modifications of the Limited-Fat Diet. The diet may be made lower in fat by using skim milk and omitting the butter. This

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will be inadequate in vitamin A and furthermore will not be very palatable.

By the use of such foods as egg white, gelatin, dry skim milk solids and cottage cheese the intake of protein may be increased without increasing the fat intake. If the patient will take these foods, appreciable increases in the protein content of the diet can be made.

Preparation of Foods. The meat, fish and poultry used on the limited-fat diet, besides being lean, should be prepared by methods not requiring added fat, such as broiling, roasting or baking or boiling. The vegetables and potatoes should likewise be prepared simply, either by boiling, baking or steaming. No sauces or gravies should be added to these foods.

Limited-Fat Diet
(Approximately 65 grams)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit, 1 serving	Whole orange, 1
Cereal, 1 serving	Whole wheat cereal, 1 serving
Egg, 1 *only* (not fried)	Poached egg, 1
Bread, 2 slices	Whole wheat toast, 2 slices
Butter, 1 teaspoon *only*	Butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Beverage	Coffee
Milk, 1 cup, *only*	Milk, 1 cup
Sugar, as desired	Sugar
Luncheon	
Lean meat, fish, poultry or cottage cheese, 2 ounces *only*	Cottage cheese, 2 ounces
Potatoes, noodles or macaroni, 1 serving	Baked noodles, 1 serving
Vegetable or salad, 1 serving	Tomato salad (no dressing), 1 serving
Fruit, 1 serving	Sliced peaches, 1 serving
Bread, 2 slices	Whole wheat bread, 2 slices
Butter, 1 teaspoon *only*	Butter, 1 teaspoon
Milk, 1 cup *only*	Milk, 1 cup
Jelly, 1 tablespoon	Jelly, 1 tablespoon

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Dinner	
Lean meat, fish or poultry, 2 to 3 ounces *only*	Broiled steak, 2 to 3 ounces
Potato, 1 serving	Baked potato, 1 serving
Vegetable, 1 serving	Peas, 1 serving
Fruit or dessert, 1 serving	Lemon ice, 1 serving
Bread, 2 slices	Whole wheat bread, 2 slices
Butter, 1 teaspoon *only*	Butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Milk, 1 cup *only*	Milk, 1 cup
Beverage	Tea with lemon or sugar

Foods to Avoid

Cream	Fried foods
Rich desserts as pastries, puddings, cake and ice cream	Sauces and gravies
	Salad dressings
Fat meat and fish	Nuts
Cheese, except cottage cheese	Oils, cooking fats
Chocolate	Strongly flavored vegetables (unless well tolerated)

Foods Allowed

Any foods not listed to avoid may be used.

Those foods containing fat that are necessary for adequate nutrition should be used only in the amounts specified.

High-Fat Diet

Gall Bladder Disease. A diet high in fat is used occasionally in some diseases of the gall bladder when it is unusually sluggish. In some instances the stimulation of the flow of bile by the high-fat intake is found to be beneficial in preventing stone formation. The diet may be made high in fat by the addition of the desired amounts of butter, cream, cooking oils and fats and fat meats to the Basic Daily Dietary Pattern.

Nervous Disorders. In some cases of epilepsy which do not respond well to the specific drug treatment the ketogenic diet may be resorted to in an attempt to control the disease. Before drug therapy was the method of choice in treating epilepsy,

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the ketogenic diet was about the only means available for treating this condition.

The ketogenic diet is extremely high in fat, very low in carbohydrate and contains an adequate amount of protein. The purpose of the diet is to have the body metabolize fat primarily. This will result in an overproduction of ketone bodies and a consequent acidosis due to the ketosis. It is believed that the mild acidosis, along with the dehydration produced, is effective in the reduction of the epileptic seizures.

The ketogenic diet must be calculated for each individual patient and the ratio of the fatty acid or ketogenic fraction to the anti-ketogenic or glucose-forming fraction must be such that the desired degree of acidosis is maintained. The diet must be accurately weighed and adhered to strictly if it is to be effective. Since it is so extremely high in fat and so low in carbohydrate it is not very palatable and it is difficult to make it attractive and interesting. Furthermore, it is inadequate in the vitamins of the B complex and ascorbic acid and supplements are imperative.

Questions and Problems

1. When may a limited-fat diet be prescribed? What is the therapeutic value of the limited-fat intake in each instance?
2. How much fat is there in a limited-fat diet? Why?
3. How can the protein content of a limited-fat diet be increased without increasing the fat content?
4. When may a high-fat diet be indicated? What is meant by a ketogenic diet? When is it prescribed?
5. Plan a menu for 2 days for the patients who are on a limited-fat diet.
6. Mrs. Black has been placed on a limited-fat high-carbohydrate diet. She has asked you how she can make her diet high in carbohydrate. What suggestions can you give her?
7. What instructions should Mrs. Black have about the preparation of her food when she is at home?
8. List the foods which Mrs. Black should avoid on her diet.

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Chapter XXIV

MODIFICATIONS OF THE NORMAL DIET IN CARBOHYDRATE

Limited-Carbohydrate Diets

Diabetes Mellitus. Diabetes mellitus is a disease of endocrine origin which results in a disturbance in the metabolic processes of the body. Several of the endocrine glands are involved. The pancreas, pituitary, thyroid and the adrenals are all implicated. Of these, the part that the secretion of the pancreas plays is best understood. The hormonal secretion of the pancreas, insulin, is necessary for the metabolism of carbohydrates. It is known to be necessary for the storage of glycogen in the liver and for the initiation of the metabolism of glucose to carbon dioxide and water, and it probably functions in other parts of the carbohydrate metabolic cycle as well.

The pituitary functions in diabetes through the formation of at least two hormones, the glycotropic factor and the diabetogenic factor. The former has been shown to have an insulin-antagonizing effect. It probably acts in opposition to insulin in the first step in glucose metabolism in which insulin is functional in the formation of hexose-6-phosphate.

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Thus diabetes may be due to a lack of insulin or it may be due to an overproduction of the glycotropic factor of the pituitary.

Since the primary disturbance in diabetes is in carbohydrate metabolism the limitation of the diet in carbohydrate is obvious. However, the fact that part of both the protein and the fat may enter into the same metabolic pool with carbohydrate means that they too must be considered in the diet.

It has been observed that when there has been a severe or prolonged restriction of carbohydrate metabolism a ketosis results. This is due to the incomplete combustion of the ketone bodies. These normal metabolites of fat (Chapter IV) are the primary sources of energy to the body when carbohydrate is not available. They are produced in such large quantities at such times that the tissue cells are not able to metabolize them as rapidly as they are produced and they accumulate. Approximately half of the protein, as well as most of the fat, contribute to the ketone formation. The part that the ketogenic factor, formed by the pituitary, plays in controlling ketone formation is not well understood.

The exact role which the other endocrine glands play in diabetes is not yet well-known and awaits much more experimental evidence before the exact nature of their influence in diabetes is understood.

Principles of the Diet

Adequate Nutrition

The primary principle of the diabetic diet, as with all other therapeutic diets, is that it should be nutritionally adequate. The foods shown in the Basic Daily Dietary Pattern must be included in the diet each day. Therefore the diet prescription must be liberal enough to allow for at least this minimum amount of food. Insulin may be prescribed as necessary to insure normal metabolism. An analysis of the Basic Daily Dietary Pattern shows it to contain approximately:

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Calories	1550
Protein	75 grams
Fat	65 grams
Carbohydrate	165 grams

According to the discretion of the physician the diet may be increased above this amount depending upon each individual patient.

Reduction of Caloric Value of Diet

The caloric value of the diet of the diabetic person is usually kept somewhat below that of the non-diabetic person of the same ideal weight. There are several reasons for this. One is that one of the most important predisposing factors in diabetes is overweight. The adult diabetic, although he may have lost weight just previous to the diagnosis of diabetes is usually still overweight and reduction of weight to within the ideal range is essential. Furthermore, since diabetes is a disease of metabolism it is well to keep the metabolic process more nearly within the limits of the patient's capabilities. Thus extremely large doses of insulin are avoided, or in some instances of mild diabetes insulin may not be necessary at all.

The caloric value of the diet of the diabetic will be kept at a level somewhat lower than for a similar non-diabetic after the desired weight reduction has been reached in order to maintain the patient's weight at this level.

The diet prescription for each diabetic patient is an individual matter and must be determined by the physician upon due examination of the patient. It will be based upon the patient's history, on the severity of the diabetes, on the physical state of the patient for his age and height and on his activity. After the total caloric needs of the patient have been determined, the division of the caloric value of the diet into protein, fat and carbohydrate will be made. This again is an individual matter for each patient.

Distribution of Carbohydrate into Meals

The distribution of carbohydrate into meals depends upon the type of insulin which is used. Four general types of in-

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sulin are in use at the present time, standard insulin, protamine zinc insulin, globin insulin and modified protamine insulin (NPH-50) (1). These insulins have various lengths of time of effectiveness after administration, which determines the amount of carbohydrate that is to be furnished at different times of the day. Standard insulin is a quick-acting insulin and it is necessary that carbohydrate be supplied within 20 minutes to one half hour after the insulin has been given. It must be given more often than any of the other types. The carbohydrate of the diet is either distributed equally in the three meals or it may be divided, breakfast $2/5$, luncheon $1/5$ and dinner $2/5$, depending upon the amount and the number of injections of insulin given. Globin insulin requires a period of 8 to 10 hours for its greatest activity. It is therefore advisable to have a larger amount of carbohydrate at the noon and evening meals. Usually a mid-afternoon feeding and sometimes an evening feeding are given. The carbohydrate is thus usually divided: breakfast—$1/7$, luncheon—$2/7$, mid-afternoon—$1/7$, dinner—$2/7$, and bedtime—$1/7$. It may also be divided: breakfast—$1/5$, luncheon—$2/5$, and dinner—$2/5$ with a mid-afternoon feeding of 10 grams of carbohydrate subtracted from the luncheon carbohydrate. Protamine insulin has a long period of action, usually from 12 to 14 hours after administration. When it is used the largest amount of carbohydrate must be given late in the day. A bedtime feeding is essential. The diet may be divided: breakfast—$2/7$, luncheon—$2/7$, dinner—$2/7$, and bedtime—$1/7$; or it may de divided: breakfast—$1/5$, luncheon—$2/5$, dinner—$2/5$, and bedtime—10 grams of carbohydrate subtracted from the luncheon carbohydrate. The most recent insulin is a modified protamine insulin which contains crystallized protamine. It lowers the blood sugar in about 2 hours after administration. Its maximum point of action is at 10 to 20 hours and it continues to act for 28 to 30 hours. The carbohydrate of the diet is usually divided: breakfast—$1/5$, luncheon—$2/5$, dinner—$2/5$ with afternoon and bedtime feedings.

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TABLE 20

SUGGESTED DIVISION OF THE CARBOHYDRATE ACCORDING TO TYPE OF INSULIN

Insulin	*Breakfast*	*Mid-morning*	*Luncheon*	*Mid-afternoon*	*Dinner*	*Bedtime*
Standard	1/3		1/3		1/3	
	2/5		1/5		2/5	
Globin	1/7		2/7	1/7	2/7	1/7
	1/5		2/5	10 grams of carbohydrate	2/5	
Protamine	2/7		2/7		2/7	1/7
	1/5		2/5		2/5	10 grams of carbohydrate
Modified protamine	1/5		2/5	10 grams of carbohydrate	2/5	20 grams of carbohydrate

Planning the Diet

Calories

The daily caloric allowance for the diabetic patient may be determined from the following table. The patient's ideal weight rather than his actual weight should be used as the basis for the calculation (Tables 39–43). Adjustment in the caloric level must be made for each individual in accordance with the principles previously mentioned.

TABLE 21

CALORIC ALLOWANCES FOR DIABETIC PATIENTS (2)

	Per pound	*Per kilogram*
Bed rest	11.5 calories	25
Light exercise	13.5 calories	30
Moderate exercise	16 calories	35
Heavy exercise	18 calories	40

Protein

After the total calories have been fixed the proportion to be derived from protein, fat and carbohydrate is determined.

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The protein intake is based on the normal requirement of 1 gram per kilogram or ½ to ⅔ grams per pound of ideal weight. Thus as a general rule, the protein will range between 60 to 80 grams per day.

Carbohydrate

There have been wide variations in the carbohydrate content of the diabetic diet from very restricted to very liberal amounts. The general trend, however, is toward moderation. The amount of carbohydrate allowed is determined on a percentage basis similar to that of the normal diet. From 40 to 60 per cent of the non-protein calories will be used as carbohydrate. It is seldom wise or necessary to use less than 100 grams of carbohydrate per day, since it is impossible to supply the foods necessary for adequate nutrition on less than this amount. Somewhat higher amounts of 150 to 200 grams of carbohydrate make more interesting, palatable and adequate diets for the patient.

Fat

The calories remaining after deducting the protein and carbohydrate calories from the total caloric allowance will be supplied by fat.

Sample Calculation of a Diet Prescription

Ideal weight of patient—130 pounds
Activity—light exercise

1. Calories (from Table 21)—13.5 calories per pound
   $130 \times 13.5 = 1755$ calories per day
2. Protein—½ to ⅔ grams per pound ideal body weight
   $130 \times 0.6 = 78$ grams per day
3. Non-protein calories
   $1755-(78 \times 4) = 1443$ calories (to be divided between carbohydrate and fat)
4. Carbohydrate—40 to 60 per cent of non-protein calories
   50% of $1443 = 721$ calories
   $721 \div 4 = 180$ grams carbohydrate per day

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5. Fat—total calories—calories from carbohydrate and protein
   $1755 - (721 + 312) = 722$ calories for fat
   $722 \div 9 = 80$ grams fat per day

The diet prescription will then read 80 grams of protein, 80 grams of fat and 180 grams of carbohydrate per day.

The division of the carbohydrate into meals will then be made on some plan as suggested in Table 20 depending upon the type of insulin which is being given to the patient.

Calculation of Diet Plan. A dietary plan for the daily planning of meals is calculated for the diabetic patient from the prescription ordered by the doctor. This is a similar procedure to the suggested plan for the normal diet or for any

TABLE 22

COMPOSITION OF BASIC FOOD GROUPS

Food	*Approximate measure*	*Wt. gm.*	*Protein gm.*	*Fat gm.*	*Carbohydrate gm.*
Milk	1 pint	480	16	20	24
Protein exchanges	1 ounce	30	7	5	—
Vegetable exchanges	½ cup	100	2	—	7
Fruit exchanges	1 portion	Varies	—	—	10
Carbohydrate exchanges	1 slice bread	25	2	—	15
	Other items vary	Varies			
Fat exchanges	1 level teaspoon fat	5	—	5	—
	Other items vary	Varies			

other therapeutic diet. If the patient has a daily plan for his meals it simplifies the planning for him; he soon learns the foods that must be included in his diet each day and it insures that he will be following the diet prescription more accurately. Furthermore, an adequate diet is assured.

There are a number of procedures that may be used in the calculation of a diabetic diet plan. A simplified method has been developed which will meet the needs of the majority of

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patients.* The principle of the calculation of diabetic diets by this simplified procedure is based on the idea of food exchanges. The basic foods allowed the diabetic patient are divided into six groups, according to their composition. For each of the six food groups given in Table 22 there is a list of the foods and the amounts that have approximately the same nutritive value in protein, fat and carbohydrate as the basic group. See Food Exchange Lists (pages 282–86). Any of these foods may then be substituted for the basic food in the amount calculated in the diet for the individual patient.

Procedure for Calculation of Diet Plan

1. List the minimum amount of milk (3 cups), vegetables (2 servings—one from list IIIA, one from list IIIB) and fruits (3 servings) to be used for the day and fill in the protein, fat and carbohydrate values, using Table 22. The diabetic diet may be calculated in grams and then translated into household measurements or calculated in household measurements to begin with. There is no need to weigh the diabetic diet, but it should be measured accurately. [Diets may be weighed in the hospital as a teaching device to show size of portions but it is not warranted otherwise.]
2. Add the carbohydrate column. Subtract from the total carbohydrate of the diet prescription. The carbohydrate remaining will be divided into carbohydrate exchanges by dividing by 15.
3. Fill in the protein value of the carbohydrate exchanges and change the vegetable protein value if the amount of vegetable is changed.
4. Add protein column and subtract from total protein of the diet prescription. The remaining protein will be used as protein exchanges by dividing by 7.

* This procedure was developed jointly by the American Dietetic Association, the American Diabetes Association and the U. S. Public Health Service, Diabetes Service.

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5. Fill in the fat value of the protein exchanges.
6. Add the fat column. The fat remaining after subtracting the fat from sources other than fat exchanges will be used as fat exchanges by dividing by 5.
7. Diets are calculated to within 3 grams of the diet prescription.
8. After the total amounts of the food for the day are calculated they are distributed into the three meals and between-meal feedings according to the carbohydrate division and the eating habits of the individual.

Between-meal feedings

When between-meal feedings are ordered they should be made up of fairly complex carbohydrate and should include some protein and fat, as such foods are less rapidly digested, absorbed and metabolized than the simple carbohydrates of fruit. The first 12 grams of carbohydrate of the between-meal feeding should come from milk (1 cup—240 grams). The remaining carbohydrate should come from crackers or bread rather than fruit or fruit juices.

A sample diet calculation for a suggested dietary plan is given on page 279.

Sample Diet Calculation

Diet order: Protein 80, Fat 80, Carbohydrate 180 (Carbohydrate divided: breakfast—30; luncheon—65; dinner—75; bedtime—10).

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Total Day's Diet

Food	*Amount*	*P*	*F*	*C*
		GM	GM	GM
Milk, whole (list I)	3 cups (standard)	24	30	36
Vegetables (list IIIA)	As desired	—	—	—
Vegetables (list IIIB)	1 serving	2	—	7
Fruit (list IV)	3 portions	—	—	30
				(73)
Carbohydrate exchanges (list V)	7 servings	14	—	105
		(38)		
Protein exchanges (list II)	6 servings	42	30	
			(60)	
Fat exchanges (list VI)	4 servings		20	
Total		80	80	178

Calculations

Carbohydrate

180 gm. carbohydrate in prescription
73 gm. carbohydrate in diet from other than carbohydrate exchanges
———
107 ÷ 15 = 7 servings of carbohydrate exchanges

Protein

80 gm. protein in prescription
38 gm. protein in diet from other than protein exchanges
———
42 ÷ 7 = 6 servings of protein exchanges

Fat

80 gm. fat in prescription
60 gm. fat from other than fat exchanges
———
20 ÷ 5 = 4 servings fat exchanges

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Suggested Dietary Plan (based on carbohydrate division)

Food	*Amount*	*C*
Breakfast		GM
Fruit	1 portion	10
Protein exchange (egg)	1 serving	—
Carbohydrate exchanges	1 serving	15
Fat exchanges	1	—
Milk	½ cup (standard)	6
	Total	31
Luncheon		
Protein exchanges	2	—
Vegetables (list IIIA)	As desired	—
Fruit	1 portion	10
Carbohydrate exchanges	3	45
Fat exchanges	1	—
Milk	½ cup	6
	Total	61
Dinner		
Protein exchanges	3	—
Vegetables (list IIIA)	As desired	—
Vegetables (list IIIB)	1 serving	7
Fruit	1 portion	10
Carbohydrate exchanges	3	45
Fat exchanges	2	—
Milk	1 cup	12
	Total	74
Bedtime		
Milk	1 cup	12

One of the most important factors in the calculation of the diabetic diet is that it meet the needs of the individual patient for whom it is ordered. It must therefore be planned with the patient and so arranged as to fit into his daily habits of

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living. Such problems as a carried lunch or restaurant meals or night working hours will call for special considerations. Within the limits of the diet, the likes and dislikes, and the national and religious food customs of the individual should be incorporated. The economic status of the patient must also be given due consideration. If all these factors are not taken into account the patient is not likely to follow the diet and its purpose will be defeated. The diabetic patient's menu should also be planned to fit into the family meal plan as much as possible. Many of the foods of the family menu may be used by the patient with little or no difference in preparation. Every effort should be made to have the diabetic patient's diet as nearly as possible like what he would have were he a non-diabetic, but still to provide the therapeutic value of the necessary restriction that must be made.

Menu Adaptations. Variety in the diabetic diet is obtained by using the various exchange lists given (pages 282–86). A wide choice of substitutions is allowed with each group of foods and this encourages an interesting and varied diet. It will be observed that the A list of vegetables allows for a full cup (2 servings) of vegetables at each meal before the carbohydrate value need be counted. This allows for a considerable amount of bulk in the diet and is an important factor in the satiety value. The use of the foods with negligible food value, both with meals and between meals, is another means of providing the diabetic patient with variations in his meals and an opportunity to satisfy any desire for between-meal eating. The planning of satisfying meals may be accomplished easily and simply. With a little thought and imagination meals can be as enjoyable an experience for him as for anyone else.

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Food Exchanges

List I—MILK

8 gm. protein, 10 gm. fat, 12 gm. carbohydrate per serving.

Food	*Approx. measure*	*Weight (grams)*
Milk, whole	1 cup	240
Milk, evaporated	½ cup	120
Milk, powder, whole	¼ cup	
	3 tbsp. level	35
Buttermilk*	1 cup	240
Milk, skim*	1 cup	240

* Add 10 gm. fat (2 fat exchanges). Most commercial buttermilk is skimmed. Check local supplies.

List II—PROTEIN OR MEAT EXCHANGES

7 gm. protein, 5 gm. fat, negligible carbohydrate per serving.

Note: All items expressed in cooked weight. One or more fat exchanges from the diet may be used to cook or season these foods.

Food	*Approx. measure*	*Weight (grams)*
Meat: beef, fowl, lamb, veal (medium fat), liver, pork, ham (lean)	1 ounce	30
Coldcuts: salami, minced ham, bologna, cervelat, liver sausage, luncheon loaf	1 slice, 4½″ diam. x ⅙″	45
Frankfurter	1 (8-9 per lb.)	50
Fish: cod, haddock, halibut, herring etc.	1 ounce	30
salmon, tuna, crabmeat, lobster	¼ cup	45
shrimp, clams, oyster (medium)	5	45
sardines	3 medium	30
Cheese: cheddar type	1 ounce	30
cottage	3 tbsp. level	45
Peanut butter**	2 tbsp. scant	30
Egg	1	50

** Limit to one serving per day unless adjustment is made to balance carbohydrate content.

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List III—VEGETABLES—One or more fat exchanges from the diet may be used to season these vegetables.

A. VEGETABLES—negligible protein, fat and carbohydrate in amounts ordinarily used.

If more than one cup in cooked form is used at one meal it should be calculated as one serving of a Group B vegetable.

Asparagus	Mushrooms	Greens, continued:
Broccoli	Okra	Kale
Beans, string	Parsley	Mustard
Cabbage	Pepper, green	Poke
Cauliflower	Radish	Sauerkraut
Celery	Romaine	Spinach
Chicory	Greens:	Turnip
Cucumber	Beet	Watercress
Escarole	Chard	Rhubarb
Eggplant	Collards	Summer squash
Lettuce	Dandelion	Tomatoes

B. VEGETABLES—2 grams protein, negligible fat, 7 grams carbohydrate per serving.

1 serving = ½ measuring cup = 100 grams

Beets	Onions	Rutabagas
Brussels sprouts	Peas, canned	Squash, winter
Carrots	Pumpkin	Turnip

List IV—FRUITS, fresh, cooked, canned or frozen *unsweetened*

1 portion = 10 grams carbohydrate

Fruit	*Approx. measure*	*Weight (grams)*
Apple, 1 small	2″ diam.	80
Applesauce	½ cup	100
Apricots, fresh	2 medium	100
Apricots, dry	4 halves	20
Banana	½ small	50
Berries (blackberries, raspberries and strawberries)	1 cup	150
Blueberries	⅔ cup	100
Cantaloupe	¼ 6″ diam.	200
Cherries	10 large or 15 small	75
Cranberries	1 cup	100
Dates	2	15

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List IV (continued)

Fruit	*Approx. measure*	*Weight (grams)*
Figs, dried	1 small	15
Figs, fresh	2 large	50
Grapefruit	½ small	125
Grapefruit juice	½ cup	100
Grapes	12	75
Grape juice	¼ cup	60
Honeydew melon	⅛ 7″ diam.	150
Mango	½ small	70
Nectarines	1 medium	80
Orange	1 small	100
Orange juice	½ cup	100
Papaya	⅓ medium	100
Peach	1 medium	100
Pear	1 small	70
Pineapple	½ cup, cubed	80
Pineapple juice	⅓ cup	80
Plums	2 medium	100
Prunes, dried	2 medium	25
Raisins	2 tbsp. level	15
Rhubarb	(See list IIIA)	
Tangerine	1 large	100
Watermelon	1 cup diced 1 slice 3″ x 1½″	175

List V—CARBOHYDRATE OR BREAD EXCHANGES
2 grams protein, negligible fat, 15 grams carbohydrate

Food	*Approx. measure*	*Weight (grams)*
Bread, bakers	1 slice	25
Biscuit, roll	2″ diam.	30
Muffin	1-2″ diam.	35
Cornbread	1½″ cube	35
Cereals, cooked	½ cup, cooked	100
Dry, flakes and puffed varieties	¾ cup, scant	20
Shredded wheat	⅔ biscuit	20
Rice, macaroni, noodles, spaghetti	½ cup, cooked	100

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List V (continued)

Food	*Approx. measure*	*Weight (grams)*
Crackers		
Graham	2 (2½ x 2¾)	20
Oyster	20 (½ cup)	20
Saltines	5 2″ sq.	20
Soda	3 (2½ x 2¾)	20
Round, thin varieties	6-8 (1½″ diam.)	20
Vegetables:		
Beans, peas, dried (cooked) Includes: lima, navy, kidney beans, blackeyes, cowpeas and split peas etc.	½ cup, scant	90
Corn	⅓ cup or ½ ear	80
Parsnips	½ cup, scant	90
Peas, fresh	½ cup	100
Potatoes, white	1 small	
Baked	2″ diam.	90
Boiled, mashed	½ cup, scant	90
Sweet or yam	¼ cup	50
Ice cream, vanilla*	⅛ quart	70
Sponge cake, no icing	1½″ cube	25

* Omit 2 fat exchanges.

List VI—FAT OR BUTTER EXCHANGES

Negligible protein, 5 grams fat, negligible carbohydrate

Food	*Approx. measure*	*Weight (grams)*
Butter or margarine	1 tsp. level	5
Bacon, crisp	1 slice	10
Cream (light) sweet or sour, 20%	2 tbsp. level	30
Cream (heavy), 40%	1 tbsp. level	15
Cream cheese	1 tbsp. level	15
French dressing	1 tbsp. level	15
Mayonnaise	1 tsp. level	5
Oil or cooking fat	1 tsp. level	5
Olives	5 small	50

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The following foods may be used as desired. (No appreciable carbohydrate, protein or fat.)

Coffee	Gelatin, unsweetened	Pickle, dill or sour
Tea	Rennet tablets	Saccharin
Clear broth	Lemon	Pepper and other spices
Bouillon (fat free)	Mustard, dry	Vinegar

Foods to Avoid

All foods not listed on the exchange lists or those listed as without food value.
Any food whose composition is not known.

Sample Menu Adaptation
Diet 80-80-180 (30-65-75-10)

SUGGESTED DIETARY PLAN		MENU ADAPTATION	
Food	*Amount*	*Food*	*Amount*
		Breakfast	
Fruit	1 portion	Orange	1 small
Protein exchange	1	Poached egg	1
Carbohydrate exchange	1 serving	Whole wheat toast	1 slice
Fat exchange	1	Butter	1 teaspoon
Milk	½ cup	Milk	½ cup
Beverage, as desired		Black coffee	
		Luncheon	
		Consomme	
Protein exchanges	2	Cottage cheese	6 level tablespoons
Vegetables (list IIIA) as desired		Tomato and lettuce salad, lemon wedge	1 serving
		Fresh asparagus	1 serving
Fruit	1 portion	Sliced banana	1 small
Carbohydrate exchanges	3	Saltines	5 2″ sqs.
		Whole wheat bread	2 slices
Fat exchanges	1	Butter	1 teaspoon
Milk	½ cup	Milk	½ cup
Beverage, as desired		Tea with lemon	

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SUGGESTED DIETARY PLAN		MENU ADAPTATION	
Food	*Amount*	*Food*	*Amount*
	Dinner		
Protein exchanges	3	Broiled steak	3 ounces
Vegetables			
(list IIIA) as desired		Celery hearts	1 serving
(list IIIB)	1 serving	Baked carrots	1 serving
Fruit	1 portion	Peach	1 medium
Carbohydrate exchanges	4	Baked potato	2 2″ diam.
		Rye bread	2 slices
Fat exchanges	2	Butter	2 teaspoons
Milk	1 cup	Milk	1 cup
Beverage, as desired		Black coffee	
	Bedtime		
Milk	1 cup	Milk	1 cup

Food Preparation. The foods used on the diabetic diet must be simply prepared and should not have any added butter, milk, cream, etc., unless these are already a part of the day's allowance.

Meats, fish and poultry may be broiled, baked or roasted or boiled. Only the natural juice, free of fat, should be used as gravy.

Vegetables should be prepared by boiling, steaming or baking. Some of the fat exchanges allowed in the diet may be used for seasoning.

Fruits should be either fresh, cooked, canned or frozen and prepared without added sugar.

Ordinary breads and cereal products may be used by the diabetic. There is no need for any specially prepared breads or cereals.

It is not advisable to use the diabetic "specialty" foods. They are usually expensive, often contain more food value than is implied by the label on the product and are often unpalatable.

Diabetes in Children. The same general principles are applied

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to the planning of the diet for the diabetic child as have been outlined for the adult.

It is essential that the growth needs of the diabetic child be met. This means that an adequate calorie and protein allowance must be made at all times. It will necessitate periodic adjustments of the diet to meet the ever-increasing requirements of growth. The selection of foods should be such as to meet the added needs for minerals and vitamins.

The diabetic child presents a problem since it is difficult for most children to forego the eating of sweets and unlimited amounts of food as desired. It takes much careful teaching and encouragement to direct the diabetic child along the lines of a measured diet. The benefits of such a regulated regimen will stand him in good stead, for his growth will be more nearly normal and the chances for many of the complications of diabetes will be lessened.

Diabetes in Pregnancy. The diet of the diabetic woman who has become pregnant must be adjusted to meet the increasing nutritional needs of the growing fetus. Increased amounts of protein, minerals and vitamins, as discussed in Chapter XIII, must be supplied. Along with adequate medical care, careful regulation of the diet has greatly lessened the hazards of pregnancy for the diabetic woman. She now has as much chance for a normal delivery as does the non-diabetic woman.

Complications of Diabetes. Changes in the diet may be necessary when the diabetic patient has some complication such as surgery, infections or coma. It is quite simple to change a diabetic diet prescription into a soft or full-fluid diet as the case may be. If a clear-fluid diet is indicated only the carbohydrate part of the prescription can be filled.

Education of the Diabetic Patient. Since the diabetic patient must adhere to a therapeutic regimen for the rest of his life it is important that he understand all the phases of his treatment. If the regimen is to be successful in the treatment of the disease the co-operation of the patient is essential. A knowledge of the nature of diabetes and the measures that are necessary for its adequate control, such as insulin ad-

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ministration and the diet, will make the patient more co-operative and the success of the regimen more assured.

Teaching of the patient should be begun as soon as possible. Hospitalization is of value so that individual dietary instruction and supervision may be given. Classes for diabetic persons are conducted in many clinics. The level of teaching must be adjusted to the capabilities of each patient. If the patient himself cannot be taught some member of his family must then accept the responsibility for his care.

Dietary instruction should include the reasons for and the principles of the diet, the types and amounts of foods to be used, the substitutions which may be made, the methods of food preparation and the types of foods that must be avoided. The hospitalized patient should have practice in planning diets and, if possible, experience in measuring his own diet before he leaves the hospital. Frequent consultations will help the patient solve his problems as they arise and make him more expert in the handling of his diet.

Functional hyperinsulinism. This disease, which is characterized by an excessive secretion of insulin, the reverse of diabetes mellitus, is nevertheless treated by a restricted carbohydrate diet. The carbohydrate is limited to approximately 100 grams or sometimes less per day in an effort to control the hypoglycemia which results. Carbohydrate is known to stimulate insulin secretion, which in turn leads to a lowering of the blood sugar. In functional hyperinsulinism the amount of insulin formed is in such quantities that the patient will be in hypoglycemia a greater part of the time if the carbohydrate intake is not carefully controlled.

The protein of the diet must be normal in amount, so that the requirements of an adequate diet will be met. It may be high protein since the glucose entering the metabolic pool from protein is released so slowly that it has little if any effect on the stimulation of insulin secretion.

The remaining caloric value of the diet will be made up of fat. Often the diet is low-caloric since many patients suffering with this disease are overweight.

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The diet must be calculated and measured accurately. The same principles as were used in the planning of the diabetic diet are applicable to the planning of the diet for the patient with hyperinsulinism. It is essential that the diet be planned to meet the needs of each individual patient.

High-Carbohydrate Diets

A diet higher in carbohydrate than the normal diet is indicated in a number of diseases. It will be recalled that carbohydrate is primarily an energy food; it is easily digested, absorbed and metabolized (Chapter III). In conditions in which increased amounts of readily available energy are needed a high-carbohydrate diet is indicated. These diseases, such as hyperthyroidism, infections, malnutrition and diseases where there is fever, have already been mentioned in the chapter on the high-caloric diet (page 225). In other diseases where there is a tendency toward hypoglycemia, except for hyperinsulinism, a high-carbohydrate intake is indicated. Two conditions are of particular importance, Addison's disease and various diseases of the liver. Pre-operative diets are also often high-carbohydrate.

Liver Diseases. It is well known that the functions of the liver are greatly enhanced by the adequate storage of glycogen, and that liver well supplied with glycogen is protected against damage due to anesthesia, drugs and other toxic materials. High-carbohydrate intakes are therefore essential for adequate storage of glycogen in the various diseases of the liver. Diets as high as 300 to 500 grams of carbohydrate per day have been used with considerable success.

Preparation for Surgery. It is important that the body have an adequate supply of glycogen pre-operatively as an energy supply until such time as he will be able to receive some form of nourishment post-operatively. The increased need for glycogen storage as a protective measure to the liver against the toxic effects of anesthesia has already been mentioned. It is advisable therefore to use a high-carbohydrate diet for some time pre-operatively, depending upon the physical state of the patient. The night before surgery carbohydrate should be

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forced by the use of hard candy and lemonade containing large amounts of glucose.

Addison's Disease. Addison's disease is a disease of endocrine origin, which results in a disturbance of mineral and carbohydrate metabolism. It is due to an impairment in function of the adrenal cortex. The disturbance in mineral metabolism, which involves sodium and potassium, is controlled by injections of the hormone, desoxycorticosterone. The disturbance in carbohydrate metabolism results in hypoglycemia. There is apparently decreased absorption as well as more rapid utilization of carbohydrate. A high-carbohydrate diet is necessary to prevent the tendency toward hypoglycemia and to bring about a weight gain in the patient.

Patients with Addison's disease have a very precarious appetite. They have little desire for food in general, and they do not tolerate well fat foods or very rich foods. They present a real challenge to those who are feeding them and many inducements may have to be offered in order to get them to eat.

Planning the Diet. The high-carbohydrate diet is essentially a high-caloric diet, and the same general principles discussed for the high-caloric diet (page 226) may be used. More emphasis will be placed on carbohydrate than on fat as a source of calories. If the diet must be restricted in fat, the principles outlined for the limited-fat diet (page 263) will be observed as well. Whenever an especially high-carbohydrate intake is desired emphasis should be placed on increased amounts of such foods as:

Breads	Sugar
Cereals and cereal products	Glucose
Jelly, jams, marmalade	Beta-lactose
Honey, sirups	

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High-Carbohydrate Diet
(Normal fat)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Citrus fruit or juice, 1 serving	Orange juice, ½ cup
Glucose, 1 tablespoon	Glucose, 1 tablespoon
Cereal, 1 serving	Enriched cream of wheat with milk and sugar
Egg, 1	Poached egg, 1
Bread, 2 slices	Whole wheat toast, 2 slices
Butter, 1 teaspoon	Butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Cream, 1 tablespoon	
Milk, ½ cup	
Sugar, 2 teaspoons or more	
Beverage	Coffee with cream and sugar
Mid-morning	
Fruit juice with 1 tablespoon glucose or beta-lactose, 1 cup	Grapefruit juice with 1 tablespoon glucose, 1 cup
Luncheon	
Cream soup, 1 cup	Cream of tomato soup, 1 cup with saltines
Protein dish, 1 serving	Macaroni au gratin
Potatoes, noodles, rice or spaghetti	
Salad, 1 serving	Vegetable salad with French dressing
Fruit, 1 serving	Sliced banana with 1 tablespoon glucose
Bread, 2 slices	Whole wheat bread, 2 slices
Butter, 1 teaspoon	Butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Milk, 1 cup	Milk, 1 cup
Glucose, 1 tablespoon	
Mid-afternoon	
Fruit juice with 2 tablespoons glucose or beta-lactose, 1 cup	Pineapple juice with 2 tablespoons glucose

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Dinner	
Meat, fish or fowl, 3 ounces	Roast beef, 3 ounces
Potato, 1 serving	Baked potato, 1
Vegetable, 1 serving	Creamed carrots, 1 serving
Dessert or fruit, 1 serving	Caramel blanc mange, 1 serving
Bread, 2 slices	Whole wheat bread, 2 slices
Butter, 1 teaspoon	Butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Milk, 1 cup	Milk, 1 cup
Glucose, 2 tablespoons	
Beverage	Tea with glucose and lemon
Bedtime	
Fruit juice with 2 tablespoons glucose, 1 cup	Grapefruit juice with 2 tablespoons glucose
Jelly sandwich, cookies or cake	Cookies

Questions and Problems

1. What is the cause of diabetes? What derangements in metabolism result?
2. What factors determine the caloric requirements of the diabetic?
3. What types of insulin are available? How is the carbohydrate of the diet divided among the meals with each type of insulin? Why?
4. Why is milk indicated as the food of choice for the between-meal feedings?
5. Plan a diet with the following diet order for a man 45 years of age. 75 grams protein, 100 grams fat, 190 grams carbohydrate, the carbohydrate to be divided: breakfast 30 grams, luncheon 70 grams, dinner 70 grams, bedtime 20 grams.
6. Plan 3 days' menu for this patient from the diet you have planned. The patient eats his noon meal in a cafeteria on the days when he works. Plan two noon meals for him that he could select in a cafeteria.
7. In planning a diet for a diabetic patient what factors should be taken into consideration so that the diet will be as satisfying as possible for the patient?
8. What is meant by carbohydrate exchange? Protein exchange? Fat exchange? Portion of fruit?

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9. A diabetic patient has asked you if there are any foods that he might use that do not count on his diet. What suggestions could you give him?
10. Mrs. Jones has been diagnosed as having diabetes. She has been regulated on her diet and insulin and is ready to leave the hospital in a few days. Outline the diet instructions she should receive. What suggestions can you make to her about the preparation of her food at home so that it will not increase her work materially, since she must prepare food for her husband and 3 children?
11. A well-meaning friend has brought a diabetic patient a box of "diabetic" candy. The patient has asked you if she may eat the candy. What will you tell her? Why?
12. How does the diet for a diabetic child differ from that of other children? What considerations must be given in planning the diet for the diabetic child?
13. What type of diet is indicated in the treatment of functional hyperinsulinism? Why?
14. For what conditions may a high-carbohydrate diet be ordered? In each case note the reason for the high-carbohydrate intake.
15. Mrs. White, who has Addison's disease, has been placed on a high-carbohydrate diet. Her appetite is very poor. Plan a day's diet for her to supply 350 grams of carbohydrate and 2200 calories.

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Chapter XXV

MODIFICATIONS OF THE NORMAL DIET IN MINERAL CONTENT

High Mineral Intake

In some instances increased amounts of the minerals above those furnished by the normal diet (Chapter VI) may be indicated in the treatment of a disease. Usually it is not possible to increase the mineral intake sufficiently to supply a therapeutic amount of the mineral in question by the use of natural foods alone. For example, if a high calcium or high iron intake is desired it is more reasonable to administer them as a medication. However, it must be borne in mind that an entirely adequate diet must be taken along with the supplement. If the benefits of the increased administration of one of the nutrients are to be effective all the other nutrients must be present in adequate amounts so that normal metabolic processes may proceed.

High Iron Intake

A high iron intake may be indicated in simple anemia of nutritional origin. Emphasis may be laid on the use of foods containing the highest amounts of available iron as listed on page 52. However, it is seldom possible to eat these foods

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in sufficient amounts to have therapeutic value and they should be considered rather as having prophylactic value. If these foods are taken in sufficient amounts to meet the recommendations for iron as set up by the National Research Council (Table 1), the nutritional type of anemia can be avoided providing there is normal digestion and metabolism. Blood donors should emphasize the use of these foods high in available iron along with an increased protein intake to insure prompt and adequate blood regeneration.

High Calcium Intake

Occasionally a high calcium intake is desired. In such diseases as rickets, osteomalacia and tetany and in fractures, an increased calcium as well as phosphorus intake is indicated. Since milk and hard cheese are the main sources of this mineral it would necessitate taking large amounts of these two foods if a therapeutic amount of calcium is to be obtained. Ordinarily such amounts are not feasible and a calcium medication is the method of choice.

Low Mineral Intake

With the exception of sodium a decrease in mineral intake below that supplied by the foods of the Basic Daily Dietary Pattern is seldom indicated. When a lowered intake of any of the minerals is desired it is usually a matter of individual calculation. In some instances a low-calcium diet is used in lead poisoning or low mineral intakes are desired in certain types of kidney stones. Such cases are relatively rare, however.

Low-Sodium Diet

The low-sodium diet is used in the treatment of diseases in which there is edema. Such a diet is effective in the reduction of edema fluid since the retention of fluid in the body is dependent upon the amount of sodium present. If for any reason sodium elimination is impaired, there will be retention of fluid with consequent edema. The reduction of the sodium intake will therefore result in less fluid retention.

Cardiac Insufficiency. A low-sodium diet is indicated since

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edema is a common accompaniment of this condition. In the more severe stages of the disease the low-sodium diet will be modified to be a soft low-sodium diet given in small frequent feedings to relieve the patient of as much work as possible and to prevent any distention of the stomach which might interfere with cardiac action.

Nephritis and Nephrosis. The edema of nephritis and nephrosis is due primarily to low serum proteins and the therapy is aimed at the regeneration of the serum proteins so that normal osmotic pressure relationships will be maintained. However, the edema may be lessened by a low-sodium diet. If the lack of sodium in the diet interferes with the palatability of the food for the patient to such an extent that the high protein intake is not maintained the low-sodium diet should be discontinued. Usually the high protein intake is the more important of the two therapeutic measures in these conditions.

Toxemia of Pregnancy. The importance of a low-sodium diet in this disease is discussed in Chapter XIII.

Hypertension. Low-sodium diets have been used recently in the treatment of hypertension with varied success. The rationale of this therapy is not yet well understood and awaits further elucidation.

Planning the Diet

Adequacy

The first principle in planning a low-sodium diet is that it should be nutritionally adequate. The diet is often used for considerable periods of time and it is essential that it furnish all the necessary nutrients. This will limit the minimum amount of sodium that the diet may contain. The Basic Daily Dietary Pattern may be selected so that the foods contain approximately 500 milligrams of sodium. Milk must be limited to 1 pint. Milk contains a high amount of sodium. A sodium-free milk has been devised which supplies all the other nutrients of milk. By using this milk the sodium of the diet may be lowered by 250 milligrams and the diet will still be nutritionally adequate.

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Sodium

In order that the diet be as low in sodium as possible only that sodium which occurs naturally in foods is allowed. It is kept at the lowest possible amount by the selection of foods which are naturally low in sodium content. Sodium in the form of sodium chloride, baking soda, baking powders or other sodium salts must not be used in the preparation of the foods. The water used for cooking must be low in sodium. Some waters are naturally high in sodium while softened waters are a considerable source of sodium. A diet containing no more than 250 milligrams of sodium is considered sufficiently low to be of therapeutic value in most of the diseases for which it will be prescribed.

Protein

The protein of the diet will be adequate, meeting the standard of 1 gram per kilogram of ideal body weight. Protein foods are generally high in sodium so that they must be limited in amount to that necessary for normal nutrition. If a high-protein diet is indicated it will of necessity be higher in sodium than the usual low-sodium diet unless the additional protein is in the form of sodium-free milk.

Calories

The caloric value of the diet will be maintained by adequate amounts of carbohydrate and fat, depending upon the individual patient. In cardiac insufficiency and in hypertension overweight is a common accompaniment and a low-caloric diet is indicated along with the low-sodium intake. Reduction in weight will relieve the work of the heart considerably. Benefit is also derived from a decreased total metabolism which also lessens the work of the heart.

Selection of Foods

In order that the limitation in sodium will be maintained the diet must be restricted in the quantity and types of foods used. A simplified method is presented for the planning of

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diets containing 250 and 500 milligrams of sodium respectively. For the 500 milligram diet regular milk is used in place of the sodium-free milk, otherwise the two diets are the same. Food lists are given which indicate the substitutions which may be made in the suggested dietary plan to keep the diet within this range of sodium content (pages 302–04).

Food Preparation

All food must be prepared without the addition of table salt or soda. No table salt should be served to the patient in any form. The water in which the foods are cooked should be tested for sodium content. Softened water must not be used. In the home the patient's portion of food must be removed from the rest of the food for the family before any salt is added.

For seasoning the following substances may be used:

All spice	Nutmeg
Sweet butter	Onion
Bay leaf	Paprika
Cinnamon	Pepper
Cloves	Peppermint extract
Lemon	Vanilla extract
Mace	Vinegar
Mustard (dry)	

A number of salt substitutes have been devised to aid in flavoring the low-sodium diet. Caution should be observed in selecting these substitutes. Many of them are sodium salts such as sodium malate or sodium formate. Some have been found to be toxic. Potassium chloride may be used. It should not be given, however, without a doctor's prescription. It does not have a very agreeable taste which is true of most of the substitutes which have been suggested.

In order to make the low-sodium diet as palatable as possible the use of various of the seasonings suggested will aid considerably. It may take some time for the patient to become used to these other flavors in place of salt.

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Low-Sodium Diet (4)
(Approximately 250 milligrams sodium)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Fruit (list III), 1 serving	Orange, 1
Whole grain or enriched cereal (list II), 1 serving	Oatmeal, 1 serving
Egg, 1 only	Soft cooked egg, 1
Unsalted enriched bread, 1 slice	Unsalted enriched toast, 1 slice
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Sodium-free milk, ½ cup	Sodium-free milk, ½ cup
Hot beverage	Coffee
Sugar as desired	Sugar
Luncheon	
Meat, fish or fowl (list I), 2 to 3 ounces	Roast beef, 2 ounces
Potato or substitute (list V), 1 serving	Baked potato, 1 serving
Vegetable or salad with unsalted French dressing or mayonnaise (list IV), 1 serving	String beans, 1 serving
Fruit (list III), 1 serving	Sliced banana, 1 serving
Unsalted enriched bread, 1 serving	Unsalted enriched bread, 1 slice
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Hot beverage with sugar or fruit juice	Tea with sugar and lemon or grapefruit juice
Sodium-free milk, 1 cup	Sodium-free milk, 1 cup
Dinner	
Meat, fish or fowl (list I), 2 to 3 ounces	Fresh codfish, 3 ounces Lemon slice
Potato (list V), 1 serving	Boiled potatoes, 1 serving
Vegetable or salad with unsalted French dressing or mayonnaise (list IV), 1 serving	Sliced tomatoes with unsalted mayonnaise, 1 serving
Fruit (list III), 1 serving	Pears, 1 serving

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Dinner	
Unsalted enriched bread, 1 slice	Unsalted enriched bread, 1 slice
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Jelly, 1 tablespoon	Jelly, 1 tablespoon
Sodium-free milk, 1 cup	Sodium-free milk, 1 cup
Hot beverage with sugar or fruit juice	Coffee with sugar

Foods to Use

List I	*List II*	*List III*
Beef	Farina	Apricots
Chicken	Oatmeal	Avocado
Cod, fresh	Pettijohns	Banana
Halibut, fresh	Puffed rice	Blackberries
Heart	Puffed wheat	Blueberries
Liver	Ralstons	Cranberries
Pork	Rice	Dates
Turkey	Shredded wheat	Grapes
Veal	Wheatena	Grape juice
		Grapefruit juice
		Oranges
		Orange juice
		Pears
		Persimmons
		Pineapple
		Pineapple juice
		Plums
		Raspberries
		Strawberries
		Tangerines

List IV	*List V*
(fresh, frozen or unsalted, canned)	White potato
Asparagus	Sweet potato
Beans, string	Macaroni
Beans, lima	Spaghetti
Broccoli	
Brussels sprouts	

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List IV (continued)

Cabbage
Cauliflower
Corn, sweet
Cucumber
Eggplant
Endive
Lettuce
Mushrooms
Okra
Onion
Parsnips
Peas
Rutabagas
Squash, all kinds
Tomato

Miscellaneous

Corn oil
Honey
Jam
Jelly
Marmalade
Olive oil
Unsalted fats such as Spry and Crisco
Unsalted nuts
Unsalted popcorn
Unsalted French dressing
Unsalted mayonnaise

Beverages

Coffee
Tea
Postum
Gingerale
Fruit juices

Foods to Avoid

Any foods not listed under foods to use

Bouillon cubes
Catsup
Caviar
Olives
Pickles
Relishes
Salted butter
Margarine
Salted nuts
Celery salt
Onion salt
Other seasoned salts
Sauerkraut

All prepared cereals except those on list II
Canned vegetables unless canned without salt
Canned soups
Canned and salted or smoked meats or fish such as bacon, chicken, ham, sausage, corned beef, chipped beef, herring, salmon, sardines, tuna fish, salt pork, salami, bologna, liver sausage
Cheese
Commercial salad dressings
Crackers of all kinds
Bread—unless made without salt

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Desserts as gingerbread, ginger cookies or spice cake in which baking powder or baking soda have been used in the preparation
Baking powder biscuits or other hot bread
Desserts or soups containing milk or eggs
Any medications containing sodium bicarbonate or any other sodium salt should not be used

Soft Low-Sodium Diet in Six Feedings
(Approximately 250 milligrams sodium)

SUGGESTED DIETARY PLAN	MENU ADAPTATION
Breakfast	
Strained whole grain or enriched cereal (list II), 1 serving	Strained oatmeal, 1 serving
Egg, 1 only	Soft cooked egg, 1
Unsalted enriched bread, 1 slice	Unsalted enriched toast, 1 slice
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Jelly, 1 teaspoon	Jelly, 1 teaspoon
Hot beverage	Coffee, 1 cup
Sodium-free milk, ½ cup	Sodium-free milk, ½ cup
Sugar, as desired	Sugar
Mid-morning	
Strained fruit or fruit juice with glucose (list III), 1 serving	Grapefruit juice with glucose
Luncheon	
Ground meat, fish or fowl (list I), 2 ounces	Ground beef, 2 ounces
Potato or substitute (list V), 1 serving	Riced potato, 1 serving
Strained vegetable (list IV), 1 serving	Strained string beans, 1 serving
Unsalted enriched bread, 1 slice	Unsalted enriched bread, 1 slice
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Jelly, 1 teaspoon	Jelly, 1 teaspoon
Hot beverage with sugar or fruit juice	Tea with sugar and lemon juice or grapefruit juice
Sodium-free milk, 1 cup	Sodium-free milk, 1 cup
Mid-afternoon	
Strained fruit (list III), 1 serving	Strained peaches, 1 serving

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SUGGESTED DIETARY PLAN	MENU ADAPTATION
Dinner	
Orange, grapefruit or tomato juice, ½ glass	Tomato juice, ½ cup
Ground meat, fish or fowl (list I), 3 ounces	Minced fresh cod fish, 3 ounces
Potato or substitute (list V), 1 serving	Boiled potato, 1 serving
Strained vegetable (list IV), 1 serving	Strained peas, 1 serving
Unsalted enriched bread, 1 slice	Unsalted enriched bread, 1 slice
Sweet butter, 1 teaspoon	Sweet butter, 1 teaspoon
Jelly, 1 teaspoon	Jelly, 1 teaspoon
Hot beverage with sugar or fruit juice	Tea with lemon and sugar
Sodium-free milk, 1 cup	Sodium-free milk, 1 cup
Bedtime	
Strained fruit (list III), 1 serving	Strained pears, 1 serving

Questions and Problems

1. Why is it usually considered inadvisable to supply therapeutic amounts of a mineral by diet alone?
2. What minerals may be needed in therapeutic amounts? Indicate the conditions that are being treated by the increased mineral intake.
3. What is the principle in the use of low-sodium diet in the treatment of cardiac insufficiency? Nephritis and nephrosis? Hypertension?
4. What modifications of the low-sodium diet may be made for the treatment of cardiac insufficiency? Why?
5. What is meant by a low-sodium diet? How many milligrams of sodium will it contain? Can this amount of sodium be lowered in any way?
6. Mrs. Brown is being discharged on a low-sodium diet. What instructions should she be given about the preparation of the food of her diet? What foods should she avoid? What suggestions for flavoring her foods can you make to her?
7. Plan a low-sodium diet (500 milligrams) to supply 100 grams of protein.

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8. Plan a soft low-sodium diet (250 milligrams) in six feedings to supply 1500 calories.

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PART III

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Chapter XXVI

INTRODUCTION TO THE STUDY OF COOKERY

THE ART and science of cookery are an essential part of the application of nutrition.

If food is to serve the function of nourishing the body, it must be consumed. It is important therefore that foods be prepared so that they will be eaten to supply the maximum of nutritive value.

Much of the nutritive value of a well-planned diet may be lost by poor selection and preparation of foods. The appearance of the food and its service are important factors as well. Food well prepared and attractively served is a stimulus to the appetite.

Meal Planning

The first step in the preparation of foods is the planning of the meals. The Basic Daily Dietary Pattern which has been outlined serves as an aid in the selection of foods to insure good nutrition (Chapter IX). The choice of foods to be used will be influenced by economic factors, religious and racial food customs, and the needs and preferences of the individual (Chapters X, XII). The specific needs of the various members of the family group must also be considered. Thus from the young child to the aged grandmother there will be indi-

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vidual needs to be met which will influence the planning of meals and the preparation of the foods (Chapters XIV, XV, XVI, XVII).

The choice of foods should also be influenced by such factors as color, flavor and texture which are important in making attractive contrasts and palatable combinations. A meal made up of foods lacking in color is not attractive and lacks appetite appeal. Thus a meal of all white foods, such as creamed chicken, boiled potatoes and steamed celery is uninteresting. By using a vegetable with color, such as peas, broiled tomatoes or carrots the meal has much more appeal. Various combinations of flavor and texture are equally important. In a meal of salmon croquettes, mashed potatoes, baked hubbard squash and blanc mange there is a monotonous repetition of soft foods. The inclusion of a salad and the use of some other food, such as a coarse vegetable, which requires more mastication will make the meal more acceptable. It is essential therefore to give attention to the use of smooth and crisp foods, hot and cold foods, and various flavors, colors and garnishes for the most attractive meals.

Food Selection and Preparation

The next step in the preparation of foods is their procurement. This is a very important part of the problem of obtaining an adequate diet. It is easy to recognize that different foods may differ greatly in their nutritive value; it is not so easy to realize that the nutritive value of any given food may vary greatly depending on where and under what conditions it was produced, and what happened to it from the time it became suitable to eat until it was actually being eaten. This is a broad and complex subject and one which is being actively investigated at the present time. It offers an extensive field for study. The following chapters deal with the various types of foods from the standpoint of their preparation and relative importance in the diet.

Food Service

The final step is the attractive service of the foods once they are prepared. For the nurse this means that generally the food

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Tray attractively and conveniently arranged for patient's breakfast.

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service will be on a tray. The following are the essentials of good tray service:

1. Size of tray
    a. Adequate for meal being served; large trays for full meals, small trays for liquid diets and nourishments.
2. Cover and napkin
    a. Should be clean and unwrinkled
    b. Linen is preferred
    c. Paper doilies are practicable
3. Silver
    a. Arrange in order of use
    b. Should be clean and well polished
    c. Use only the amount of silver needed for the meal
4. China and glassware
    a. Use as attractive china and glassware as possible
    b. Arrange conveniently for the patient
    c. Should be clean
    d. Warm for hot foods, chill for cold foods
5. Use pleasing color combinations
    a. In selection of china and linen
    b. In selection of food
6. Size of portions
    a. Not too large or too small
    b. Second servings may be used when large portions of food are desired
7. Service of tray
    a. Serve on time
    b. Preparation of food should be such that all food will be ready in proper form at the desired time
    c. Serve hot food hot and cold food cold
    d. There should be no spilled foods or liquids

In the service of food to the patient the nurse must also consider the surroundings of the patient. First of all the patient must be made comfortable and the tray so placed that it is within easy reach. If possible unpleasant odors or disturbing objects should be removed from the room. The patient should not have any painful treatments or dressings near

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mealtime and any form of undue excitement should be avoided. All effort should be made to make the mealtime a pleasant and relaxing time so that the patient will want to eat.

Reasons for Cooking Food

One of the important reasons for cooking foods is to make them more digestible. Thus the connective tissue of meats is softened and cellulose is softened and broken down to some extent. Furthermore in the process of cooking microorganisms present in the foods are killed and the food is made safe for eating. Cooking also makes food more appetizing and improves its appearance and flavor. Various flavors may be combined during cooking to make new and interesting dishes.

Methods of Cookery

Baking: Cooking by heated air in an open or covered pan. Roasting meat is a baking procedure.

Baking temperatures:	
Slow oven	250°F.-350°F.
Moderate oven	350°F.-400°F.
Hot oven	400°F.-450°F.
Very hot oven	450°F.-550°F.

Boiling: Cooking in water at 212°F. or 100°C. Bubbles break rapidly on the surface of the water.

Braising: A combination of baking and stewing.

Broiling: Cooking by direct heat from live coals, electrically heated wires or gas flame. The temperature at first is high enough to sear the surface.

Fricasseeing: A combination of sautéing and stewing.

Frying: Cooking by use of a small amount of fat.

Pan-broiling: Cooking through hot, dry metal over direct heat.

Sautéing: Cooking by use of a small amount of fat.

Simmering: Cooking in water slightly below the boiling point—about 200°F. Bubbles rise slowly to the surface of the water.

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Steaming: Cooking by heat conveyed directly by steam or a steam jacket. Cooking in a double boiler is a modification of steaming in which the temperature is slightly below that of boiling water. Cooking in a pressure cooker is also a modification of steaming. The temperature is raised above 100°C. by the pressure, thus shortening the period of cooking.

Stewing: Cooking in water slightly below the boiling point for a long period of time. It is used for tougher cuts of meat and dried fruits.

Questions and Problems

1. What are the factors to be kept in mind in planning attractive meals?
2. Below is a meal which has been planned for the patients on a regular diet. What suggestions can you make for improving the meal plan?

   Cream of celery soup
   Creamed minced beef on toast
   Mashed potatoes
   Stewed tomatoes
   Baked custard
   Enriched white bread
   Butter
   Milk
3. What factors should be kept in mind in the service of food to patients?
4. Why is food cooked?
5. What are the various methods which may be used to cook food? What types of foods are cooked by each of these procedures?

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Chapter XXVII

FOOD HYGIENE

FOOD IS essential to good health. However, if food is not properly handled it can become a carrier of disease and instead of contributing to health it can have an adverse effect.

Food Poisoning

Food poisoning may come from two sources. It may result from the contamination of the food with pathogenic microorganisms of various types or it may come from chemical poisons present in the foods either naturally or added during some phase of production.

Both food and water may serve as media for the transfer of pathogenic organisms as a result of contamination with such organisms. Those causing typhoid fever, scarlet fever, diphtheria, tuberculosis, paratyphoid infection, dysentery and various gastrointestinal disturbances are among those that may be carried in this way. Some of these may be transmitted from man to man through unsanitary handling of the food, while others may be derived from an animal host through the use of some part or product of this animal as food. Milk is the most common food for carrying this type of infection which includes undulant fever and septic sore throat.

Typhoid fever is caused by the organism *Eberthella typho-*

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sus. The salmonella or paratyphoid organisms and *Staphylococcus aureus* cause severe gastrointestinal disturbances within a matter of a few hours after the food has been consumed. These pathogenic organisms produce toxic materials as they multiply which it is believed are the active agents in causing the illness.

The organism *Clostridium botulinum* is responsible for the disease of botulism. These organisms occur widely in soils, are spore-bearing and are anaerobic in nature. They are thus not easily destroyed. They produce an extremely potent toxin which is the active agent in causing the symptoms characteristic of this serious disease.

The brucella organisms give rise to undulant fever contracted from cattle. Drinking unpasteurized milk is the common means of acquiring this disease.

Parasitic organisms also may be transmitted by food. Most common among these are *Endamoeba histolytica,* responsible for dysentery, *Trichinella spiralis* responsible for trichinosis and various types of worms, such as tape worms and pin worms.

Tuberculosis can be a food-borne disease as well as various virus infections, such as those causing the common cold and scarlet fever.

Chemical poisons which cause illness may come from two sources in foods. One means is through the various sprays and insecticides that are used on plants to protect them from insects while the plants are growing. Such sprays often contain arsenic and lead. It is essential that fruit and vegetables be adequately washed before being eaten. Lead is a particularly toxic metal since it accumulates in the body and contamination of food with the metal from any source is to be avoided. Other metals, such as aluminum, zinc and tin have not been shown to have the toxic effects of lead.

There are certain naturally occurring poisons in foods which belong to the group of nitrogen-containing compounds known as the alkaloids. These include strychnine, salonine and scopolamine as well as other related compounds. The poisonous effect of hemlock, foxglove and related plants, and

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certain varieties of mushrooms are due to such substances. Confusion of poisonous varieties with edible ones often leads to accidental poisonings. The mussels along the Pacific Coast have been found to contain an extremely toxic substance, and therefore cannot be used as food. Some plants vary in their toxic effects. For example the green part of white potatoes has enough toxic material to cause a severe illness and even death; the leaves of rhubarb can cause illness due to the very high oxalic acid content while the stems are quite edible; and young pokeweed is entirely edible while the older vegetable may be toxic.

Care and Preservation of Food

Care of Food. Since food is a perishable material easily subject to bacterial contamination and to spoilage, particular attention should be given to the manner in which it is handled. There are some general rules that apply to the handling of food which should be observed always whether the food is being prepared in the home, restaurant, hospital or other institutional kitchen.

First of all, before touching food the hands should be washed thoroughly, and the food should not be handled any more than necessary. All people who are engaged in any phase of food production should be free of any type of infection. Periodic physical examination of food handlers is important to prevent the spread of food-borne diseases. It is essential, of course, that clean utensils and clean containers be used in food preparation. Food should be stored in a clean dry place and any exposure to dust, insects and other carriers of microorganisms must be avoided.

Preservation of Food. There are a variety of ways in which food may be preserved from spoilage. The objective in the preservation of foods is to make the condition of the food such that microorganisms cannot grow. It is important to realize that in some of these procedures the nutritive value of the foods may be altered or lost. The main means of preserving foods are by refrigeration and cold storage, freezing, canning, dehydration and the use of various chemicals.

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Refrigeration and Cold Storage

In preserving food by refrigeration or cold storage, the temperature to be maintained depends upon the type of food under storage. Butter may be left at 0°F. for long periods without deterioration. Fruits and vegetables may be held between 30° and 40°F. for several months and still remain fresh. Bananas are an exception since they survive best at temperatures somewhat above this upper limit. Meat, eggs and milk are also kept fresh for considerable periods under cold storage conditions.

Cold storage helps preserve foods in two ways. Foods normally contain a number of enzymes essential to the metabolic processes of growth. At lowered temperatures the action of these enzymes is slowed down with the result that the concomitant cellular changes in the foods are reduced. Care must be taken, however, that the storage temperature is not so low as to freeze the food. Humidity is an important factor in long-time storage and in commercial cold storage establishments both temperature and humidity are carefully controlled.

Freezing

Relatively recently freezing has become one of the popular means of preserving food not only commercially but in the home as well. With the development of home freezers this method has surpassed canning in the preservation of certain types of fruits and vegetables.

In commercial practice the fruits and vegetables used are carefully developed and selected to give the highest quality product. They are therefore very choice foods.

In the freezing process the fruits and vegetables are prepared as rapidly as possible. After cleaning, they are blanched and then quickly frozen. The blanching process, or the placing of the product in boiling water for a given period of time, destroys the native enzymes and thus stops the metabolic processes. Freezing is done immediately at very low temperatures, about −35°F. The faster the freezing process the finer the crystals formed and the less damage to the cells of the food,

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thus giving a food when thawed more nearly resembling the fresh one. The food is stored at 0°F. or lower until it is to be used. Frozen foods should be thawed only shortly before they are to be used. Vegetables when they are to be cooked may be put into the boiling water in the frozen state.

Since the freezing of fruits and vegetables results in some changes in the cell wall if the freezing process has been done too slowly it is advisable not to refreeze fruits and vegetables after they have once been thawed if the natural texture of the food is to be retained.

Freezing inhibits the growth of the various microorganisms but does not result in their destruction. As soon as the food is thawed it should be eaten since if the food is allowed to stand bacterial spoilage can occur just as in the case of fresh foods. This is another reason too for not refreezing foods which have once been thawed.

Freezing in itself has little or no effect on the nutritive value of the food. However, in the blanching process some ascorbic acid is lost, and a considerable loss may occur if the food is allowed to stand for any length of time after thawing. The blanching process may remove soluble nutrients, especially if the cell membranes are cut.

Meats, eggs and a variety of other foods as well as fruits and vegetables are now preserved by freezing. Each product requires a special technique. Not all foods lend themselves to this method of preservation, however.

Canning

One of the most extensively used methods of preserving foods, both in the home and commercially, is canning. In this process the food is placed in an airtight container and then sterilized under steam pressure. The pressure cooker is the safest method of canning in the home since this is the only means to assure temperatures high enough to destroy all organisms. Whether done in the home or commercially canning gives an entirely safe food product when the process has been properly carried out. Sufficiently high temperatures for adequate lengths of time must be used to insure that all

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microorganisms, including the spore-bearing types, are destroyed.

Any canned food that has a bad odor or appearance should be rejected promptly. Bulging of the can and gas formation are a sure sign of a spoiled food. Botulism, the disease resulting from the toxin of the botulinus bacillus, is one of the diseases commonly resulting from improperly canned foods, particularly home-canned foods. The toxin from this organism, although it is extremely toxic, is destroyed by heat. It is recommended that home-canned vegetables and meats should be cooked for 5 to 10 minutes after removal from the container before they are eaten.

A variety of foods may be canned but the usual ones are fruits, vegetables, meats and milk. There may be some slight losses in nutritive value on canning but these appear to be small, particularly in the commercially canned foods where oxygen is more effectively eliminated. The most severe losses are in content of ascorbic acid and thiamine.

Dehydration

In dehydration or drying the water is removed from the food to such an extent that there is not enough moisture present to allow the microorganisms to grow and spoilage is thus prevented. A variety of foods has been preserved by this means. The process is particularly valuable for foods that are to be shipped any great distance since the weight and volume have been much reduced. Fruits, such as prunes, apricots, pears, raisins, apples, figs and dates are preserved by this means, as well as milk, eggs and some vegetables. The palatability and nutritive value of these foods is altered considerably in some instances. The loss of ascorbic acid, carotene and thiamine may be considerable.

Chemicals

A variety of chemicals are used in preserving foods. The one used most commonly is probably sugar which is the means of preservation of jellies, jams, marmalades and preserves. If the food is not kept in a sterile condition after preparation

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mold growth can occur. Salt is another material commonly used in preservation. Meats and such vegetables as cabbage (sauerkraut) or cucumbers (pickles) are the foods usually preserved in this manner. Immersion in vinegar (pickling) is another method used with some types of foods.

Certain chemicals are allowed by law for use as preservatives. These include benzoic acid or sodium benzoate to 0.2 per cent if the concentration is noted on the label; sulfur dioxide in fruits especially dried fruits such as apples; and certain phenols used in the smoke-curing of meats.

A newer development in the prevention of food spoilage is the use of ultraviolet light in commercial food production. The use of this and similar processes which are being developed should do much to make foods even safer for consumption than they are now.

Food Legislation

Because of the ever increasing amounts of foods produced outside of the home, many possibilities of fraudulent representation had to be dealt with. It became necessary, therefore, to have certain laws passed to control the production of imported foods and of foods sold in interstate commerce so that the consumer could be assured of receiving a product which is what it is represented to be. The first of these acts was passed in 1906. This has now been replaced by the more comprehensive Federal Food, Drug and Cosmetic Act of 1938. There is also a Meat Inspection Act, passed in 1906, which with amendments is still in force for the control of safe meat production.

These acts empower the Department of Agriculture to set up standards for food products and for the containers used. Thus the quality of the food, its identification, the amount allowed in the container, dyes and colorings that may be used and similar matters are established by law. Detection and proof of any infringement of these standards leads to prosecution.

Foods showing any of the following characteristics are considered to be adulterated or misbranded.

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1. A food is considered adulterated
   a. If it contains poisons or deleterious substances injurious to health
   b. If it consists of filthy, putrid or decomposed substances
   c. If it is packed under unsanitary conditions
   d. If diseased animals were used in preparation
   e. If offered for sale in containers made of poisonous materials
   f. If valuable constituents are omitted
   g. If added substances have been used to conceal inferiority
   h. If it contains coloring other than that legally allowed
2. A food is considered misbranded
   a. If false claims are made on the label
   b. If the food is sold under another name
   c. If imitations are not clearly indicated
   d. If the size of the container is misleading
   e. If the name of the manufacturer, packer or distributor is not listed on the container
   f. If a statement of weight, measure or count is not given
   g. If the food is below standard without indication of substandard quality on label
   h. If there is failure to list artificial flavoring, coloring and preservatives; except in butter, cheese and ice cream
   i. If there is failure to list vitamin and mineral values when they are supposed to be of special dietary value

Meat Inspection Act

This act provides for the inspection of all meats for interstate commerce and of exported and imported meats. The act provides for: a) inspection of animals for slaughter; b) inspection of carcasses and all meat products; c) enforcement of sanitary regulations; and d) prevention of the use of harmful preservatives.

Meat which meets the prescribed standards is so stamped

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(Chapter XXXIX). That which does not meet the standards is condemned and must be destroyed. The federal inspection of meat is another important procedure in protecting the food supply of the nation.

State and Community Legislation

A further means of protecting food production is through local legislation. This is applicable to foods that are produced mainly for local consumption. These laws cannot be lower in standard than any federal regulations that are established and often they are more stringent. Milk production is the outstanding example of food controlled mainly by state and community legislation (Chapter XXIX).

It is essential that everyone be interested in food legislation and its enforcement if safe food production is to be maintained.

Questions and Problems

1. What are the sources of food poisoning?
2. What diseases may be carried by contamination of food and water with pathogenic microorganisms?
3. What toxic chemicals may be used on foods? Why? What measures should be taken to avoid poisoning by this means?
4. What naturally occurring poisons are present in foods?
5. What points shoud be kept in mind in the care and handling of foods?
6. What are the various methods of preservation of foods? What are the advantages of each method?
7. What nutrients are lost by each method of food preservation? In each case why is the nutrient lost?
8. What is the purpose of the Federal Food, Drug and Cosmetic Act? The Meat Inspection Act?
9. What is meant by an adulterated food? A misbranded food?
10. What are the regulations in your community concerning the production and sale of milk?

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Chapter XXVIII

BEVERAGES

A BEVERAGE is any substance used as a drink to relieve thirst and administer fluid to the body. It may also serve as a source of nourishment and as a stimulant. Water is the chief constituent of all beverages with other materials added to give flavor, nutritive value or stimulation.

Classification of Beverages

Beverages may be classified as refreshing, nourishing and stimulating. Refreshing beverages include water, fruit juices and carbonated beverages. Nourishing beverages include milk in all forms, albuminized fruit juices, beverages to which whole egg is added, such as eggnogs, and fruit juices to which glucose is added. Stimulating beverages include coffee, tea and eggnogs made with whiskey, brandy or rum. These various types of beverages will be discussed in this and the following chapter.

Fruit Juices. Fruit juices may be both refreshing and nourishing. The tartness and flavor of various fruit juices make them refreshing beverages. The citrus fruit juices are excellent sources of ascorbic acid, while various amounts of carbohydrate, occurring either naturally or added, supply energy. The nutritive value of fruit juices may be increased by the addition of egg white or whole egg.

Coffee. Coffee as drunk, is the extract of the roasted coffee

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berry. Coffee has no caloric value in itself but when taken with cream and sugar includes the food values of these substances. There is approximately 1 milligram of niacin per cup of the coffee brew.

The coffee berry contains an alkaloid, caffeine. This substance is soluble in water and has several physiological effects. It raises the blood pressure, stimulates renal activity and averts momentary fatigue. A cup of coffee may contain from 1.5 to 2.5 grains of caffeine. The caffeine may be removed from the coffee berry by suitable processing. Such decaffeinated coffee will not have the stimulating effects of ordinary coffee.

Tannin is also present in coffee, the amount depending upon the method of brewing. Long boiling of coffee increases its tannin content. It is this tannin which gives coffee its bitter flavor and which may also interfere with digestion.

Coffee contains caffeol, a volatile oil, which gives it its characteristic flavor and aroma. It is essential that coffee be freshly ground and kept in a tightly covered container if the flavor and aroma are to be retained, as caffeol is lost from ground coffee when it is exposed to the air.

There are a number of factors entering into the preparation of good coffee. First of all the coffee must be freshly roasted and ground. Coffee is usually shipped in the "green" form and roasted shortly before it is sent to the retail store. It may be ground in the store but some people prefer to grind their coffee at home just before they prepare the beverage. Vacuum-packed coffee is ground before it reaches the store but the aroma and flavor are well preserved.

Coffee comes in several types of grinds: (a) drip or pulverized, which is used in drip coffee makers; (b) percolator grind; and (c) coarse grind for boiled coffee. Dehydrated extracts commonly referred to as "instant coffee" and prepared by various methods are being sold extensively at present.

In the preparation of coffee it is essential that the pot be scrupulously clean. Coffee may be prepared in glass, enamel, granite, pottery or aluminum utensils. Metal pots are the most difficult to clean since they absorb the oils. Fresh boiled

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water should be used and the coffee should be served immediately upon preparation. If coffee is reheated it becomes bitter and loses its flavor and aroma.

There are three methods for the extraction of coffee. In the drip or filter type of coffeepot the water passes over the grounds only once. Coffee prepared in this way contains the least tannin and retains the most caffeol. A dripolator or vacuum coffee maker may be used for the preparation of this type of coffee. In percolated coffee extraction is carried out with water just below the boiling point. Such coffee contains more caffeine than does drip coffee. So-called boiled coffee, which is more correctly designated steeped coffee, contains the least caffeol, but there is a greater retention of tannin and caffeine. Instant coffee is made by the addition of hot water to small quantities (½ to 1 teaspoon) of the dehydrated extract in a cup. The caffeine and tannin content of these instant coffees is fairly high depending upon the amount of coffee used in their preparation.

Tea. Tea is an infusion made from the dried leaves of the tea bush. It also has no caloric value in itself. It contains an alkaloid, theine, which is similar in its effect to the caffeine of coffee. It also contains tannin and volatile oils.

There are three general types of tea, depending upon the treatment of the leaves after picking. Black tea is prepared by fermenting the leaves before they are dried. This product is dark in color and contains less tannin than the leaves from which it is made. Green tea is prepared by a process of steaming and drying only and thus has a light color and is higher in tannin content than the black variety. Oolong tea is fermented only slightly and is thus intermediate between the green and black types.

There are a number of variations of these three types of teas, depending upon the selection of the leaves on the tea bush. The top leaf buds furnish the choicest tea, called flowering pekoes. The first opened leaf furnishes the orange pekoe, the most common variety sold. Pekoe tea is made from the third leaves, while Souchong is made from the leaves next below these and is considered to be of poorer quality.

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Tea should be prepared in a preheated glass or earthenware pot and should be steeped for from 3 to 5 minutes in freshly boiled water, depending upon the strength of tea desired. The leaves should be removed immediately for if the infusion is allowed to stand in contact with the leaves, it will become bitter and strong due to the extraction of large amounts of tannin.

Cereal Coffee. Cereal coffees are prepared from roasted cereal grains. They do not contain caffeine or other stimulants. However, they do contain secretagogues formed in the roasting process. These coffees are prepared by the addition of boiling water to a given amount of the powdered material.

Reinforced Beverages. Beverages may be increased in food value by the addition of egg white, dried milk solids or protein hydrolyzates. Alcoholic beverages such as whiskey, brandy or rum may be added as stimulants. Additional caloric value may be had by using cream and either glucose or lactose.

Albuminized beverages are those to which egg white has been added. Egg white may also be added to fruit juices, milk, water, broth and any other beverage which the patient will take. The addition of egg white increases the protein intake.

Whole eggs may be added to milk, fruit juices, broth and other beverages. These add not only protein but the other nutrients of whole eggs, such as the minerals and vitamins.

Dried whole milk or dried skimmed milk solids may be added to milk, fruit juices and other fluids. These increase the nutritive value in protein, minerals and vitamins and are particularly useful for high-protein diets.

Various types of protein hydrolyzates have been used to increase the protein content of milk, fruit juices and especially broth. If the flavor of the hydrolyzates can be sufficiently masked the protein intake of the patient may be considerably increased in this way.

The addition to eggnog of alcoholic beverages such as whiskey, brandy or rum is sometimes ordered as a stimulant for patients who have a poor appetite. A less stimulating beverage may be made by the addition of coffee to eggnog.

Flavorings. Beverages may be varied by the use of flavorings.

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Coffee, chocolate, cocoa, vanilla, lemon, cinnamon, nutmeg and other spices are the ones usually used.

Chocolate and Cocoa. Chocolate is the paste formed from the cocoa bean. It is approximately 50 per cent fat, 5 per cent protein and 18 per cent carbohydrate. It contains the stimulants theobromine and tannin. In addition it has a fairly high content of oxalic acid, the substance which may interfere with calcium absorption.

There are three types of chocolate. Bitter chocolate is made by fermenting, drying, roasting and mashing the cocoa bean. This substance is then made into molds and is sold in this form. Sweet chocolate is bitter chocolate to which sugar has been added; milk chocolate is bitter chocolate with both sugar and milk added.

Cocoa is the product resulting from grinding the cocoa bean after some of the fat has been removed. Cocoa contains from 18 to 22 per cent fat, 9 per cent protein and 31 per cent carbohydrate. It also contains the stimulants theobromine and tannin.

Cocoa and chocolate are used mainly as flavoring agents although they do contain starch, that in cocoa being quite high. Scorching can occur very easily if cocoa is prepared by heating too long over a direct flame. Such heating should be done only long enough to cook the starch and develop the flavor. The remainder of the cooking should then be done in a double boiler.

Questions and Problems

1. What is a beverage? What are the functions of a beverage?
2. How may beverages be classified?
3. Make a table listing the types of beverages and the nutritive values supplied by each.
4. What is coffee? Tea? What stimulants are present in each?
5. What means may be taken to increase the nutritive value of a beverage?
6. What is cocoa? Chocolate? How should each be cooked? Why?
7. Plan a recipe for an eggnog which is to supply 250 calories and 15 grams of protein per glass.

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Chapter XXIX

MILK

MILK IS the opaque secretion of the mammary gland of the female of the Mammalia. It is the food of the young. Although it is not a perfect food, it is very nearly so, and with some supplementation forms the basis of the diet for the infant. Throughout life it remains an important dietary essential.

Composition

	Per cent
Protein	3.5
Fat	4.0
Carbohydrate	4.9
Water	87.0
Minerals:	Per 100 grams
Calcium	118 mg.
Phosphorus	0.09 gm.
Iron	.1 mg.
Vitamins:	
Vitamin A	160 I.U.
Riboflavin	0.17 mg.
Thiamine	0.04 mg.

Nutritive Value

Milk is an economical food. It supplies more of the nutritional requirements for the cost than any other single food.

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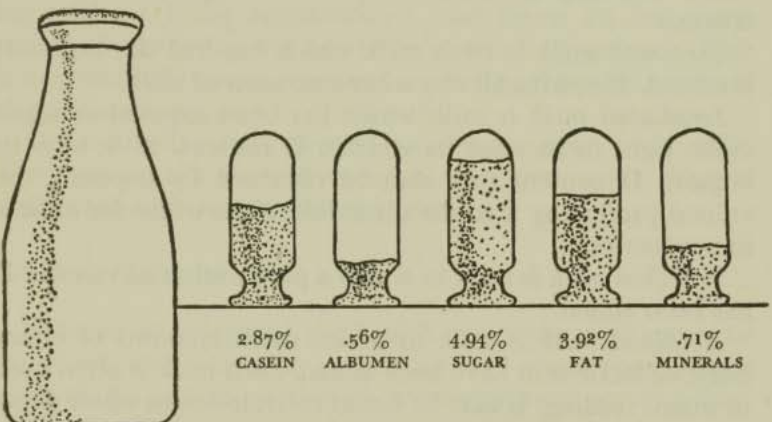
The protein of milk contains all the essential amino acids and is an excellent protein for growth. The fat in milk is in an emulsified form; the carbohydrate occurs as lactose. The high-calcium content of milk makes it the best dietary source of this nutrient. Although the amount of iron in milk is very small it is in a readily available form. Milk is an excellent source of riboflavin and supplies vitamin A and thiamine in fair amounts. The vitamin D content of milk may be increased by irradiation with ultraviolet light or vitamin D may be added in the form of a concentrate. Milk has a very low ascorbic acid content and is lacking in bulk.



Milk is easily and completely digested. It leaves no residue in the gastrointestinal tract and it is neither constipating nor laxative. Boiling does not alter these properties, the only effect being to destroy certain microorganisms which might be a cause of diarrhea in some cases. Furthermore, milk does not cause distention, a misconception held by many people.

The amount of milk recommended to be taken daily is:

Child	3 to 4 cups
Adult	3 cups
Pregnancy	1 quart
Lactation	1½ quarts

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Types of Milk

There are a number of types of milk available both fresh and canned. There are several modifications of fresh milk, such as skimmed, homogenized, irradiated, fortified, acidified and cultured. Canned milks may be evaporated, condensed or dried.

Fresh milk, which is usually pasteurized, is the form in which much of the milk is consumed.

Homogenized milk is fresh pasteurized milk which has been treated in such a way that the fat particles are so finely divided and dispersed that they cannot separate and form cream.

Skimmed milk is fresh milk which has had the butterfat removed. It retains all the other nutrients of milk.

Irradiated milk is milk which has been exposed to ultraviolet light to increase its vitamin D content. Milk high in vitamin D content may also be obtained by exposing the animal producing it to the ultraviolet light while the milk is in production.

Fortified milk is milk to which a preparation of vitamin D has been added.

Acidified milk is milk to which small amounts of either citric or lactic acid have been added. Such milk is often used in infant feeding. It may be better tolerated than whole sweet milk.

Cultured or *fermented milk* is produced by the addition of certain specific microorganisms to the fresh whole milk. Such milks are also used for infant feeding.

Evaporated milk is fresh whole milk concentrated to about half its original volume. There is a slight change in the protein during this process which makes for a softer and finer curd. On dilution to its original volume it will have the same nutritive value as whole fresh milk. Once the can is open the milk must be handled with the same care as fresh milk. Evaporated milk may be irradiated or fortified like fresh milk. Because of the ease of storage and handling, evaporated milk is widely used for infant formulas.

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Condensed milk is milk from which even more water has been removed than from evaporated milk and to which sugar has been added to the amount of 40 per cent of the contents. This type of milk is used mainly for cooking and is not satisfactory for infant formulas because of its high carbohydrate content.

Dried milk is usually prepared by spraying partially evaporated milk into a chamber of warm dry air and may be made from either skimmed or whole milk. Nearly all of the water is removed and the product is a fine powder. In order to make one quart of milk 4½ ounces of this dried powder must be used in one quart of water. Dried milk may be used in cooking without being reconstituted, and forms an important means of increasing the nutritive value of many foods. This is a particularly useful means of increasing the milk intake of those who do not care to drink milk.

Canned milks have several advantages over fresh milk. They are usually more economical, are more easily shipped and stored and are convenient to use.

Safe Milk Production

In order to safeguard the health of people, milk must be produced under certain conditions and must contain not more than a certain number of microorganisms per milliliter. These standards may vary somewhat in different localities, but they all include certain standards of health for the workers and for the sanitation of the milk areas on the farm and in the dairies and of the utensils used. There are three grades of milk; raw, certified and pasteurized. These are characterized by the allowable bacterial count and the conditions under which the milk is produced. In all cases only milk from healthy cows may be used.

Grade A raw milk is milk which does not contain over 50,000 bacteria per milliliter.

Certified milk must be produced under such conditions that the bacterial count is not over 10,000 per milliliter. It may be pasteurized, thus further lowering the bacterial count.

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The production of this type of milk adds greatly to its cost and it is not commonly used except for infants.

Grade A pasteurized milk must not contain more than 200,000 bacteria per milliliter before pasteurization and not over 30,000 per milliliter after pasteurization.

Grades B and C milk have bacterial counts of not over 50,000 per milliliter after pasteurization. These grades are usually used only in cooking or for manufacturing purposes.

Pasteurization

Besides the standards established for the production of milk, the process of pasteurization is used as a further means of insuring safe milk. There are many milk-borne diseases, such as undulant fever, tuberculosis, typhoid fever, scarlet fever, diphtheria, septic sore throat and foot and mouth disease. Pasteurization of milk does much to control the spread of these diseases.

Pasteurization is the process of heating milk to a temperature of 140° to 145°F. and holding at that temperature from 20 to 30 minutes. This process reduces not only the number of bacteria but also the amount of lactalbumin and ascorbic acid. The solubility of the calcium salts is also lowered.

Care of Milk

Milk should be properly handled after it leaves the dairy. It should not be allowed to stand in the sunlight for any length of time since that will reduce the riboflavin content. It should be placed as soon as possible in the coldest part of the refrigerator. Milk is an excellent medium for the growth of microorganisms. Since milk absorbs odors and flavors readily it should be kept in containers with tight covers and should not be placed near strongly flavored foods.

Use of Milk in the Diet

Because of the great nutritive value of milk it is essential that it be included in the diet in the recommended amounts. It may be incorporated into the menu in many ways.

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Milk may be used as a beverage. It has a mild flavor, acceptable to the majority of people. It is adaptable for use in a variety of ways. Whole eggs, egg white, cocoa, chocolate, glucose, lactose, dried milk solids and malted milk may be added to whole milk, thus increasing its nutritive value. Milk may be used as buttermilk, acidified milk or skimmed milk.

Milk is used with cereals and is thus an important supplement to the incomplete protein of the cereal grains.

Milk is used in soups, such as cream of vegetable soups, and in chowders. White sauces are an important way of including milk in the diet. Creamed meats, eggs, potatoes and vegetables are dishes to be used in the menu.

There are many milk desserts. These include junket, ice cream, sherbet, custards of all types and cornstarch and rice puddings made with milk.

Principles of Cookery

Since high temperatures coagulate and toughen protein (Chapter II) it is advisable to use low temperatures in the preparation of milk dishes. Thus a double boiler is recommended and a slow oven should be used for most baked dishes. The albumin of the milk sticks to the sides and bottom of the pan and will scorch easily. Insoluble calcium salts are held along with the protein. The casein of the milk concentrates on the top of the liquid. Heat also breaks down some of the emulsified fat and dissolved gases are driven off. The little ascorbic acid present in milk is lost on heating.

When milk is heated to relatively high temperatures, as in baking, the lactose caramelizes. The acids formed aid in coagulating the protein present.

Questions and Problems

1. What is milk?
2. What nutrients does milk contain? Why is it not a perfect food?
3. What is the recommended daily intake of milk for an adult? For a child? In pregnancy? In lactation?
4. Define the various forms of milk that are available.

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5. What factors are taken into consideration in order to produce milk that is safe to be consumed?
6. What is grade A pasteurized milk? Certified milk? Grade A raw milk?
7. What is pasteurization? What effects does it have on the milk?
8. How should milk be cared for after it leaves the dairy?
9. Mrs. Smith does not like to drink milk. Suggest to her at least five means whereby she may incorporate milk into her diet in the recommended amounts.
10. What principles should be observed in cooking milk dishes?

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Chapter XXX

EGGS

EGGS ARE surpassed only by milk in their value as food. They are of high nutritive value, may be prepared in a variety of ways and are generally acceptable to the majority of people. They are an especially valuable food for people who are ill.

Composition

	Measure of 100 gms.	*Protein per cent*	*Fat per cent*	*Carbohydrate per cent*	*Water per cent*	*Iron mg.*	*Ca mg.*	*P gm.*	*Vitamin A I.U.*	*Thiamine mg.*	*Riboflavin mg.*
White	3½ whites	11	0	1	85-88	0.2	6	0.01	0	0	0.26
Yolk	7 yolks	16	32	1	80	7.2	147	0.52	3210	0.27	0.35
Whole egg	2 eggs	13	12	1	74	2.7	54	0.21	1140	0.10	0.29

Nutritive Value

Whole eggs contain protein of high biological value. The yolk contains the protein, ovovitellin, and the white is made up of ovalbumin. The fat of the egg is in the yolk and is in emulsified form. The yolk also contains iron in a readily

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available form, vitamin A, riboflavin and thiamine. Eggs are a poor source of calcium, niacin and ascorbic acid.

Because there are many people who believe that the color of the shell of the egg influences its nutritive value it is well to point out that such is not the case. Whether the shell of the egg is brown or white has no bearing on its nutritive value.

Because of its high nutritive value the inclusion of at least one egg in the diet each day is recommended. If this is not feasible, then at least 3 to 5 per week should be used. Eggs may be used as an alternate for meat. One egg is equivalent to 1 ounce of meat in protein content. The digestibility of eggs is not altered by cooking, hard or soft eggs being equally well digested.

Selection and Care of Eggs

Eggs are graded on several bases, depending upon their external and internal condition. They are graded according to size as: large, containing 24 ounces per dozen; medium, containing 20½ ounces per dozen; and small, containing 17 ounces per dozen. Uniformity of size, cleanliness and freedom from cracks and freshness also are taken into account in the grading.

Eggs are graded according to quality into three main grades. Grade A eggs have firm yolks centered in clear, fairly viscous whites and have little or no air inside the shells. These eggs may be used for all types of egg cookery and for drying. Grade B eggs have the yolks less well centered than do grade A and have large air spaces inside the shells. These eggs are suitable for all types of egg cookery except perhaps poaching. Grade C eggs have somewhat flabby yolks, watery thin whites and considerable air spaces inside the shells. The flavor of grade C eggs is inferior to the other two grades but not sufficiently so as to make them unsatisfactory for cooking, if they are used soon after they are graded.

Eggs may be day-old, fresh or cold storage. The meaning of day-old eggs is obvious. The meaning of fresh eggs varies but implies those next best in freshness to day-old ones. Cold stor-

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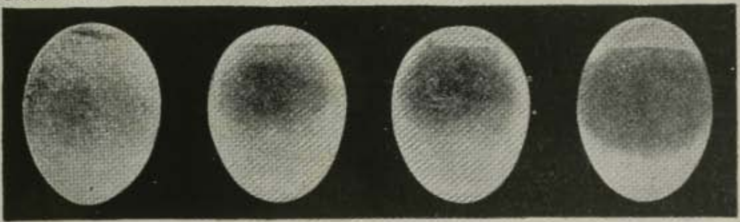
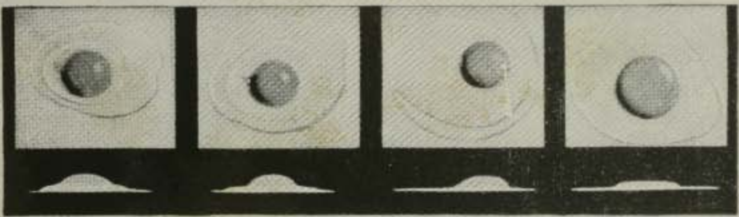
GRADE: AA A B C



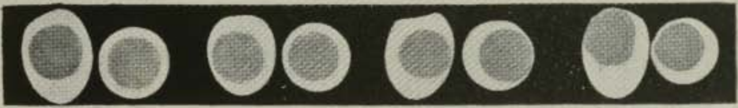
BEFORE THE CANDLER (white shells shown)

AA	A	B	C
Yolk not more than dimly visible. Air cell not more than 1/8 inch deep.	Yolk may be visible. Air cell not more than 2/8 inch deep.	Yolk may be plainly visible. Air cell not more than 3/8 inch deep.	Yolk may be plainly visible and freely mobile. Air cell large and may be freely mobile.



OPENED above: **Top View**; below: **Side View**

AA	A	B	C
Egg covers small area; much firm albumin standing very high; little thin albumin apparent; yolk round and upstanding.	Egg covers moderate area; much firm albumin standing up well; little thin albumin apparent; yolk round and upstanding.	Egg covers wide area; less firm albumin; flattened; more thin albumin; yolk somewhat flattened.	Egg covers very wide area; little if any firm albumin; most thin albumin; yolk very flat, breaks easily.



HARD COOKED

AA	A	B	C
Yolk well centered and round; air cell very small.	Yolk may be slightly off-center but round; air cell small.	Yolk approaches shell; air cell larger.	Yolk against shell; irregular in outline; air cell very large.

FRIED

AA	A	B	C
Much firm albumin standing up very well around yolk; covers small area; yolk round and upstanding.	Much firm albumin but somewhat spread out; yolk round and upstanding.	Firm albumin hardly noticeable; thin albumin spread widely; yolk somewhat flattened.	Albumin all thin and spread out over large area; yolk very flat and often broken.

Grades of eggs, their appearance, and uses. (Courtesy Beacon Milling Co., Cayuga, New York and New York State College of Agriculture, Cornell University.)

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age eggs are those preserved by storage at temperatures of 29-32°F. These eggs may be of better quality than the so-called fresh eggs which have not been properly handled. The eggs used for cold storage are selected for quality and the conditions set up for cold storage are such as to keep the eggs in the best possible state. Their nutritive value does not change during storage and they can be used for all types of egg dishes, except that often they are not satisfactory for poaching.

Other methods of preserving eggs include drying, freezing and preservation in waterglass. In drying the yolk and white are usually dried separately. These products are best used in prepared dishes rather than as eggs alone. The use of frozen eggs is limited mainly to large quantity cookery. Frozen eggs should be used soon after thawing. Preserving eggs in waterglass, a solution of sodium silicate, is an old method of preservation.

As eggs become older various changes occur. The shell assumes a shiny appearance and there are various internal changes. These are determined by a process called candling. By concentrating a beam of light on the shell the contents may be observed in relief. As the eggs become older the air space at the large end of the egg enlarges. The albumin adheres to the shell membrane. Water is lost from the white to the yolk and also through the shell. The white thus becomes less gelatinous and it is not as easily separated from the yolk. Carbon dioxide escapes from the shell with a resultant increase in the alkalinity of the contents. Bacteria may enter through the pores of the shell and bring about decomposition.

Eggs should be stored in a cool clean place and kept away from strongly flavored foods.

Uses and Cookery of Eggs

Eggs may be used in a variety of ways in the daily menu. First of all they may be used as a food in themselves. Eggs may be prepared for breakfast in many ways, such as soft- or hard-cooked, poached, scrambled, coddled, fried or as omelets. For luncheon dishes they may be served as souffles and omelets, as

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escalloped and creamed eggs, in salads, as deviled eggs and as sandwich fillings. As desserts eggs may be served as custards, either baked or soft, and as whips.

Eggs are used as agents in cookery for a number of purposes and thus are incorporated into the diet, although it may be in small amounts. They serve as an agent in cookery mainly because of their protein content. In custards and similar dishes they serve as a thickening agent. In souffles, cakes, such as angel food cake or sponge cake, and popovers eggs serve as a leavening agent. The beaten egg white retains air which on baking expands and thus acts as a leavening agent. In such dishes as meat loaves, hamburgers, croquettes and dressings, eggs act as a binding agent. In mayonnaise they act as an emulsifying agent, separating the small fat particles by a thin coating of protein, thus keeping the particles in suspension.

In cooking eggs it is essential to remember that a low temperature should be used if a tender product is to be obtained. Albumin, the protein of egg, begins to coagulate at about 135°F. and becomes a solid at 162°F. As the temperature goes higher the protein becomes tough and less palatable. Thus simmering water is used in the preparation of soft and hard-cooked and poached eggs, a double boiler is used in making custards and scrambled eggs, and a slow oven is used for baking any foods containing eggs.

Eggs and foods containing eggs should not be cooked any longer than the time specified since overcooking results in the shrinkage and toughening of the egg protein.

The protein of eggs is said to coagulate when it is changed from a liquid to a more solid state. Several factors besides heat may aid in this coagulation. Dilute acids, such as vinegar and salt, aid coagulation, while dilute alkali hinders it.

When eggs are used as a leavening agent the amount of air incorporated within the egg protein during beating of the whites is the important factor. The best volume is obtained when they are whipped at room temperature until stiff but not dry. The beaten whites should be folded into the other mixture with which they are to be combined with great care

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so as to avoid breaking down the air bubbles. A low temperature is used in baking.

Questions and Problems

1. What are the main nutrients in eggs? What is the recommended number of eggs which should be eaten per week?
2. What is meant by grade A eggs? Grade B eggs? Grade C?
3. What methods may be used to preserve eggs?
4. What is the appearance of an old egg? What changes occur in eggs as they become older?
5. What is meant by candling?
6. List at least 15 ways in which eggs may be included in the diet.
7. At what temperature should eggs be cooked? Why?
8. In addition to cooking how else may coagulation of protein be brought about?
9. What is the function of egg white in angel food cake?

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Chapter XXXI

CEREALS

CEREALS ARE DEFINED as any grain or edible fruit of the grass family which may be used for food. Thus cereals include wheat, rice, oats, rye, barley, corn and millet. From this list it is evident that cereals form one of the largest, if not the largest, group of agricultural products. Cereals in one form or another are grown in all parts of the world. The world production of rice exceeds that of any other grain, although in this country production of wheat and corn predominate.

Structure of the Whole Grain

Four parts are recognized in the cereal grain. There is the bran or hard outer layer which amounts to about 5 per cent of the grain. It is made up of cellulose and contains iron, phosphorus and certain members of the vitamin B complex. It is this layer which is removed in the milling process.

The second layer is termed the aleurone layer. It is made up largely of protein and constitutes about 8 per cent of the grain.

A third part of the grain is the germ or embryo, constituting about 5 per cent of the grain. This is the growing part. It contains iron and phosphorus and various members of the vitamin B complex.

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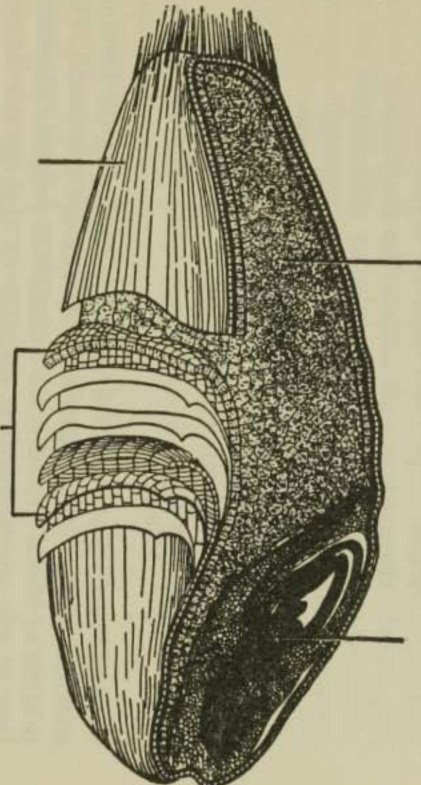
STRUCTURE OF THE WHEAT KERNEL
(Courtesy Continental Baking Co.)



THE OUTER BITTER SKIN

This skin has practically no food value, is coarse and irritating to the digestive tract of many when included in bread. The new Earle Process peels this from the wheat, without destroying the valuable layers beneath, before the wheat is made into flour. This process has been applied in making flour for whole wheat bread and a new creamy white bread.

BRAN

These are the outer bran layers of a grain of wheat. They are a rich source of the natural wheat vitamins and minerals. They also are considered as roughage. They are included in whole wheat breads and give it its brown color.

CENTER OF THE WHEAT GRAIN

This is the starchy center of the grain of wheat. It is an excellent source of energy, but contains only a small part of the vitamins and minerals that are in the whole grain. This part alone is used to make most white breads.

WHEAT GERM

This is a rich source of vitamins. It is that part which sprouts when planted. It is included in all 100% whole wheat breads.

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The remainder, 82 per cent, consists of starch cells, characteristic for each type of grain. A fine network of protein surrounds the starch granules.

Composition

WHOLE GRAIN

Average Composition

	Per cent
Protein	12
Fat	2
Carbohydrate	75
Water	10
Minerals:	Per 100 grams
Calcium	46.00 mg.
Iron	3.40 mg.
Phosphorus	.30 gm.
Vitamins:	
Thiamine	.55 mg.
Riboflavin	.15 mg.
Niacin	4.40 mg.
Vitamin E	

The carbohydrate in cereal grains is mainly in the form of starch, although some sugars and dextrins are also found. The protein of cereal grains is an incomplete protein. However, that of the whole grain is superior to that of the refined cereals. The kind of protein in the grain under consideration will determine its use. For example, the hard spring wheats are high in gluten and are used for bread baking where this quality is particularly valuable. Soft winter wheats are lower in gluten content and are therefore used for making cakes and pastries. The fat in cereal grains is found mainly in the germ and bran layers. Because of the amount of fat present whole-grain cereals do not keep well and are subject to spoilage, particularly when they are not stored properly. Whole-grain cereals are good sources of iron, but most of it is removed in refining. The phosphorous content of grains is high but they are notably lacking in calcium. Thiamine, riboflavin, niacin and vitamin E are the main vitamins present but these may be almost entirely removed in the milling process.

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Nutritive Value

Cereal grains furnish the largest single source of energy in the average diet. It is estimated that they furnish about 26 per cent of the total energy value. The bran contains much of the nutritive value of the grain, other than its energy value. The content of minerals and vitamins of the bran is important while the cellulose present is a valuable source of bulk to stimulate peristalsis in the gastrointestinal tract. The starch must first be freed from the cells of the grain by cooking. It is then easily digested and almost completely utilized.

Since cereal grains are grown and stored more cheaply than almost any other food product they comprise the larger part of the diet of most people, particularly those in low-income groups. They are considered our most economical energy food.

Enriched Flours and Breads

Flours and breads are used mainly in the white form, only a relatively small portion being used as the whole grain product.

The process of milling to produce white flour removes the bran or outer coating and the germ, with the resultant loss of iron and the B complex vitamins. In recent years steps have been instituted to restore whole grain values to the refined products preferred by the consumer. Under this enrichment program standards have been established by the government regulating the materials and the amounts to be added and specifying the products to which they shall be added, Table 23. A flour may be called enriched if it meets these standards.

TABLE 23

CONTENT OF ENRICHED FLOUR

	Per pound of flour *mg.*	*Per pound of bread* *mg.*
Thiamine	2.0- 2.5	1.9
Riboflavin	1.2- 1.5	1.6
Niacin	16.0-20.0	15.0
Iron	13.0-16.5	12.0

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Recommended Daily Intake

It is advisable to include not less than two servings and preferably four servings of whole grain or enriched cereals or breads in the diet each day. It is recommended also that when additional calories are needed some of them be supplied through additional amounts of whole grain cereals or breads, thus increasing the mineral and vitamin intake as well as the caloric value.

Uses of Cereal Grains and Their Products

One of the most valuable ways in which cereal grains may be used is as flour. Wheat is the most common type of flour, but rye, barley and corn may also be made into flours. Wheat flour may be had as whole-grain flour which still contains most of the outer layers and germ and as white flour which is largely endosperm and has been bleached. White flour may be enriched with iron and vitamins of the B complex to restore some of the original nutritive value of the whole grain. Gluten flour is flour which has had most of the starch removed. It is therefore higher in protein than whole-grain or white flours.

Breakfast cereals form another important means of introducing cereal grains into the diet. They may be had as whole-grain cereals and as refined cereals. The latter are made up largely of the endosperm of the grain and thus have much less nutritive value than do the whole-grain breakfast foods. They may be enriched in a manner similar to the enrichment of flours. Breakfast cereals come in several forms. They may be uncooked. These are the most economical forms, especially if they are purchased in bulk. Such cereals require a considerable period of time to cook, however. Partially or precooked cereals are also available. These take only a few minutes to prepare and if not refined contain the nutritive value of the whole germ. They cost only a little more than the uncooked variety. Ready-to-eat cereals are relatively expensive as compared to the other types described. They usually do not have a high nutritive value since in most cases they are prepared

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from refined cereals and under such conditions as to eliminate much of the nutritive value.

Cereal grains may be had in the form of macaroni, spaghetti, noodles and similar foods known as alimentary pastes. These may be used in soups, meat and cheese dishes and in other combinations. Certain varieties of wheat are necessary for the production of these foods, particularly macaroni and spaghetti.

Rice may be had as the whole grain or brown rice and as white rice. The latter may be enriched. Rice may be used in a variety of ways: as a breakfast cereal, as a substitute for potatoes in luncheon and dinner dishes, in soups and in desserts.

Care of Cereals

Cereals should be kept in a cool dry place and in closed containers. Whole grain cereals and flours, especially, will not keep well in a warm place or when exposed to the air for any length of time.

Cookery

Cereals are cooked in order to soften or rupture the cellulose walls in order to free the starch granules. The starch it-

TABLE 24

RECIPES FOR COOKED CEREAL

	Amount of cereal	*Liquid*	*Salt*	*Time*
Rolled oats	1/3 c.	1 c.	1/4 t.	1-2 hrs.
Fine cereal (except corn meal and Wheatena)	1/6 c.	1 c.	1/4 t.	1/2-1 hr.
Wheatena	1/4 c.	1 c.	1/4 t.	1/2-1 hr.
Corn meal	1/6 c.	1 c.	1/4 t.	2-3 hrs.

Method: Have the water boiling in the top of a double boiler over direct heat. Add the salt and then add the cereal very slowly to the boiling water, stirring constantly; boil 2 minutes. Place over hot water in a double boiler. Cover and allow to cook for the necessary period of time. If too dry, add more boiling water. Dates, raisins or prunes may be added for variation in flavor.

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self is also cooked and thus prepared for digestion. Cooking also improves the flavor.

Since cereal grains stick to the utensil and burn easily a double boiler is used in their cookery. It is essential to use the proper proportion of cereal, water and salt, if a good product is to be obtained. Water is absorbed by the starch granules which then expand and become more soluble. The dry cereal is added slowly to the boiling salted water, with constant stirring, and the mixture is then boiled for about 2 minutes. The remainder of the cooking is done over boiling water in a double boiler.

Questions and Problems

1. What is a cereal?
2. What are the four parts of the cereal grain? What nutrients does each contain?
3. What is the difference between spring and winter wheats?
4. What proportion of the energy value of the average diet is supplied by cereals? Why?
5. What is meant by enriched flour?
6. What is the recommended daily intake of cereals?
7. How may cereals be used in the diet?
8. Why should cereals be stored in a cool dry place and in closed containers?
9. Why are cereals cooked?
10. Why is the cooking of cereals begun on direct heat and then finished in a double boiler?

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Chapter XXXII

BATTERS AND DOUGHS

THE FLOURS discussed in Chapter XXXI may be made into batters and doughs which are the means of preparing breads, both loaf breads and quick breads such as muffins, biscuits, griddle cakes and waffles. Doughs may be kneaded or rolled, while batters are usually thinner and may be poured or dropped from a spoon.

Yeast Breads

Yeast breads are made up of flour, milk, sugar, shortening, salt and a leavening agent. The leavening agent used is yeast. It may be obtained as compressed yeast or as dry cakes or powder. Compressed yeast is composed of yeast plants with starch. At the proper temperature (70° to 90°F.) and in the presence of moisture and carbohydrate, the organisms grow and reproduce with the resultant formation of carbon dioxide. It is this carbon dioxide which acts as the leavening agent.

The flour used for bread is from hard or spring wheat. This flour has a relatively high gluten content and this along with the starch absorbs a considerable quantity of water. The gluten is responsible for the porosity and elasticity essential in good bread.

Milk is used in the preparation of doughs not only to in-

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crease their nutritive value but in order to produce a more tender product of finer texture and better flavor. Dried milk solids and water may be used in place of fresh milk, if desired.

Sugar is included in the dough primarily as a food for the yeast, but it also serves to produce a more tender product because less gluten is developed and it adds to the flavor.

Three processes are involved in the preparation and cooking of bread; kneading, rising and baking. After the ingredients are mixed the dough is worked by hand or by machine. This kneading process makes the dough smooth, distributes the yeast throughout the dough and develops the elastic gluten or protein of the wheat which serves to hold the carbon dioxide produced by the yeast. If the dough is kneaded too long the gluten will become tough. The amount of moisture present determines the rate at which gluten is formed. An adequate amount of moisture allows the gluten to develop at a maximum speed. When the dough is cut after kneading the air spaces should be small and evenly distributed.

The rising dough is allowed to stand at 75° to 80°F. for 2½ hours until it about doubles in size. It is then kneaded again and allowed to rise for another hour. The purpose of rising is to allow the yeast to grow and produce carbon dioxide which is occluded within the particles of gluten. Bread is baked at 400°F. for the first 15 minutes and for the remainder of the time of 30 to 35 minutes at 350°F. During baking the elastic gluten is first pushed into hollow spheres by the expansion of the occluded carbon dioxide gas and then, as the temperature becomes higher, it "sets" giving the characteristic porosity of bread. The alcohol formed by the yeast is driven off during the baking process. Bread is done when the sides of the loaf shrink slightly from the sides of the pan and the crust is an even brown.

The quality of bread is judged by a number of criteria. The score card for yeast breads indicates the various points which must be taken into consideration.

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Score Card for Yeast Breads

	Points
General appearance	10
Shape—roundness of "dome"	
Smoothness—no cracks, bulges, lumps or the like	
Color of crust—golden brown	
Lightness	10
Crust	10
Thickness	
Quality—crispness and tenderness	
Crumb	30
Color—light cream color (5)	
Texture (25)	
No streaks or extreme closeness of grain	
Size and uniformity of cells, thinness of cell walls	
Elasticity—softness and springiness	
Flavor—taste and odor	30
Sweet, nutty flavor with no "off" taste	
Keeping qualities	10
TOTAL	100

Quick Breads

Quick breads include biscuits, muffins, popovers, waffles and griddle cakes. These require batters of varying thickness, from a drop batter for biscuits to a thin pour batter for griddle cakes and waffles.

Quick breads have many of the same ingredients as do yeast breads. There are several variations, however. One relates to the source of carbon dioxide or the leavening agent which may be either baking powder or soda. Since sodium bicarbonate is an alkaline salt (the salt of a strong base and a weak acid) other acids easily displace the bicarbonate radical with the production of carbonic acid or carbon dioxide gas. The different types of baking powders depend upon the kind of acid or acid salt used to bring about this reaction. These are classed as (1) acids, tartaric or lactic; (2) acid salts, potassium acid tartrate (cream of tartar), calcium monophosphate, disodium pyrophosphate; and (3) neutral salts, sodium alumi-

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num sulfate or calcium lactate. The different kinds vary somewhat in the time of reaction, that is whether they are slow or fast acting. When soda is used alone, the action depends upon some acid constituent in one of the ingredients in the dough mixture. Sour milk and molasses are such ingredients.

The flour for quick breads may be an all-purpose flour. In the preparation of the batter the sugar is mixed with the fat thus forming a batter with finer texture. When the sugar-fat mixture is combined with the flour it separates the particles making for slower gluten formation. Gluten formation is also reduced by adding the sugar-fat mixture to the liquid portion first.

The fat, milk and salt are added to batters for the same reasons that they are included in yeast breads.

Eggs are included in batters; the yolk increases the tenderness and fineness of texture of the final product while the white acts as a binding and leavening agent.

In mixing the ingredients for quick breads it is important not to add the liquid to the dry ingredients until the very last so that there will be as little loss of carbon dioxide as possible. If the flour and baking powder are evenly distributed the function of the gluten is lessened. In preparing a batter it is advisable to handle it as little as possible so as not to overdevelop the gluten and produce a tough product or to form tunnels. Thus dough is rolled only until smooth and batter is stirred only until the dry ingredients are moistened. Batters need not be stirred until smooth or free of lumps. Too little mixing, on the other hand, results in muffins of coarse texture. Quick breads, such as muffins, should be light with a fluffy tender crumb and free from large holes and tunnels.

Cakes

Leavening in cakes may be produced in several ways. Thus air beaten into egg white, as is done in making angel food cake, expands within the elastic protein and "raises" the batter; or the steam produced from the moisture in the batter by

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the baking process will also expand and act as a leavening agent. Baking powders and baking soda may also be used.

An all-purpose flour may be used for cakes, but a cake flour is preferable as it has less gluten and therefore makes a more tender product.

Cakes are judged on their general appearance, flavor, lightness and crumb. The accompanying score card indicates how these factors may be taken into consideration in determining the quality of a cake.

Score Card for Cakes

		Points
General appearance		20
Shape—uniform, no bulges		
Crust—crisp but tender		
Smooth		
Less than ⅛ inch thick		
Flavor		35
Odor		
Taste		
Lightness		15
Crumb		30
Character	(20)	
Coarse or fine		
Tough or tender		
Moist or dry		
Elastic or not		
Color	(5)	
Grain—even distribution of grain	(5)	
TOTAL		100

Questions and Problems

1. What are the ingredients used in preparing yeast breads? What are the functions of each?
2. What three processes are involved in the making of bread? What occurs during each process?
3. What are the criteria of a good loaf of bread?
4. What is a quick bread?

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5. What is the purpose of baking powder? What types of baking powders can be used?
6. What are the other ingredients used in preparing quick breads? What are the functions of each ingredient?
7. Why should a batter or dough not be handled any more than necessary during preparation?
8. What leavening agents are used in cakes?
9. What other ingredients are used in preparing cakes? What are the functions of each?
10. What are the criteria of a good cake?
11. Estimate the nutritive value of a baking powder biscuit, an average-size serving of sponge cake and a slice of homemade bread.

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Chapter XXXIII

WHITE SAUCES

WHITE SAUCES are a combination of a thickening agent, a fat and a liquid in various proportions and are used as a binding or thickening agent for various foods. In addition white sauces serve as a means of increasing the caloric value of a dish, of adding more milk to the diet, of providing variety in the menu, or of extending leftover foods.

Composition

The thickening agent usually used is flour. However, cornstarch, tapioca or egg yolk may be used equally well. For 1 tablespoon of raw flour, 2 tablespoons of browned flour, ⅔ tablespoon of cornstarch, 1 teaspoon tapioca or 1 egg yolk may be substituted.

The fat used may be butter, margarine, meat drippings or a vegetable oil depending upon the purpose for which the sauce is to be used.

The liquid used is usually milk although meat broths or vegetable juices may serve equally well, also depending upon how the sauce is to be used.

Various flavors may be incorporated into the basic white sauce. Thus caramel or chocolate will give a bitter flavor, while fruits, sugar, molasses and honey will give a sweet

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flavor. Salt, herbs, mushrooms, onions and various spices lend variety. The color of the sauce may be varied by including finely chopped vegetables or their juices, browning the flour before it is mixed with the other ingredients or by using commercial flavorings and colorings.

Preparation

There are three variations in the thickness of white sauce determined by the use to which it is to be put. A thin white sauce is used in cream soups and for vegetables. A medium white sauce is used in creamed and escalloped dishes and for meats or fish. Thick white sauces are used for binding croquettes or cutlets and in souffles.

In the preparation the thickening agent is blended with the fat, thus separating the starch granules. These starch grains then absorb the liquid and swell, thickening the sauce. As with other foods containing milk and starch, white sauce should be cooked in a double boiler in order to prevent scorching and sticking on the sides and bottom of the pan.

When browned flour is used, twice as much must be used since the direct heat used to brown the flour reduces its thickening power.

The proportions of the ingredients for the three thicknesses of the sauce and the procedure for their preparation are given in Table 25.

TABLE 25

RECIPES FOR WHITE SAUCE

Kind	*Liquid*	*Flour*	*Fat*	*Salt*
Thin	1 c.	1 T.	1 T.	½ t.
Medium	1 c.	2 T.	2 T.	½ t.
Thick	1 c.	3 T.	3 T.	½ t.

Method: Melt the butter in the top of a double boiler over hot water. Add the flour and salt slowly and stir until blended. Add the liquid gradually and stir until the mixture is smooth and thickened. Then cover and cook over hot water for 10 to 15 minutes. The liquid may be hot when added to the melted fat and flour. This is desirable when several cups or quarts of sauce are being made.

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Questions and Problems

1. What is a white sauce? What function does it serve?
2. What variations may be made in white sauce? When is each type used?
3. Why is the flour blended with the fat?
4. What is the function of the starch?
5. Why is a white sauce made in a double boiler?

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Chapter XXXIV

SOUPS

SOUP IS a universally favored dish. It may comprise the greater part of the meal or be the appetizer. It may have little more than flavor or it may be a concentrated source of nutrients. It is liked by people when they are well and when they are ill.

Soups are generally classified as those made with a stock base and those made with a milk or white sauce base. Stock-base soups are prepared from meats, poultry, fish or vegetables and include broth, bouillon, consomme, jellied soups, clam broth and vegetable soups. Milk or white sauce soups include cream soups of all types, bisque or shell fish soups, chowders which are fish and mixed vegetables or mixed vegetables alone and stew such as oyster stew.

Stock soups are used mainly to stimulate the appetite. Those made from meat or poultry are particularly useful in this respect since they contain a high amount of the meat extractives which are the active materials in stimulating gastric secretion. Clear soups have no nutritive value other than the liquid they supply and some salt. However, stock soups may be made to have considerable nutritive value. By the addition of such cereal products as rice, barley or noodles the caloric value of the soup may be increased materially. The protein content of stock soups is increased by including the meat

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from which the stock is prepared or by adding legumes. The juices of vegetables, as well as the vegetables themselves, may be included in the stock thus adding valuable minerals and vitamins.

Milk and white sauce soups are high in nutritive value, and may even be used in place of a main dish at luncheon. Such soups supply goodly amounts of protein, calories, calcium and vitamins, depending upon the exact ingredients used. The caloric value may be increased even more by using part cream in place of the milk in the preparation of the white sauce, and by the addition of butter or margarine before serving.

Preparation of Soups

Meat stock soups may be prepared by simmering soup bones and meat with salt, seasoning and herbs for at least 3 hours. The stock is then cleared by adding beaten egg white, boiling for a few minutes and then allowing to settle before straining. For many people such preparation of soup is not practicable and canned or dehydrated soup may be used from which an acceptable soup is prepared by the simple addition of water.

Except for stews, when only milk is used, a thin white sauce forms the basis of most milk soups. A smooth and creamy soup is produced, the white sauce preventing the fat from separating from the vegetables or fish.

Questions and Problems

1. What is the difference between a stock soup and a milk soup?
2. What nutrients are supplied by milk soups as a group?
3. In what ways may the nutritive value of a stock soup be increased?
4. How are milk soups prepared? Stock soups?

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Chapter XXXV

VEGETABLES

VEGETABLES INCLUDE the edible parts of plants, except the fruits of certain grains, shrubs and trees. The following classification is given which is based mainly on the part of the plant used.

Classification of Vegetables

Seeds—beans, lentils, corn, soybeans, peanuts
Roots and tubers—potatoes (sweet and white), beets, turnips, carrots, parsnips
Flowering heads—cauliflower, broccoli, artichokes
Stems and leaves—lettuce, spinach, celery, chard, Brussels sprouts, asparagus, greens of all types, endive, cabbage
Fruits—tomatoes, cucumbers, squash, corn, okra, eggplant
Bulbs—onions, shallots

Composition

Vegetables contain varying amounts of carbohydrate. There is some sugar present in most vegetables, but the digestible carbohydrate is preponderantly starch. For convenience in dietary calculations vegetables have been classified on the basis of their carbohydrate content. Leafy and stem vegetables, tomatoes and the flowering types are low in carbohydrate, about 3 per cent, while the seed, root and tuber types

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may contain as much as 23 per cent. For the calculation of therapeutic diets a simplified classification of vegetables may be used (Chapter XXIV). For more detailed calculations the figures given in Table 3 may be used. The indigestible carbohydrate in vegetables is present mainly as cellulose, which forms the structural part. This is the bulk necessary for the normal functioning of the gastrointestinal tract.

The protein content of most vegetables is quite low, about 2 per cent, and is not of high biological value. An exception is the protein of seed vegetables or legumes. The protein of these, particularly that of soybeans, is of good quality. Nuts also have protein of excellent quality and make a valuable addition to the diet.

The fat is negligible in most vegetables and is not of importance from a nutritional standpoint. Nuts are of high fat content, however, and therefore increase materially the caloric value of the diet.

The mineral content of vegetables varies considerably according to the type. Calcium is found in appreciable amounts in broccoli and cauliflower, and especially in such greens as the brassicas, turnip greens and kale. The calcium present in some vegetables, such as spinach, is not available because of the high oxalic acid content of these vegetables. Iron is found in many of the green leafy vegetables but not all of it is in an available form. Other minerals, particularly potassium, are present in some vegetables in large quantities, and are an important factor in regulating the acid-base balance of the body, contributing materially to the basic reaction of the diet.

Vegetables are an especially valuable source of many of the vitamins. The precursor of vitamin A, carotene, is present in large amounts in the green leafy and yellow vegetables and in tomatoes. Ascorbic acid is found in tomatoes and in many of the raw leafy vegetables. Although potatoes have only a fair amount of ascorbic acid they are a material source of this vitamin because of the quantities in which they are eaten by many people. Vegetables also serve as a source of the vitamins of the B complex. The green leafy vegetables, legumes, peas

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and potatoes contain some riboflavin and thiamine and are a fair source of niacin. Peanuts are a valuable source of niacin.

Recommended Daily Intake

It is recommended that two to three servings of vegetables, besides potatoes should be eaten each day. One serving of these should be a green leafy or a yellow vegetable and preferably should be eaten raw. Besides supplying bulk, minerals and certain of the vitamins, vegetables add interest to the diet by variations in color, texture and flavor.

Types of Vegetables

Vegetables may be obtained in several forms. They may be procured fresh, canned, dried or frozen. Fresh vegetables are to be preferred and in season are usually the cheapest. Canned vegetables provide out-of-season foods at a reasonable price. The nutritive value of the fresh vegetables is well retained in the canning procedure. Dried or dehydrated vegetables are quite cheap. The main types preserved by this means are the legumes, although some others have been dried also. There is some change in texture and flavor when water is returned to dried vegetables. Many kinds of dried peas and beans are now precooked and thus do not require overnight soaking. Frozen vegetables are the most expensive type. They are choice varieties and are ready-prepared for cooking. The nutritive value of the frozen vegetables is essentially equal to that of fresh ones, especially under proper conditions of preparation and storage.

Selection and Care of Vegetables

Only those vegetables which are crisp and fresh should be chosen. Wilted dried ones have lost much of their nutritive value. No decay or other defects should be present. Headed vegetables such as cabbage and lettuce should be solid, while root vegetables should be firm and the tops should be crisp. Vegetables are best when used fresh from the garden or, if purchased, soon after they are obtained. If they must be held, root, tuber and bulb vegetables may be stored in a cool dry

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room with adequate ventilation. Other types should be washed and cleaned and kept in a refrigerator wrapped either in wax paper, cellophane or similar material, or stored in the hydrator of the refrigerator without wrapping. Frozen vegetables should not be allowed to thaw until they are to be cooked. They may be placed into the boiling water while they are still frozen.

Cookery and Serving of Vegetables

Vegetables are cooked in order to soften the cellulose and to increase the digestibility of the starch. Changes in flavor also occur on cooking which make them more palatable.

Generally vegetables are prepared by boiling, steaming, baking or frying. Boiling is the most common method used. It is particularly applicable to the preparation of the so-called strong-flavored vegetables, as well as for any other type. Steaming in a pressure cooker, or by other means, can be used for any type of vegetable while baking or cooking with hot air is used most commonly for potatoes and others of this type. Some vegetables may be fried.

Following are some general rules for the preparation and cooking of vegetables which will do much to help retain the nutritive value of the vegetables.

a. Vegetables are prepared just before they are to be cooked. Paring removes some of the nutrients present just under the skin. Long soaking in water results in further loss of minerals and vitamins, particularly ascorbic acid and thiamine, and should be avoided.
b. The vegetables are placed in boiling salted water. For mild vegetables the water should be about ¼ inch deep. Root and strong-flavored vegetables require more water, while tender greens require no added water above that clinging to the leaves after rinsing.
c. Except for the strong-flavored ones the vegetables are covered and cooked until tender, according to the time given in Table 26. There may be some slight variation in time because of the difference in texture due to age.

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Young vegetables take the least time to cook. Frozen vegetables usually require a little less time to cook than do the fresh ones. Canned vegetables need only to be heated in their own juice until hot and should not be overcooked. The steaming of vegetables shortens the time of cooking to a minimum and thus saves much of the nutritive value. If vegetables are overcooked there is a change in flavor, color and texture and a resultant loss of nutritive content.

d. The juices of vegetables which result from cooking should be served with them, unless they are to be used for sauces, gravy or soup stock. If the juice as well as the solid part is eaten the water soluble vitamins and minerals will not be lost.

Vegetables are most important in the diet for their contribution of minerals and vitamins. Great care should be taken in their preparation to conserve their supply of these nutrients. The most significant losses are those due to solution in the cooking water when the vegetables are boiled or steamed. Minerals and vitamins are the ones most likely to be lost in this way unless the residual liquid is served and eaten with the vegetable or otherwise used. Several of the vitamins are easily destroyed by heat and for this reason long cooking is to be avoided as far as possible. The high temperature of the pressure cooker is more destructive than the temperature prevailing in steaming and boiling, but the deleterious effect is somewhat offset by the shorter cooking time. Other soluble nutrients include sugar and some protein. Some of the vitamins are more susceptible to destruction in an alkaline than in an acid medium, which implies that the use of baking soda is not an acceptable practice.

As far as practicable vegetables should be cooked with an intact outer covering. Peeled and diced vegetables offer more surface and therefore suffer greater losses of nutritive value than do those cooked whole and unpeeled.

Cooked vegetables may be served in a variety of ways. They may be buttered and seasoned with salt and pepper; creamed

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in a white sauce or in plain cream; served with a sauce such as Hollandaise or a cheese sauce; and they may be escalloped. In this latter method the vegetable is combined with white sauce, placed in a baking dish, covered with crumbs and baked until the crumbs are browned.

The following timetable for boiling vegetables is given merely as a guide. Any vegetable should be cooked only as long as necessary to make it edible. This depends almost entirely on its age, freshness, size and the consumer's opinion of what is "doneness."

TABLE 26

TIMETABLE FOR BOILING VEGETABLES

Vegetable	*Time to boil*		*Vegetable*	*Time to boil*	
Asparagus			Onions, white	25-35	minutes
Tips	5-10	minutes	Onions, yellow	20-25	"
Stalks	20-25	"	Parsnips	30-40	"
Beans, string	15-30	"	Peas	10-15	"
Beets, young	20-60	"	Potatoes, Irish	20-30	"
Beets, old	3-4	hours	Potatoes, sweet	20-25	"
Broccoli	15-25	minutes	Rutabagas	25-30	"
Brussels sprouts	9-10	"	Spinach—		
Cabbage	5-10	"	with stems	6-10	"
Cabbage, red	20-25	"	Spinach—		
Carrots, young	15-20	"	without stems	4-5	"
Carrots, old	30-40	"	Squash,		
Cauliflower	8-10	"	Hubbard	20-30	"
Celery	15-20	"	Tomatoes	5-10	"
			Turnips, white	20-25	"

QUESTIONS AND PROBLEMS

1. What are the main nutrients supplied to the diet by vegetables in general? What are the specific contributions of each of the following: legumes, nuts, broccoli, green leafy vegetables, yellow vegetables, tomatoes?
2. Besides furnishing nutrients what other functions do vegetables have in the diet?
3. What is the recommended daily dietary intake of vegetables?

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4. In what forms may vegetables be procured? How do the nutritive values of these types compare? How do the costs compare?
5. Why are vegetables cooked? What procedures are usually used in cooking?
6. What points should be kept in mind in preparing and cooking vegetables to retain their nutritive value?
7. How long should vegetables be cooked? What factors determine this?

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Chapter XXXVI

FRUITS

FRUITS INCLUDE the fleshy, seed-bearing parts of plants. Because of their varied flavor, aroma and texture fruits are one of the most acceptable of foods.

Composition

Fruits contain varying amounts of carbohydrate, ranging from approximately 3 per cent for melons to about 25 per cent for bananas. The carbohydrate of fruits may occur as glucose, fructose, sucrose, starch, pectin and cellulose. The cellulose is the structural part of the fruit and adds bulk to the diet. Pectin is a polysaccharide which with sugar gives the jellying power to certain fruits. The other types of carbohydrate found depend on the ripeness of the fruit. Green fruits have more starch and less invert sugar, glucose and fructose, than do ripe fruits. In order to use fruits for certain therapeutic diets, such as the diabetic diet, they have been classified according to their carbohydrate content (Chapter XXIV).

The protein and fat content of most fruits is negligible. Avocados and olives have an unusually high fat content and are exceptions.

Fresh fruits have a very high content of water, ranging from 80 per cent to as high as 98 per cent.

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Some fruits are a particularly valuable source of the minerals. The potassium content of fruits is quite high and is usually found combined with the organic acids. Calcium is found in relatively high amounts in the dried fruits and in moderate amounts in oranges, raspberries and strawberries. Iron is found in apricots, bananas, raspberries, peaches, dates, figs, prunes and raisins. That in apricots, peaches, prunes and raisins is present in quite high amounts and most of it is in an available form. The mineral content of fruits contributes considerably to the base-forming elements of the diet.

Fruits are particularly valuable for their ascorbic acid content. The citrus fruits, oranges, grapefruits, tangerines and lemons, are the most important sources. Berries and melons in season are also good sources. All fresh fruits, in fact, will make some contribution of ascorbic acid to the diet. The juice of one orange, approximately 5 to 6 ounces, will supply the daily ascorbic acid requirement of the average adult. Table below shows the amount of other fruit juices that would have to be consumed to supply the same amount of ascorbic acid as that from the juice of one orange.

AMOUNT OF FRUIT JUICE NECESSARY TO SUPPLY THE ASCORBIC ACID REQUIREMENT OF AN ADULT

	Ounces
Fresh orange juice	5½
Frozen orange juice	5½
Canned grapefruit juice	8½
Canned tomato juice	18½
Canned pineapple juice	33
Canned apple juice	100
Canned prune juice	100

In the form of the precursor of vitamin A, carotene, such fruits as apricots, peaches, cantaloupes and bananas supply appreciable amounts. Apricots and peaches in the dried form are an even more concentrated source of the vitamin.

Fruits contain only a small amount of the vitamin B com-

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To section citrus fruits, peel deeply enough to remove membrane which covers pulp.

Cut toward the center along the membranes and remove the section.

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plex. Some of the dried fruits and the citrus fruits contribute some thiamine to the diet, however.

Fruits contain a number of different organic acids which are chiefly responsible for much of their distinctive flavor. Malic acid is found in apples, pears, berries, grapes and cherries. Citric acid is present in oranges, limes, lemons, unripe tomatoes and grapefruit. Tartaric acid is present in grapes. Acetic acid is found in fruits when fermentation of the sugars and starches occurs.

It is to be remembered that these organic acids are metabolized in the body to carbon dioxide and water and do not leave any residue to alter the acid-base balance of the body. (Chapter VI.)

Recommended Daily Intake

The Basic Daily Dietary Pattern includes two servings of fruits, one of which should be a citrus fruit. Besides supplying ascorbic acid, bulk and base-forming elements, fruits, because of their high organic acid content, aid in the passage of food along the gastrointestinal tract. They also add color, flavor and variety to the diet.

Preservation

Fruits may be preserved from bacterial spoilage in a number of ways, either by altering certain conditions of moisture and temperature, or by sugar concentration. Thus they may be dried, providing a relatively inexpensive product. They may be preserved with sugar as is done in the making of jams, jellies and preserves. Fruits may also be canned with varying concentrations of sugar. This and the size and the perfection of the fruit used determine the grade of the product. Fruits may be canned in water only; in such cases they are termed water-pack fruit. This type is used for low-carbohydrate and low-caloric diets especially. Fruits are preserved by cold storage and by freezing. Cold storage is used mainly for such items as apples, pears, oranges and grapefruit. Many types are preserved by freezing, although the citrus fruits, apples, pears

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and bananas especially do not lend themselves to this form of preservation. Most frozen products have considerable quantities of sugar added to help maintain texture as well as flavor. Frozen fruits should be served soon after they are thawed.

Selection and Care of Fruits

In selecting fruits only firm, ripe ones should be chosen. They should be free of decay or other blemishes. If they are overripe, spoilage through fermentation may have occurred, while if they are underripe, their sugar content is not fully developed.

Fruits should be kept in a cool place. Except for bananas, ripe fruits may be stored in a refrigerator. All fruits should be carefully washed to remove any traces of residual insecticides. Some of these may be harmful. Berries and other soft fruits should be washed only shortly before they are to be served since moisture allows molds and other microorganisms to grow and cause destruction and spoilage.

Cookery and Uses of Fruits

Fruits are cooked in order to soften the cellulose and thus render them more easily digested. Cooking also accomplishes a degree of sterilization and thus improves their keeping qualities. Cooked fruits make for a further variation in the diet as the flavor is usually somewhat different from that of the fresh ones.

Fruits may be cooked by steaming, stewing and baking. A simmering temperature should be used in stewing since very high temperatures will toughen the fruit. It is usually advisable to add sugar after rather than during cooking. Dried fruits, after they are washed, must be soaked for several hours before they are cooked.

Fresh, frozen and canned fruits may be used as such, and in salads, desserts and as fruit beverages. The juices drained from fruits served in a salad may be combined and used as a fruit beverage with other fruit juices.

Since any treatment tends to reduce the nutritive value of fruits as well as of vegetables, fresh fruits are to be preferred

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over preserved forms, and especially over those preserved in concentrated sugar syrups.

Questions and Problems

1. What is a fruit?
2. List the main nutrients found in fruits as a class? What nutrients are supplied by the following specific fruits:
   - Oranges
   - Bananas
   - Cantaloupes
   - Apricots
   - Peaches
   - Raspberries
   - Apples
3. What is chiefly responsible for the flavor of fruits?
4. What is the function of fruit in the diet? What is the recommended daily intake of fruit?
5. What various means may be used to preserve fruits? Note the types of fruits which are preserved by each method.
6. What precautions should be taken in the selection and care of fruits?
7. What procedures may be used in the cooking of fruits? What are the advantages and disadvantages of cooking fruits?

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Chapter XXXVII

SALADS AND SALAD DRESSINGS

SALADS INCLUDE a variety of combinations of vegetables, fruits, and other food stuffs which are served cold, and lettuce or some other crisp green, accompanied by a dressing of some type. They make important contributions to the diet depending upon the ingredients which are used. Salads may be classified into several groups according to their composition and the uses to be made of them.

Types of Salads

Appetizer or Green Salads. One of the most popular types is the green or appetizer salad. Such salads are made up of the crisp green leaves of the salad plants such as lettuce, romaine, escarole, endive, watercress or other greens. Fruits, tomatoes, radishes and similar vegetables may be added to them. These salads are served usually either with lemon or French dressing and are often used as a first course or appetizer for dinners or as an accompaniment to the main course of a meal.

Hearty or Main-Course Salads. This type contains besides the salad greens such protein foods as meat, fish, chicken, eggs or cheese, often with fruits or vegetables added. They may be varied by being jellied and served with different types of dressings. As the name indicates, they are used for the main dish especially for luncheons. They are high in nutritive value. Examples of such salads are egg and potato salad,

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chicken, tuna fish or salmon salad, jellied meat salads and cottage cheese and fruit salads.

Relishes. Such raw vegetables as celery sticks, carrot sticks, radishes and green onions are termed relishes. They are served without a dressing of any type as a first course or as an accompaniment to the main course.

Main-Course-Accompaniment Salads. A light crisp salad similar to the appetizer salad is often classed by itself as a main-course-accompaniment salad. Such salads as cole slaw, shredded carrot and cabbage, grapefruit and green pepper, tomato and other salads of similar type are the usual ones included in this group.

Separate Course Salads. At formal dinners the salad is often served as a separate course. Crisp vegetable or fruit salads or jellied salads are the ones usually served in this manner.

Dessert Salads. Salads may be served as desserts. This is done frequently at luncheons. A combination of fruits blended together with a salad dressing or mayonnaise is the usual type. Nuts, cream cheese, marshmallows or whipped cream may be added. These salads may also be served frozen. Examples are pineapple, white cherry and marshmallows in whipped cream; grapefruit, orange and peach; or stuffed prune.

Essentials of a Good Salad

There are certain standards which are fundamental to a good salad. First of all it must be attractive in color and arrangement. The ingredients should be cold, crisp and free of adhering moisture. Salads should be simple rather than elaborate and should not contain too many kinds of ingredients. The seasoning should be selected for the best flavor and the dressing should be appropriate for the ingredients.

Preparation of Salads

The greens for a salad should be washed, drained and then chilled in a refrigerator. First of all, the wilted or hardened portions of the leaves are removed. In order to separate the leaves of a head of lettuce the core is removed with a sharp knife and the head is held under cold running water which

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aids in separating each leaf without tearing. For storage the greens are wrapped in a damp cloth, wax paper, cellophane or similar material, or placed in a covered container and kept in the refrigerator. Before serving the excess moisture is removed from the greens with a clean dry towel.

The other ingredients used in the salads should be cut in attractive shapes and sizes. Too large or too fine pieces are to be avoided. These other ingredients should vary in texture and color but should be few in number. Fruits and vegetables should be drained thoroughly before they are combined with the greens. Salads should not be prepared too far ahead of the time when they are to be served. This is extremely important for fruit salads that contain bananas, fresh apples, peaches or pears which discolor easily on exposure to the air. The use of a little citrus juice or ascorbic acid on such fruits will help to prevent much of this discoloration. All ingredients should be chilled thoroughly before they are combined. It is best to mix the ingredients by tossing them together with a fork rather than by stirring them with a spoon.

The garnishes for salads should be simple but attractive and should add to the appearance.

Nutritive Value

Salads have an important place in the diet. They are a source of minerals, vitamins and bulk when fruits and vegetables are used; a source of protein when meat, fish, cheese or eggs are used; and a source of calories due to the salad dressings as well as to some of the other ingredients included.

Salad Dressings

A dressing of some type is usually served with a salad. This adds color and flavor and is a means of combining the ingredients. Salad dressings add caloric value also.

Types of Salad Dressings

There are three general types of salad dressings from which many variations may be made. The three basic ones are: (1) mayonnaise which is a stable emulsion of oil; (2) French dressing, a temporary emulsion of oil and acid; and (3)

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cooked dressing which is a dressing thickened with egg and flour.

Salad Oils

Various types of oils may be used in the preparation of salad dressing, such as olive oil, corn oil, cottonseed oil, and peanut oil.

Olive oil is the most popular salad oil. It has a fine pleasing flavor but is generally quite expensive because it is usually imported. There are three grades of olive oil obtained from the flesh of ripe olives.

1. Virgin—separates from olives spontaneously or with very little pressure. This is the choicest type.
2. Second grade—extracted from thoroughly crushed olives. Most of the oil on the market is of this type.
3. Third grade—obtained by extraction after the second grade has been removed.

Corn oil is obtained by expression of the oil under heavy pressure from the dried crushed corn germ. Cottonseed oil is expressed from the seed of the cotton plant. Peanut oil is expressed from less choice peanuts or as a by-product in the manufacture of peanut butter.

All salad oils should be kept in tightly covered containers in a cool place, preferably in the refrigerator. They will become rancid upon exposure to the air at ordinary temperatures for any length of time.

Preparation of Salad Dressings

Mayonnaise and French dressing are emulsions. An emulsion is formed when the tiny droplets of one liquid are held suspended in another liquid. The stability of an emulsion depends upon the fineness of the droplets and the thickness of the emulsifying agent. Other examples of emulsions in foods are cream and homogenized milk. In mayonnaise the protein of the egg yolk acts as the emulsifying agent forming a fine coating over the fat droplets. An acid such as lemon juice or vinegar is used. This acid has the property of thinning the oil and makes it easier to break the oil into fine

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particles. Egg yolk is usually used in preparing mayonnaise but whole egg may be used. It gives a large volume and a thinner dressing than when only the yolk is used. It is important that the egg be fresh. The oil is added in very small amounts to the egg-acid mixture so that it will be broken into tiny particles which can be well coated with the mixture.

If excess salt is added or the oil is added too rapidly or there is incontinuous beating, the emulsion may break and the oil will separate. When this happens a fresh egg yolk is beaten in a clean bowl and the broken emulsion is added very slowly, beating continuously until all is added. Then the remainder of the oil may be added.

French dressing is a temporary emulsion and separates almost immediately. It must be well shaken just before it is to be used. The acid reduces the thickness of the oil and makes it easier to form small droplets, which however will stay in suspension for only a short time since no emulsifying agent is present.

In cooked salad dressing flour and eggs are used as thickening agents. This type of dressing is prepared in a manner similar to that of white sauce (Chapter XXXIII).

Questions and Problems

1. What is a salad?
2. What are the various types of salads? Give 3 examples of each? When is each used?
3. What are the essentials of a good salad?
4. Describe in detail how you would prepare the ingredients for a chef's salad, noting the reason for each step which you would take.
5. Estimate the nutritive value of one of each of the types of salads which you listed in question 2.
6. What are the differences among the three main types of salad dressings?
7. What is the function of a salad dressing? What is its nutritive value?
8. How is mayonnaise prepared? What is the function of the egg yolk in mayonnaise? The acid?
9. What is the thickening agent in a cooked salad dressing?

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Chapter XXXVIII

DESSERTS

DESSERTS ARE the final touch to the meal. They are served at the end and should complement the main part. Thus if the meal has been a heavy one a lighter type of dessert will be chosen. On the other hand, desserts may be used to increase the nutritive value of a lighter main course. Calories, protein, calcium and vitamins may be added, depending upon the type of dessert served. Desserts are used, too, to satisfy a liking for sweets. As a group desserts are easily digested and make valuable contributions to the diet.

Types of Desserts

There are five general types of desserts: 1) fruits, which have already been discussed (Chapter XXXVI) and fruit desserts; 2) pastries, pies and cakes mentioned in Chapter XXXII; 3) gelatin desserts; 4) milk desserts; and 5) frozen desserts.

Fruit Desserts. Besides fruits as such, other fruit desserts include whips, souffles, creams and puddings. A whip is a combination of sweetened fruit pulp with beaten egg white. A fruit souffle is a baked fruit whip. Fruit creams are fruit combined with whole egg or with whipped cream. Fruit puddings are a combination of fruit with bread, such as a brown Betty.

Gelatin Desserts. Gelatin desserts are an acceptable type of

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dessert, especially for those who are ill. Such desserts may be varied in color and texture and by the addition of fruits, marshmallows, nuts, egg white and whipped cream.

Gelatin is extracted from the cartilage, connective tissue, and the bones of animals by boiling. In the dry state it contains 86 per cent of protein. However, this protein is lacking especially in the essential amino acids, tryptophan and tyrosine, so that gelatin is an inadequate source of protein. The remainder of the gelatin, 14 per cent, is water. Furthermore, in prepared dishes the actual amount of gelatin will be very small. Gelatin may be obtained in granulated, shredded or sheet form. The most common is the granulated type. Gelatin softens and swells in cold water, dissolves in hot water and on cooling forms a gel.

Gelatin desserts are prepared with the previously mentioned facts in mind. The gelatin is first soaked in cold water, then boiling water is added and the mixture stirred until the gelatin is entirely dissolved. Sweetening, flavor, fruits or vegetables are added as the mixture begins to cool and the gelatin is then allowed to solidify at a low temperature. After gelatin has solidified it may be whipped, and beaten egg white or whipped cream added. When fruit is to be added fresh pineapple must not be used as it contains an enzyme which acts on the gelatin and will not allow it to set.

Milk Desserts. Custards, puddings and junket are made primarily of milk in combination with various other food substances such as eggs or cereals.

Custards are a combination of milk and eggs with added sweetening and flavorings. There are soft custards, made in the double boiler, and baked custards which are cooked in the oven. The principles of cooking discussed for both eggs and milk must be applied to the making of custard. Low temperatures are essential to a good product.

Puddings are a combination of a cereal such as tapioca, rice or cornstarch with milk. The principles of cookery for white sauces are applicable in the preparation of these desserts. A double boiler must be used to prevent scorching and the toughening of the milk proteins.

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Junket is made of milk and a flavoring of some type. It is prepared by adding rennin, the enzyme which coagulates milk, to milk which has been warmed to 100°F. As soon as the rennin is dissolved, the warmed, flavored milk is poured into molds and allowed to set until firm. If the milk is heated to too high a temperature, the enzyme will be destroyed and the milk will not set.

Frozen Desserts. Frozen desserts are one of the most acceptable types. Ices, sherbets and ice cream are included in this group. Ices are prepared from frozen fruit juices and sherbets will contain in addition beaten egg white or milk. Ice cream may be prepared in a number of ways and in a variety of flavors. Condensed milk, cream or custard mixes form the basis of this universally popular dish.

Questions and Problems

1. List the types of desserts that may be used. Give at least 5 examples of each type.
2. What are the functions of a dessert? Do they have any nutritive value?
3. What is gelatin? How is a gelatin dessert prepared?
4. What is rennin? What precautions must be taken in preparing junket? Why?

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Chapter XXXIX

SANDWICHES

As SANDWICHES form an important part of the American diet a few words should be said about them. Sandwiches may be classified into three general groups, luncheon or hearty sandwiches, dainty sandwiches and canapes.

Hearty Sandwiches

Hearty sandwiches which may be used in place of a main dish at luncheon are made with a filling of meat, fish, chicken, cheese, eggs, peanut butter or similar foods. Lettuce, tomatoes or some other salad greens are usually included as well. Mayonnaise, cooked salad dressing, butter or other spread is usually added. A variety of breads may be used for such hearty sandwiches. White, whole wheat, brown, rye and nut breads, and rolls, toast or waffles may be suggested. Usually the bread is cut about ½ inch thick.

Dainty Sandwiches

For dainty sandwiches, which are used for teas or as an accompaniment to a luncheon, thinly sliced bread, with the crusts removed, is used. The fillings for these sandwiches are mainly meat pastes, cream cheese or jellies. Such sandwiches may be varied in flavor, size and shape.

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Canapes

Canapes are small open-faced sandwiches of varied shape. They may be garnished in many attractive ways and are used for teas and parties of all kinds. Hard-cooked eggs, cream cheese, olives, pimento, green peppers, pickles, parsley, water cress, nuts, caviar and anchovy are among the ingredients used. Besides different shapes and varieties of bread, crackers of various types may also be used.

Questions and Problems

1. Suggest 5 types of hearty sandwiches that might be included for the lunches of school children. Estimate the nutritive value of each of these sandwiches.

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Chapter XL

CHEESE

CHEESE IS the consolidated curd of milk formed by the action of rennin, lactic acid or various types of microorganisms.

Types of Cheese

Cheese may be divided into four general groups, soft, semihard, hard and processed.

1. Soft: Cottage, cream, Camembert, Limburger, Liederkranz, Brie
2. Semihard: Brick, Munster, Gorgonzola, Roquefort, Stilton
3. Hard: Cheddar, Edam, Gouda, Gruyere, Parmesan, Swiss, pineapple
4. Processed cheese: Hard cheese to which an emulsifying agent has been added which changes its texture

Method of Manufacture

Over 400 different varieties of cheeses are known. These many kinds are brought about through variation in the type of milk used, the type of microorganism and the method of

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manufacture. The milk used in cheese may come from cows, goats or sheep and may be whole, skimmed, and may or may not have added cream.

The first step in the manufacture of cheese is the curdling of the milk. This may be brought about by rennin or lactic acid forming bacteria. The curd thus formed is separated from the whey and compressed into the form characteristic of the cheese being made. The cheese is then cured. The amount of salt or flavoring used, the time, temperature and humidity of the curing process and the kinds and amounts of molds or bacteria remaining give the cheese its characteristic flavor. Besides the acids formed by the microorganisms, gases are also produced which are responsible for the holes in cheese.

Cottage cheese and cream cheese are not ripened or cured. Cottage cheese is made from pasteurized skimmed milk. Much of the calcium of the milk is lost in the making of this cheese. Cottage cheese is primarily protein and is of lower caloric value than any other type of cheese. Cream cheese is made from cream. It is therefore quite high in fat, approximately 30 per cent.

In order to control the composition and manufacture of cheese, standards have been adopted by legislation which regulate the percentage of fat and water allowed and which define the sanitary conditions under which the cheese must be prepared so that it is a safe food product.

Composition of Hard Cheese

	Per cent
Protein	25
Fat	33
Carbohydrate	2
Minerals:	Per 100 grams
Calcium	725 mg.
Phosphorus	0.68 gm.
Vitamins:	
Vitamin A	1400 I.U.
Riboflavin	.42 mg.

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The protein of cheese is mostly casein with a small amount of albumin. Therefore it is a complete protein and of good nutritive value.

Hard cheese has a high content of fat which is not as perfectly emulsified as it was in milk. This cheese is a fairly concentrated source of calories.

Cheese has a negligible carbohydrate content. The lactose present in the milk has remained in the whey.

All cheeses, except cottage cheese, are a good source of calcium. An ounce of cheddar cheese, for example, is equivalent to a cup of milk in calcium content. Cheese is also an excellent source of phosphorus.

Cheese made from whole milk, like the original milk, is a good source of vitamin A and is a particularly good source of riboflavin.

Uses of Cheese in the Diet

Since the protein of cheese is of high biological value it may be substituted for eggs, milk or meat in protein value (page 19). Domestic cheese is a cheaper source of complete protein than is meat and in low cost diets may form an important part of the day's protein intake.

Cheese is a concentrated food. One ounce of cheese, about a 1 inch cube, is equivalent to a glass of milk in food value, or 1 pound of cheese contains the casein and fat equivalent to 1 gallon of milk. Cheese is an easily digested food.

Cheese may be used in the menu in a variety of ways.

a. In soup
   1. Grated cheese used
b. With vegetables and starchy foods
   1. Cheese sauce on vegetables
   2. Au gratin dishes
   3. Macaroni and cheese
   4. Rice and cheese
c. In main dishes
   1. Omelets
   2. Souffles

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3. Croquettes
4. Rarebits
5. Fondue

d. Salads
1. Cottage cheese
2. Vegetables mixed with cheese
3. Fruits stuffed with cream cheese
4. Mixed in salad dressings

e. Sandwiches

f. Desserts
1. With crackers
2. With pie
3. Cheesecake

Selection and Care of Cheese

A good quality American cheddar cheese should have a nutlike flavor, a slightly acid taste, be of a waxy, smooth, uniform texture, have an even color and a smooth rind. The cheese should melt easily. Cheese which melts quickly when held on the tongue may be used for all types of hot cheese dishes. Old, well-cured cheeses are distinguishable from new green cheeses because they are more crumbly.

Cheese should be stored in a cool, well-ventilated place. The cut surface should be placed face down on a plate or covered with wax paper, cellophane, plastic film or paraffin to protect it from drying out. If cheese does become hardened it may be used in cookery by grating it.

Cookery of Cheese

As cheese is high in protein it is essential that it be cooked at a low temperature. For dishes cooked on the top of the stove a double boiler must be used and those baked in the oven should be placed in a pan of hot water. Cheddar cheese softens at 102°F., melts at 139°F. and becomes tough at 185°F. The fat separates from the protein and the protein becomes tough and stringy. Slightly higher temperatures may be used for toasted cheese sandwiches, but they should be used

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for only a short time or the cheese will become tough and stringy. Cheese is grated, finely flaked or pressed through a strainer when it is to be used in cooking.

Questions and Problems

1. What is cheese? How is it made?
2. How do cream cheese and cottage cheese differ from other varieties of cheese?
3. What are the main nutrients found in hard cheese?
4. How may cheese be used in the menu for luncheon dishes?
5. Compare the protein content of 1 ounce of cheese, 1 ounce of beef, 1 glass of milk and 1 egg. How do they compare in calcium content?
6. What are the characteristics of a good quality cheddar cheese?
7. At what temperature should cheese be cooked? Why?

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Chapter XLI

MEAT, FISH AND POULTRY

FROM a nutritional point of view meat, fish and poultry are classified together and often the term meat is used to represent all three because for most of the nutrients they are comparable. However, meat in the strict sense of the word refers to the flesh of large animals, such as veal, beef, lamb, mutton and pork.

Composition

Protein. The protein content of meat varies according to the amount of fat present in the tissues. It ranges from approximately 16 to 25 per cent. The higher the amount of fat present the lower the protein content. The protein of meat, including fish and poultry, is of high biological value containing adequate amounts of the essential amino acids.

Fat. The fat content of meat varies widely depending upon the cut of the meat, and the type and age of animal from which it came. For example, pork is higher in fat than beef, beef is higher in fat than veal, and a round steak is less fat than a T-bone steak.

Carbohydrate. Very small amounts of carbohydrate in the form of glycogen are found in meats. It makes a negligible contribution to the diet.

Minerals. Except for calcium, meats are a good source of

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many of the important minerals. Potassium, sulfur and phosphorus are found in appreciable amounts. Iron is present in high amounts in the organ tissues especially and in less amounts in the muscle tissues. Liver, all types, is one of the best sources of this mineral.

Vitamins. Meats are a good source of the vitamins of the B complex. Thiamine is especially high in pork muscle and in the liver and kidney of all animals. Riboflavin is found in all types of meat generally, and liver is a good source of this vitamin also. Varying amounts of niacin are found in meats. Vitamin A is present in liver in high concentration and this meat furnishes one of the important sources of this vitamin.

Extractives. Meats owe their characteristic flavor to the creatine and purines which are found in all meats in varying amounts but which have no food value. Broth or meat stock is essentially an extraction of these non-protein nitrogenous substances.

Recommended Intake

The Basic Daily Dietary Pattern suggests that 3 ounces (raw weight) of meat, fish or poultry should be included in the daily diet. Besides supplying complete protein, minerals and certain of the vitamins, meat increases the satiety value of the diet. It has long been a favored food. It is, however, an expensive one.

Meat in itself is an easily digested food when properly prepared. The amount of fat present and the amount used in preparation are determining factors in the digestibility of the finally prepared dish.

Factors Which Affect Texture and Tenderness of Meat

A tender piece of meat is one of the most palatable and delectable of foods. However, there are a number of factors which enter into the production of tender meat. The first consideration is the character of the cell walls. This is determined by the cut of the meat and the amount of muscular development. Those parts of the animal which have been exercised are less tender than the more fleshy parts. Thus the

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meat from the ribs and loin are considerably more tender than that from the shank, chuck or round. These less tender cuts of meat are very flavorful, however, as they are higher in the extractives. The meat from young animals is more tender than that from older ones. The amount and type of connective tissue is the determining factor in the tenderness of meat. White connective tissue can be softened by cooking but yellow connective tissue is not affected. If it is present in appreciable amounts it results in the toughness of the meat. Other factors which affect the tenderness of the meat are the general nutrition of the animal when it was killed and the length of time the meat is allowed to hang or season after slaughter. Meat that has been allowed to age properly is considerably more tender.

Selection of Meat, Fish and Poultry

General Points. Since meat is generally an expensive food its economical purchase is an important factor in its inclusion in the menu. In selecting meat the cost must be considered from the point of view of the nutritive value supplied. Thus the cost per pound is not the determining factor. Such cost should be based on the amount of edible meat that is available in the pound of meat purchased. Thus, although a pound of stew meat may be cheap, if it is mostly bones it is actually expensive from a nutritional angle. On the other hand, ounce for ounce, the nutritive value of the edible portion of a round steak and a T-bone steak are equal but the latter is considerably more expensive. In selecting meat the menu in which it is to be used must be considered. The length of time necessary to cook the meat will be another consideration. Furthermore, thought should be given to the use for which the meat is intended. An expensive steak should not be ground for a meat loaf, when a less expensive cut is equally satisfactory.

In selecting meat it is wise to see that it has been inspected and graded. The round purple stamp of the federal inspector is placed on all meats in interstate commerce. This stamp means that the meat and the conditions under which it was produced have met certain standards and that the product

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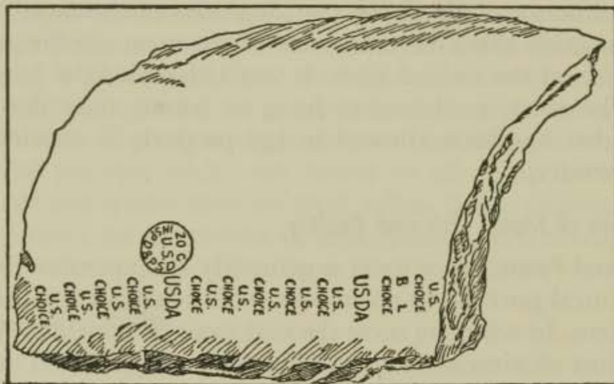
may be presumed to be safe for consumption. It is always important to purchase meat in markets where good sanitary conditions are maintained.

Grades of meat depend upon the conformation of the animal, its finish and quality. The following grades of beef have been established, based on these factors, and are stamped on the meat by the meat packers.



Grades of beef

Prime—excellent quality beef
Choice—high quality beef which will usually be leaner than prime
Good—relatively tender beef with a high ratio of lean to fat
Commercial—beef from mature animals with a more pronounced beef flavor than that of the good grade

Each kind of meat has certain characteristics which must be considered when selecting that particular type. A brief discussion of each is given.

Beef. Beef is the meat of 3- to 4-year-old steers. Good quality beef must be a bright cherry-red color and have a good marbling of fat. The cut surface should be smooth and velvety showing a firm fine grain. Red porous bones indicate a young animal.

The choice cuts of beef, which take only a short time to

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cook, include the loin and ribs which are used for steaks and for choice roasts. The tougher cuts of meat are the pot roast, round steaks, stews and soup meats. These come from the rump, shank, chuck, plate and brisket and require a considerable time to cook.

Veal. Veal is the meat of the young calf. It must not be less than 3 weeks old. Good quality veal has a fine-grain texture but does not show any marbling. There is only a small amount of clear hard fat around the meat and the flesh is pinkish-gray in color. The bones are porous and tinged with red. Veal chops from the rib and loin and steaks and cutlets are tender cuts and quickly cooked. The leg, shoulder and breast are best roasted. Less choice cuts of veal may be made into stews.

Pork. Pork is the meat of the pig. Good quality pork is pinkish-white in color with firm, well-marbled flesh. The bones have a slight tinge of red. Chops and steaks from the loin require a short time to cook, while roasts from the leg, shoulder and loin require a much longer time. Many types of smoked and cured meats are made from pork.

Lamb. Lamb is the meat of the immature sheep, while mutton is the meat of the older sheep. Characteristics of good quality lamb are a light pink flesh with firm white fat. The bones should be slightly red, moist and porous. Mutton may be distinguished from lamb by the breaking of the knee joint. Loin chops are the choice cut of lamb and the leg makes excellent roasts. The tougher parts of the lamb are used in stews or as ground meat.

Poultry. Poultry includes chicken, turkey, duck, goose and any wild fowl. The characteristics of good quality poultry may be observed by examination of the head, feet, skin and other parts of the fowl. Poultry of good quality should have a red comb, clear full eyes, and there should be no sores present. The feet should be moist, soft and limber. They should not be scaly and the toes should not be blunt. It is wise not to select poultry with long thin legs. The breastbone should be flexible with a large portion of flesh in relation to bone. The wings should spring back into place readily when pulled

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out. The skin of good quality poultry is dry and firm. If many hairs are present, it is a sign that the fowl is old.

Fish. Good quality fish must have full bright eyes, a fresh odor, smooth moist skin with fresh fins and tails. The flesh should be firm.

Preservation and Care of Meat

Meat may be preserved by a variety of means such as by cold storage, freezing, salting, smoking, drying and canning. All of these have the purpose of either inhibiting or destroying microorganisms so that putrefaction will not occur (Chapter XXVII).

Commercially, meat must be handled in the slaughter house, storage spaces, during shipping and in the retail market so that the bacterial count is kept at a minimum. This means that the workers, the working areas and the utensils used must all be scrupulously clean. Meat should not be purchased where the highest standards of cleanliness are not practiced.

In the home, meat should be wrapped in wax paper or similar material and stored in the refrigerator until it is to be used. It should be wiped with a damp cloth before cooking.

Cooking of Meat

Meat is cooked in order to improve the flavor, to make it more tender and more easily digested and to destroy any harmful organisms. It is particularly important that pork be well cooked so than any trichinae present will be destroyed.

Meat is essentially a protein food. Cooking, therefore, must be done at low temperatures since protein coagulates below the boiling temperature. It becomes tough when cooked at high temperatures. For roasting, a moderate oven (300° to 350°F.) is used. This produces the most tender meat with the least amount of shrinkage. For the tougher cuts which require longer cooking time, simmering is used in preference to boiling.

Besides thorough cooking procedures, tough cuts of meat

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are made more tender by various tenderizing processes, by grinding and by pounding. By such means the connective tissue is broken into fine pieces. However, some of the meat extractives may be lost. Marinating in oil or vinegar has been

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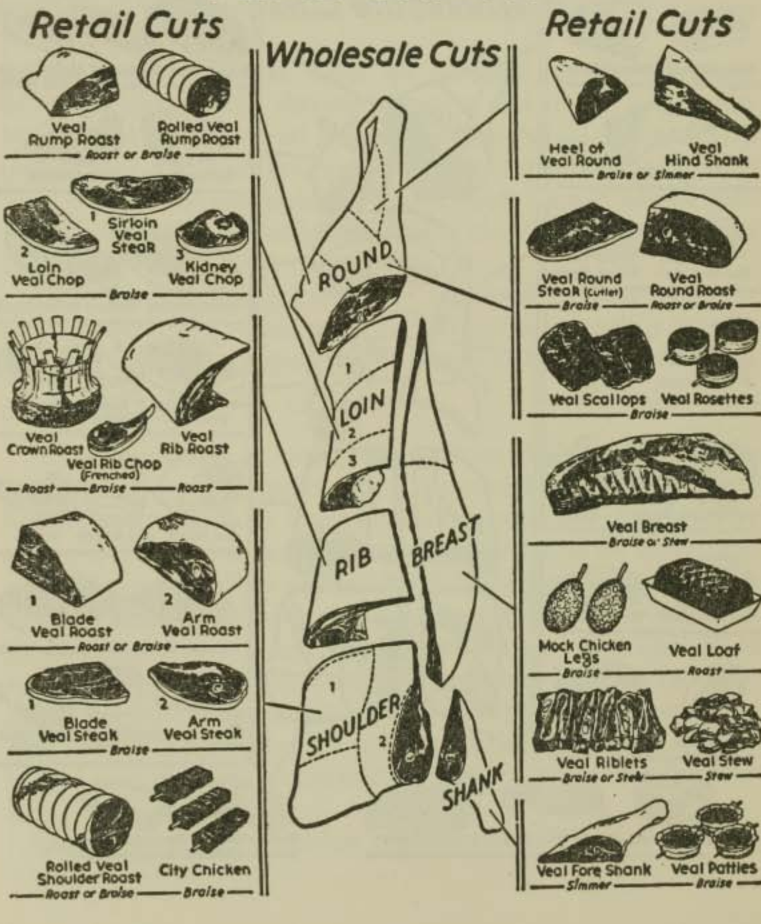
used to soften connective tissue. Placing strips of fat or bacon in meat, termed larding, is another means of making a more tender meat.

The method of choice for cooking tender cuts of meat is by dry heat. This includes oven-broiling, pan-broiling and roasting. In roasting it is essential to use an oven or a meat

Meat Cuts and How to Cook Them
VEAL CHART



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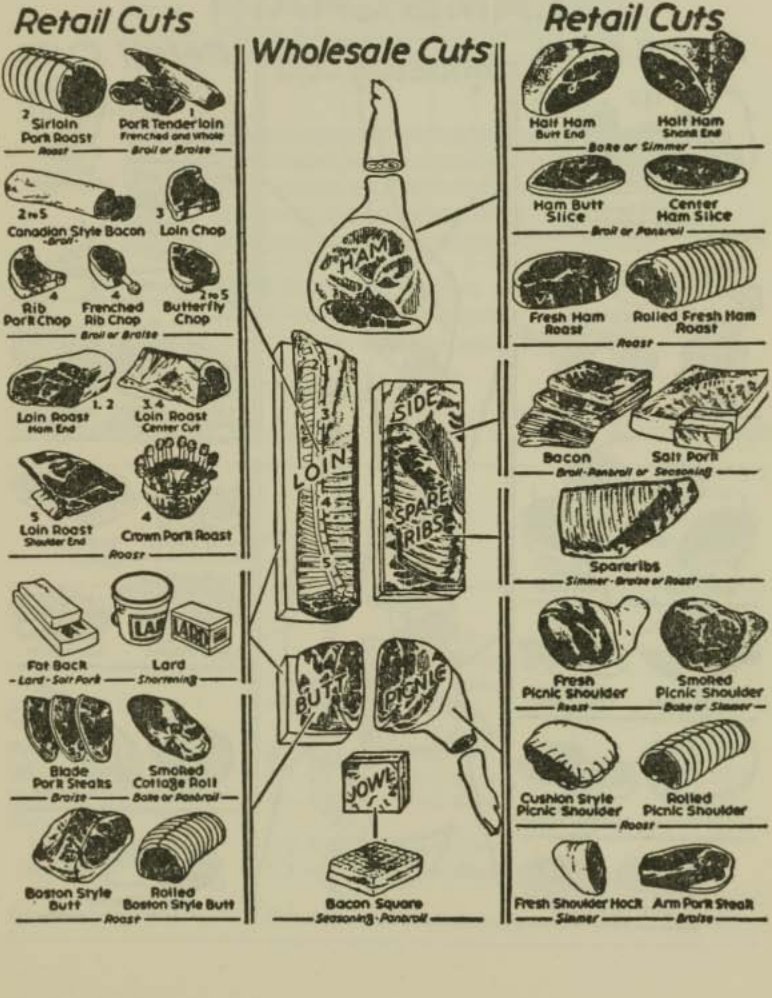
thermometer in order to regulate the temperature. Moist heat, such as simmering, stewing and braising, is used for the tougher cuts.

The protein value of meat is not altered in cooking. However, there is variation in the amount of the vitamin B com-

Meat Cuts and How to Cook Them
PORK CHART



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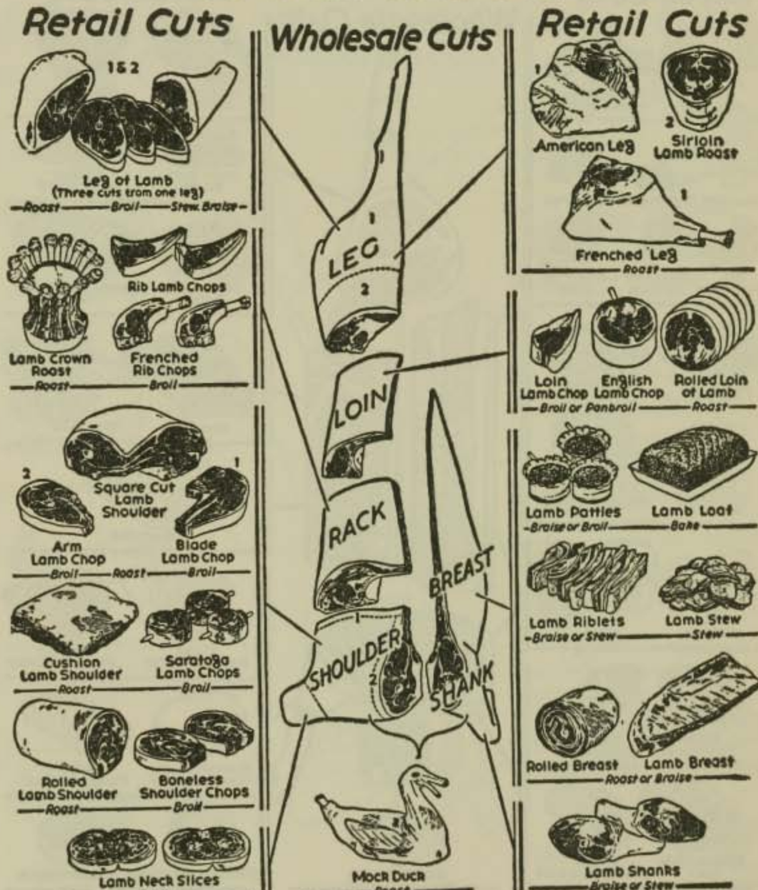
plex retained by the different cooking procedures. It has been shown that frying causes little loss of thiamine but some loss of riboflavin and niacin. In braising and stewing there is greater loss of thiamine than of riboflavin or niacin. Roasting and boiling result in about an equal loss of all members of the B complex.

Meat Cuts and How to Cook Them
LAMB CHART



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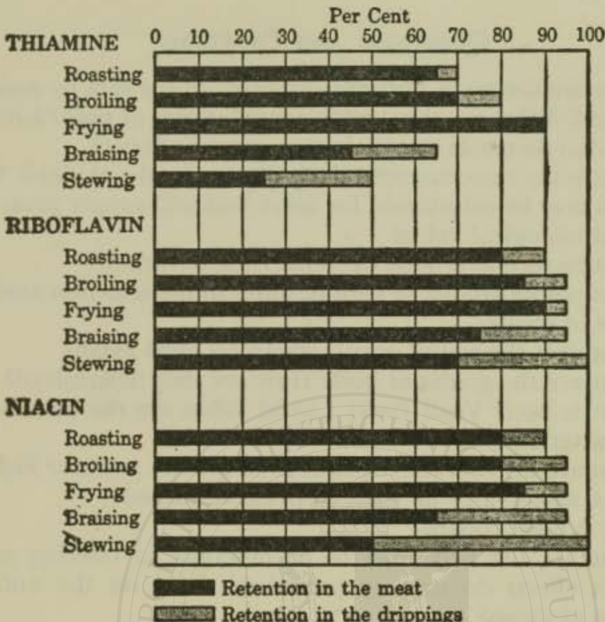
VITAMIN RETENTION IN COOKING MEAT



(Courtesy of National Livestock and Meat Board.)

TABLE 27

TIMETABLE FOR ROASTING MEAT, POULTRY, FISH, GAME

Meat	Oven temp. degrees F.	Stage	Internal temp. degrees F.	Time per pound (approx.) minutes
Beef, tender	325–350	Rare	140	18–20
		Medium	160	22–25
		Well done	180	30–35
Veal	260–300	Well done	165	30–35
Lamb and mutton	300–350	Medium	170	25–30
		Well done	180	30–35
Pork	325–350	Well done	185	25–30
Whole ham	275–300	Well done	160	25–30
Poultry	325–350	Well done		20–30
Fish				
Whole, large	375–400	Well done		10
Splits	375–400	Well done		25–35 (total time)
Small wild game	325–350	Well done		15–20

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Questions and Problems

1. What are the main nutrients supplied to the diet by meats in general? What are the specific contributions of pork? Liver?
2. To what do meats owe their characteristic flavor?
3. What is the recommended daily dietary intake of meat? What foods may be substituted for meat that will supply protein of equal biological value?
4. What factors determine the tenderness of meat?
5. What points should be kept in mind in the selection and purchase of meat?
6. What does the round purple stamp on meat mean?
7. What are the grades of beef? How are they determined?
8. What is beef? Veal? Pork? Lamb? What are the outstanding characteristics of each?
9. What are the characteristics of good quality poultry? Fish?
10. What means may be used to preserve meats?
11. Why is meat cooked?
12. What are the principles to be observed in cooking meats?
13. What effects do cookery procedures have on the nutritive value of meats?

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PART IV

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Appendix

CALCULATION OF FOOD VALUES

THERE ARE various tables of food composition available which may be used to determine the nutritive content of a single food or of an entire day's food intake for an individual. Such a set of tables is given on pages 414–66. In using these tables it is essential to remember that the food values given represent the average of many determinations of the nutritive content of the food. These figures represent the best possible estimate obtainable for a particular kind of food.

There are many factors which make for variations in the composition of a food, so that upon analysis any one sample will not necessarily show the same values as those listed in the tables. These factors include such variables as age, variety of product, place of growth, ripeness, type of fertilizer used, storage conditions, handling procedures and similar factors. Different methods of analysis and the procedure of sampling the material for analysis also bring about variations in results. In spite of these possible variations, tables of composition of foods may be used with considerable confidence for obtaining an indication of the nutritive value of a food.

It should be realized that still other factors will influence the actual amount of the nutrients of a food available to the

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body. The chemical composition of a food does not necessarily indicate its actual biological value. There is wide variation in individual human beings in their physiological use of foods. Furthermore, the preparation and care of foods determine the amount of certain nutrients which are available to the body.

It must be realized also that the values given for the nutrient content of foods in the tables of food composition in the majority of cases apply to untreated foods. The preparation of foods, as has been pointed out in previous chapters, reduces the amount of certain of the nutrients. Thus the actual nutritive value of the foods as eaten may be somewhat less than that as calculated.

These tables of food composition are given on a percentage basis, that is parts per hundred. Grams is the usual weight unit in which foods are measured to determine their nutritive value. Unless the food is weighed directly in grams, the amount of the food must be converted to grams. From the standard tables of composition of foods the nutritive value of a particular food, a recipe or an entire meal is calculated as follows:

1. Protein, fat and carbohydrate are calculated to the nearest whole number. Any value of 0.5 or over shall be considered as the next whole number.

   Example:

   Calculation of the carbohydrate value of one slice of bread.

   Bread—50 per cent carbohydrate
   1 slice of bread weighs 30 grams
   Carbohydrate value therefore equals $0.50 \times 30 = 15.0$ grams
2. Calories are calculated to the nearest whole number. Any value of 0.5 or over shall be considered as the next whole number. In calculating daily food intakes it is permissible to calculate calories to the nearest five.
3. Calcium is calculated to the nearest whole number.

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4. Iron is calculated to one decimal place.
5. Vitamin A and ascorbic acid are calculated to the nearest whole number.
6. Thiamine, riboflavin and niacin are calculated to two decimal places.
7. Procedure:
   a. List in household measurements all foods used in the recipe, or in the case of a meal, list all the foods consumed by the person.
   b. Convert the measurements to grams by using the appropriate columns in Table 31. The foods are given by measure for 100 gram portions. The approximate weight of any size serving of food can be determined from these figures.
   c. Calculate the food values from Table 31 as indicated in 1 to 6.
   d. Total the amounts of each nutrient. If the calculation is for a recipe the value of one portion is obtained by dividing the totals by the number of servings in the recipe. See example.
8. The caloric value may be obtained by using the physiological fuel value factors (page 43) for protein, fat and carbohydrate.

   Example:

   Physiological fuel values

   Protein = 4
   Fat = 9
   Carbohydrate = 4

   Totals

   Protein = 18 grams
   Fat = 33 grams
   Carbohydrate = 101 grams

   Caloric values

   Protein = $18 \times 4 = 72$
   Fat = $33 \times 9 = 297$
   Carbohydrate = $101 \times 4 = \underline{404}$
   Total 773 Calories

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TABLE 28

Muffins (6 Muffins)

Food	Measure	Weight gm.	Pro. gm.	Fat gm.	Cho. gm.	Energy Value Cal-ories	Fe mg.	Ca. mg.	Vitamins A I.U.	Thia-mine mg.	Ribo-flavin mg.	Niacin mg.	Ascorbic Acid mg.
Flour, enriched	1 c.	110	12	1	84	401	18	3.2	0	.48	.29	3.8	0
Eggs	½	25	3	3	0	39	13	.68	285	.04	.13	(.5)	0
Milk	½ c.	122	4	5	6	84	144	.10	192	.05	.20	.2	0
Butter	2 T.	28	0	23	0	200	3	0	920	0	0	0	0
Sugar	1 T.	12	0	0	12	48	0	0	0	0	0	0	0
Baking powder	1½ t.												
Salt	¼ t.												
	Total		19	32	102	772	178	3.98	1397	.57	.62	4.5	0
	Value for one muffin		3	5	17	128	30	.66	266	.09	.10	.8	0

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TABLE 29

LUNCHEON

Food	Measure	Weight gm.	Pro. gm.	Fat gm.	Cho. gm.	Energy Value Cal-ories	Ca. mg.	Fe mg.	Vitamins A I.U.	Thia-mine mg.	Ribo-flavin mg.	Niacin mg.	Ascorbic Acid mg.
Peanut butter	1 T.	16	4	8	3	92	12	.3	0	.02	.02	2.6	0
Bread, W.W.	2 slices	46	4	1	23	110	44	1.0	0	.14	.06	1.4	0
Butter	1 T.	14	0	11	0	100	3	0	460	0	0	0	0
Tomato	1 med.	150	2	0	6	30	16	.9	1640	.08	.06	.8	35
Lettuce leaf	1												
Mayonnaise	1 T.	13	0	10	0	92	2	.1	30	0	0	0	0
Peaches canned syrup pack	2 halves + 2 T. syrup	117	1	—	21	79	6	.5	530	.01	.02	.8	5
Milk	1 c.	244	9	10	12	166	288	.2	390	.09	.42	.3	3
	Total		20	40	65	669	371	3.0	3050	.34	.58	5.9	43

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TABLE 30

Food Composition Table for Short Method of Dietary Analysis

The estimation of the nutritive value of a diet may be done as illustrated in Table 29 (page 405). Such a detailed procedure is time consuming and may assume a greater degree of accuracy than is warranted by the wide variation in the composition of any given food. As a result a short method for estimating the nutritive value of a diet has been developed (1). The food composition values to be used in this short method are given in Table 30. In this method foods of similar composition are grouped together.

To illustrate the use of the food composition table, a sample day's menu from a high school girl's record is given (2).

Breakfast:	Orange	1
	Cornflakes	1 serving
	Sugar	2 teaspoons
	Milk	1 cup
	Bread, white	2 slices
	Butter	2 teaspoons
	Jelly	4 teaspoons
Lunch:	Luncheon meat	1 slice
	Tomato	½
	Bread, white	2 slices
	Butter	2 teaspoons
	Banana	1 medium
	Cookies, chocolate	2
Midafternoon lunch:	Apple	1 small
	Candy, creams	4 pieces
Dinner:	Beef, roast	1 medium serving
	Potato, boiled	1 small
	Onions, creamed	½ cup
	Gravy	1 tablespoon
	Bread	1 slice
	Butter	1 teaspoon
	Milk	1 glass
	Celery	2 pieces
	Rhubarb sauce	½ cup

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Summarizing this day's menu for calculation gives:

	No. of Servings
Cereals: enriched	6
Dairy products:	
butter	5
milk, whole	1¾
Desserts: cookies	1
Fruits: banana	1
citrus	1
other, fresh and canned	2
Gravy: white sauce	1¼
Meat:	
beef	1
luncheon meat	½
Sweets	7
Vegetables:	
potato	1
tomato	½
other, cooked	½
other, commonly served raw	1

The nutritive content of the day's diet is determined by multiplying the values in the food composition table by the number of servings.

The short method has been found to result in a considerable saving of time without sacrificing accuracy. It should be pointed out, however, that the method is most satisfactory when applied to a varied diet.

References

1. Donelson, E. G., and Leichsenring, J. M. "A short method for dietary analysis," *J. Am. Dietet. A.*, 18:429, 1942.
2. Turner, D. *Handbook of Diet Therapy,* Chicago: University of Chicago Press, 1946.

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TABLE 30

Food Composition Table for Short Method of Dietary Analysis*†(1)

Food	Approximate Measure	Weight (Gm.)	Calories	Protein (Gm.)	Fat (Gm.)	Carbohydrate (Gm.)	Ca (Gm.)	P (Gm.)	Fe (Mg.)	Vitamin A (I.U.)	Ascorbic Acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Cereal products: refined	1 sl. bread (30 gm.); ½ c. cooked cereal and cereal products (20 gm. dry); 1 c. prep. cereal (30 gm.); 3 soda crackers (20 gm.); 1½ c. popcorn (20 gm.); 1 griddle cake	—	80	2.5	1	15	.01	.03	.2	—	—	.02	.02	.2
whole grain and enriched	1 sl. bread (30 gm.); ½ c. cooked cereal (20 gm. dry); 1 c. prep. cereal (30 gm.); 2 Graham crackers (20 gm.)	—	80	2.5	1	15	.01	.04	.6	—	—	.06	.04	.6
Dairy products: butter	1 tsp.	5	35	—	4	—	—	—	—	160	—	—	—	—
cheese, Cheddar type	1 cu. in.	30	120	7.0	10	1	.25	.18	.3	430	—	.01	.14	—
cheese, cottage, skim	½ c.	100	100	19.0	1	4	.08	.26	.2	70	—	.01	.13	—
cream, light	⅛ c.	30	60	1.0	6	1	.03	.02	.1	360	—	.01	.04	—
custard	½ c.	130	150	7.0	7	15	.13	.14	.9	435	—	.08	.26	.1
eggs	1 med.	50	80	6.5	6	—	.03	.10	1.4	495	—	.07	.18	—
ice cream, commercial	⅜ c.	80	165	3.0	10	16	.06	.05	.1†	265	—	.02	.21	.1
milk, buttermilk, skim	1 c.	240	90	8.5	1	12	.29	.23	.2†	25	2	.11	.43	.2
milk, whole	1 c.	240	160	8.5	9	12	.28	.22	.2†	410	2	.10	.43	.3
Desserts: cake, plain, chocolate	1 piece cake 2½ × 2½ × 2½ in. (75 gm.), for iced add 1 serving sweets; 1 waffle 6 in. dia. (60 gm.)	—	225	4.0	11	28	.03	.06	.8	175	—	.09	.11	.6

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cookies, plain	2 med. 3 in. dia.; 1 brownie	40	150	2.0	7	20	.01	.03	.3	155	—	.04	.03	.2
pie crust	⅙ shell, single crust	25	105	1.5	6	11	—	.02	.4	—	—	.06	.04	.5
puddings, cream fillings	½ c.	140	210	4.5	6	35	.16	.13	.6	230	—	.06	.22	.1
Fats	2 sl. bacon (20 gm.); 1 tbsp. fat (12 gm.); 1 tbsp. mayonnaise (15 gm.); 1 cu. in. salt pork (15 gm.); 1½ tbsp. French dressing (15 gm.)	—	120	1.0	13	—	—	.01	.2	5	—	.01	.01	.2
Fish: cod, haddock, fresh, cooked	1 med. serving	75	50	12.5	—	—	.01	.14	1.5	—	—	.05	.06	.8
halibut, herring, tuna, whitefish, cooked	1 med. serving; tuna (60 gm.); others (75 gm.)	—	105	15.0	5	—	.02	.17	.8	35	—	.04	.08	2.4
salmon, canned	1 med. serving	75	125	15.5	7	—	.05	.22	.7	220	—	.02	.12	5.9
Fruits: banana	1 small	100	95	1.0	—	23	.01	.03	.6	350	10	.04	.07	.6
cantaloupe	½ melon, 4½ in. dia.	150	35	1.0	—	8	.02	.02	.6	3,600	52	.08	.08	.1
citrus	1 med. orange; ½ med. grapefruit; ½ c. juice; 1 med. large lemon	100	50	1.0	—	11	.02	.02	.4	180	42	.07	.03	.2
yellow, fresh, canned, dried	fresh (100 gm.): 1 med. peach, 2 to 3 apricots, 3 plums; dried (30 gm.), add ½ serving sweets; for sweetened canned, dried or fresh, add 1 serving sweets	—	55	.5	—	13	.01	.02	.4	585	4	.01	.02	.6

* The nutritive value of food mixtures such as macaroni and cheese, Spanish rice, chow mein, creamed vegetables, soups, etc., should be computed on the basis of the kind and approximate amount of the foods in the combination.

† Revised to correspond with values in Misc. Pub. No. 572, U.S. Department of Agriculture (1945).

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TABLE 30 (Continued)

Food	Approximate Measure	Weight (Gm.)	Calories	Protein (Gm.)	Fat (Gm.)	Carbohydrate (Gm.)	Ca (Gm.)	P (Gm.)	Fe (Mg.)	Vitamin A (I.U.)	Ascorbic Acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Fruits, continued														
other, dried	3 to 4 dates; 1½ to 2 small figs; dried apple; ¼ c. raisins	30	90	.5	—	22	.02	.03	.9	30	1	.04	.03	.2
other, fresh and canned	½ c. cooked; sweetened, add 1 serving sweets	100	65	.5	—	15	.01	.01	.4	80	6	.02	.02	.1
Gravy; white sauce	¼ c.	60	70	2.5	5	4	.05	.05	.2	180	—	.04	.11	.1
Legumes; beans, peas	½ c. cooked; dried (30 gm.)	—	105	6.5	—	19	.03	.12	2.4	20	—	.14	.06	.5
soybeans	½ c. cooked; dried (30 gm.)	—	105	10.5	5	4	.07	.18	2.5	55	—	.24	.10	.8
Meat: beef, fowl, lamb, veal, cooked	1 med. serving	75	160	18.0	10	—	.01	.18	3.1	20	—	.09	.15	3.9
liver, cooked	1 small serving	60	80	12.0	2	4	.01	.22	4.9	16,500	9	.12	1.22	6.0
luncheon meats, cooked	2 sl. sausage, minced ham, dried beef, luncheon roll (0 gm.); ½ frankfurter (30 gm.)	—	80	5.0	6	1	—	.06	.7	—	—	.09	.07	.8
pork; ham, cooked	1 med. serving	75	205	18.0	15	—	.01	.18	2.4	—	—	.60	.15	3.2
Nuts	1 tbsp. peanut butter; 8 to 15 halves walnuts; 16 peanuts; 12 to 15 almonds; 12 halves pecans	15	95	3.5	8	3	.01	.06	.3	—	—	.03	.02	1.4
Sweets: candy, sugar, syrup	1 tbsp. sugar, jelly, jam, syrup, honey; 1 serving plain Jello; plain candy (fondant or mints, 14 gm.); 6-oz. bottle soft drink	—	55	—	—	14	—	—	—	—	—	—	—	—

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candy bar	1 2-oz. chocolate-coated bar	—	275	5.0	13	35	.05	.10	1.4	—	—	.03	.09	3.3
molasses; sorghum	1 tbsp.	20	50	—	—	12	.04	.01	1.3	—	—	.01	.04	—
Vegetables: cabbage;														
sauerkraut, cooked	⅔ c.	100	25	1.5	—	5	.05	.03	.5	30	28‡	.05	.04	.2
cabbage, raw; cauliflower, cooked	1 c. cabbage (50 gm.); ⅔ c. cauliflower (70 gm.)	—	15	1.0	—	3	.02	.02	.3	20	26	.04	.08	.1
corn; parsnips, cooked	½ c. corn; 1 large parsnip	100	95	2.0	1	20	.02	.07	.4	75	6	.04	.05	.6
green and yellow;														
asparagus, cooked	⅔ c.	100	25	2.0	—	4	.02	.04	.9	775	38§	.14§	.11	1.0
broccoli, cooked	⅔ c.	100	35	3.5	—	6	.15	.08	1.4	4,800	63	.08	.28	.6
carrots, cooked	⅔ c.	100	40	1.0	—	9	.04	.04	.8	12,000	3	.04	.06	.5
green beans, cooked	½ c.	100	40	2.5	—	8	.06	.04	1.4	480	13§	.06§	.12	.4
leafy green, cooked	⅔ c. kale, spinach, turnip, other greens	100	30	2.5	—	4	.25‖	.05	2.7	6,285	46§	.08§	.27	.5
peas, fresh, cooked, canned	½ c.	100	70	4.5	—	12	.02	.09	1.4	590	11§	.15§	.09	1.1
sweet potato, cooked	½ large	100	130	2.0	1	28	.04	.05	.7	5,920	14	.08	.06	.5
potato, cooked	1 small; for fried add 1 serving fats	100	85	2.0	—	19	.01	.05	.7	35	8	.08	.03	1.0
tomato, fresh, canned, juice	½ c.; 1 small tomato (100 gm.); 2½ tbsp. catsup (50 gm.) add ½ serving sweets	—	20	1.0	—	4	.01	.02	.6	990	19	.05	.03	.7
other, cooked	½ c. beets, eggplant, onions, rutabagas, etc.	100	45	1.5	—	10	.04	.04	.6	—	8	.01	.02	.2
other, commonly served raw	2 pieces celery; 8 sl. cucumber; ⅛ hd. lettuce	50	10	0.5	—	2	.02	.01	.2	70	3	.03	.02	.1

‡ For sauerkraut, omit ascorbic acid.
§ For canned, reduce ascorbic acid and thiamine by one half.
‖ Calcium unavailable in chard, spinach and beet greens.

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TABLE 31

Composition of the Edible Portion of Common Foods

Basic data on the composition of foods are an essential tool for those dealing in the quantitative aspects of diet planning. No food or food product has an invariable or fixed composition. Type and kind of food, methods of production, storage and processing are some of the more important factors influencing the composition of a food item. In selecting values expressive of the composition of any food, the purpose is usually to use values as nearly as possible representative of the most general conditions.

The values shown in the following table have been taken for the most part from the U.S. Department of Agriculture Handbook No. 8, Washington, D.C., June, 1950. A few were taken from *Rose's Laboratory Handbook for Dietetics* (1) and some represent unpublished data (H.E.M.). For details concerning the derivation and general overall significance of the data the preface to the Agriculture Handbook should be consulted. The following are some of the more important statements made:

> *Protein* values have been calculated from nitrogen content, nearly always total nitrogen, by applying suitable conversion factors such as those published by Jones (2). Counted with the true protein are other nitrogenous compounds such as amino acids and the purine bases. In cases where the nonprotein nitrogen, exclusive of amino acid nitrogen, is fairly large, the figures for the protein content of the food have been adjusted to more nearly represent the sum of the true protein and amino acids present.
>
> *Fat* refers in the main to ether-extractable materials, including in addition to the glyceryl esters of fatty acids or true fats, various fatty acids, sterols, chlorophyll and other pigments or substances of similar solubility.
>
> *Carbohydrate* frequently referred to as "total carbohydrate by difference" is the term that has come to be used in this country to apply to the balance of the food components and is the difference between 100 per cent and the sum of the percentages of protein, fat, ash and water. In addition to the

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sugars and starches which the body uses almost completely it includes other forms of carbohydrate which the body utilizes to a lesser degree if at all, such as fiber and pentosans. Included also are other substances that are not carbohydrate, such as organic acids.

Fiber as it has usually been determined is that portion of the sample which resists solution when boiled in dilute acid and dilute alkali. It is made up largely of celluloses, hemicellulose and lignin.

Food Energy. Calories are the units used for expressing food energy. In this publication calories have been calculated by a modification of the procedure that has been in use in this country for 50 years. Instead of applying the general calorie factors 4, 9, 4 to the percentage composition of protein, fat and carbohydrate respectively, as has usually been done heretofore, more specific factors have been developed along the lines of Atwater's plan but take into consideration the more recent literature on digestibility and physiological energy value of foods.

The principle for this revised procedure of estimating the calorie values was published (3) in the report of the Committee convened by the Nutrition Division of the Food and Agriculture Organization. Details of applying this procedure in the estimation of the calorie values of wheat flours of different extractions have also been published (4). Factors not shown in either of these publications for calculating the calories from protein, fat and carbohydrate in foods were based on an unpublished compilation of data in the files of the Bureau of Human Nutrition and Home Economics.

References

1. MacLeod, G. and Taylor, C. *Rose's Laboratory Handbook for Dietetics*. New York: The Macmillan Co., 1949.
2. Jones, D. B. "Factors for converting percentages of nitrogen in foods and feeds into percentages of protein," U.S. Department of Agriculture Circular 183 (S_1, rev. ed.), 1941.
3. "Energy-yielding components of food and computation of calorie values," Food and Agriculture Organization, Nutrition Division, 1947.
4. Merrill, A. L. and Watt, B. K. "Physiologic energy values of wheat," *Jour. Amer. Dietet.* 24:953-956, 1948.

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TABLE 31

Composition per Edible Portion (E. P.)

ITEM	MEASURE WEIGHT	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.*	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Breads and Cakes															
Biscuits, baking powder, made with unenriched flour		100	342	8.2	10.6	52.2	.2	218	.5	0	.05	.09	.5	0	
	1 (2½" diam.)	38	129	3.1	4.0	19.8	.1	83	.2	0	.02	.03	.2	(0)	
enriched flour		100	342	8.2	10.6	52.2	.2	218	1.8	0	.23	.22	2.0	0	
	1 (2½" diam.)	38	129	3.1	4.0	19.8	.1	83	.7	0	.09	.08	.7	(0)	
enriched self-rising flour		100	334	8.0	10.9	49.9	.2	220	1.8	0	.24	.23	2.0	0	
	1 (2½" diam.)	38	127	3.0	4.1	19.0	.1	84	.7	0	.09	.09	.8	(0)	
Biscuits, canned, unbaked		100	287	6.9	8.9	43.9	.2	184	1.5	0	.24	.20	1.8	0	
Breads:															
Boston Brown made with degermed meal:															
unenriched		100	219	4.8	2.1	46.0	.3	185	2.5	140	.08	.12	1.4	0	
	1 slice (3" x ¾")	48	105	2.3	1.0	22.1	.1	89	1.2	70	.04	.06	.7	(0)	
enriched		100	219	4.8	2.1	46.0	.3	185	2.9	140	.13	.17	1.9	0	
	1 slice (3" x ¾")	48	105	2.3	1.0	22.1	.1	89	1.4	70	.06	.08	.9	(0)	
Cracked wheat made with unenriched flour		100	259	8.5	2.2	51.4	.5	83	1.0	0	.11	.10	1.4	0	
	1 slice, ½" thick	23	60	2.0	.5	11.8	.1	19	.2	0	.03	.02	.3	(0)	
enriched flour		100	259	8.5	2.2	51.4	.5	83	2.0	0	.25	.19	2.5	0	
	1 slice, ½" thick	23	60	2.0	.5	11.8	.1	19	.5	0	.06	.04	.6	0	

* 1 gram = 1000 milligrams.

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French or Vienna														
unenriched		100	270	8.1	2.7	52.0	.2	24	.7	0	.05	.06	.9	0
	1 lb.	454	1225	36.8	12.3	236.1	1.0	109	3.2	0	.21	.28	4.2	0
enriched		100	270	8.1	2.7	52.0	.2	24	1.8	0	.24	.15	2.2	0
	1 lb.	454	1225	36.8	12.3	236.1	1.0	109	8.0	0	1.1	.7	10.0	0
Italian														
unenriched		100	263	8.7	.8	53.7	.2	13	.7	0	.05	.07	1.0	0
	1 lb.	454	1195	39.5	3.6	243.8	1.0	59	3.2	0	.23	.30	4.5	0
enriched		100	263	8.7	.8	53.7	.2	13	1.8	0	.24	.15	2.2	0
	1 lb.	454	1195	39.5	3.6	243.8	1.0	59	8.0	0	1.1	.7	10.0	0
Raisin:														
unenriched		100	284	7.1	3.1	57.8	.2	80	1.3	10	.07	.11	.9	0
	1 slice, ½″ thick	23	65	1.6	.7	13.3	.0	18	.3	tr	.02	.02	.2	0
enriched		100	284	7.1	3.1	57.8	.2	80	1.8	10	.24	.15	2.2	0
	1 slice, ½″ thick	23	65	1.6	.7	13.3	.0	18	.4	tr	.06	.04	.5	0
Rye (⅓ rye, ⅔ clear wheat flour)		100	244	9.1	1.2	52.4	.4	72	1.6	0	.18	.08	1.5	0
	1 slice, ½″ thick	23	57	2.1	.3	12.1	.1	17	.4	0	.04	.02	.4	(0)
White made with unenriched flour														
2 per cent non-fat milk solids		100	276	8.2	3.3	52.3	.2	65	.6	0	.05	.08	.9	0
	1 slice, ½″ thick	23	64	1.9	.8	12.0	.0	15	.1	0	.01	.02	.2	(0)
4 per cent non-fat milk solids		100	275	8.5	3.2	51.8	.2	79	.6	0	.05	.11	.9	0
	1 slice, ½″ thick	23	63	2.0	.7	11.9	.0	18	.1	0	.01	.02	.2	(0)
6 per cent non-fat milk solids		100	276	8.6	3.1	52.3	.2	92	.6	0	.05	.12	.9	0
	1 slice, ½″ thick	23	63	2.0	.7	12.0	.0	21	.1	0	.01	.03	.02	(0)
White made with enriched flour														
2 per cent non-fat milk solids		100	276	8.2	3.3	52.3	.2	65	1.8	0	.24	.15	2.2	0
	1 slice, ½″ thick	23	64	1.9	.8	12.0	.0	15	.4	0	.06	.04	.5	(0)
4 per cent non-fat milk solids		100	275	8.5	3.2	51.8	.2	79	1.8	0	.24	.15	2.2	0
	1 slice, ½″ thick	23	63	2.0	.7	11.9	.0	18	.4	0	.06	.04	.5	(0)

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Breads and Cakes															
White, continued															
6 per cent non-fat milk		100	276	8.6	3.1	52.3	.2	92	1.8	0	.24	.15	2.2	0	
solids	1 slice, ½″ thick	23	63	2.0	.7	20.0	.0	21	.4	0	.06	.04	.5	(0)	
Whole wheat		100	240	9.3	2.6	49.0	1.5	96	2.2	0	.30	.13	3.0	0	
	1 slice, ½″ thick	23	55	2.1	.6	11.3	.4	22	.5	0	.07	.03	.7	(0)	
Bread crumbs, dry, grated		100	385	11.9	4.5	72.5	.2	111	2.6	0	.27	.22	3.1	0	
	1 cup	88	339	10.5	4.0	63.8	.2	98	2.3	0	.24	.19	2.7	(0)	
Cakes:															
Angel Food	2″ sector (1/12 of	100	270	8.4	.3	58.7	0.	6	.3	(0)	.01	.14	.2	(0)	
	8″ diam.)	40	108	3.4	.1	23.5	0.	2	.1	0	tr	.05	.1	(0)	
Foundation	1 square (3″ x 2″	100	350	5.9	11.7	55.9	.1	126	.5	160[1]	.03	.08	.2	(0)	
	x 1¾″)	65	228	3.8	7.6	36.3	.1	82	.3	100	.02	.05	.2	(0)	
Fruit, dark	1 piece (2″ x 2″	100	354	5.2	13.8	55.9	1.2	97	2.8	160[1]	.14	.14	1.1	(0)	
	x ½″)	30	106	1.6	4.1	16.8	.4	29	.8	50	.04	.04	.3	(0)	
Plain	1 piece (3″ x 2″	100	327	6.4	8.2	57.0	.1	155	.4	120[1]	.03	.08	.3	(0)	
	x 1½″)	55	180	3.4	4.5	31.4	.1	85	.2	70	.02	.05	.2	(0)	
	1 cupcake (2¾″ diam.)	40	131	2.6	3.3	22.8	.0	62	.2	50	.01	.03	.1	(0)	

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Pound	1 slice (2¾" x 3" x ⅝")	100	434	7.1	23.5	49.3	.1	52	1.6	330	.12	.16	.9	(0)
		30	130	2.1	7.0	14.8	.0	16	.4	100	.04	.05	.3	(0)
Rich	1 square (3" x 2" x 2")	100	392	5.0	17.7	54.2	.1	105	.6	210	.03	.08	.2	(0)
		75	294	3.8	13.3	40.6	.1	79	.4	160	.02	.06	.2	(0)
Sponge	2" sector (1/12 of 8" diam.)	100	291	7.9	5.0	54.4	.2	28	1.4	520	.05	.15	.2	(0)
		40	117	3.2	2.0	21.8	.1	11	.6	210	.02	.06	.1	(0)
Cookies, plain and assorted	1 (3" diam. ½" thick)	100	436	6.0	12.7	75.0	—	22	.6	(0)	.04	.04	.5	(0)
		25	109	1.5	3.2	18.8	—	6	.2	(0)	.01	.01	.1	(0)
	2 wafers (2⅛" diam.)	10	44	.6	1.3	7.5	—	2	.1	(0)	tr	tr	tr	(0)
Corn bread made with:														
whole corn meal	1 muffin (2¾" diam.)	100	215	7.2	5.7	34.8	.6	141	1.7	130[2]	.15	.18	.8	(0)
		48	103	3.5	2.7	16.7	.3	68	.8	60[2]	.07	.09	.4	(0)
enriched, degermed corn meal	1 muffin (2¾" diam.)	100	219	6.7	4.7	36.6	.2	139	1.9	130[2]	.17	.23	1.3	(0)
		48	106	3.2	2.3	17.6	.1	67	.9	60[2]	.08	.11	.6	(0)
Crackers:		100	393	8.0	10.0	74.3	.8	20	1.9	(0)	.30	.12	1.5	(0)
graham	4 small or 2 med.	14	55	1.1	1.4	10.4	.1	3	.3	(0)	.04	.02	.2	(0)
		100	431	9.2	11.8	71.1	.4	19	1.0	(0)	.06	.04	1.0	(0)
saltines	2, 2" sq.	8	34	.7	.9	5.7	.0	2	.1	(0)	tr	tr	.1	(0)
soda, plain	2, 2½" sq.	100	420	9.6	9.6	72.7	.2	20	1.1	(0)	.06	.05	1.1	(0)
	1 cup oyster crackers—1 oz.	11	47	1.1	1.1	8.0	.0	2	.1	(0)	.01	.01	.1	(0)
		28.4	119	2.7	2.7	20.6	.1	6	.3	(0)	.02	.01	.3	(0)
	10 oyster crackers or 1 tbsp. cracker meal	10	43	1.0	1.0	7.3	.0	2	.1	(0)	.01	tr	.1	(0)

[1] If fat used is butter or fortified margarine the vitamin A value would be: foundation cake, 540 I.U.; dark fruit cake 410 I.U.; plain cake, 370, I.U.; pound cake, 990 I.U.; rich cake, 830 I.U.

[2] Based on white corn meal. With yellow cornmeal values would be: whole meal, 330 I.U., degermed meal, 250 I.U.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Breads and Cakes															
Doughnuts, cake type	1 (13½ oz. per	100	425	6.6	21.0	52.7	.2	73	(.7)	140	.16	.13	1.2	(0)	
	dozen)	32	136	2.1	6.7	16.9	.0	23	(.2)	40	.05	.04	.4	(0)	
Pretzels	1 lg. (5" x 3"); 7														
	sm. (2" x 1");	100	369	8.8	3.2	74.5	.3	(12)	(.7)	(0)	(.01)	(.04)	(.7)	(0)	
	15 small sticks	15	55	1.3	.5	11.2	.4	(1)	(.1)	(0)	(tr)	(.01)	(.1)	(0)	
Rolls:															
plain, made with unenriched		100	309	9.0	5.5	55.1	.2	55	.7	0	.06	.11	1.0	(0)	
flour	1 (12 per lb.)	38	118	3.4	2.1	20.9	.1	21	.3	0	.02	.04	.4	(0)	
plain, made with enriched		100	309	9.0	5.5	55.1	.2	55	1.8	0	.24	.15	2.2	(0)	
flour	1 (12 per lb.)	38	118	3.4	2.1	20.9	.1	21	.7	0	.09	.06	.8	(0)	
sweet, made with unenriched		100	323	8.5	7.8	53.8	.2	63	.6	0	.05	.13	1.0	(0)	
flour	1 (2 oz.)	55	178	4.7	4.3	29.6	1.	35	.3	0	.03	.07	.6	(0)	
sweet, made with enriched		100	323	8.5	7.8	53.8	.2	63	1.8	0	.24	.15	2.2	(0)	
flour	1 (2 oz.)	55	178	4.7	4.3	29.6	.1	35	1.0	0	.13	.08	1.2	(0)	
Rye Wafers (Swedish health															
bread)	2 wafers (1 7/8" x	100	324	12.4	1.2	75.3	2.1	50	4.4	(0)	.32	.20	1.2	(0)	
	3½")	13	43	1.6	.2	9.8	.3	6	.6	(0)	.04	.03	.2	(0)	
Short bread	2 squares (1¾" x	100	504	6.8	24.4	64.3	.2	10	.4	0	.04	.02	.5	(0)	
	1¾")	16	81	1.1	3.9	10.3	.0	2	.1	0	.01	tr	.1	(0)	

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Tortillas, cooked		100	211	5.8	(2.8)	48.6	(1.4)	111	2.2	210[1]	.19	.06	1.0	—
	1 (5″ diam.)	23	50	1.2	(.6)	9.7	(.3)	22	.4	40[1]	.04	.01	.2	—
Cereals and Flour														
Barley, pearled, light, dry		100	349	8.2	1.0	78.8	.5	16	(2.0)	(0)	.12	.08	3.1	0
	1 cup	203	708	16.6	2.0	160.0	1.0	32	(4.1)	(0)	.25	.17	6.3	(0)
Bran (nearly 100 per cent)		100	242	12.0	3.4	74.2	8.8	94	10.3	(0)	.37	.39	19.2	(0)
	1 cup	60	145	7.2	2.0	44.5	5.3	56	6.2	(0)	.22	.23	11.5	(0)
Bran flakes (40 per cent bran)		100	292	10.8	1.9	78.8	3.9	61	5.1	(0)	.46	.23	8.7	(0)
	1 cup	40	117	4.3	.8	31.5	1.6	24	2.0	(0)	.19	.09	3.5	(0)
Bran with raisins		100	297	9.0	1.8	78.6	3.5	60	4.8	(0)	.39	.19	7.0	(0)
	1 cup	50	149	4.5	.9	39.3	1.8	30	2.4	(0)	.19	.09	3.5	(0)
Breakfast cereals mixed:														
Corn and soy grits (added		100	354	18.0	.4	75.2	1.8	66	6.4	(0)	.68	.12	2.0	(0)
thiamine and niacin)	1 cup	50	177	9.0	.2	37.6	.9	33	3.2	(0)	.34	.06	1.0	(0)
Wheat and malted barley		100	389	11.0	.6	82.8	1.8	47	3.5	(0)	.53	.17	4.7	(0)
	1 cup	105	408	11.6	.6	86.9	1.9	49	3.7	(0)	.56	.18	4.9	(0)
Buckwheat flour:														
dark		100	347	11.7	2.5	72.0	1.6	33	2.8	(0)	.58	.15	2.9	(0)
	1 cup, sifted	98	340	11.5	2.4	70.6	1.6	32	2.7	(0)	.56	.15	2.8	(0)
light		100	348	6.4	1.2	79.5	.5	11	1.0	(0)	.08	.04	(.4)	(0)
	1 cup, sifted	98	342	6.3	1.2	77.9	.5	11	1.0	(0)	.08	(.04)	(.4)	(0)
Cereal food for infants, dry,		100	364	14.2	2.4	73.4	1.4	651	33.9	(0)	1.19	.46	4.9	(0)
precooked	1 oz.	28.4	104	4.0	.7	20.8	.5	185	9.6	(0)	.34	.13	1.4	(0)
Corn flakes		100	385	8.1	.4	85.0	.6	11	1.3	(0)	.04	.10	1.6	(0)
	1 cup	25	96	2.0	.1	21.2	.2	3	.3	(0)	.01	.02	.4	(0)
Corn flakes, enriched		100	385	8.1	.4	85.0	.6	11	2.2	(0)	.41	.10	2.2	(0)
	1 cup	25	96	2.0	.1	21.2	.2	3	.6	(0)	.10	.02	.6	(0)
Corn grits, degermed, dry:														
unenriched		100	362	8.7	.8	78.1	.4	4	1.0	300[1]	.13	.04	1.2	(0)
	1 cup	160	579	13.9	1.3	125.0	.6	6	1.6	480[1]	.21	.06	1.8	(0)

[1] Made with yellow corn; tortillas made with white corn have no vitamin A.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Cereals and Flour															
Corn grits, continued															
enriched		100	362	8.7	.8	78.1	.4	4	2.9	300[1]	.44	.26	3.5	(0)	
	1 cup	160	579	13.9	1.3	125.0	.6	6	4.6	480[1]	.71	.42	5.6	(0)	
Cornmeal, white or yellow, dry															
Whole, ground, unbolted		100	355	9.2	3.9	73.7	1.6	10	2.4	510[1]	.38	.11	2.0	(0)	
	1 cup	118	419	10.9	4.6	87.0	1.9	12	2.8	600[1]	.45	.13	2.4	(0)	
Whole, ground, bolted		100	362	9.0	3.4	74.5	1.0	6	1.8	440[1]	.30	.08	1.9	(0)	
	1 cup	127	459	11.4	4.3	94.6	1.3	8	2.3	570[1]	.38	.10	2.4	(0)	
Degermed, unenriched		100	363	7.9	1.2	78.4	.6	6	1.1	300[1]	.14	.05	1.0	(0)	
		145	527	11.5	1.7	113.7	.9	9	1.6	430[1]	.20	.07	1.5	(0)	
Degermed, enriched	1 cup	100	363	7.9	1.2	78.4	.6	6	2.9	300[1]	.44	.26	3.5	(0)	
	1 cup	145	527	11.5	1.7	113.7	.9	9	4.2	430[1]	.64	.38	5.1	(0)	
Self rising, unenriched		100	340	8.7	3.7	70.8	1.5	262	2.3	480[1]	.36	.10	1.9	(0)	
	1 cup	118	401	10.3	4.4	83.5	1.8	309	2.7	570[1]	.42	.12	2.2	(0)	
Self rising, enriched		100	340	8.7	3.7	70.8	1.5	262	2.9	480[1]	.44	.26	3.5	(0)	
	1 cup	118	401	10.3	4.4	83.5	1.8	309	3.4	570[1]	.52	.31	4.2	(0)	
Farina, dry:															
unenriched		100	370	10.9	.8	77.4	.4	28	1.0	(0)	.06	.06	.8	(0)	
	1 cup	169	625	18.4	1.4	130.8	.7	47	1.7	(0)	.09	.10	1.4	(0)	
enriched		100	370	10.9	.8	77.4	.4	28	1.3	(0)	.37	.26	1.3	(0)	
	1 cup	169	625	18.4	1.4	130.8	.7	47	2.2	(0)	.62	.45	2.2	(0)	

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Macaroni, dry:														
unenriched		100	377	12.8	1.4	76.5	.4	22	1.5	(0)	.09	.06	2.0	(0)
	1 cup (1″ pieces)	110	415	14.1	1.5	84.2	.4	24	1.6	(0)	.10	.07	2.2	(0)
enriched		100	377	12.8	1.4	76.5	.4	22	2.9	(0)	.88	.37	6.0	(0)
	1 cup (1″ pieces)	110	415	14.1	1.5	84.2	.4	24	3.2	(0)	.97	.41	6.5	(0)
Noodles, dry:														
unenriched		100	381	12.6	3.4	73.2	.4	22	2.1	200	.20	.11	2.3	(0)
	1 cup (1½″ strips)	73	278	9.2	2.5	53.4	.3	16	1.5	140	.15	.08	1.7	(0)
enriched		100	381	12.6	3.4	73.2	.4	22	2.9	200	.88	.37	6.0	(0)
	1 cup (1½″ strips)	73	278	9.2	2.5	53.4	.3	16	2.1	140	.64	.27	4.3	(0)
Oat cereal, ready to eat (added		100	396	14.5	7.0	70.2	2.0	160	4.1	(0)	.82	.19	1.9	(0)
minerals and vitamins)	1 cup	25	100	3.7	1.8	17.6	.5	40	1.0	(0)	.20	.05	.5	(0)
Oatmeal or rolled oats, dry		100	390	14.2	7.4	68.2	1.2	53	4.5	(0)	.60	.14	1.0	(0)
	1 cup	80	312	11.4	5.9	54.6	1.0	42	3.6	(0)	.48	.11	.8	(0)
Oatmeal, precooked (infant		100	375	15.0	5.0	68.7	1.5	792	31.5	(0)	1.26	.35	2.3[2]	(0)
food) dry	1 oz.	28.4	106	4.3	1.4	19.5	.4	225	8.9	(0)	.36	.10	.7[2]	(0)
Pancake mix, self-rising, dry:														
Wheat and other flours														
unenriched		100	349	9.5	1.4	73.1	.4	465	2.0	0	.14	.07	1.4	(0)
	1 cup	135	471	12.8	1.9	98.7	.5	628	2.7	0	.20	.10	1.9	(0)
enriched		100	349	9.5	1.4	73.1	.4	465	3.3	0	.39	.31	2.9	(0)
	1 cup	135	471	12.8	1.9	98.7	.5	628	4.5	0	.53	.42	3.9	(0)
Buckwheat flour		100	319	10.5	1.9	70.3	1.4	467	3.1	0	.37	.11	2.2	(0)
	1 cup	135	432	14.2	2.6	94.9	1.9	630	4.2	0	.49	.15	3.0	(0)
Popcorn:														
unpopped		100	362	11.9	4.7	72.1	2.1	(10)	(2.5)	(0)	(.39)	(.11)	(2.1)	(0)
	¼ cup	25	91	3.0	1.2	18.0	.5	(3)	.6	(0)	(.10)	(.03)	(.5)	(0)
popped		100	386	12.7	5.0	76.7	2.2	(11)	(2.7)	(0)	(.39)	(.12)	(2.2)	(0)
	1 cup	14	54	1.8	.7	10.7	.3	(2)	(.4)	(0)	(.05)	(.02)	(.3)	(0)

[1] Yellow corn; white corn contains only a trace.
[2] Value may be higher depending product used.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Pro-tein	Fat	Carbo-hydrate	Fiber	Cal-cium	Iron	Vita-min A	Thia-mine	Ribo-flavin	Nia-cin	Ascor-bic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Cereals and Flour															
Potato flour		100	357	7.1	.7	82.2	2.2	25	4.0	40	.30	.11	4.5	23	
Rice, dry:															
brown		100	360	7.5	1.7	77.7	.6	39	2.0	(0)	.32	.05	4.6	(0)	
	1 cup	208	748	15.6	3.5	161.6	1.2	81	4.2	(0)	.66	.10	9.6	(0)	
converted		100	362	7.6	.3	79.4	.2	24	.8	(0)	.20	.03	3.8	(0)	
	1 cup	187	677	14.2	.6	148.5	.4	45	1.5	(0)	.38	.06	7.2	(0)	
white or milled		100	362	7.6	.3	79.4	.2	24	.8	(0)	.07	.03	1.6	(0)	
	1 cup	191	692	14.5	.6	151.7	.4	46	1.5	(0)	.13	.05	3.1	(0)	
Rice, white, precooked, dry		100	382	8.8	.2	83.3	.4	4	.8	(0)	.02	.02	.1	(0)	
	1 cup	110	420	9.7	.2	91.6	.4	4	.9	(0)	.02	.02	.1	(0)	
Rice flakes		100	392	5.9	.6	87.7	.5	21	1.8	(0)	.08	.08	.9	(0)	
	1 cup	30	118	1.8	.2	26.3	.2	6	.5	(0)	.02	.03	.3	(0)	
Rice flakes, thiamine and niacin added		100	392	5.9	.6	87.7	.5	21	1.8	(0)	.46	.08	5.5	(0)	
	1 cup	30	118	1.8	.2	26.3	.2	6	.5	(0)	.14	.03	1.6	(0)	
Rice puffed		100	392	5.9	.6	87.7	.5	21	1.8	(0)	.08	.08	.9	(0)	
	1 cup	14	55	.8	.1	12.3	.1	3	.3	(0)	.01	.01	.1	(0)	
Rice puffed, thiamine and niacin added		100	392	5.9	.6	87.7	.5	21	1.8	(0)	.46	.08	5.5	(0)	
	1 cup	14	55	.8	.1	12.3	.1	3	.3	(0)	.06	.01	.8	(0)	
Rye flour:															
light		100	356	9.4	1.0	77.9	.4	22	1.1	(0)	.15	.07	.6	(0)	
	1 cup, sifted	80	285	7.5	.8	62.3	.3	18	.9	(0)	.12	.06	.5	(0)	

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medium	1 cup	100	326	11.4	1.7	74.8	1.0	(27)	2.6	(0)	.30	.12	2.5	(0)
dark	1 cup	100	318	16.3	2.6	68.1	2.4	54	4.5	(0)	.61	.22	2.7	(0)
Rye meal (whole grain)		100	321	12.1	1.7	73.4	2.0	(38)	3.7	(0)	.43	.22	1.6	(0)
Soybean flour, flakes, grits:														
low fat	1 cup flour, stirred	100	228	44.7	1.1	37.7[1]	2.3	265	13.0	70	1.10	.35	2.9	(0)
medium fat		100	264	42.5	6.5	37.2[1]	2.6	244	13.0	110	.82	.34	2.6	(0)
	1 cup flour, stirred	88	232	37.4	6.7	32.7[1]	2.3	215	11.4	100	.72	.30	2.3	(0)
	1 cup grits	138	365	58.6	9.0	51.3	3.6	337	17.9	150	1.12	.46	3.6	(0)
full fat		100	347	35.9	20.6	29.9[1]	2.3	195	12.1	100	.77	.28	2.2	(0)
	1 cup flour, stirred	72	250	25.8	14.8	21.5[1]	1.7	140	8.7	140	.56	2.20	1.6	(0)
Spaghetti, dry:														
unenriched		100	377	12.8	1.4	76.5	.4	22	1.5	(0)	.09	.06	2.0	(0)
	1 cup, 2″ pieces	94	354	12.0	1.3	71.9	.4	21	1.4	(0)	.09	.06	1.9	(0)
enriched		100	377	12.8	1.4	76.5	.4	22	2.9	(0)	.88	.37	6.0	(0)
	1 cup, 2″ pieces	94	354	12.0	1.3	71.9	.4	21	2.7	(0)	.83	.35	5.6	(0)
Starch (arrowroot, corn, etc.)		100	362	.5	.2	87.0	.1	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	1 cup	128	464	.6	.3	111.4	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	1 tbsp	8	29	.0	.0	7.0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Wheat flakes		100	355	10.8	1.6	80.2	1.7	46	3.0	(0)	.08	.18	4.8	(0)
	1 cup	35	125	3.8	.6	28.1	.6	16	1.0	(0)	.03	.06	1.7	(0)
Wheat flakes, iron, thiamine, niacin added		100	355	10.8	1.6	80.2	1.7	46	4.2	(0)	.56	.18	6.4	(0)
	1 cup	35	125	3.8	.6	28.1	.6	16	1.5	(0)	.20	.06	2.2	(0)
Wheat flour:														
whole (hard wheat)		100	333	13.3	2.0	71.0	2.3	41	3.3	(0)	.55	.12	4.3	(0)
	1 cup, stirred	120	400	16.0	2.4	85.2	2.8	49	4.0	(0)	.66	.14	5.2	(0)
80 per cent extraction		100	365	12.0	1.3	74.1	.5	24	1.3	(0)	.26	.07	2.0	(0)
(hard wheat)	1 cup, sifted	110	401	13.2	1.4	81.5	.6	26	1.4	(0)	.28	.08	2.3	(0)
straight (hard wheat)		100	365	11.8	1.2	74.5	.4	20	1.4	(0)	.12	.07	1.4	(0)

[1] About 60 per cent may not be utilized.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Cereals and Flour															
Wheat flour, continued															
straight (soft wheat)		100	364	9.7	1.0	76.9	.4	20	1.1	(0)	.08	.05	1.2	(0)	
self-rising:															
unenriched		100	350	9.2	1.0	73.8	.4	272	1.0	(0)	.08	.05	1.1	(0)	
	1 cup, sifted	110	385	10.1	1.1	81.2	.4	299	1.1	(0)	.08	.05	1.3	(0)	
enriched		100	350	9.2	1.0	73.8	.4	272	2.9	(0)	.44	.26	3.5	(0)	
	1 cup, sifted	110	385	10.1	1.1	81.2	.4	299	3.2	(0)	.48	.29	3.8	(0)	
patent, all purpose:															
unenriched		100	364	10.5	1.0	76.1	.3	16	.8	(0)	.06	.05	.9	(0)	
	1 cup, sifted	110	401	11.6	1.1	83.7	.3	18	.9	(0)	.07	.05	1.0	(0)	
enriched		100	364	10.5	1.0	76.1	.3	16	2.9	(0)	.44	.26	3.5	(0)	
	1 cup, sifted	110	401	11.6	1.1	83.7	.3	18	3.2	(0)	.48	.29	3.8	(0)	
patent, bread															
unenriched		100	365	11.8	1.1	74.7	.3	16	.9	(0)	.08	.06	1.0	(0)	
	1 cup, sifted	112	408	13.2	1.2	83.7	.4	18	1.0	(0)	.09	.06	1.1	(0)	
enriched		100	365	11.8	1.1	74.7	.3	16	2.9	(0)	.44	.26	3.5	(0)	
	1 cup, sifted	112	408	13.2	1.2	83.7	.4	18	3.2	(0)	.49	.29	3.9	(0)	
patent, cake or pastry	1 cup, sifted	100	365	7.5	.8	79.4	.2	17	.5	(0)	.03	.03	.7	(0)	
Wheat germ		100	361	25.2	10.0	49.5	2.5	84	8.1	(0)	2.05	.80	4.6	(0)	
	1 cup, stirred	68	246	17.1	6.8	33.7	1.7	57	5.5	(0)	1.39	.54	3.1	(0)	
Wheat puffed		100	355	10.8	1.6	80.2	1.7	46	3.0	(0)	.08	.18	4.8	(0)	
	1 cup	12	43	1.3	.2	9.6	.2	6	.4	(0)	.01	.02	.6	(0)	

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Wheat puffed, iron, thiamine,		100	355	10.8	1.6	80.2	1.7	46	4.2	(0)	.56	.18	6.4	(0)	
niacin added	1 cup	12	43	1.3	.2	9.6	.2	6	.5	(0)	.07	.02	.8	(0)	
Wheat rolled dry		100	340	9.9	2.0	76.2	2.2	36	3.2	(0)	.36	.12	4.1	(0)	
Wheat, shredded		100	360	10.1	2.5	80.1	2.3	47	3.5	(0)	.22	.12	4.4	(0)	
	1 round biscuit	24	86	2.4	.6	19.2	.6	11	.8	(0)	.05	.03	1.1	(0)	
	1 square biscuit	28.4	102	2.9	.7	22.7	.6	13	1.0	(0)	.06	.03	1.3	(0)	
	1 sm. biscuit (2⅓" x 2")	22	79	2.2	.6	17.6	.5	10	.8	(0)	.05	.03	1.0	(0)	
Wheat meal, whole, dry		100	344	12.7	1.7	75.3	2.2	46	3.4	(0)	.55	.15	4.4	(0)	
Wheat, meal, whole, dry wheat germ, iron and thiamine added		100	336	12.8	2.0	72.4	1.8	50	30.0	(0)	1.50	.16	5.2	(0)	
Eggs															
Eggs, hen, fresh, stored or frozen															
whole, raw		100	162	12.8	11.5	.7	0	54	2.7	1140	.10	.29	.1	0	112 in shell
whole, raw	one	48	77	6.1	5.5	.3	0	26	1.3	550	.04	.13	tr.	0	54 in shell
white, raw		100	50	10.8	0.	.8	0	6	.2	(0)	0	.26	(.1)	0	
white, raw	one	31	16	3.4	0.	.2	0	2	.1	(0)	0	.08	tr.	0	
yolks, raw		100	361	16.3	31.9	.7	0	147	7.2	3210	.27	.35	tr.	0	
yolks, raw	one	17	61	2.7	5.4	.1	0	25	1.2	550	.05	.06	0	0	
whole, dried		100	592	46.8	42.0	2.5	0	190	8.8	3740	.34	1.06	.2	0	
whole, dried	1 cup	108	640	50.5	45.4	2.7	0	205	9.5	4040	.36	1.14	.3	0	
white, dried		100	398	85.9	0.	6.3	0	48	1.6	0	0	2.05	.7	0	
white, dried	1 cup	56	223	48.1	0.	3.5	0	27	.9	0	0	1.15	.4	0	
yolk, dried		100	693	31.2	61.2	1.3	0	282	13.8	5540	.50	.66	.1	0	
yolk, dried	1 cup	96	666	30.0	58.8	1.2	0	271	13.2	5320	.48	.64	.1	0	
Fats and Oils															
Butter		100	716	.6	81.0	.4	0	20	.0	3300[1]	tr.	.01	.1	(0)	
Butter	1 cup	224	1604	1.3	181.4	.9	0	45	.0	7390[1]	tr.	.02	.2	(0)	
Butter	1 tbsp.; ½ oz.	14	100	.1	11.3	.1	0	3	.0	460[1]	0	tr.	tr.	(0)	

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fats and Oils															
Butter	1 pat or square (64 per lb.)	7	50	.0	5.7	.0	0	1	.0	230[1]	0	tr.	tr.	(0)	
Fats, cooking (vegetable)		100	884	0.	100.0	0.	0	0	.0	0	0	0	0	0	
Fats, cooking (vegetable)	1 cup	200	1768	0.	200.0	0.	0	0	.0	0	0	0	0	0	
Fats, cooking (vegetable)	1 tbsp.	12.5	110	0.	12.5	0.	0	0	.0	0	0	0	0	0	
Lard		100	902	0.	100.0	0.	0	0	.0	0	0	0	0	0	
Lard	1 cup	220	1984	0.	220.0	0.	0	0	.0	0	0	0	0	0	
Lard	1 tbsp.	14	126	0.	14.0	0.	0	0	.0	0	0	0	0	0	
Margarine		100	720	.6	81.0	.4	0	20	.0	3300[2]	(0)	(0)	(0)	(0)	
Margarine	1 cup	224	1613	1.3	181.4	.9	0	45	.0	7400[2]	(0)	(0)	(0)	(0)	
Margarine	1 tbsp.	14	101	.1	11.3	.1	0	3	.0	460[2]	(0)	(0)	(0)	(0)	
Margarine	1 pat or square (64 per lb.)	7	50	.0	5.7	.0	0	1	.0	230[2]	(0)	(0)	(0)	(0)	
Oil, salad and cooking (corn, cottonseed, olive, peanut)		100	884	.0	100.0	0.	0	0	0	0	0	0	0	0	
Oil, salad and cooking (corn, cottonseed, olive, peanut)	1 cup	220	1945	0.	220.0	0.	0	0	0	0	0	0	0	0	
Oil, salad and cooking (corn, cottonseed, olive, peanut)	1 tbsp.	14	124	0.	14.0	0.	0	0	0	0	0	0	0	0	
Peanut butter		100	576	26.1	47.8	21.0	2.0	74	1.9	0	.12	.13	16.2	0	
Peanut butter	1 cup	258	1486	67.3	123.3	54.2	5.2	191	4.9	0	.31	.34	41.8	(0)	
Peanut butter	1 tbsp.	16	92	4.2	7.6	3.4	.3	12	.3	0	.02	.02	2.6	(0)	

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Fruits

Apples:															
raw		100	58	.3	.4	14.9	1.0	6	.3	90	.04	.03	.2	5	114 whole fruit
raw	1 med., 2½″ diam.	132	76	.4	.5	19.7	1.3	8	.4	120	.05	.04	.2	6	150 whole fruit
canned, unsweetened		100	42	.2	.2	10.9	.6	4	.4	30	.02	.01	tr.	1	
canned, unsweetened	1 cup	239	100	.5	.5	26.1	1.4	10	1.0	70	.05	.02	.1	3	
canned, strained (infant food)		100	61	.5	.2	16.0	.6	5	.4	80	.01	.02	.2	2	
canned, strained	1 oz.	28.4	17	.1	.1	4.5	.2	1	.1	20	tr.	tr.	tr.	1	
dehydrated		100	354	1.8	2.4	91.0	4.9	24	1.8	(0)	.07	.10	1.2	12	
dehydrated	1 oz.	28.4	100	.5	.7	25.2	1.4	7	.5	(0)	.02	.03	.3	3	
dried, uncooked		100	277	1.4	1.0	73.2	3.9	19	1.4	(0)	.10	.10	1.0	12	
dried, uncooked	1 cup	114	315	1.6	1.1	83.4	4.5	22	1.6	(0)	.11	.11	1.1	14	
Apple juice, fresh or canned		100	50	.1	(0)	13.8	—	6	.5	40	.02	.03	tr.	1	
Apple juice, fresh or canned	1 cup	249	124	.2	(0)	34.4	—	15	1.2	90	.05	.07	tr.	2	
Apricots:															
raw		100	51	1.0	.1	12.9	.6	16	.5	2790	.03	.05	.8	7	106 whole fruit
raw	three	107	54	1.1	.1	13.8	.6	17	.5	2990	.03	.05	.9	7	114 whole fruit
frozen		100	82	.7	.1	21.0	.4	11	.4	1660	.02	.03	.5	4	
frozen	3 oz.	85	70	.6	.1	17.9	.3	9	.3	1410	.02	.03	.4	3	
canned, water pack, solids and liquid		100	32	.5	.1	8.1	.3	10	.3	1350	.02	.02	.3	4	
canned, water pack, solids and liquid	1 cup, halves and liquid	244	77	1.2	.2	19.8	.7	24	.7	3300	.04	.05	.8	10	
canned, syrup pack, solids and liquid		100	80	.6	.1	21.4	.4	10	.3	1350	.02	.02	.3	4	
canned, syrup pack, solids and liquid	4 med. halves + 2 tbsp. syrup	122	97	.7	.1	26.1	.5	12	.4	1650	.02	.03	.4	5	
canned, strained (infant food)		100	61	1.0	.4	15.2	1.2	20	(1.1)	(1700)	(.02)	(.02)	(.2)	(3)	

[1] Year-round average.

[2] Based on the average vitamin A content of fortified margarine (15,000 I.U. per lb.). The minimum Federal specifications for fortified margarine require the addition of 9,000 I.U. of vitamin A per lb. See manufacturer's claim.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fruits															
Apricots, continued															
canned, strained (infant food)	1 oz.	28.4	17	.3	.1	4.3	.3	6	(.3)	(480)	(.01)	(.01)	(.1)	(1)	
dried, sulfured		100	262	5.2	.4	66.9	3.2	86	4.9	7430	.01	.16	3.3	12	
dried, sulfured	1 cup, medium	156	408	8.1	.6	104.5	5.0	134	7.6	11,600	.02	.24	5.1	19	
Avocados		100	245	1.7	26.4	5.1	1.8	10	.6	290	.06	.13	1.1	16	133 whole fruit
Avocados	½ peeled avocado, 3½" x 3¼"	114	279	1.9	30.1	5.8	2.1	11	.7	330	.07	.15	1.3	18	152 whole fruit
Bananas		100	88	1.2	.2	23.0	.6	8	.6	430	.04	.05	.7	10	149 whole fruit
Bananas	1 lg., 8" x 1½"	134	119	1.6	.3	31.0	.8	11	.8	570	.06	.06	1.0	13	200 whole fruit
Blackberries:															
raw		100	57	1.2	1.0	12.5	4.2	32	.9	200	.04	.04	.4	21	
raw	1 cup	144	82	1.7	1.4	18.0	6.1	46	1.3	280	.05	.06	.5	30	
canned, water pack, solids and liquid		100	43	.9	.7	9.4	2.0	18	(.7)	180	.01	.02	.2	6	
canned, water pack, solids and liquid	1 cup	244	104	2.2	1.7	22.9	4.9	44	(1.7)	450	.03	.05	.5	15	
canned, syrup pack, solids and liquid		100	86	.7	.2	22.8	2.9	18	(.7)	180	.01	.02	.2	6	
canned, syrup pack, solids and liquid	1 cup	251	216	1.8	.5	57.2	7.3	45	(1.8)	460	.03	.05	.5	16	
Blueberries:															
raw		100	61	.6	.6	15.1	1.2	16	.8	280	(.02)	(.02)	(.3)	16	
raw	1 cup	140	85	.8	.8	21.1	1.7	22	1.1	400	(.04)	(.03)	(.4)	23	

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frozen, without sugar		100	61	.6	.6	15.1	1.2	16	.8	240	(.02)	(.02)	(.3)	14	
frozen, without sugar	3 oz.	85	52	.5	.5	12.8	1.0	14	.7	200	(.01)	(.01)	(.2)	12	
canned, water pack, solids and liquid		100	37	.4	.4	9.0	1.0	11	(.5)	40	.01	.01	.2	13	
canned, water pack, solids and liquid	1 cup	242	90	1.0	1.0	21.8	2.4	27	(1.2)	100	.03	.03	.5	32	
canned, syrup pack, solids and liquid		100	98	.4	.4	26.0	1.0	11	(.5)	40	.01	.01	.2	13	
canned, syrup pack, solids and liquid	1 cup	249	245	1.0	1.0	64.7	2.5	27	(1.2)	100	.03	.03	.5	33	
Cantaloupe, raw		100	20	.6	.2	4.6	.6	17	.4	3420[1]	.05	.04	.5	33	213 whole fruit
Cantaloupe, raw	½ melon, 5" diam.	181	37	1.1	.4	8.3	1.1	31	.7	6190[1]	.09	.07	.9	59	385 whole fruit
Cherries; sour, sweet or hybrid, raw		100	61	1.1	.5	14.8	.3	18	.4	620	.05	.06	.4	8	106 whole fruit
Cherries; sour, sweet or hybrid, raw	1 cup	107	65	1.2	.5	15.8	.3	19	.4	660	.05	.06	.4	9	114 whole fruit
Cherries, red, sour, pitted, canned		100	48	.8	.3	11.9	.1	11	(.3)	720	.03	.02	.2	6	
Cherries, red, sour, pitted, canned	1 cup	254	122	2.0	.8	30.2	.3	28	(.8)	1840	.07	.04	.4	14	
Cranberries:															
raw		100	48	.4	.7	11.3	1.4	14	.6	40	(.03)	(.02)	.1	12	
raw	1 cup	113	54	.5	.8	12.8	1.6	16	.7	50	(.03)	(.02)	.1	13	
dried		100	368	2.8	6.6	84.3	8.7	82	3.4	(300)	.19	.18	.9	34	
Cranberry sauce, canned or cooked, sweetened		100	198	.1	.3	51.4	.4	(8)	(.3)	(30)	(.02)	(.02)	(.1)	2	
Cranberry sauce, canned or cooked, sweetened	1 cup	277	549	.3	.8	142.4	1.1	(22)	(.8)	(80)	(.06)	(.06)	(.3)	5	
Currants, red, raw		100	55	1.2	.2	13.6	4.0	36	.9	120	.04	—	—	36	
Currants, red, raw	1 cup	110	60	1.3	.2	15.0	4.4	40	1.0	130	.04	—	—	40	

[1]Deeply colored varieties.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fruits															
Dates, "fresh" and dried		100	284	2.2	.6	75.4	2.4	72	2.1	60	.09	.10	2.2	(0)	115 with pits
Dates, "fresh" and dried	1 cup, pitted, cut	178	505	3.9	1.1	134.2	4.3	128	3.7	100	.16	.17	3.9	(0)	
Figs:															
fresh	4 large; 8 small	100	79	1.4	.4	19.6	1.7	54	.6	80	.06	.05	.5	2	
canned, water pack	4 with juice	100	57	.5	.1	13.5	.6	—	—	—	—	—	—	—	
canned, in syrup	4 with juice	100	113	.8	.3	30.0	.9	35	.4	50	.03	.03	.4	tr.	
canned, in syrup	1 cup	265	300	2.1	.8	79.5	2.4	93	1.1	140	.08	.08	.9	1	
dried	6 pulled	100	270	4.0	1.2	68.4	5.8	186	3.0	80	.16	.12	1.7	(0)	
dried	1 cup, cut	168	453	6.7	2.0	114.9	9.7	312	5.0	140	.26	.20	2.9	(0)	
Gooseberries, raw		100	39	.8	.2	9.7	1.9	22	.5	290	—	—	—	33	
Gooseberries, raw	1 cup	150	59	1.2	.3	14.6	2.9	33	.8	440	—	—	—	49	
Grapefruit:															
raw		100	40	.5	.2	10.1	.3	22	.2	tr.	.04	.02	.2	40	152 whole fruit
raw	½ med. (4¼" diam.; No. 64's; approx. 1 cup sections)	188	75	.9	.4	19.0	.6	41	.4	20	.07	.04	.4	76	285 whole fruit
canned, in syrup, solids and liquid		100	72	.6	.2	19.1	.2	13	.3	tr.	.03	.02	.2	30	
canned, in syrup, solids and liquid	1 cup	249	181	1.5	.5	47.6	.5	32	.7	20	.07	.05	.5	74	
Grapefruit juice:															
fresh		100	36	.5	.1	9.2	.1	8	.3	tr.	.04	.02	.2	40	
fresh	1 cup	246	87	1.2	.2	22.6	.2	20	.7	20	.09	.05	.5	99	

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canned, unsweetened		100	38	.5	.1	9.8	.1	8	.3	tr.	.03	.02	.2	35	
canned, unsweetened	1 cup	246	92	1.2	.2	24.1	.2	20	.7	20	.07	.04	.4	85	
canned, sweetened		100	52	.5	.1	13.7	.1	8	.3	tr.	.03	.02	.2	35	
canned, sweetened	1 cup	251	131	1.3	.3	34.4	.3	20	.8	20	.08	.04	.5	87	
Grapefruit juice concentrate, frozen		100	147	1.9	.4	38.1	.2	31	1.2	30	.12	.07	.7	135	
Grapefruit juice concentrate, frozen	1 can (6 fl. oz.)	202	297	3.8	.8	77.0	.4	63	2.4	60	.24	.13	1.4	272	
Grapefruit-orange juice blend:															
canned, unsweetened		100	40	.6	.1	10.4	.1	9	.3	40	.05	.02	.2	38	
canned, unsweetened	1 cup	246	99	1.5	.2	25.6	.2	22	.7	110	.11	.04	.5	92	
canned, sweetened		100	52	.5	.1	13.9	.1	9	.3	40	.05	.02	.2	38	
canned, sweetened	1 cup	251	132	1.3	.3	39.9	.3	23	.8	110	.12	.04	.5	94	
Grapefruit-orange juice concentrate, frozen		100	147	2.2	.4	37.9	.2	33	1.1	160	.17	.06	.7	137	
Grapefruit-orange juice concentrate, frozen	1 can (6 fl. oz.)	202	297	4.4	.8	76.6	.2	67	2.2	330	.34	.13	1.5	277	
Grapes:															
American type, slip skin, (Concord, Delaware, Niagara, Scuppernong)															
raw	1 bunch; 3½" x 3"	100	70	1.4	1.4	14.9	.5	17	.6	80	.06	.04	.2	4	128 whole fruit
raw	1 cup, with skins and seeds	119	84	1.7	1.7	17.7	.8	20	.7	90	.07	.05	.3	5	153 whole fruit
European type, adherent skin, (Malaga, Muscat, Sultanine, Flame Tokay)															
raw		100	66	.8	.4	16.7	.5	17	.6	80	.06	.04	.2	4	103 whole fruit
raw	1 cup (40 grapes, ¾" diam.)	155	102	1.2	.6	25.9	.8	26	.9	120	.09	.06	.4	6	160 whole fruit
Grape juice, bottled, commercial		100	67	.4	.0	18.2	—	10	.3	—	.04	.05	(.2)	tr.	

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fruits															
Grape juice, bottled, commercial	1 cup	254	170	1.0	.0	46.2	—	25	.8	—	.09	.12	(.6)	tr.	
Guavas, common, raw		100	70	1.0	.6	17.1	5.5	30	.7	250	.07	.04	1.2	302	115 whole fruit
Guavas, common, raw	one	70	49	.7	.4	12.0	3.9	21	.5	180	.05	.03	.8	212	80 whole fruit
Honeydew melon		100	32	.5	0.	8.5	.4	(17)	(.4)	40	.05	.03	.2	23	159 whole fruit
Honeydew melon	1 wedge (2″ x 7″, from melon 6½″ x 7″)	150	49	.8	0.	12.8	.6	(26)	(.6)	60	.07	.04	.3	34	238 whole fruit
Lemons		100	32	.9	.6	8.7	.9	40	.6	0	.04	tr.	.1	50	161 whole fruit
Lemons	1 med. (2¾″ x 2″)	62	20	.6	.4	5.4	.6	25	.4	0	.03	tr.	.1	31	100 whole fruit
Lemon juice:															
fresh		100	24	.4	.2	7.7	.0	14	.1	0	.04	tr.	.1	50	
fresh	1 cup	246	59	1.0	.5	18.9	.0	34	.2	0	.11	.01	.3	122	
fresh	1 tbsp.	15	4	.1	.0	1.2	.0	2	.0	0	.01	tr.	tr.	7	
canned, unsweetened		100	24	.4	.2	7.7	.0	14	.1	0	.04	tr.	.1	42	
canned, unsweetened	1 cup	246	59	1.0	.5	18.9	.0	34	.2	0	.11	.01	.3	104	
canned, unsweetened	1 tbsp.	15	4	.1	.0	1.2	.0	2	.0	0	.01	tr.	tr.	6	
Lemon juice concentrate, canned		100	116	2.0	1.0	37.5	.1	68	.5	(0)	.22	.02	.7	230	
Lemon juice concentrate, canned	1 oz.	28.4	33	.6	.3	10.6	.0	19	.1	(0)	.06	tr.	.2	65	

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Limes		100	37	.8	.1	12.3	(.9)	(40)	(.6)	0	(.04)	(tr.)	(.1)	27	132 whole fruit
Limes	1 med. (2″ diam.)	52	19	.4	.1	6.4	(.5)	(21)	(.3)	0	(.02)	(tr.)	(.1)	14	68 whole fruit
Lime juice, fresh		100	24	.4	.0	8.3	.0	(14)	(.1)	0	(.04)	(tr.)	(.1)	27	
Lime juice, fresh	1 cup	246	58	1.0	.0	20.4	.0	(34)	(.2)	0	(.11)	(.01)	(.3)	65	
Loganberries		100	62	1.0	.6	15.0	1.4	35	1.2	(200)	(.03)	(.07)	(.3)	24	
Loganberries	1 cup	144	90	1.4	.9	21.6	2.0	50	1.7	(280)	(.04)	(.10)	(.4)	34	
Mangos		100	66	.7	.2	17.2	1.0	9	.2	6350	.06	.06	.9	41	151 whole fruit
Mangos	1 med.	132	87	.9	.3	22.7	1.3	12	.3	8380	.08	.07	1.2	55	200 whole fruit
Oranges		100	45	.9	.2	11.2	.6	33	.4	(190)	.08	.03	.2	49	139 whole fruit
Oranges	1 med. (3″ diam., No. 200's)	155	70	1.4	.3	17.4	.9	51	.6	(290)	.12	.04	.4	77	215 whole fruit
Orange juice:															
fresh		100	44	.8	.2	11.0	.1	19	.2	(190)	.08	.03	.2	49	
fresh	1 cup	246	108	2.0	.5	27.1	.2	47	.5	(460)	.19	.06	.6	122	
canned, unsweetened		100	44	.8	.2	11.1	.1	10	.3	(100)	.07	.02	.2	42	
canned, unsweetened	1 cup	246	109	2.0	.5	27.3	.2	25	.7	(240)	.17	.04	.6	103	
canned, sweetened		100	54	.6	.2	13.9	.1	10	.3	(100)	.07	.02	.2	42	
canned, sweetened	1 cup	251	135	1.5	.5	34.9	.3	25	.8	(250)	.18	.05	.6	105	
Orange juice concentrate:															
frozen		100	149	2.7	.7	37.1	.2	34	1.0	(330)	.24	.05	.7	141	
frozen	1 can (6 fl. oz.)	202	300	5.5	1.4	74.9	.4	69	2.0	(670)	.48	.11	1.5	285	
canned		100	229	4.2	.7	58.0	.2	61	1.6	(510)	.37	.08	1.1	221	
canned	1 oz.	28.4	65	1.2	.2	16.4	.1	17	.5	(140)	.10	.02	.3	63	
Papayas		100	39	.6	.1	10.0	.9	20	.3	1750	.03	.04	.3	56	
Papayas	1 cup (½″ cubes)	182	71	1.1	.2	18.2	1.6	36	.5	3190	.06	.07	.5	102	
Peaches:															
fresh	1 med. (2⅓″ x 2″)	100	46	.5	.1	12.0	.6	8	.6	880	.02	.05	.9	8	114 whole fruit
fresh	1 cup, sliced	168	77	.8	.2	20.2	1.0	13	1.0	1480	.04	.08	1.5	13	
frozen		100	78	.4	.1	20.2	.4	6	.4	520	.01	.03	.5	4	
frozen	4 oz.	114	89	.5	.1	22.9	.5	7	.5	590	.01	.03	.6	5	
canned, water pack, solids and liquid		100	27	.5	.1	6.8	.3	5	.4	450	.01	.02	.7	4	

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
	WEIGHT	gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fruits															
Peaches, continued															
canned, water pack, solids and liquid	1 cup	244	66	1.2	.2	16.6	.7	12	1.0	1110	.02	.05	1.7	10	
canned, syrup pack		100	68	.4	.1	18.2	.4	5	.4	450	.01	.02	.7	4	
canned, syrup pack	1 cup	256	174	1.0	.3	46.6	1.6	13	1.0	1160	.02	.05	1.8	11	
canned, syrup pack	2 med. halves + 2 tbsp. syrup	117	79	.5	.1	21.3	.5	6	.5	530	.01	.02	.8	5	
canned, strained (infant food)		100	60	.8	.3	15.1	.4	7	.9	630	.02	.02	.6	3	
canned, strained (infant food)	1 oz.	28.4	17	.2	.1	4.3	.1	2	.3	180	.0	.01	.2	1	
dried, sulfured		100	265	3.0	.6	69.4	3.5	44	6.9	3250	.01	.20	5.4	19	
dried, sulfured	1 cup, uncooked	160	424	4.8	1.0	111.0	5.6	70	11.0	5200	.02	.31	8.6	30	
Pears:															
fresh		100	63	.7	.4	15.8	1.4	13	.3	20	.02	.04	.1	4	121 whole fruit
fresh	one (3″ x 2½″ diam.), peeled	151	95	1.1	.6	23.9	2.1	20	.5	30	.03	.06	.2	6	182 whole fruit
canned, water pack		100	31	.3	.1	8.2	.7	8	.2	tr.	.01	.02	.1	2	
canned, water pack	1 cup	242	75	.7	.2	19.8	1.7	19	.5	10	.02	.04	.3	4	
canned, syrup pack		100	68	.2	.1	18.4	.8	8	.2	tr.	.01	.02	.1	2	
canned, syrup pack	1 cup	256	174	.5	.3	47.1	2.0	20	.5	10	.02	.04	.4	5	
canned, syrup pack	2 med. halves + 2 tbsp. syrup	117	79	.2	.1	21.5	.9	9	.2	tr.	.01	.02	.2	2	

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canned, strained (infant food)		100	51	.7	.2	13.1	1.1	11	(.2)	40	.01	.02	.2	1	
canned, strained (infant food)	1 oz.	28.4	15	.2	.1	3.7	.3	3	(.1)	10	tr.	.01	.1	tr.	
Persimmons		100	78	.8	.4	20.0	1.9	6	.3	2710	.05	.05	tr.	11	
Persimmons	one (2¼″ diam.); seedless kind	121	95	1.0	.5	24.2	2.3	7	.4	3270	.06	.05	tr.	13	125 whole fruit
Persimmons	one (2¼″ diam.); kind with seeds	95	74	.8	.4	19.0	1.8	6	.3	2570	.05	.04	tr.	10	125 whole fruit
Pineapple:															
fresh		100	52	.4	.2	13.7	.4	16	.3	130	.08	.02	.2	24	189 whole fruit
fresh	1 cup, diced	140	74	.6	.3	19.2	.6	22	.4	180	.12	.04	.3	33	264 whole fruit
fresh	1 slice (¾″ x 3½″ diam.)	84	44	.3	.2	11.5	.3	13	.3	110	.07	.02	.2	20	159 whole fruit
frozen		100	86	.4	.2	22.2	.4	14	.3	100	.06	.02	.2	19	
frozen	4 oz.	114	97	.5	.2	25.2	.5	16	.3	110	.07	.02	.2	22	
canned, syrup pack		100	78	.4	.1	21.1	.3	29	.6	80	.07	.02	.2	9	
canned, syrup pack	1 cup, crushed	260	204	1.0	.3	54.9	.8	75	1.6	210	.20	.04	.4	23	
canned, syrup pack	2 sm. or 1 lg. slice + 2 tbsp. syrup	122	95	.5	.1	25.7	.4	35	.7	100	.09	.02	.2	11	
Pineapple juice, canned		100	49	.3	.1	13.0	.1	15	.5	80	.05	.02	.2	9	
Pineapple juice, canned	1 cup	249	121	.7	.2	32.4	.2	37	1.2	200	.13	.04	.4	22	
Plums, excluding prunes		100	50	.7	.2	12.9	.5	17	.5	350	.06	.04	.5	5	105 whole fruit
Plums, excluding prunes	one (2″ diam.)	57	29	.4	.1	7.4	.3	10	.3	200	.04	.02	.3	3	60 whole fruit
Plums, excluding prunes	1 cup halves (2″ diam.)	185	94	1.3	.4	23.9	.9	31	.9	650	.12	.08	.9	9	195 whole fruit
Plums (Italian prunes), canned, syrup pack		100	76	.4	1	20.4	.3	8	1.1	230	.03	.03	.4	1	104 with pits
Plums (Italian prunes), canned, syrup pack	1 cup, fruit and juice	244	186	1.0	.2	50.2	.7	20	2.7	560	.07	.06	.9	3	256 with pits
Plums (Italian prunes), canned, syrup pack	3 prunes, pitted, + 2 tbsp. juice	122	92	.5	.1	24.9	.4	10	1.3	280	.03	.03	.5	1	127 with pits

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Pro-tein	Fat	Carbo-hydrate	Fiber	Cal-cium	Iron	Vita-min A	Thia-mine	Ribo-flavin	Nia-cin	Ascor-bic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fruits															
Prunes:															
canned, strained (infant food)		100	97	1.1	.2	25.4	.7	26	1.5	730	.03	.05	.6	3	
canned, strained (infant food)	1 oz.	28.4	28	.3	.1	7.2	.2	7	.4	210	.01	.01	.2	1	
dried, unsulfured		100	268	2.3	.6	71.0	1.6	54	3.9	1890	.10	.16	1.7	3	118 with pits
dried, unsulfured	1 cup med.	140	375	3.2	.8	99.4	2.2	76	5.5	2650	.14	.23	2.4	4	165 with pits
dried, unsulfured	4 med. (50–60 per lb.)	27	73	.6	.2	19.2	.4	15	1.1	510	.03	.04	.5	1	32 with pits
Prune juice, canned		100	71	.4	0.	19.3	—	(25)	(1.8)	—	(.03)	(.08)	.4	(1)	
Prune juice, canned	1 cup	240	170	1.0	0.	46.3	—	(60)	(4.3)	—	(.07)	(.19)	1.0	(2)	
Raisins, dried, unsulfured		100	268	2.3	.5	71.2	—	78	3.3	50	.15	.08	.5	tr.	
Raisins, dried, unsulfured	1 cup	160	429	3.7	.8	113.9	—	125	5.3	80	.24	.13	.8	tr.	
Raisins, dried, unsulfured	1 tbsp.	10	26	.2	.0	7.1	—	8	.3	tr.	.02	.01	tr.	tr.	
Raspberries, Black, fresh		100	74	1.5	1.6	15.7	6.8	40	.9	0	.02	(.07)	(.3)	(24)	
Raspberries, Black, fresh	1 cup	134	100	2.0	2.1	21.0	9.1	54	1.2	0	.03	(.09)	(.4)	(32)	
Raspberries, Red:															
fresh		100	57	1.2	.4	13.8	4.7	40	.9	130	.02	(.07)	(.3)	24	
fresh	1 cup	123	70	1.5	.5	17.0	5.8	49	1.1	160	.03	(.08)	(.4)	29	
frozen		100	98	.8	.3	24.7	3.3	28	.6	80	.01	(.04)	(.2)	16	
frozen	3 oz.	85	84	.7	.3	21.0	2.8	24	.5	70	.01	(.03)	(.2)	14	
Rhubarb, stems:															
fresh		100	16	.5	.1	3.8	.7	51[1]	.5	30	.01	—	.1	9	
fresh	1 cup, diced	122	19	.6	.1	4.6	.9	62[1]	.6	40	.01	—	.1	11	

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canned, syrup pack		100	141	.4	.1	36.0	.6	41[1]	.4	20	.01	—	.1	6	
canned, syrup pack	1 cup	272	383	1.1	.3	97.9	1.6	112[1]	1.1	70	.02	—	.2	17	
Strawberries:															
fresh		100	37	.8	.5	8.3	1.4	28	.8	60	.03	.07	.3	60	104 with hulls
fresh	1 cup, capped	149	54	1.2	.7	12.4	2.1	42	1.2	90	.04	.10	.4	89	
frozen		100	106	.6	.4	26.6	1.1	22	.6	40	.02	.05	.2	41	
frozen	3 oz.	85	90	.5	.3	22.6	.9	19	.5	30	.02	.04	.2	35	
Tangerines		100	44	.8	.3	10.9	1.0	(33)	(.4)	(420)	.07	(.03)	(.2)	31	141 whole fruit
Tangerines	1 med. (2⅖" diam.)	81	35	.6	.2	8.8		(27)	(.3)	(340)	.06	(.02)	(.2)	25	114 whole fruit
Tangerine juice:															
fresh		100	39	.9	.3	9.2	—	19	(.2)	(420)	.07	(.03)	.2	31	
fresh	1 cup	246	95	2.2	.7	22.6	—	47	(.5)	(1040)	.17	(.06)	.6	75	
canned		100	39	.9	.3	9.2	—	19	.2	(420)	(.06)	(.03)	(.2)	(26)	
canned	1 cup	246	95	2.2	.7	22.6	—	47	.5	(1040)	(.15)	(.06)	(.6)	(64)	
Watermelon		100	28	.5	.2	6.9	.6	7	.2	590	.05	.05	.2	6	218 whole fruit
Watermelon	1 wedge (4" x 8")	425	120	2.1	.9	29.4	2.6	30	.9	2530	.20	.22	.7	26	925 whole fruit
Watermelon	½ slice (¾" x 10")	159	45	.8	.3	11.0	.9	11	.3	950	.08	.08	.3	10	345 whole fruit
Meat, Poultry, Fish															
Muscle Meats—Beef															
Beef, medium fat, raw:															
chuck		100	224	18.6	16.0	0.	0	11	2.8	(0)	.08	.17	4.5	0	115 with bone
	4 oz. without bone	113.4	254	21.1	18.1	0.	0	12	3.2	(0)	.09	.19	5.1	0	130 with bone
flank		100	247	19.9	18.0	0.	0	12	3.0	(0)	.09	.18	4.8	0	102 with bone
	4 oz. without bone	113.4	280	22.6	20.4	0.	0	14	3.4	(0)	.10	.20	5.4	0	116 with bone
hamburger		100	321	16.0	28.0	0.	0	9	2.4	(0)	.07	.14	3.8	0	
	4 oz.	113.4	352	18.1	31.8	0.	0	10	2.7	(0)	.08	.16	4.3	0	
porterhouse		100	296	16.4	25.0	0.	0	10	2.5	(0)	.07	.15	3.9	0	116 with bone
	4 oz. without bone	113.4	335	18.6	28.4	0.	0	11	2.8	(0)	.08	.17	4.4	0	132 with bone
rib roast		100	282	17.4	23.0	0.	0	10	2.6	(0)	.07	.15	4.2	0	127 with bone
	4 oz. without bone	113.4	320	19.7	26.1	0.	0	11	2.9	(0)	.08	.17	4.8	0	149 with bone
round		100	182	19.5	11.0	0.	0	11	2.9	(0)	.08	.17	4.7	0	111 with bone
	4 oz. without bone	113.4	207	22.2	12.5	0.	0	12	3.3	(0)	.09	.19	5.3	0	126 with bone

[1] May not be available because of oxalic acid.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Muscle Meats—Beef															
Beef, continued															
rump		100	322	16.2	28.0	0.	0	9	2.4	(0)	.07	.14	3.9	0	135 with bone
	4 oz. without bone	113.4	365	18.4	31.8	0.	0	10	2.7	(0)	.08	.16	4.4	0	154 with bone
sirloin		100	254	17.3	20.0	0.	0	10	2.6	(0)	.07	.15	4.2	0	111 with bone
	4 oz. without bone	113.4	288	19.6	22.7	0.	0	11	2.9	(0)	.08	.17	4.8	0	126 with bone
Beef, canned, strained		100	105	17.4	3.4	0.	0	11	4.2	(0)	.01	.22	3.3	0	
(infant food)	1 oz.	28.4	30	4.9	1.0	0.	0	3	1.2	(0)	tr	.06	.9	0	
Beef, corned, boneless:															
raw, medium fat		100	293	15.8	25.0	0.	0	9	2.4	(0)	.03	.15	1.7	0	
raw, medium fat	4 oz.	113.4	332	17.9	28.3	0.	0	10	2.7	(0)	.03	.17	1.9	0	
canned, lean		100	185	26.4	8.0	0.	0	21	4.5	(0)	.02	.25	3.5	0	
canned, lean	3 oz.	85	159	22.5	7.0	0.	0	18	3.8	(0)	.01	.21	3.0	0	
canned, medium fat		100	216	25.3	12.0	0.	0	20	4.3	(0)	.02	.24	3.4	0	
canned, medium fat	3 oz.	85	182	21.5	10.0	0.	0	17	3.7	(0)	.01	.20	2.9	0	
canned, fat		100	263	23.5	18.0	0.	0	19	4.0	(0)	.01	.22	3.2	0	
canned, fat	3 oz.	85	221	20.0	15.0	0.	0	16	3.4	(0)	.01	.19	2.7	0	
Beef, dried		100	203	34.3	6.3	0.	0	20	5.1	(0)	(.07)	(.32)	(3.8)	0	
	1 cup	165	336	56.6	10.4	0.	0	33	8.4	(0)	(.12)	(.53)	(6.3)	0	
	2 oz.	56.7	115	19.4	3.6	0.	0	11	2.9	(0)	(.04)	(.18)	(2.2)	0	
Muscle Meats—Lamb															
Lamb, medium fat, raw:															
rib chop		100	356	14.9	32.4	0.	0	9	2.2	(0)	.13	.18	4.3	0	132 with bone
	4 oz	113.4	404	16.9	36.7	0.	0	10	2.5	(0)	.15	.20	4.9	0	150 with bone

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shoulder roast, 3 rib		100	295	15.6	25.3	0.	0	9	2.3	(0)	.14	.19	4.5	0	125 with bone
	4 oz.	113.4	334	17.7	28.7	0.	0	10	2.6	(0)	.16	.21	5.6	0	142 with bone
leg roast		100	235	18.0	17.5	0.	0	10	2.7	(0)	.16	.22	5.2	0	121 with bone
	4 oz.	113.4	266	20.4	19.8	0.	0	11	3.1	(0)	.18	.25	5.9	0	137 with bone
Lamb, canned, strained		100	107	15.6	4.5	0.	0	16	2.3	(0)	.03	.26	4.0	0	
(infant food)	1 oz.	28.4	30	4.4	1.3	0.	0	5	.7	(0)	.01	.07	1.1	0	
Muscle Meats—Pork															
Bacon, medium fat:															
raw		100	630	9.1	65.0	1.1	0	13	.8	(0)	.38	.12	1.9	0	
	4 oz.—4 to 5 strips	113.4	714	10.3	73.6	1.2	0	15	.9	(0)	.43	.14	2.2	0	
canned		100	692	8.7	72.4	.6	0	15	1.4	(0)	.24	.10	1.5	0	
	4 oz.	113.4	784	9.9	82.0	.7	0	17	1.6	(0)	.27	.11	1.7	0	
Bacon, Canadian:															
raw		100	231	22.1	15.0	(.3)	0	13	3.3	(0)	.91	.25	5.2	0	
	4 oz.	113.4	262	25.1	17.0	(.3)	0	14	3.7	(0)	1.04	.28	5.9	0	
Pork, fresh, medium fat, raw															
ham		100	344	15.2	31.0	0.	0	9	2.3	(0)	.74	.18	4.0	0	116 with bone
	4 oz.	113.4	390	17.2	35.2	0.	0	10	2.6	(0)	.84	.20	4.5	0	132 with bone
loin or chop		100	296	16.4	25.0	0.	0	10	2.5	(0)	.80	.19	4.3	0	123 with bone
	4 oz.	113.4	336	18.6	28.4	0.	0	11	2.8	(0)	.91	.22	4.9	0	140 with bone
miscellaneous lean cuts		100	357	14.5	32.7	0.	0	8	2.2	(0)	.70	.17	3.8	0	121 with bone
	4 oz.	113.4	405	16.4	37.0	0.	0	9	2.5	(0)	.79	.19	4.3	0	137 with bone
Pork, cured:															
ham, medium fat, smoked,		100	389	16.9	35.0	(.3)	0	10	2.5	(0)	.70	.19	4.0	0	115 with bone
raw	4 oz.	113.4	440	19.2	39.7	(.3)	0	11	2.8	(0)	.79	.22	4.5	0	131 with bone
ham, boiled (luncheon meat)		100	302	22.8	22.7	0.	0	9	2.7	(0)	1.01	.26	5.1	0	
	4 oz.	113.4	342	25.8	25.7	0.	0	10	3.0	(0)	1.05	.29	5.8	0	
ham, spiced, canned		100	289	14.9	24.3	1.5	.2	9	2.2	(0)	.32	.22	2.8	0	
	4 oz.	113.4	328	16.9	27.6	1.7	.2	10	2.5	(0)	.36	.25	3.2	0	
Pork, salt, fat, raw		100	783	3.9	85.0	0.	(0)	tr	.6	(0)	(.18)	(.04)	(.9)	0	104 untrimmed
	1 oz.	28.4	222	1.1	24.1	0.	(0)	tr	.2	(0)	(.05)	(.01)	(.3)	0	30 untrimmed
Pork, canned, strained		100	127	17.1	6.0	0.	0	14	1.7	(0)	.35	.28	4.7	0	
(infant food)	1 oz.	28.4	36	4.8	1.7	0.	0	4	.5	(0)	.10	.08	1.3	0	

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Muscle Meats—Veal															
Veal, medium fat, raw															
cutlet, boned		100	164	19.5	9.0	0.	0	11	2.9	(0)	.14	.26	6.5	0	
	4 oz.	113.4	186	22.1	10.2	0.	0	12	3.3	(0)	.16	.30	7.4	0	
shoulder roast, boned		100	173	19.4	10.0	0.	0	11	2.9	(0)	.14	.26	6.5	0	125 with bone
	4 oz.	113.4	196	22.0	11.3	0.	0	12	3.3	(0)	.16	.30	7.4	0	142 with bone
stew meat, without bone		100	231	18.3	17.0	0.	0	11	2.7	(0)	.13	.24	6.1	0	
	4 oz.	113.4	262	20.8	19.3	0.	0	12	3.1	(0)	.15	.27	6.9	0	
canned, strained (infant food)		100	84	16.0	1.7	0.	0	14	1.6	(0)	.03	.30	5.5	0	
	1 oz.	28.4	24	4.5	.5	0.	0	4	.5	(0)	.01	.09	1.6	0	
Organ Meats															
Brains, all kinds		100	125	10.4	8.6	.8	0	16	3.6	0	.23	.26	4.4	18	
	3 oz.	85	106	8.8	7.3	.7	0	14	3.1	0	.20	.22	3.8	15	
Heart:															
beef, lean, raw		100	108	16.9	3.7	.7	0	9	4.6	30	.58	.89	7.8	6	
	3 oz.	85	92	14.4	3.1	.6	0	8	3.9	30	.50	.75	6.6	5	
calf, strained, canned (infant food)		100	81	13.4	2.5	.2	0	12	3.6	—	.06	.82	4.5	—	
	1 oz.	28.4	23	3.8	.7	.1	0	3	1.0	—	.02	.23	1.3	—	
chicken, raw		100	157	20.5	7.0	1.6	0	23	1.7	30	.12	.91	5.2	6	
	3 oz.	85	134	17.4	6.0	1.4	0	20	1.4	30	.10	.77	4.4	5	
pork, raw		100	117	16.9	4.8	.4	0	35	2.7	30	.43	1.24	6.0	6	
	3 oz.	85	100	14.4	4.1	.3	0	30	2.3	30	.36	1.05	5.1	5	
Kidney: beef, raw		100	141	15.0	8.1	.9	0	9	7.9	1150	.37	2.55	6.4	13	
	3 oz.	85	120	12.8	6.9	.8	0	8	6.7	980	.32	2.16	5.5	11	

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lamb, raw		100	105	16.6	3.3	1.0	0	13	9.2	(1150)	.51	2.42	7.4	13	
	3 oz.	85	89	14.1	2.8	.9	0	11	7.8	(980)	.44	2.06	6.3	11	
pork, raw		100	114	16.3	4.6	.8	0	11	8.0	130	.58	1.74	9.8	13	
	3 oz.	85	97	13.9	3.9	.7	0	9	6.8	110	.50	1.47	8.4	11	
Liver:															
beef, raw		100	136	19.7	3.2	6.0	0	7	6.6	43900	.26	3.33	13.7	31	
	3 oz.	85	116	16.8	2.7	5.1	0	6	5.6	37350	.22	2.83	11.7	26	
calf, raw		100	141	19.0	4.9	4.0	0	6	10.6	22500	.21	3.12	16.1	36	
	3 oz.	85	120	16.2	4.2	3.4	0	5	9.0	19130	.18	2.65	13.7	30	
chicken, raw		100	141	22.1	4.0	2.6	0	16	7.4	32200	.20	2.46	11.8	20	
	3 oz.	85	120	18.8	3.4	2.2	0	14	6.3	27370	.17	2.10	10.0	17	
lamb, raw		100	136	21.0	3.9	2.9	0	8	12.6	50500	.40	3.28	16.9	33	
	3 oz.	85	116	17.8	3.3	2.5	0	7	10.7	42930	.34	2.79	14.3	28	
pork, raw		100	134	19.7	4.8	1.7	0	10	18.0	14200	.40	2.98	16.7	23	
	3 oz.	85	114	16.7	4.1	1.4	0	8	15.3	12070	.34	2.53	14.2	19	
canned, strained (infant		100	108	16.0	3.9	1.0	0	24	7.1	19200	.04	2.14	6.4	—	
food)	1 oz.	28.4	30	4.5	1.1	.3	0	7	2.0	5440	.01	.61	1.8	—	
Tongue, beef, medium fat, raw		100	207	16.4	15.0	.4	(0)	9	2.8	(0)	.12	.29	5.0	(0)	105 untrimmed
	4 oz.	113.4	235	18.6	17.0	.5	(0)	10	3.2	(0)	.14	.33	5.7	(0)	120 untrimmed
Poultry															
Chicken muscle meat, raw:															
broiler		100	151	20.2	7.2	0.	0	14	1.5	(0)	.08	.16	10.2	(0)	182 dressed wt.
	½ bird (8 oz. bone out)	227	332	44.4	15.8	0.	0	31	3.3	(0)	.18	.36	22.4	(0)	413 dressed wt.
roaster		100	200	20.2	12.6	0.	0	14	1.5	(0)	.08	.16	8.0	(0)	164 dressed wt.
	4 oz. (bone out)	113.4	227	22.9	14.3	0.	0	16	1.7	(0)	.09	.18	9.1	(0)	186 dressed wt.
hen		100	302	18.0	25.0	0.	0	14	1.5	(0)	.08	.16	8.0	(0)	156 dressed wt.
	4 oz. (bone out)	113.4	342	20.4	28.3	0.	0	16	1.7	(0)	.09	.18	9.1	(0)	177 dressed wt.
fryer, breast		100	104	23.3	0.5	0.	0	14	1.1	(0)	.07	.09	10.5	(0)	132 dressed wt.
	1 (8 oz. bone out)	227	210	47.0	1.0	0.	0	28	2.2	(0)	.13	.18	21.1	(0)	299 dressed wt.
fryer, leg		100	112	20.5	2.7	0.	0	15	1.8	(0)	.10	.24	5.6	(0)	130 dressed wt.
	1 (5 oz. bone out)	142	159	29.1	3.8	0.	0	21	2.6	(0)	.14	.34	8.0	(0)	185 dressed wt.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Poultry															
Chicken muscle meat, boned,		100	199	29.8	8.0	0.	0	14	1.8	(0)	.04	.16	6.4	(0)	
canned	3 oz.	85	169	25.3	6.8	0.	0	12	1.5	(0)	.03	.14	5.4	(0)	
Duck, muscle meat, raw		100	159	21.4	8.2	0.	0	15	2.0						176 drawn wt.
	4 oz.	113.4	180	24.3	9.3	0.	0	18	2.3						199 drawn wt.
Goose, muscle meat, raw		100	153	22.3	7.1	0.	0								204 drawn wt.
	4 oz.	113.4	174	25.3	8.1	0.	0								232 drawn wt.
Turkey, medium fat, raw		100	268	20.1	20.2	0.	0	23	3.8	tr	.09	.14	8.0	(0)	147 dressed wt.
	4 oz.	113.4	304	22.8	22.9	0.	0	26	4.3	tr	.10	.16	9.1	(0)	169 dressed wt.
Variety Meats															
Bologna		100	221	14.8	15.9	3.6	—	(9)	2.2	(0)	.18	.19	2.7	0	
	1 piece (1 x 1½" diam.)	211	467	31.2	33.5	7.6	—	(19)	4.6	(0)	.37	.40	5.7	0	
Chile con Carne* (without		100	200	10.3	14.8	5.8	.2	38	1.4	150	.02	.12	2.2	—	
beans) canned	⅓ cup	85	170	8.8	12.6	4.9	.2	32	1.2	130	.01	.10	1.9	—	
Frankfurter, raw		100	257	14.2	20.5	2.7	—	8	1.5	(0)	.18	.19	2.8	0	
	1 (10 to the pound)	45	117	6.4	9.3	1.2	—	4	.7	(0)	.08	.09	1.2	0	
Liverwurst		100	263	16.7	20.6	1.5	—	9	5.4	5750	.17	1.12	4.6	(0)	
	2 oz.	56.7	150	9.5	11.7	.9	—	5	3.1	3260	.10	.63	2.6	(0)	
Pork sausage, raw: link or bulk		100	450	10.8	44.8	0.	0	6	1.6	(0)	.43	.17	2.3	0	
	4 oz.	113.4	510	12.2	50.8	0.	0	7	1.8	(0)	.49	.19	2.6	0	

* Not less than 60% meat; not more than 8% cereals, seasonings.

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bulk, canned		100	299	15.4	25.9	0.	0	9	2.3	(0)	.20	.24	3.0	0	
	4 oz.	113.4	340	17.5	29.4	0.	0	10	2.6	(0)	.23	.27	3.4	0	
Vienna sausage, canned		100	215	15.8	16.4	0.	0	9	2.4	(0)	.10	.12	3.1	0	
	4 oz.	113.4	244	17.9	18.6	0.	0	10	2.7	(0)	.11	.14	3.5	0	
Fish and Shellfish															
Bluefish, raw		100	124	20.5	4.0	0.	0	23	.6	—	(.12)	(.09)	1.9	—	196 whole
	4 oz.	113.4	141	23.2	4.5	0.	0	26	.7	—	(.14)	(.10)	2.2	—	222 whole
Clams, long and round:															
raw		100	81	12.8	1.4	3.4	—	(96)	(7.0)	110	.10	.18	(1.6)	—	286 long clams 588 round clams
	4 oz.	113.4	92	14.5	1.6	3.9	—	(109)	(7.9)	120	.11	.20	(1.8)	—	325 long clams 667 round clams
canned: solids and liquids		100	51	7.9	1.0	2.1	—	87	6.3	(80)	(.05)	.10	1.1	—	
	3 oz.	85	44	6.7	.9	1.8	—	74	5.4	(70)	(.04)	.08	.9	—	
Codfish:															
fresh, raw		100	74	16.5	.4	0.	0	10	.4	0	.06	.09	2.2	2	110 with bone
	4 oz.	113.4	84	18.7	.5	0.	0	11	.5	0	.07	.10	2.5	2	125 with bone
dried		100	375	81.8	2.8	0.	0	(50)	3.6	0	.08	.45	10.9	(0)	
	1 oz.	28.4	106	23.2	.8	0.	0	(14)	1.0	0	.02	.13	3.1	(0)	
Crabs, hard-shell, Atlantic and Pacific:															
raw		100	86	16.1	1.6	.6	—	(39)	(.8)	—	.14	.06	2.7	—	208 in shell
	3 oz.	85	73	13.7	1.4	.5	—	(33)	(.7)	—	.12	.05	2.3	—	177 in shell
canned, meat only		100	104	16.9	2.9	1.3	—	45	.9	—	(.05)	(.06)	(2.5)	—	
	3 oz.	85	89	14.4	2.5	1.1	—	38	.8	—	(.04)	(.05)	(2.1)	—	
Croaker, raw		100	96	17.8	2.2	0.	0	—	—	—	.16	.06	(1.8)	—	294 whole
	4 oz.	113.4	109	20.2	2.5	0.	—	—	—	—	.18	.07	(2.0)	—	334 whole
Eels, raw		100	162	18.6	9.1	0.	0	18	.7	1800	.28	.37	1.4	—	312 dressed wt.
	4 oz.	113.4	183	21.1	10.3	0.	0	20	.8	2040	.31	.42	1.6	—	150 dressed wt.
Flounder, raw		100	68	14.9	.5	0.	0	61	.8	—	.06	.05	1.7	—	256 whole
	4 oz.	113.4	78	16.9	.6	0.	0	69	.9	—	.07	.06	1.9	—	291 whole

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fish and Shellfish															
Haddock, raw		100	79	18.2	.1	0.	0	23	.7	—	.05	.08	2.4	—	208 whole
	4 oz.	113.4	90	20.6	.1	0.	0	26	.8	—	.06	.09	2.7	—	236 whole
Halibut, raw		100	126	18.6	5.2	0.	0	13	.7	440	.07	.06	9.2	—	124 with bones, skin
	4 oz.	113.4	143	21.1	5.9	0.	0	15	.8	500	.08	.07	10.4	—	140 with bones, skin
Herring, Atlantic, raw		100	191	18.3	12.5	0.	0	—	1.1	110	.02	.15	3.4	—	196 whole
	4 oz.	113.4	217	20.8	14.2	0.	0	—	1.2	130	.02	.17	3.9	—	222 whole
Herring, Lake, raw		100	140	18.5	6.8	0.	0	12	.5	(100)	.09	.09	3.1	—	179 whole
	4 oz.	113.4	159	21.0	7.7	0.	0	14	.6	(110)	.10	.10	3.5	—	203 whole
Herring, Pacific, raw		100	94	16.6	2.6	0.	0	—	—	100	.02	.22	(2.2)	—	—
	4 oz.	113.4	106	18.8	2.9	0.	0	—	—	110	.03	.25	(2.5)	—	
Herring, smoked, kippered		100	211	22.2	12.9	0.	0	66	(1.4)	0	tr	.28	(2.9)	—	
	3 oz.	85	180	18.9	11.0	0.	0	56	(1.2)	0	tr	.24	(2.5)	—	
Lobster, raw		100	88	16.2	1.9	.5	0	61	.6	—	(.13)	.06	(1.9)	—	278 in shell
	3 oz.	85	75	13.8	1.6	.4	0	51	.5	—	(.11)	.05	(1.6)	—	236 in shell
Lobster, canned		100	92	18.4	1.3	.4	0	65	.8	—	(.03)	.07	(2.2)	—	
	3 oz.	85	78	15.6	1.1	.3	0	55	.7	—	(.03)	.06	(1.9)	—	
Mackerel, Atlantic:															
raw		100	188	18.7	12.0	0.	0	5	1.0	(450)	.15	.35	8.4	—	185 whole
	4 oz.	113.4	213	20.2	13.6	0.	0	6	1.1	(510)	.17	.40	9.5	—	210 whole
canned: solids and liquid[3]		100	182	19.3	11.1	0.	0	185	2.1	430	.06	.21	5.8	—	
	3 oz.	85	155	16.4	9.4	0.	0	157	1.8	370	.05	.18	4.9	—	

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Mackerel, Pacific:															
canned: solids and liquid		100	180	21.1	10.0	0.	0	260	2.2	30	.03	.33	8.8	—	
	3 oz.	85	153	17.9	8.5	0.	0	221	1.9	20	.02	.28	7.4	—	
Oysters, meat only, raw		100	84	9.8	2.1	5.6	—	94	5.6	320	.15	.20	1.2	—	
	1 cup (13–19 med., selects)	240	200	23.5	5.0	13.4	—	226	13.4	770	.35	.48	2.8	—	
Salmon, Chinook or King, raw		100	223	17.4	16.5	0.	0	—	(.9)	310	.10	.23	7.2	9	112 with bones,
	4 oz.	113.4	253	19.7	18.7	0.	0	—	(1.0)	350	.11	.26	8.2	10	128 with skin, bones
Salmon, canned, solids and liquid:		100	203	19.7	13.2	0.	0	154[1]	.9	230	.03	.14	7.3	(0)	
Chinook or King	3 oz.	85	173	16.8	11.2	0.	0	131[1]	.9	200	.02	.12	6.2	(0)	
Chum		100	139	21.5	5.2	0.	0	249[1]	.7	60	.02	.16	7.1	(0)	
	3 oz.	85	118	18.3	4.4	0.	0	212[1]	.6	50	.02	.13	6.0	(0)	
Coho or silver		100	166	21.1	8.4	0.	0	232[1]	.9	80	.03	.18	7.4	(0)	
	3 oz.	85	140	17.9	7.1	0.	0	197[1]	.8	70	.02	.15	6.3	(0)	
Pink or humpback		100	143	20.5	6.2	0.	0	187[1]	.8	70	.03	.18	8.0	(0)	
	3 oz.	85	122	17.4	5.3	0.	0	159[1]	.7	60	.03	.16	6.8	(0)	
Sockeye or red		100	173	20.2	9.6	0.	0	259[1]	1.2	230	.04	.16	7.3	(0)	
	3 oz.	85	147	12.2	8.2	0.	0	220[1]	1.0	200	.03	.14	6.2	(0)	
Sardines: Atlantic type, canned in oil															
solids and liquid		100	338	21.1	27.0	1.0	—	354	3.5	—	(.01)	(.14)	(3.9)	(0)	
	3 oz.	85	288	17.9	23.0	.9	—	301	3.0	—	(.01)	(.12)	(3.3)	(0)	
drained solids		100	214	25.7	11.0	1.2	—	386	2.7	220	.02	.17	4.8	(0)	
	3 oz.	85	182	21.9	9.4	1.0	—	328	2.3	190	.01	.15	4.1	(0)	
Sardines: Pacific type (Pilchards) canned															
natural pack, solids and liquid		100	200	17.7	13.5	.7	0	(381)	4.1	(30)	(.01)	(.30)	(7.4)	(0)	
	3 oz.	85	171	15.1	11.5	.6	0	(324)	(3.5)	(20)	(.01)	(.26)	(6.3)	(0)	
tomato sauce, solids and liquid		100	216	17.8	13.8	1.7	.2	381	4.1	30	.01	.27	5.3	(0)	
	3 oz.	85	184	15.1	12.6	1.4	.2	324	3.5	20	.01	.23	4.5	(0)	

[1] Bone included. Bone about 2 per cent of can contents.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Fish and Shellfish															
Scallops, raw		100	78	14.8	.1	3.4	0	26	1.8	0	(.04)	.10	1.4	—	
	4 oz.	113.4	89	16.8	.1	3.9	0	29	2.0	0	(.05)	.11	1.6	—	
Shad or American shad, raw		100	168	18.7	9.8	0.	0	—	.5	—	(.15)	(.24)	(8.4)	—	208 whole
	4 oz.	113.4	191	21.2	11.1	0.	0	—	.6	—	(.17)	(.27)	(9.6)	—	236 whole
Shrimp, canned:															
dry pack		100	127	26.8	1.4	—	—	115	3.1	60	.01	.03	2.2	(0)	
	3 oz.	85	108	22.8	1.2	—	—	98	2.6	50	.01	.03	1.9	(0)	
wet pack, solids and liquid		100	89	18.7	.9	.3	—	59	1.8	60	.01	.03	1.4	(0)	
	3 oz.	85	76	15.9	.8	.3	—	50	1.5	50	.01	.03	1.2	(0)	
wet pack, drained solids		100	127	26.8	1.4	—	—	115	3.1	60	.01	.03	2.2	(0)	
	3 oz.	85	108	22.8	1.2	—	—	98	2.6	50	.01	.03	1.9	(0)	
Swordfish, raw		100	118	19.2	4.0	0.	0	19	.9	1580	.05	.05	9.1	—	
	4 oz.	113.4	134	21.8	4.5	0.	0	22	1.0	1790	.06	.06	10.3	—	
Tuna fish, canned:															
solids and liquid		100	290	23.8	20.9	0.	0	7	1.2	(220)	(.04)	(.10)	(10.8)	(0)	
	3 oz.	85	247	20.2	17.8	0.	0	6	1.0	(180)	(.04)	(.08)	(9.1)	(0)	
drained solids		100	198	29.0	8.2	0.	0	(8)	1.4	80	.05	.12	12.8	(0)	
	3 oz.	85	169	24.7	7.0	0.	0	(7)	1.2	70	.04	.10	10.9	(0)	
Milk															
Milk:															
cow's, whole:															
raw and pasteurized		100	68	3.5	3.9	4.9	0	118	.1	(160)	.04	.17	.1	1	
raw and pasteurized	1 quart	976	666	34.2	38.1	47.8	0	1152	.7	(1150)	.35	1.68	1.1	13	
raw and pasteurized	1 cup	244	166	8.5	9.5	12.0	0	288	.2	(390)	.09	.42	.3	3	

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evaporated		100	138	7.0	7.9	9.9	0	243	.2	400	.05	.36	.2	1
evaporated	1 cup	252	346	17.6	19.9	24.9	0	612	.4	1010	.12	.91	.5	3
evaporated	1 tbsp.	16	22	1.1	1.2	1.6	0	38	tr.	63	tr.	.06	tr.	tr.
condensed		100	320	8.1	8.4	54.8	0	273	.2	(430)	.05	.39	.2	1
condensed	1 cup	306	981	24.8	25.7	167.7	0	835	.6	(1300)	.16	1.19	.6	3
condensed	1 tbsp.	19	61	1.5	1.6	10.5	0	52	tr.	(81)	.01	.07	tr.	tr.
dried		100	492	25.8	26.7	38.0	0	949	.6	1400	.30	1.46	.7	6
dried	1 cup	128	630	33.0	34.2	48.6	0	1215	.7	1790	.39	1.87	.8	8
dried	1 tbsp.	8	39	2.1	2.1	3.0	0	76	.0	110	.02	.12	.1	1
cow's, skimmed:														
fresh		100	36	3.5	.1	5.1	0	123	.1	tr.	.04	.18	.1	1
fresh	1 quart	984	350	34.4	1.0	50.2	0	1210	.7	(40)	.35	1.75	1.1	13
fresh	1 cup	246	87	8.6	.2	12.5	0	303	.2	(10)	.09	.44	.3	3
dried		100	362	35.6	1.0	52.0	0	1300	.6	(50)	.35	1.96	1.1	7
dried	1 cup	120	434	42.7	1.2	62.4	0	1560	.7	(50)	.42	2.35	1.4	9
dried	1 tbsp.	7.5	28	2.7	.1	3.9	0	98	.0	(tr.)	.03	.15	.1	1
cow's, malted, dried		100	407	14.6	8.5	70.7	.3	287	2.1	1020	.33	.54	—	(0)
cow's, malted, dried	1 oz.	28.4	115	4.1	2.4	20.0	.1	81	.6	290	.09	.15	—	(0)
buttermilk, cultured		100	36	3.5	.1	5.1	0	(118)	.1	tr.	.04	.18	.1	1
buttermilk, cultured	1 quart	976	348	34.2	1.0	49.8	0	(1152)	.7	40	.35	1.74	1.1	13
buttermilk, cultured	1 cup	244	86	8 .5	.2	12.4	0	(288)	.2	10	.09	.43	.3	3
chocolate beverage		100	74	3.2	2.2	10.6	(0)	109	.1	90	.03	.16	.1	1
chocolate beverage	1 quart	1000	740	32.0	22.0	106.0	(0)	1090	.7	910	.32	1.59	1.0	10
chocolate beverage	1 cup	250	185	8.0	5.5	26.5	(0)	272	.2	230	.08	.40	.2	2
goat's, fluid		100	67	3.3	4.0	4.6	0	129	.1	(160)	.04	.11	.3	1
goat's, fluid	1 quart	976	654	32.2	39.0	44.9	0	1259	1.0	(1550)	.39	1.04	2.8	10
goat's, fluid	1 cup	244	164	8.1	9.8	11.2	0	315	.2	390	.10	.26	.7	2
human		100	68	1.4	3.7	7.2	0	27	.2	211	.01	.04	.2	5

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Pro-tein	Fat	Carbo-hydrate	Fiber	Cal-cium	Iron	Vita-min A	Thia-mine	Ribo-flavin	Nia-cin	Ascor-bic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Milk Products															
Cheese:															
blue mold, domestic		100	368	21.5	30.5	2.0	0	315	(.5)	(1240)	.03	.61	.4	(0)	
blue mold, domestic	1 oz.	28.4	104	6.1	8.6	.6	0	89	(.1)	(350)	.01	.17	.1	(0)	
Camembert		100	299	17.5	24.7	1.8	0	105	.5	(1020)	.04	.75	1.1	(0)	
Camembert	1 oz.	28.4	85	5.0	7.0	.5	0	30	.1	(290)	.01	.21	.3	(0)	
Cheddar		100	398	25.0	32.2	2.1	0	725	1.0	1400	.02	.42	tr.	(0)	
Cheddar	1 cup, grated	112	446	28.0	36.1	2.4	0	812	1.1	1570	.03	.47	tr.	(0)	
Cheddar	1 oz. (1 inch cube)	28.4	113	7.1	9.1	.6	0	206	.3	400	.01	.12	tr.	(0)	
Cheddar, processed		100	370	23.2	29.9	2.0	0	673	.9	(1300)	.02	.41	tr.	(0)	
Cheddar, processed	1 oz.	28.4	105	6.6	8.5	.6	0	191	.3	(370)	tr.	.12	tr.	(0)	
Cottage, from skim milk		100	95	19.5	.5	2.0	0	96	.3	(20)	.02	.31	(.1)	(0)	
Cottage, from skim milk	1 cup	225	215	43.9	1.1	4.5	0	216	.7	(50)	.04	.69	(.2)	(0)	
Cottage, from skim milk	1 oz.	28.4	27	5.5	.1	.6	0	27	.1	(10)	.01	.09	tr.	(0)	
Cream		100	371	9.0	37.0	2.0	0	68	.2	(1450)	(.01)	.22	.1	(0)	
Cream	1 oz.	28.4	106	2.6	10.5	.6	0	19	.1	(110)	(tr.)	.06	tr.	(0)	
Cream	1 tbsp.	15	56	1.4	5.6	.3	0	10	.0	(220)	(tr.)	.03	tr.	(0)	
Limburger		100	345	21.2	28.0	2.2	0	590	.6	1280	.08	.50	.2	(0)	
Limburger	1 oz.	28.4	97	6.0	7.9	.6	0	167	.2	360	.02	.14	tr.	(0)	
Parmesan		100	393	36.0	26.0	2.9	0	1160	.4	(1060)	.02	.73	.2	(0)	
Parmesan	1 oz.	28.4	112	10.2	7.4	.8	0	329	.1	(300)	.01	.21	.1	(0)	
Swiss		100	370	27.5	28.0	1.7	0	925	.9	(1450)	.01	(.40)	(.1)	(0)	
Swiss	1 oz.	28.4	105	7.8	7.9	.5	0	262	.3	(410)	tr.	(.11)	(tr.)	(0)	
Swiss, processed		100	355	26.4	26.9	1.6	0	887	.9	1390	.01	.40	.1	(0)	
Swiss, processed	1 oz.	28.4	101	7.5	7.6	.5	0	251	.3	390	tr.	.11	tr.	(0)	

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Cream:														
heavy, whipping		100	330	2.3	35.0	3.2	0	78	.0	1440	.02	.11	.1	1
heavy, whipping	½ pt. (approx. 1 pt. whipped)	236	779	5.4	86.2	7.6	0	184	.1	3390	.06	.26	.1	1
heavy, whipping	1 tbsp.	15	49	.3	5.2	.5	0	12	.0	220	tr.	.02	tr.	tr.
light, table or coffee		100	204	2.9	20.0	4.0	0	97	.1	830	.03	.14	.1	1
light, table or coffee	½ pt.	240	489	7.0	48.0	9.6	0	233	.1	1980	.07	.34	.2	3
light, table or coffee	1 tbsp.	15	30	.4	3.0	.6	0	15	.0	120	tr.	.02	tr.	tr.
Ice cream, plain		100	270	4.0	12.5	20.6	0	123	.1	520	.04	.19	.1	1
Ice cream, plain	8 fl. oz.	142	294	5.7	17.8	29.3	0	175	.1	740	.06	.27	.1	1
Legumes, dry														
Beans, Peas and Peanuts														
Beans, common or kidney:														
Navy, pea bean		100	338	21.4	1.6	61.6	4.0	163	6.9	0	.67	.23	2.2	2
Navy, pea bean	1 cup (raw)	190	642	40.7	3.0	117.0	7.6	310	13.1	0	1.28	.44	4.1	3
Pinto		100	349	23.0	1.2	63.7	3.9	163	6.9	0	.65	.24	2.0	2
Red Kidney		100	336	23.1	1.7	59.4	3.5	163	6.9	0	.57	.22	2.5	2
Red Kidney	⅙ cup (½ cup when cooked)	34	114	7.9	.6	21.0	1.2	55	2.3		.19	.07	.9	1
Beans, Lima		100	333	20.7	1.3	61.6	4.3	68	7.5	0	.48	.18	2.0	2
Beans, Lima	⅛ cup, scant (½ cup when cooked)	23	76	4.7	.3	14.1	1.0	16	1.7	0	.11	.04	.5	tr.
Chickpeas		100	359	20.8	4.7	60.9	5.3	92	7.1	0	.55	.17	1.5	(2)
Chickpeas	1 cup	210	755	43.7	9.9	127.9	11.1	193	14.9	tr.	1.16	.37	3.2	(4)
Cowpeas		100	342	22.9	1.4	61.6	4.2	77	6.5	30	.92	.16	2.2	2
Cowpeas	⅛ cup, scant (½ cup when cooked)	22	75	5.0	.3	13.6	.9	17	1.4	7	.20	.04	.5	tr.
Garbanzo, see Chickpeas														
Lentils:														
whole		100	337	25.0	1.0	59.5	3.7	59	7.4	570	.56	.24	2.2	5
split		100	339	24.0	1.2	60.4	1.7	34	7.4	570	.56	.24	2.2	5

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbo-hydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Legumes, dry															
Beans, Peas and Peanuts															
Peanuts, Virginia type:															
shelled, raw, with skins		100	561	31.1	49.2	10.2	2.2	64	2.6	tr.	.62	.11	21.0	0	
shelled, raw, with skins	1 oz.	28.4	159	8.8	14.0	2.9	.6	18	.7	tr.	.18	.03	6.0	0	
shelled, raw, without skins		100	562	31.3	49.1	10.5	1.6	46	1.8	tr.	.68	.10	20.9	0	
shelled, raw, without skins	1 oz.	28.4	160	8.9	14.0	3.0	.5	13	.5	tr.	.19	.03	5.9	0	
shelled, roasted		100	559	26.9	44.2	23.6	2.4	74	1.9	0	.30	.13	16.2	0	
shelled, roasted	1 oz.	28.4	159	7.6	12.6	6.7	.7	21	.5	0	.09	.04	4.6	0	
Peanut Butter		100	576	26.1	47.8	21.0	2.0	74	1.9	0	.12	.13	16.2	0	
Peanut Butter	1 cup	258	1486	67.3	123.3	54.2	5.2	191	4.9	0	.31	.34	41.8	(0)	
Peanut Butter	1 tbsp.	16	92	4.2	7.6	3.4	.3	12	.3	0	.02	.02	2.6	(0)	
Peas:															
whole	½ cup	100	339	23.8	1.4	60.2	5.4	57	4.7	370	.77	.28	3.1	2	
split	½ cup	100	344	24.5	1.0	61.7	1.2	33	5.1	370	.77	.28	3.1	2	
Soybeans, whole		100	331	34.9	18.1	34.8[1]	5.0	227	8.0	110	1.07	.31	2.3	tr.	
Soybeans, whole	1 cup	210	695	73.3	38.0	73.1[1]	10.5	477	16.8	230	2.25	.65	4.9	tr.	
Soybean flour:															
low fat	1 cup, stirred	100	228	44.7	1.1	37.7[1]	2.3	265	13.0	70	1.10	.35	2.9	(0)	
medium fat		100	264	42.5	6.5	37.2[1]	2.6	244	13.0	110	.82	.34	2.6	(0)	
medium fat	1 cup, stirred	88	232	37.4	5.7	32.7[1]	2.3	215	11.4	100	.72	.30	2.3	(0)	
full fat		100	347	35.9	20.6	29.9[1]	2.3	195	12.1	140	.77	.28	2.2	(0)	
full fat	1 cup, stirred	72	250	25.8	14.8	21.5[1]	1.7	140	8.7	100	.56	.20	1.6	(0)	

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Nuts														
Almonds, unblanched		100	597	18.6	54.1	19.6	2.7	254	4.4	0	.25	.67	4.6	tr.	196 in shell
Almonds, unblanched	1 cup, shelled	142	848	26.4	76.8	27.8	3.8	361	6.2	0	.35	.95	6.5	tr.	278 in shell
Brazil nuts		100	646	14.4	65.9	11.0	2.1	186	3.4	tr.	.86	—	—	—	200 in shell
Brazil nuts	1 cup, shelled; 32 kernels	140	905	20.2	92.3	15.4	2.9	260	4.8	tr.	1.21	—	—	—	280 in shell
Cashew nuts, roasted or cooked		100	578	18.5	48.2	27.0	1.3	46	5.0	—	.63	.19	2.1	—	
Cashew nuts, roasted or cooked	1 oz.	28.4	164	5.2	13.7	7.7	.4	13	1.4	—	.18	.05	.6	—	
Coconut meat	1 cup, shredded	100	359	3.4	34.7	14.0	3.2	21	2.0	0	.10	.01	.2	2	189 in shell with milk
Coconut meat	1 piece, 2" x 2" x ½"	45	161	1.5	15.6	6.3	1.4	9	.9	0	.04	tr.	.1	1	85 in shell with milk
Coconut meat, dried, shredded, sweetened		100	556	3.6	39.1	53.2	4.1	43	3.6	0	tr.	tr.	tr.	(0)	
Coconut meat, dried, shredded, sweetened	1 cup	62	344	2.2	24.2	33.0	2.5	27	2.2	0	tr.	tr.	tr.	(0)	
Coconut meat, dried, shredded, sweetened	4 oz. package	113	629	4.1	44.2	60.1	4.6	49	4.1	0	tr.	tr.	tr.	(0)	
Filberts		100	670	12.7	60.9	17.7		290	4.0	100	.40			0	211 in shell
Filberts	1 oz.	28.4	190	3.6	17.3	5.0		82	1.1	28	.11			0	60 in shell
Hickory nuts		100	714	15.4	67.4	11.4									264 in shell
Hickory nuts	1 oz.	28.4	202	4.4	19.1	3.2									75 in shell
Pecans	1 cup, scant, halves	100	696	9.4	73.0	13.0	2.2	74	2.4	50	.72	.11	.9	2	192 in shell
Pecans	1 tbsp., chopped	7.5	52	.7	5.5	1.0	.2	6	.2	tr.	.05	.01	.1	tr.	15 in shell
Walnuts, English	1 cup, halves	100	654	15.0	64.4	15.6	2.1	83	2.1	30	.48	.13	1.2	3	222 in shell
Walnuts, English	1 tbsp., chopped	8	49	1.1	4.8	1.2	.2	6	.2	tr.	.04	.01	.1	tr.	18 in shell
Walnuts, black	1 cup	100	672	18.3	58.2	18.7	1.9	(83)	(2.1)	70	.33	.11	1.2	0	

[1] About 60 per cent poorly utilized.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Sugars and Syrups															
Corn syrup		100	286	(0.)	(0.)	(74.0)	—	46	4.1	0	0	.01	.1	(0)	
	1 cup	328	936	(0.)	(0.)	242.7	—	151	13.4	0	0	.03	.3	(0)	
	1 tbsp.	20	57	(0.)	(0.)	14.8	—	9	.8	0	0	tr	tr	(0)	
Honey, strained or extracted		100	294	.3	0.	79.5	—	5	.9	(0)	tr	.04	.2	4	
	1 cup	338	992	1.0	0.	268.7	—	17	3.0	(0)	.02	.13	.7	12	
	1 tbsp.	21	62	.1	0.	16.7	—	1	.2	(0)	tr	.01	tr	1	
Jams, marmalades, preserves		100	278	.5	.3	70.8	.6	12	.3	10	.02	.02	.2	6	
	1 tbsp.	20	55	.1	.1	14.2	.1	2	.1	tr	tr	tr	tr	1	
Jellies		100	252	.2	.0	65.0	0	(12)	(.3)	(10)	(.02)	(.02)	(.2)	4	
	1 tbsp.	20	50	.0	.0	13.0	0	(2)	(.1)	(tr)	(tr)	(tr)	(tr)	1	
Molasses, cane, medium		100	232	—	—	60.0	—	290	6.0	—	—	—	—	—	
	1 cup	328	762	—	—	196.8	—	951	19.7	—	—	—	—	—	
	1 tbsp.	20	46	—	—	12.0	—	58	1.2	—	—	—	—	—	
Sugar:															
white, granulated		100	385	(0.)	(0.)	99.5	(0)	—	—	(0)	(0)	(0)	(0)	(0)	
	1 cup	200	770	(0.)	(0.)	199.0	(0)	—	—	(0)	(0)	(0)	(0)	(0)	
	1 tbsp.	12	48	(0.)	(0.)	12.4	(0)	—	—	(0)	(0)	(0)	(0)	(0)	
	1 tsp.	4	16	(0.)	(0.)	4.2	(0)	—	—	(0)	(0)	(0)	(0)	(0)	
	1 lump, 1⅛ x ⅝ x ⅛	7	27	(0.)	(0.)	7.0	(0)	—	—	(0)	(0)	(0)	(0)	(0)	
brown		100	370	(0.)	(0.)	95.5	—	76[1]	2.6	(0)	(0)	(0)	(0)	(0)	
	1 cup, firmly packed	220	813	(0.)	(0.)	210.1	—	167[1]	5.7	(0)	(0)	(0)	(0)	(0)	
	1 tbsp.	14	51	(0.)	(0.)	13.1	—	10[1]	.4	(0)	(0)	(0)	(0)	(0)	
maple		100	348	—	—	(90.0)	—	—	—	—	—	—	—	—	

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Sugar, dextrose, anhydrous		100	385	(0)	(0)	99.5	(0)	—	—	(0)	(0)	(0)	(0)	(0)	
	1 tbsp.	10	39	(0)	(0)	10.0	(0)			(0)	(0)	(0)	(0)	(0)	
Vegetables															
Asparagus:															
raw		100	21	2.2	.2	3.9	.7	21	.9	1000	.16	.19	1.4	33	133 untrimmed
raw	4 oz.:4 stalks (10″ x ⅜″)	86	18	1.9	.2	3.3	.6	18	.8	860	.14	.16	1.2	28	114 untrimmed
frozen		100	21	2.2	.2	3.9	.7	21	.9	850	.14	.15	1.2	21	
frozen	4 oz.	114	24	2.5	.2	4.4	.8	24	1.0	970	.16	.17	1.4	24	
canned, green:															
solids and liquid		100	18	1.9	.3	2.9	.5	18	1.7	600	.07	.10	.9	15	
solids and liquid	1 cup cut, with liquid	239	42	4.5	.7	6.9	1.2	43	4.1	1450	.16	.23	2.1	35	
solids and liquid	6 med. spears and 2 tbsp. liquid	126	22	2.4	.4	3.7	.6	23	2.1	760	.09	.12	1.1	19	
drained solids	6 med. spears	100	21	2.4	.4	3.4	.8	19	1.9	800	.06	.08	1.0	18	
drained solids	1 cup cut	175	38	4.2	.7	6.0	1.4	33	3.3	1400	.11	.14	1.7	31	
canned, bleached:															
solids and liquid		100	18	1.6	.3	3.3	.5	15	.9	50	.05	.07	.8	15	
solids and liquid	1 cup cut with liquid	239	43	3.8	.7	7.9	1.2	36	2.2	110	.13	.16	1.8	35	
solids and liquid	6 med. spears and 2 tbsp. liquid	126	23	2.0	.4	4.2	.6	19	1.1	60	.07	.08	.9	19	
drained solids	6 med. spears	100	22	2.1	.5	3.6	.8	16	1.0	80	.05	.08	(.9)	18	
drained solids	1 cup cut	175	39	3.7	.9	6.3	1.4	28	1.8	140	.09	.13	(1.5)	31	
Beans, Lima, immature seeds:															
raw		100	128	7.5	.8	23.5	1.5	63	2.3	280	.21	.11	1.4	32	250 in shell
raw	1 cup	162	208	9.5	1.0	38.0	2.4	102	3.7	460	.34	.19	2.2	51	405 in shell
frozen		100	109	6.4	.7	19.9	1.3	53	1.9	220	.10	.07	.8	17	
frozen	4 oz.	114	124	7.3	.8	22.6	1.5	60	2.2	250	.11	.08	.9	19	

[1] Dark brown; values would be lower for light brown.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Vegetables															
Beans, continued															
canned:															
solids and liquid		100	71	3.8	.3	13.5	1.3	27	1.7	130	.04	.04	.5	8	
solids and liquid	1 cup	249	177	9.5	.7	33.6	3.2	67	4.2	330	.09	.11	1.3	20	
drained solids		100	95	5.0	.4	18.3	2.0	29	1.7	180	.03	.05	.5	6	
drained solids	1 cup	160	152	8.0	.6	29.3	3.2	46	2.7	290	.04	.09	.8	9	
Beans:															
Navy, baked with pork and molasses, canned		100	125	5.8	3.0	19.2	.9	56	2.1	30	.05	.04	.5	2	
Navy, baked with pork and molasses, canned	1 cup	261	325	15.1	7.8	50.1	2.4	146	5.5	90	.13	.09	1.2	7	
Navy, baked with pork and tomato sauce, canned		100	113	5.8	2.1	18.4	1.0	41	1.8	80	.05	.04	.5	2	
Navy, baked with pork and tomato sauce, canned	1 cup	261	295	15.1	5.5	48.0	2.6	107	4.7	220	.13	.09	1.2	7	
Red Kidney, canned		100	90	5.7	.4	16.4	.9	40	1.9	(0)	.05	.05	.8	(0)	
Red Kidney, canned	1 cup, solids and liquid	256	230	14.6	1.0	42.0	2.3	102	4.9	(0)	.12	.12	2.0	(0)	
Beans, snap, green:															
raw	1 cup, 1" pieces	100	35	2.4	.2	7.7	1.4	65	1.1	630	.08	.11	.5	19	111 untrimmed
canned:															
solids and liquid		100	18	1.0	.1	4.2	.6	27	1.4	410	.03	.04	.3	4	
solids and liquid	1 cup	239	43	2.4	.2	10.0	1.4	65	3.3	990	.08	.10	.7	9	

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drained solids		100	22	1.4	.2	4.7	.5	36	1.7	500	.04	.05	.4	5	
drained solids	1 cup	125	27	1.8	.2	5.9	.6	45	2.1	620	.04	.07	.5	7	
canned, strained (infant food)		100	22	1.8	.1	4.6	1.1	33	.6	490	.03	.07	.3	5	
canned, strained (infant food)	1 oz.	28.4	6	.5	.0	1.3	.3	9	.2	140	.01	.02	.1	1	
Beans, snap, wax:															
raw	1 cup, 1" pieces	100	35	2.4	.2	7.7	1.4	65	1.1	150	.08	.11	.5	19	111 untrimmed
canned:															
solids and liquid		100	18	1.0	.1	4.2	.6	27	1.4	100	.03	.04	.3	4	
solids and liquid	1 cup	239	43	2.4	.2	10.0	1.4	65	3.3	230	.08	.10	.7	9	
drained solids		100	22	1.4	.2	4.7	.5	36	1.7	120	.04	.05	.4	5	
drained solids	1 cup	125	27	1.8	.2	5.9	.6	45	2.1	150	.04	.07	.5	7	
Beets, common red:															
raw peeled		100	42	1.6	.1	9.6	.9	27	1.0	20	.02	.05	.4	10	133 without tops
raw peeled	1 cup, diced	134	56	2.1	.1	12.9	1.3	36	1.3	30	.03	.06	.6	13	179 without tops
canned:															
solids and liquid		100	34	.9	.1	7.9	.5	15	.6	20	.01	.02	.1	5	
solids and liquid	1 cup	246	82	2.2	.2	19.4	1.2	37	1.5	40	.02	.06	.3	12	
drained solids		100	41	1.0	.1	9.8	.8	21	.7	20	.01	.03	.1	5	
drained solids	1 cup, diced	165	68	1.6	.2	16.2	1.3	35	1.2	30	.02	.05	.2	8	
canned, strained (infant food)		100	34	1.4	.1	7.7	.6	18	.8	10	.01	.03	.2	6	
canned, strained (infant food)	1 oz.	28.4	10	.4	.0	2.2	.2	5	.2	tr	tr	.01	tr	2	
Beet tops, raw	(approx. ½ c. steamed)	100	27	2.0	.3	5.6	1.4	118[1]	3.2	6700	.08	.18	.4	34	133 untrimmed
Broccoli, flower stalks:															
raw		100	29	3.3	.2	5.5	1.3	130	1.3	3500	.10	.21	1.1	118	164 untrimmed
raw	1 stalk (5½" x 1½" diam.)	90	26	3.0	.2	5.0	1.2	117	1.2	3150	.09	.19	1.0	106	148 untrimmed

[1] Calcium may not be available due to presence of oxalic acid.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Vegetables															
Broccoli, continued															
frozen	4 oz.	100	23	2.5	.2	4.3	1.0	100	1.0	2330	.07	.12	.9	75	
		114	26	2.9	.2	4.9	1.1	114	1.1	2650	.08	.14	1.0	85	
Brussels sprouts:															
raw		100	47	4.4	.5	8.9	1.3	34	1.3	400	.08	.16	.7	94	130 untrimmed
raw	4 oz.	88	41	3.9	.4	7.9	1.1	30	1.2	350	.07	.15	.6	82	114 untrimmed
frozen		100	47	4.4	.5	8.9	1.3	34	1.3	340	.05	.14	.6	63	
frozen	4 oz.	114	53	5.0	.6	10.2	1.5	39	1.5	390	.06	.16	.7	72	
Cabbage, raw	1 cup finely shredded or 1 wedge (3½" x 4½")	100	24	1.4	.2	5.3	1.0	46	.5	80	.06	.05	.3	50	137 untrimmed
Cabbage, Chinese; raw	1 cup, leaves and stem, 1" pieces	100	14	1.2	.3	2.4	.5	43	.9	260	.03	.04	.4	31	139 untrimmed
Carrots:															
raw	2 (5½" x 1") or 50 thin strips	100	42	1.2	.3	9.3	1.1	39	.8	12000	.06	.06	.5	6	114
raw	1 cup grated	110	45	1.3	.3	10.2	1.2	43	.9	13200	.06	.06	.7	7	125
canned:															
solids and liquid		100	28	.5	.4	6.1	.6	22	.6	12000	.02	.02	.3	2	
solids and liquid	1 cup diced	246	69	1.2	1.0	15.0	1.5	54	1.5	29520	.06	.05	.8	6	
drained solids		100	30	.6	.5	6.4	.8	26	.6	17570	.02	.02	.3	3	
drained solids	1 cup diced	145	44	.9	.7	9.3	1.2	38	.9	25470	.03	.03	.4	4	
strained (infant food)		100	26	1.1	.1	5.9	.9	25	.6	8940	.02	.03	.5	4	
strained (infant food)	1 oz.	28.4	7	.3	.0	1.7	.3	7	.2	2530	.01	.01	.1	1	

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Cauliflower:															
raw	1 cup flower buds	100	25	2.4	.2	4.9	.9	22	1.1	90	.11	.10	.6	69	222
frozen		100	25	2.4	.2	4.9	.9	22	1.1	80	.09	.08	.5	51	
frozen	4 oz.	114	28.3	2.7	.2	5.6	1.0	25	1.3	90	.10	.09	.6	58	
Celery, bleached, raw	1 cup diced	100	18	1.3	.2	3.7	.7	50	.5	0	.05	.04	.4	7	159
Celery, bleached, raw	3 sm. inner stalks (5" x ¾")	50	9	.6	.1	1.8	.4	25	.2	0	.03	.02	.2	4	79
Celery, bleached, raw	1 large outer stalk (8" x 1")	40	7	.5	.1	1.5	.2	20	.2	0	.02	.02	.2	3	64
Chard:															
leaves and stalks, raw		100	21	1.4	.2	4.4	.9	105[1]	2.5	2800	.06	.07	.4	38	116
leaves only, raw		100	27	2.6	.4	4.8	.8	105[1]	2.5	8720	.06	.18	.4	38	
Collards, raw		100	40	3.9	.6	7.2	1.2	249	1.6	6870	.11	.27	(2.0)	100	222
Corn, sweet, white or yellow:															
raw		100	92	3.7	1.2	20.5	.8	9	.5	390[2]	.15	.12	1.7	12	263 with husks 141 without husks
frozen		100	77	3.2	.9	17.3	.7	8	.4	110[2]	.12	.10	1.4	8	
frozen	3 oz., kernels	85	65	2.7	.8	14.7	.6	7	.3	90[2]	.10	.09	1.2	7	
canned:															
solids and liquid		100	67	2.0	.5	16.1	.8	4	.5	200[2]	.03	.05	.9	5	
solids and liquid	1 cup	256	170	5.1	1.3	41.2	2.0	10	1.3	520[2]	.07	.13	2.4	14	
drained solids		100	85	2.7	.7	20.2	1.1	5	.6	230[2]	.03	.06	.9	5	
drained solids	1 cup	165	140	4.5	1.2	33.3	1.8	8	1.0	380[2]	.06	.10	1.5	9	
Cowpeas, immature seeds, raw		100	130	9.4	.6	22.7	—	37	2.5	360	.39	.09	.9	31	
Cowpeas, immature seeds, raw	1 cup	132	172	12.4	.8	29.6	—	48	3.3	470	.51	.12	1.2	40	
Cowpeas, immature pods with beans, raw	1 cup, 1" pieces	100	44	3.4	.3	9.2	1.8	53	1.1	1670	.16	.10	1.1	34	110 untrimmed
Cress, garden, raw		100	41	4.2	1.4	5.3	1.2	211	(2.9)	2970	.11	.17	1.0	87	159
Cress, garden, raw	1 cup	180	74	7.6	2.5	9.5	2.2	380	(5.2)	5350	.20	.31	1.8	157	285 untrimmed

[1] Calcium may not be available due to presence of oxalic acid.
[2] Yellow, white contain trace.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Vegetables															
Cucumbers		100	12	.7	.1	2.7	.5	10	.3[1] 1.2[2]	0[1] 260[2]	.03	.04	.2	8	143 unpeeled
Cucumbers	1 (7½" x 2" diam.) peeled	203	25	1.4	.2	5.5	1.0	20	.6[1]	0[1]	.07	.09	.4	17	290
Cucumbers	6 slices (⅛" thick- center section.	50	6	.4	.0	1.4	.3	5	.2[1] .6[2]	0[1] 130[2]	.02	.02	.1	4	
Dandelion greens, raw		100	44	2.7	.7	8.8	1.8	187	3.1	13650	.19	.14	(.8)	36	
Dandelion greens, raw	4 oz.	114	50	3.1	.8	10.0	2.1	212	3.5	15500	.21	.16	(1.0)	41	
Eggplant raw		100	24	1.1	.2	5.5	.9	15	.4	30	.04	.05	.6	5	115 untrimmed; unpeeled
	3 slices (4" diam. x ½")	179	43	2.0	.4	9.8	1.6	27	.7	50	.07	.09	1.0	9	206 untrimmed; unpeeled
Endive, raw		100	20	1.6	.2	4.0	.8	79	1.7	3000	.07	.12	.4	11	192 untrimmed
Escarole, raw (See Endive)															
Kale:															
raw		100	40	3.9	.6	7.2	1.2	225	2.2	7540	.10	.26	2.0	115	156 untrimmed
frozen		100	40	3.9	.6	7.2	1.2	225	2.2	7000	.08	.22	1.7	47	
Kohlrabi raw		100	30	2.1	.1	6.7	1.1	46	.6	tr	.06	.05	.2	61	185 untrimmed unpeeled
	1 cup diced	138	41	2.9	.1	9.2	1.5	63	.8	tr	.08	.07	.3	84	256 untrimmed unpeeled
Lettuce:															
headed, raw	¼ small head; 6 lg. leaves	100	15	1.2	.2	2.9	.6	22	.5	540	.04	.08	.2	8	145 untrimmed

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all other, raw		100	15	1.2	.2	2.9	.6	62	1.1	1620	.04	.08	.2	18	145 untrimmed
Mung bean sprouts		100	23	2.9	.2	4.1	.7	29	.8	10	.07	.09	.5	15	
	1 cup	90	21	2.6	.2	3.7	.6	16	.7	10	.06	.08	.5	14	
Mushrooms,	4 (2½" diam.)–10 (1½" diam.)	100	16	2.4	.3	4.0	.9	9	1.0	0	.10	.44	4.9	5	110 unpeeled
raw	1 cup	150	24	3.6	.5	6.0	1.4	14	1.5	0	.15	.66	7.4	8	165 unpeeled
canned: solids and liquid		100	11	1.4	.2	3.7	—	(7)	(.8)	0	.02	.25	2.0	—	
	1 cup	244	28	3.4	.5	9.0	—	(17)	(2.0)	0	.04	.60	4.8	—	
Mustard greens, raw		100	22	2.3	.3	4.0	.8	220	2.9	6460	.09	.20	.8	102	137 untrimmed
Okra, raw	10 to 12 pods	100	32	1.8	.2	7.4	1.0	82	.7	740	.08	.07	1.1	30	114 untrimmed
Onions, mature:															
raw	1 (2½" diam.)	100	45	1.4	.2	10.3	.8	32	.5	50	.03	.04	.2	9	106 unpeeled
raw	1 tbsp., chopped	10	4	.1	.0	1.0	.1	3	.0	tr.	tr.	tr.	tr.	1	
dehydrated, flaked		100	347	10.8	1.1	80.2	4.5	168	3.4	130	.25	.18	1.4	36	
dehydrated, flaked	1 tsp.	5	17	.5	.1	4.0	.2	8	.2	10	.01	.01	.1	2	
Onions, young, green; raw		100	45	1.0	.2	10.6	1.8	135	.9	(50)	(.03)	(.04)	(.2)	24	244 with tops
Onions, young, green; raw	6 small	50	23	.5	.1	5.3	.9	68	.4	(30)	(.02)	(.02)	(.1)	12	57 without tops
Parsley, raw		100	50	3.7	1.0	9.0	1.8	193[3]	4.3	8230	.11	.28	1.4	193	
Parsley, raw	1 tbsp., chopped	3.5	1	.1	.0	.3	.1	7[3]	.2	290	tr.	.01	.1	7	
Parsnips, raw		100	78	1.5	.5	18.2	2.2	57	.7	0	.08	.12	.2	18	128 unpeeled
Parsnips, raw	1, 7" long	121	94	1.8	.6	22.0	2.7	69	.8	0	.10	.15	.2	22	154 unpeeled
Peas, green, immature:															
raw		100	98	6.7	.4	17.7	2.2	22	1.9	680	.34	.16	2.7	26	222 in shell
raw	1 cup	132	129	8.8	.5	23.4	2.9	29	2.5	900	.45	.21	3.6	34	293 in shell
frozen		100	75	5.7	.3	12.9	1.9	17	1.5	670	.33	.11	1.9	18	
canned:															
solids and liquid		100	68	3.4	.4	12.9	1.4	25	1.8	540	.11	.06	1.0	8	
solids and liquid	1 cup	249	168	8.5	1.0	32.1	3.5	62	4.5	1350	.28	.15	2.6	21	

[1] Peeled.

[2] Unpeeled.

[3] Calcium may not be available due to presence of oxalic acid.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Vegetables															
Peas, canned, continued															
drained solids		100	91	4.5	.6	17.2	2.3	32	2.1	670	.12	.06	1.0	9	
drained solids	1 cup	160	145	7.2	1.0	27.5	3.7	51	3.4	1070	.19	1.0	1.6	15	
strained (infant food)		100	49	4.1	.3	7.9	1.0	16	1.4	630	.09	.08	1.1	8	
strained (infant food)	1 oz.	28.4	14	1.2	.1	2.2	.3	5	.4	180	.03	.02	.3	2	
Peppers, sweet, green		100	25	1.2	.2	5.7	1.4	11	.4	630	.04	.07	.4	120	119 untrimmed
Peppers, sweet, green	1 med.	64	16	.8	.1	3.6	.9	7	.3	400	.02	.04	.2	77	76 untrimmed
Pimientos, canned		100	27	.9	.5	5.8	.6	7	1.5	2300	.02	.06	.4	95	
Pimientos, canned	1 med.	38	10	.3	.2	2.2	.2	3	.6	870	.01	.02	.1	36	
Plantain (baking banana), raw	½ plantain, 10″ long	100	119	1.1	.4	31.2	.4	7	.7	10 to 1200[1]	.06	.04	.6	14	130 unpeeled
Potatoes, white:															
raw		100	83	2.0	.1	19.1	.4	11	.7	20	.11	.04	1.2	17[3]	119 unpeeled
raw	one (2½″ diam.)	126	105	2.5	.1	24.1	.5	14	.9	30	.14	.05	1.5	21[3]	150 unpeeled
canned:															
solids and liquid		100	58	1.7	.0	13.1	.3	8	.5	10	.06	.03	.8	9	
solids and liquid	1 cup	250	144	4.2	.0	32.8	.8	20	1.2	30	.14	.07	2.1	22	
drained solids		100	83	2.0	.1	19.1	.4	11	.7	20	.08	.03	.9	13	
	3–4 very small potatoes	142	118	2.8	.1	27.1	.6	16	1.0	30	.11	.05	1.3	18	
dehydrated		100	357	7.1	.7	82.2	2.2	25	4.0	40	.30	.11	4.5	23	
Potato chips		100	544	6.7	37.1	49.1	(1.1)	(30)	(1.9)	(50)	(.18)	(.11)	(3.2)	11	

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Pumpkin:															
raw	½ cup, cubed	100	31	1.2	.2	7.3	1.3	21	.8	(3400)	(.05)	(.08)	(.6)	8	145 untrimmed
canned		100	33	1.0	.3	7.9	1.2	(20)	(.7)	3400	.02	.06	.5	—	
	1 cup	228	76	2.3	.7	18.0	2.7	(46)	(1.6)	7750	.04	.14	1.2	—	
Radishes, raw		100	20	1.2	.1	4.2	.7	37	1.0	30	.03	.02	.3	24	204 with tops
	4 small	20	4	.2	.0	.8	.1	7	.2	10	.01	tr	.1	5	40 with tops
Rutabagas, raw		100	38	1.1	.1	8.9	.8	55	.4	330	.07	.08	.9	36	118 unpeeled
	1 cup, ½" cubes	146	55	1.6	.2	10.3	1.2	80	.6	480	.10	.12	1.3	53	172 unpeeled
Sauerkraut, canned:															
solids and liquid		100	16	1.1	.2	3.4	.7	36	(.5)	30	.03	.06	.1	16	
solids and liquid	1 cup	235	39	2.6	.5	8.0	1.6	85	(1.2)	80	.08	.15	.3	38	
drained solids		100	22	1.4	.3	4.4	.9	36	(.5)	40	.03	.06	.1	16	
	1 cup	150	32	2.1	.4	6.6	1.3	54	(.8)	60	.05	.10	.2	24	
Soybean sprouts, raw		100	46	6.2	1.4	5.3	.8	48	1.0	180	.23	.20	.8	13	
	1 cup	107	49	6.6	1.5	5.7	.9	51	1.1	190	.24	.21	.9	14	
Spinach:															
raw		100	20	2.3	.3	3.2	.6	81[3]	3.0	9420	.11	.20	.6	59	122 untrimmed
	1 cup	31	6	.7	.1	1.0	.2	25[3]	.9	2920	.03	.06	.2	18	38 untrimmed
canned:															
solids and liquid		100	20	2.3	.4	3.0	.7	90[3]	1.6	2790	.02	.10	.3	14	
	1 cup	232	45	5.3	.9	7.0	1.6	209[3]	3.7	15750	.04	.23	.8	34	
drained solids		100	26	3.1	.6	3.6	1.0	124[3]	2.0	7630	.02	.12	.4	14	
	1 cup	180	46	5.6	1.1	6.5	1.8	223[3]	3.6	13740	.04	.21	.7	26	
canned, strained (infant food)		100	17	1.9	.4	2.6	.6	77[3]	1.4	4200	.02	.11	.3	7	
	1 oz.	28.4	4	.5	.1	.7	.2	22[3]	.4	1190	.01	.03	.1	2	
frozen		100	20	2.3	.3	3.2	.6	81[3]	3.0	6820	.07	.17	.5	38	
Squash, summer:															
raw		100	16	.6	.1	3.9	.5	15	.4	260	.05	.09	.8	17	
frozen		100	16	.6	.1	3.9	.5	15	.4	220	.04	.08	.7	11	

[1] Depends on depth of yellow color.
[2] Value depends on time of storage. Recently dug, 24 mg.; stored 3 mos. 12 mg.; stored 6 mos., 8 mg.
[3] Calcium may not be available due to presence of oxalic acid.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Vegetables															
Squash, winter:															
raw		100	38	1.5	.3	8.8	1.4	19	.6	4950	.05	.12	.5	8	135 untrimmed
canned, strained (infant food)		100	28	1.1	.2	6.7	.7	31	.4	1960	.02	.06	(.4)	4	
Sweet potatoes:															
raw		100	123	1.8	.7	27.9	1.0	30	.7	7700[1]	.09	.05	.6	22	116 unpeeled
raw	1 med. (5" x 2½" diam.)	238	240	3.5	1.4	104.4	2.4	59	1.4	15,015[1]	.19	.10	1.3	43	277 unpeeled
canned, vacuum or solid pack		100	107	2.0	.1	25.0	1.0	25	.8	8850	.05	.04	.5	14	
canned, vacuum or solid pack	1 cup	218	233	4.4	.2	54.5	2.2	54	1.7	19,300	.12	.09	1.1	31	
dehydrated		100	362	5.0	.9	84.5	3.1	75	2.3	19,980	.21	.14	1.9	32	
Tomatoes:															
raw		100	20	1.0	.3	4.0	.6	11	.6	1100	.06	.04	.5	23	114 untrimmed
raw	1 med. (2" x 2½")	150	30	1.5	.4	6.0	.9	16	.9	1640	.08	.06	.8	35	170 untrimmed
raw	1 sm. (1¾" x 2¼")	110	22	1.1	.3	4.4	.7	12	.7	1210	.06	.05	.6	26	125 untrimmed
canned		100	19	1.0	.2	3.9	.4	(11)	(.6)	1050	.06	.03	.7	16	
canned	1 cup	242	46	2.4	.5	9.4	1.0	(27)	(1.5)	2540	.14	.08	1.7	40	
Tomato, dried, flakes		100	340	10.8	3.3	76.7	6.5	119	6.5	3720	.65	.43	6.5	114	
Tomato juice, canned		100	21	1.0	.2	4.3	.2	(7)	(.4)	1050	.05	.03	.8	16	
Tomato juice, canned	1 cup	242	50	2.4	.5	10.4	.5	(17)	(1.0)	2540	.12	.07	1.8	38	
Tomato puree, canned		100	36	1.8	.5	7.2	.4	(11)	(1.1)	1880	.09	.07	1.8	28	
Tomato puree, canned	1 cup	249	90	4.5	1.2	17.9	1.0	(27)	(2.7)	4680	.22	.17	4.5	69	

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Turnips, raw	1 turnip (2¼" x 2⅛" diam.)	100	32	1.1	.2	7.1	1.1	40	.5	tr.	.05	.07	.5	28	114 without tops
Turnips, raw	1 cup, diced	134	43	1.5	.3	9.5	1.5	54	.7	tr.	.07	.09	.6	38	154 without tops
Turnip greens:															
raw		100	30	2.9	.4	5.4	1.2	259	2.4	9540	.09	.46	.8	136	119 untrimmed
canned, solids and liquid		100	18	1.5	.3	3.2	.7	100	1.6	4400	.02	.09	.6	20	
canned, solids and liquid	1 cup	232	41	3.5	.7	7.4	1.6	232	3.7	10210	.03	.21	1.3	45	
Vegetables, mixed, strained, canned		100	29	1.6	.1	6.9	.7	30	1.0	970 to 5340	.03	.03	.4	3	
Vegetables, mixed, strained, canned	1 oz.	28.4	8	.5	.0	2.0	.2	9	.3	270 to 1510	.01	.01	.1	1	
Water cress, leaves and stems, raw	2½ cups	100	18	1.7	.3	3.3	.5	195	2.0	4720	.08	.16	.8	77	
Miscellaneous															
Beer, 4% alcohol		100	(48)	.6	.0	4.4	—	4	.0	(0)	tr	.03	.2	0	
	1 cup	240	(114)	1.4	.0	10.6	—	10	.0	(0)	tr	.06	.4	0	
Carbonated beverage:															
Ginger Ale		100	35	—	—	9.0	—	—	—	—	—	—	—	—	
	8 fl. oz. (1 cup)	230	80	—	—	21.0	—	—	—	—	—	—	—	—	
Kola type		100	46	—	—	12.0	—	—	—	—	—	—	—	—	
	8 fl. oz. (1 cup)	230	107	—	—	28.0	—	—	—	—	—	—	—	—	
Bouillon cubes		100	48	(6.)	2.5	(0)	0	—	—	—	—	1.8	25.6	0	
	1 cube (⅝")	4	2	(.2)	(.1)	(0.)	0	—	—	—	—	.07	1.0	0	
Chocolate, bitter		100	501	(5.5)	52.9	29.2[1]	2.6	98[2]	(4.4)	60	.05	.24	1.1	(0)	
	1 oz.	28.4	142	(1.6)	15.0	8.3[1]	.7	28	(1.2)	20	.01	.06	.3	(0)	
	1 cup, grated	132	661	(7.3)	69.8	38.5[1]	3.4	129	(5.8)	80	.06	.32	1.3	(0)	
Chocolate, sweetened, plain		100	471	(.2)	29.8	62.7	1.4	63[2]	2.8	(30)	(.03)	(.15)	(.6)	(0)	
	1 oz.	28.4	133	(.6)	8.4	17.8	.4	(18)[2]	.8	(10)	(.01)	(.04)	(.2)	(0)	
Chocolate sirup		100	209	(1.2)	1.1	56.6	.6	(15)[2]	(1.4)	—	—	—	—	—	
	1 tbsp.	20	42	(.2)	.2	11.3	.1	(3)[2]	(.3)	—	—	—	—	—	

[1] About ⅜ probably not utilized.
[2] Calcium may not be available due to presence of oxalic acid.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Miscellaneous															
Cocoa, breakfast, plain,		100	293	(8.)	23.8	48.9[1]	4.6	125[2]	11.6	(30)	.12	.38	2.3	(0)	
powder	1 cup stirred	112	329	(9.0)	26.7	54.8[1]	5.2	140[2]	13.0	(30)	.14	.43	2.6	(0)	
	1 tbsp.	7	21	(.6)	1.7	3.4[1]	.3	9[2]	.8	tr	.01	.03	.2	(0)	
Cocoa, beverage, made with		100	95	3.8	4.6	10.9	.1	119	.4	160	.04	.19	.2	1	
all milk	1 cup	250	236	9.5	11.5	27.2	.3	298	1.0	400	.10	.46	.5	3	
Cocoanut:															
fresh		100	359	3.4	34.7	14.0	3.2	21	2.0	0	.10	.01	.2	2	
	1 cup, shredded	97	349	3.3	33.7	13.6	3.1	20	1.9	0	.09	.01	.2	2	
dry, shredded, sweetened		100	556	3.6	39.1	53.2	4.1	43	3.6	0	tr	tr	tr	(0)	
dry, shredded, sweetened	1 cup	62	344	2.2	24.2	33.0	2.5	27	2.2	0	tr	tr	tr	(0)	
dry, shredded, sweetened	4 oz. pkg.	113	629	4.1	44.2	60.1	4.6	49	4.1	0	tr	tr	tr	(0)	
Cocoanut, milk		100	25	.3	.4	5.0	—	24	.1	0	tr	tr	.1	2	
	1 cup	240	60	.7	1.0	12.0	—	58	.2	0	tr	tr	.2	4	
Gelatin, dry:															
plain		100	335	85.6	.1	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
	1 tbsp.	10	34	8.6	.0	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
dessert powder		100	380	9.4	.0	88.7	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
	½ cup; 3 oz. pkg.	85	324	8.0	.0	75.6	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
Olives, pickled:															
green		100	132	1.5	13.5	4.0	1.2	87	1.6	300	tr	—	—	—	119 with pits
green	10 "mammoth" size	55	72	.8	7.4	2.2	.6	48	.9	160	tr	—	—	—	65 with pits
ripe, Mission		100	191	1.8	21.0	2.6	1.5	87	1.6	60	tr	tr	—	—	119 with pits
ripe, Mission	10	55	106	1.0	11.6	1.4	.8	48	.9	40	tr	tr	—	—	65 with pits

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Olives, continued															
ripe, manganilla and other		100	128	1.2	13.5	3.1	1.7	87	1.6	60	tr	tr	—	—	119 with pits
varieties	10	55	70	.7	7.4	1.7	.9	48	.9	30	tr	tr	—	—	65 with pits
Pickles:															
dill, cucumber		100	11	.7	.2	2.1	.4	25	1.2	310	tr	.06	tr	6	
	1 large (4" x 1¾" diam.)	135	15	.9	.3	2.8	.5	34	1.6	420	tr	.09	.1	8	
fresh, cucumber (bread and butter)		100	70	.9	.2	17.0	—	32	1.8	180	.02	.04	tr	9	
	1 cup (22–24 slices)	170	118	1.5	.3	28.9	—	54	3.1	310	.04	.07	.1	15	
	6 slices (¼" x 1½" diam.)	42	29	.4	.1	7.1	—	13	.8	80	.01	.02	tr	4	
sour, cucumber or mixed		100	11	.5	.2	2.2	.4	25	1.2	310	tr	.06	tr	6	
	1 lg. (4" x 1¾")	135	15	.7	.3	3.0	.5	34	1.6	420	tr	.09	tr	8	
sweet, cucumber or mixed		100	108	.8	.4	26.4	—	16	1.3	110	(0)	.02	tr	7	
	1 (2¾" x ¾" diam.) or 2 (2" x ⅝" diam.)	20	22	.2	.1	5.3	—	3	.3	20	(0)	tr	tr	1	
	1 cup, chopped	210	225	1.7	.8	55.4	—	34	2.7	240	(0)	.04	tr	15	
	1 tbsp., chopped	13	14	.1	.1	3.4	—	2	.2	10	(0)	tr	tr	1	
Pimientos, canned		100	27	.9	.5	5.8	.6	7	1.5	2300	.02	.06	.4	95	
	1 med.	38	10	.3	.2	2.2	.2	3	.6	870	.01	.02	.1	36	
Salad dressings:															
commercial, plain, mayonnaise type		100	384	1.1	36.8	13.9	(0)	9	.4	140	.02	.03	(0)	0	
	1 cup	235	902	2.6	86.5	32.7	(0)	21	.9	340	.04	.07	(0)	0	
	1 tbsp.	15	58	.2	5.5	2.1	(0)	1	.1	20	tr	tr	(0)	0	
French		100	394	.6	35.5	20.3	.3	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
	1 cup	240	945	1.4	85.2	48.7	.7	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
	1 tbsp.	15	59	.1	5.3	3.0	.0	(0)	(0)	(0)	(0)	(0)	(0)	(0)	

[1] About ⅔ probably not utilized.
[2] Calcium may not be available due to presence of oxalic acid.

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TABLE 31 (Continued)

ITEM	MEASURE	Weight E.P.	Energy Value	Protein	Fat	Carbohydrate	Fiber	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Weight A.P.
		gm.	calories	gm.	gm.	gm.	gm.	mgm.	mgm.	I.U.	mgm.	mgm.	mgm.	mgm.	gm.
Miscellaneous															
Salad dressings, continued															
Mayonnaise		100	708	1.5	78.0	3.0	(0)	19	1.0	210	.04	.04	(0)	0	
	1 cup	205	1451	3.1	159.9	6.2	(0)	39	2.0	430	.07	.07	(0)	0	
	1 tbsp.	13	92	.2	10.1	.4	(0)	2	.1	30	tr	tr	(0)	0	
Soybean curd		100	71	7.0	4.1	3.0	.1	100	1.5	—	.06	.05	.4	(0)	
	1 cake (2¾" x 2½")	120	85	8.4	4.9	3.6	.0	120	1.8	—	.07	.06	.4	(0)	
Soybean milk, plain		100	33	3.4	1.5	2.1	.0	21	.7	—	.09	.04	.3	(0)	
	4 oz.	113	38	3.9	1.7	2.4	.0	24	.8	—	.10	.05	.3	(0)	
Vinegar		100	12	0.	—	(5.0)	(0)	7	.5	—	—	—	—	—	
	1 cup	240	29	0.	—	(12.0)	(0)	17	1.2	—	—	—	—	—	
Yeast:															
compressed, baker's		100	86	(10.6)	.4	13.0	.3	25	4.9	(0)	.45	2.07	28.2	(0)	
	1 oz.	28.4	24	(3.0)	.1	3.7	.1	7	1.4	(0)	.13	.59	8.0	(0)	
dried, brewer's		100	273	(36.9)	1.6	37.4	.8	106	18.2	(0)	(9.69)	5.45	36.2	(0)	
	1 tbsp.	8	22	3.0	.1	3.0	.1	8	1.5	(0)	.78	.44	2.9	(0)	

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TABLE 32

Sodium and Potassium Content of Foods*

(Analyses made on edible portions of unprocessed foods except as otherwise designated)

Food	Sodium *mg./100 gm.*	Potassium *mg./100 gm.*
All-Bran cereal	1400	1200
Allspice	62	680
Almond		
Raw	3	690
Roasted in oil, salted	160	710
Anchovy paste	9800	200
Apples		
Juice (sweet cider), bottled	4	100
June, less skin and core	0.1	71
Mackintosh, less skin and core	0.2	90
Red Delicious, less skin and core	0.3	76
Sauce, canned	0.3	55
Apricot		
Canned in sirup	2	65
Dried	11	1700
Raw, with skin	0.6	440
Artichoke, globe	43	430
Asparagus		
Spears, canned	410	130
Tips, fresh	2	240
Tips, frozen	3	320
Avocado	3	340
Bacon		
Fried crisp	2400	390
Raw	680	110
Baking powder		
Alum type	10,000	150
Phosphate type	9000	170
Tartrate type	7300	5000
Banana	0.5	420
Barley, pearled	3	160
Beans		
Baked, Heinz, Navy		
With pork and tomato sauce, canned	480	210
With tomato sauce, canned	400	140
Dry, Navy	1	1300
Green, in pods		
Canned	410	120
Fresh	0.9	300
Frozen	2	110
Lima		
Canned	310	210
Fresh	1	680
Frozen	310	580
Beef		
Corned	1300	60
Dried	4300	200

* Mead Johnson and Co.

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TABLE 32 (Continued)

Food	Sodium *mg./100 gm.*	Potassium *mg./100 gm.*
Beef, continued		
Lean, koshered, raw	1600	290
Lean, raw	51	360
Beer	8	46
Beets		
Canned	36	120
Greens, fresh	130	570
Raw	110	350
Blackberry	0.2	150
Blueberry	0.6	89
Bouillon cube	24,000	100
Brain, pig	150	340
Bran, wheat, crude	15	980
Brandy	3	4
Brazil nuts		
Raw	1	670
Roasted in oil, salted	190	730
Bread		
Boston brown, with raisins	280	360
Low-sodium—4 laboratory samples	3	94
Low-sodium cinnamon roll—laboratory sample	2	120
Low-sodium—14 commercial "salt-free" breads:		
Maximum	76	200
Minimum	4	72
Average	28	120
Passover—See matzoth		
Rye and wheat	590	160
White, enriched	640	180
Whole wheat	930	230
Whole wheat and white	620	250
Breakfast cereals—See individual cereal		
Broccoli		
Fresh	16	400
Frozen	13	250
Brussels sprouts		
Fresh	11	450
Frozen	9	300
Butter		
Theoretical sodium value based on U. S. average salt content of 2.5%	980	
4 Indiana samples	880	23
Unsalted	5	4
Buttermilk, cultured	130	140
Cabbage	5	230
Candy		
Bar, Baby Ruth	170	300
Bar, Milky Way	220	150
Bar, Oh Henry	76	420
Gum drop	41	18
Marshmallow	41	6
Milk chocolate	86	420

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TABLE 32 (Continued)

Food	Sodium *mg./100 gm.*	Potassium *mg./100 gm.*
Candy, continued		
Necco Wafers	5	2
Peppermint patty, Schrafft's	10	110
Sweet chocolate	35	230
Cantaloupe	12	230
Caraway seed	17	1400
Carbonated drinks—See individual drinks		
Carrots		
Canned	280	110
Scraped and trimmed	31	410
Casein		
Acid-washed	0.4	2
Low-ash commercial	13	39
Vitamin-free	160	900
Cashew nuts		
Raw	14	560
Roasted in oil, salted	200	560
Catchup, tomato	1300	800
Catfish (fiddler), Ohio River	60	330
Cauliflower		
Buds	24	400
Buds, frozen	22	290
Caviar, salmon, canned	2200	180
Celery		
Salt	28,000	380
Seed	140	1400
Stalks, less leaves	110	300
Cereals, dry		
Bran		
All-Bran	1400	1200
Crude, unsalted	15	980
Corn flakes	660	160
Farina		
Cream of Wheat, plain	2	86
Cream of Wheat, quick-cooking, enriched	90	84
Grape-Nuts	660	230
Pabena	640	340
Pablum	620	380
Rolled oats	2	340
Ry-Krisp	1500	600
Wheat		
Flakes	1300	320
Germ, malt-flavored, Zing	9	780
Instant Ralston	1	360
Maltex	4	250
Muffets	4	300
Pettijohn's	2	380
Puffed	4	340
Shredded	2	330
Wheatena	2	380
Certo (pectin solution)	15	110
Chard		
Large leaves	210	720
Small leaves	84	380

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TABLE 32 (Continued)

Food	Sodium mg./100 gm.	Potassium mg./100 gm.
Cheese		
American Swiss	710	100
Cheddar	700	92
Cottage	290	72
Cream, Philadelphia	250	74
Process	1500	80
Whey, Velveeta	1600	270
Cherries		
Sour, frozen in sirup	2	78
Sweet		
Dark		
Raw	1	260
Canned in sirup	0.8	77
Frozen in sirup	1	280
Light, canned in sirup	3	55
Chestnut	2	410
Chicken, raw		
Breast meat	78	320
Leg meat	110	250
Chocolate—See also individual candy		
Sirup, Hershey	60	130
Unsweetened	4	830
Cider, sweet (apple juice), bottled	4	100
Cinnamon	8	200
Citron, candied	290	120
Clam	180	240
Clove	210	1000
Coca-Cola	1	52
Cocoa		
Dutch process	57	3200
Plain, Hershey	5	1400
Coconut		
Dry, shredded	16	770
Meat	29	320
Milk	53	190
Cod		
Raw	60	360
Fozen fillets	400	400
-liver oil	0.1	0
Salted, dried	8100	160
Coffee		
Instant, Nescafe, dry	84	3100
Roasted		
Decaffeinated, Sanka, dry	6	2000
Regular, dry	2	1600
Cookie, salt-free, Betty Bakerite	12	240
Corn		
Flakes	660	160
Meal, yellow, enriched, degerminated	0.7	120
Oil	0.2	0.1
Popcorn, popped and oiled	3	240
Popcorn, popped, oiled, and salted	2000	240

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TABLE 32 (Continued)

Food	Sodium *mg./100 gm.*	Potassium *mg./100 gm.*
Corn, continued		
Starch	4	4
Sweet		
White		
Canned	200	200
Milk stage	0.3	240
Yellow		
Canned	210	200
Frozen	9	190
Milk stage	0.4	370
Yellow field, dry—5 varieties	0.6	290
Cowpeas, fresh, shelled	2	560
Crab, canned	1000	110
Crackers		
Graham	710	330
Rye, Ry-Krisp	1500	600
Soda	1100	120
Unsalted, Jewish—See matzoth		
Cranberry		
Raw	1	65
Sauce, canned	1	17
Cream of tartar—theoretical value for pure $KHC_4H_4O_6$	0	20,776
Cream, whipping, 32% fat	40	56
Crisco (vegetable shortening)	4	0
Cucumber, less parings	0.9	230
Currants		
Red	2	160
Zante, dried (Zante raisins)	22	730
Curry powder	45	1300
Dandelion greens	76	430
Date, semi-dry, California	1	790
Dextri-Maltose		
No. 1	840	160
No. 2	46	160
No. 3	46	1300
B	52	360
Dextrin	14	14
Dextrose	1	0.4
Dill, seed	13	1000
Duck, domesticated, raw		
Breast meat	68	360
Leg meat	95	210
Egg		
Whites only	110	100
Whole	81	100
Yolks only	26	100
Eggplant, less skin	0.9	190
Endive greens	18	400
Farina		
Cream of Wheat, plain, dry	2	86
Cream of Wheat, quick-cooking, enriched, dry	90	84
Figs		
Canned in sirup	1	105

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TABLE 32 (Continued)

Food	Sodium mg./100 mg.	Potassium mg./100 gm.
Figs, continued		
Dried	34	780
Raw	2	190
Filberts (hazelnut)	1	560
Flour		
Bleached		
Enriched, Gold Medal	1	86
Enriched, phosphated	13	78
Buckwheat	1	680
Gluten	2	24
Rye, dark	1	860
Self-rising	1500	90
Untreated, high-extraction	1	120
Whole wheat (Graham)	2	290
Fruit cocktail, canned in sirup	9	160
Garlic, less skin	6	510
Gelatin		
Dessert, flavored, Jell-O	330	210
Plain	36	22
Gin	0.7	0.3
Ginger	29	1100
Ginger ale	8	0.6
Gizzard, turkey	58	170
Gluten flour	2	24
Goose, raw		
Breast meat	76	420
Leg meat	96	420
Gooseberry		
Frozen	2	150
Raw	0.7	87
Grapes		
Concord, less seeds and skin	3	84
Emperor, less seeds, with skin	4	180
Jam	7	78
Juice, Concord, sweetened, bottled	1	120
Thompson Seedless, with skin	4	180
Tokay, less seeds, with skin	0.7	160
Grapefruit		
Fresh	0.5	200
Jui e, sweetened, canned	0.4	150
Sections, sweetened, frozen	5	60
Grape-Nuts cereal	660	230
Gravy flavoring, Kitchen Bouquet	86	280
Gum, chewing, spearmint	22	27
Halibut		
Raw	56	540
Steak, frozen	460	500
Ham, raw	1100	340
Hash, corned beef, canned	540	200
Hazelnuts—See filberts		
Heart		
Beef	90	160
Turkey	69	240

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TABLE 32 (Continued)

Food	Sodium *mg./100 gm.*	Potassium *mg./100 gm.*
Hominy, canned	250	22
Honey	7	10
Horse-radish, prepared	96	290
Ice cream	100	90
Jam, grape	7	78
Kale, leaves and midribs	110	410
Kidney, beef	210	310
Kumquat, pulp and rind, less seeds	7	230
Lactalbumin	47	69
Lactose, U.S.P.	2	0
Lamb		
Chop, lean, raw	98	340
Leg, lean, raw	78	380
Lard	0.3	0.2
Lemon-lime soda	7	33
Lemons		
Peel		
Candied	50	12
Fresh	9	360
Pulp and juice	0.7	130
Lentils, dry	3	1200
Lettuce		
Head	12	140
Leaf	7	230
Lime, pulp and juice	1	100
Litchi, dried	3	1100
Liver, raw		
Calf	110	380
Goose	140	230
Pig	77	350
Turkey	51	160
Lobster, boiled in tap water	210	180
Lonalac, dry	13	1300
Macaroni, plain, dry	1	160
Mace	45	180
Maize—See corn		
Maltex cereal, dry	4	250
Maple sirup	14	130
Marmalade, orange	13	19
Matzoth		
American style (salted)	470	120
Egg	16	160
Farfel (dough balls)	28	130
Meal	4	130
Passover (Passover bread)	1	140
Plain	1	160
Poppy seed	350	110
Thin tea	2	130
Whole wheat	280	420
Mayonnaise	590	25
Meat extract, flavored	11,000	6000

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 32 (Continued)

Food	Sodium mg./100 mg.	Potassium mg./100 gm.
Milk		
Cow's		
Buttermilk, cultured	130	140
Condensed, sweetened	140	340
Evaporated	100	270
Fat	0.4	0.3
Skim	52	150
Whole		
Dry	410	1100
Liquid	50	140
Goat's	34	180
Human		
From 10 mothers, 3 to 10 days post-partum	37	68
From 4 mothers, 49 to 77 days post-partum	11	51
Low-sodium—See Lonalac		
Malted, dry	440	720
Molasses, cane	80	1500
Muffets cereal	4	300
Mulberry	0.7	200
Mushrooms		
Canned	400	150
Raw	5	520
Mustard		
Greens	48	450
Powder	3	840
Prepared paste	1300	130
Nectarine, less skin	2	320
Nutmeg	14	160
Oats, rolled (oatmeal), dry	2	340
Okra, fresh	1	220
Oleomargarine	1100	58
Olives		
Green, pickled	2400	55
Oil	0.2	0.2
Ripe, pickled	980	23
Stuffed, pickled	2800	55
Onion, less tops and dry skins	1	130
Orange crush	2	100
Oranges		
Juice, unsweetened, canned	0.5	190
Pulp and juice	0.3	170
Temple, pulp and juice	3	220
Oyster, raw	73	110
Pabena cereal, dry	640	340
Pablum cereal, dry	620	380
Pancreas, pig, raw	57	240
Paprika	82	2300
Parsley, fresh	28	880
Parsnip, scraped and trimmed, fresh	7	740
Peaches		
Canned in sirup	5	31
Dried	12	1100

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Food	Sodium mg./100 gm.	Potassium mg./100 gm.
Peaches, continued		
Frozen in sirup	3	120
Raw, less skin	0.5	160
Peanuts		
Butter	120	820
Oil	0.2	0.1
Raw, with skin	2	720
Roasted		
Dry, with skin	2	740
In oil and salted, with skin	460	700
Pears		
Bartlett		
Canned in sirup	8	52
Raw, less skin and core	2	100
Peas		
Canned, less liquor	270	96
Dry, split	42	880
Fresh	1	370
Frozen	100	160
Pecan, raw	0.3	420
Pectin solution, Certo	15	110
Pepper (spice)		
Black	16	880
Red	46	2400
White	5	48
Peppermint extract	0.3	5
Peppers, green, empty pods	0.6	170
Pepsi-Cola	15	3
Persimmon, wild	0.6	310
Pettijohn's cereal, dry	2	380
Pickle, dill	1400	200
Pilchard—See sardine		
Pineapple		
Canned in sirup	1	120
Frozen in sirup	1	38
Juice, unsweetened, canned	0.5	140
Raw	0.3	210
Plums		
Canned in sirup	18	110
Raw	0.6	170
Polyvitamin dispersion, Mead's, dry	6	10
Pomegranate, pulp and juice	0.3	200
Popcorn		
Popped		
Oiled	3	240
Oiled and salted	2000	240
Pork		
Lean, raw	58	260
Salt	1800	27
Postum		
Cereal beverage, dry	36	1300
Instant, dry	71	2200

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 32 (Continued)

Food	Sodium mg./100 gm.	Potassium mg./100 gm.
Potatoes		
Chips	340	880
Sweet		
Canned	48	200
Raw, less skin	4	530
White		
Canned	350	240
Raw, less skin	0.8	410
Poultry seasoning	26	840
Pretzel	1700	130
Protenum, dry	360	1100
Prunes		
Canned in sirup	3	220
Dried	6	600
Juice, unsweetened, bottled	2	260
Raw, with skin	0.7	210
Pumpkin		
Canned	2	240
Raw, less rind and seeds	0.6	480
Quail, raw		
Breast meat	35	160
Leg meat	44	190
Quince, less skin and core, raw	0.7	290
Rabbit, domesticated, raw		
Foreleg	47	370
Loin	34	400
Radish, with skin	9	260
Raisin		
Seedless	21	720
Zante	22	730
Ralston cereal, Instant, dry	1	360
Raspberries		
Black	0.3	190
Oriental (wineberry)	0.9	170
Red	0.5	130
Rennet tablets, Junket	38,000	36
Rhubarb		
Frozen in sirup	2	160
Raw	1	70
Rice, dry		
Brown	9	150
Flakes	720	180
Polished and coated	2	130
Puffed	0.9	100
Vitaminized	4	170
Wild (*Zizania*)	7	220
Root beer	8	0.5
Royal Crown Cola	5	2
Rum	2	3
Rutabaga (yellow turnip), less skin and tops, raw	5	260
Ry-Krisp	1500	600
Sage	20	670

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Food	Sodium mg./100 gm.	Potassium mg./100 gm.
Salmon		
Canned	540	300
Raw	48	410
Salt—theoretical value for pure NaCl	39,342	0
Sardines		
Herring, canned in oil	510	560
Pilchard		
Canned in natural sauce	760	260
Canned in tomato sauce	400	320
Sauerkraut, canned	630	140
Sausage		
Bologna	1300	230
Frankfurt	1100	220
Pork	740	140
Scallop, frozen	150	420
Shortening, vegetable		
Crisco	4	0
Spry	0.4	0.2
Shrimp, raw	140	220
Sirup		
Chocolate, Hershey	60	130
Maple	14	130
Sorghum	21	600
Table, corn-and-cane, Karo Crystal White	68	4
Soda, baking—theoretical value for pure $NaHCO_3$	27,373	0
Soft drinks		
Carbonated water		
Canada Dry	18	0.6
Made with Sparklet carbon dioxide capsule and distilled water	0	0
White Rock	1	0.6
Coca-Cola	1	52
Ginger ale	8	0.6
Lemon-lime soda	7	33
Orange Crush	2	100
Pepsi-Cola	15	3
Royal Crown Cola	5	2
Root beer	8	0.5
Sorghum sirup	21	600
Soup		
Beef, canned, diluted as served	410	100
Tomato, canned, diluted as served	380	110
Vegetable, canned, diluted as served	380	120
Soybeans		
Dry	4	1900
Flour, solvent-extracted	1	1700
Spaghetti—See macaroni		
Spinach		
Canned	320	260
Frozen	60	380
Raw	82	780
Spry (vegetable shortening)	0.4	0.2

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 32 (Continued)

Food	Sodium *mg./100 gm.*	Potassium *mg./100 gm.*
Squash, raw		
Acorn, less rind and seeds	0.4	260
Hubbard, less rind and seeds	0.3	240
White summer, less rind, with seeds	0.2	150
Yellow summer, less rind, with seeds	0.6	200
Squash, cooked, frozen	6	120
Starch, corn	4	4
Strawberries		
Frozen, sweetened	2	180
Raw	0.8	180
Sugar		
Light brown	24	230
White	0.3	0.5
Sweetbreads—See pancreas and thymus		
Tangerines		
Juice, sweetened, canned	0.6	170
Pulp and juice	2	110
Tapioca, dry	5	19
Tea, India-Ceylon-Java blend, dry	4	1800
Thyme	38	500
Thymus, beef, raw	96	360
Tobacco, chewing, Spark Plug	1600	1800
Tomatoes		
Canned	18	130
Catchup	1300	800
Juice, canned	230	230
Raw, with skin	3	230
Tongue, beef, raw	100	260
Tripe, pickled	46	19
Tuna, canned	800	240
Turkey, raw		
Breast meat	40	320
Leg meat	92	310
Turmeric	22	2700
Turnips, raw		
Leaves	10	440
White, less skin and tops	37	230
Yellow (rutabaga), less skin and tops	5	260
Vanilla extract	1	74
Veal, lean, raw	48	330
Vinegar		
Cider	1	100
Distilled	0.6	15
Walnuts, raw		
Black	3	460
English	2	450
Water, carbonated—See soft drinks		
Watermelon, pink part of fruit	0.3	110
Wheat		
Beeswing (outermost coats)	4	360
Bran, crude	15	980
Flakes cereal	1300	320

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TABLE 32 (Continued)

Food	Sodium *mg./100 gm.*	Potassium *mg./100 gm.*
Wheat, continued		
Germ		
Crude	2	780
Malt-flavored, Zing	9	780
Gluten	2	24
Puffed	4	340
Scourings (dirt and fragments)	8	470
Shredded	2	330
Winter, scoured—4 samples	2	370
Wheatena cereal, dry	2	380
Whiskey		
Blended	0.3	1
Bonded	0.1	0.6
Wild rice (*Zizania*), dry	7	220
Wine		
Port	4	75
Sauterne	10	87
Wineberry (oriental raspberry)	0.9	170
Worcestershire sauce	2100	480
Yeast		
Compressed	4	360
Debittered brewers', dry	150	1700
Primary cultured, dry—19 samples		
Maximum	320	2200
Minimum	9	1700
Average	115	1860
Zwieback	250	150

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 33

CHOLESTEROL CONTENT OF FOOD SAMPLES ANALYZED BY OKEY*

Food	Total Cholesterol (Per Cent Moist Weight)	Food	Total Cholesterol (Per Cent Moist Weight)
Muscle meats		*Cheeses*	
Beef round (medium fat)	0.125	American	0.16
Beef round (lean)	0.095	American, processed	0.155
Veal shank	0.14	Swiss, processed	0.145
Veal breast	0.10	Monterey Jack	0.19
Pork spareribs	0.105	Velveeta	0.16
Variety meats		Limburger, processed	0.135
Liver		Pimento cream, processed	0.14
Lamb (4 samples)	0.61	Butter	0.28
Pork	0.42	Egg yolk, dried	3.9
Beef	0.32	Egg yolk, fresh	2.0
Calf (4 samples)	0.36	Primex†	0.15
Tripe	0.15	Brewers' yeast, dry†	0.68
Sweetbread	0.28	Casein, raw	0.065
Shellfish			
Oysters, eastern†	0.23		
Oysters, California I†	0.28		
Oysters, California II†	0.47		
Crab†	0.145		

* From Turner, D., *Handbook of Diet Therapy*, University of Chicago Press, 1946.

† Total digitonin precipitable sterol. These foods are known to contain sterols other than cholesterol.

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TABLE 34

Cholesterol Content of Substances Used as Foods*

Food	Total Cholesterol (Per Cent Moist Weight)	Food	Total Cholesterol (Per Cent Moist Weight)
Organs		*Skeletal muscle (Cont.)*	
Beef brain	2.36; 2.11	Veal	0.065
Beef heart	0.15; 0.14	"Av. mammal"	0.087
Beef kidney	0.40; 0.41	Chicken, light	0.09
Beef liver	0.26; 0.19	Chicken, dark	0.06
Beef lung	0.39; 0.35	Hen	0.07
Beef thymus		Duck	0.07
(sweetbread)	0.25; 0.22	Pigeon	0.11
Heart muscle		Codfish	0.05
Rabbit	0.20	Frog	0.04
"Av. mammal"	0.18	Salmon	0.06
Hen	0.16	Shrimp	0.15
Pigeon	0.16	Turtle	0.06; 0.07
Duck, wild	0.16	*Eggs (hen's)*	
Turtle	0.16	Frozen whole	0.56
Skeletal muscle		Frozen yolk	1.33
Beef	0.06	Liquid whole	0.518
Lamb	0.07	Dehydrated whole	2.14
Pork	0.06	Dehydrated yolk	2.81
Rabbit, laboratory	0.05	Fresh whole	0.468
Rabbit, wild	0.08		

* From Turner D., *Handbook of Diet Therapy*, University of Chicago Press, 1946.

† Recomputed by Okey (Cholesterol content of food, J. Am. Dietet. A., 21:341–44, 1945) to approximate raw-food bases from dry-weight figures given in recent papers.

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TABLE 35

Percentages of Major Mineral Elements in the Edible Portion of Foods*

(Fresh basis)

Food	Magnesium	Phosphorus	Chlorine	Sulfur
Almonds	.275	.465	.037	.164
Apples, fresh	.006	.011	.004	.004
dried	.029	.053	.019	.019
Apricots, fresh	.012	.038	.004	.006
dried	.062	.198	.021	.031
Asparagus	.015	.055	.047	.051
Bananas	.024	.029	.163	.013
Barley, entire	.126	.343	.139	.152
Beans, dried	.165	.495	.007	.224
Lima, fresh	.067	.128	.009	.068
dried	.181	.367	.025	.156
string or green	.032	.050	.045	.024
Beef	.032	.198	.056	.221
Beets	.027	.040	.040	.017
Beet greens	.097	.040	*	.035
Brains	.016	.385	.155	.130
Bread, white	.034	.080	.602	.083
Broccoli	.024	.086	.076	.126
Brussels sprouts	.015	.051	*	.098
Butter	.002	.004	(a)	.009
Cabbage	.016	.031	.034	.074
celery	.011	.041	.023	.013
Cantaloupe	.016	.016	.048	.016
Carrots	.020	.037	.035	.019
Cauliflower	.023	.068	.038	.074
Celery	.025	.041	.225	.021
Cheese, hard	.031	.547	.972	.214
Cherries	.012	.031	.004	.018
Chestnuts	.048	.081	.010	.049
Chicken	.047	.218	.034	.303
Chocolate	.082	.285	.009	.114
Cocoa	.192	.476	.050	.197
Coconut, fresh	.040	.118	.120	.044
Collards	.017	.078	*	*
Corn, field, mature	.142	.341	.041	.124
sweet, fresh	.047	.117	*	.037
mature	.121	.349	.050	.146
Cowpeas, dried	.265	.390	.019	.250
Crabs	.117	.261	.570	.255
Cranberries	.005	.008	.004	.008
Cream	.006	.048	.067	.033

* From Peterson, W. H., Skinner, J. T. and Strong, F. M., Elements of Food Biochemistry, Prentice-Hall, Inc., New York, 1943.

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TABLE 35 (Continued)

Food	Magnesium	Phosphorus	Chlorine	Sulfur
Cucumbers	.020	.037	.028	.011
Currants, fresh	.031	.044	.010	.021
dried	.155	.220	.050	.105
Dates	.065	.059	.253	.048
Eel	.018	.177	.035	.133
Eggplant	.015	.037	.063	.020
Eggs	.009	.166	.100	.233
Egg white	.011	.014	.131	.211
yolk	.013	.577	.067	.214
Figs, fresh	.020	.021	.037	.017
dried	.068	.074	.126	.060
Fish (all kinds)	.024	.221	.137	.199
Flour, wheat, white	.021	.096	.079	.155
Frog	.024	.196	.040	.163
Garlic	.008	.090	.004	.318
Goose	.031	.197	*	.326
Gooseberries	.009	.036	.009	.015
Grapefruit	.007	.035	.007	.005
Grapes	.004	.018	.002	.009
Haddock	.017	.137	.241	.225
Heart	.035	.313	.204	.151
Honey	.004	.015	.015	.003
Horseradish	.028	.059	.013	.234
Kale	.055	.089	.120	.160
Kidney	.019	.233	.376	.148
Kohlrabi	.052	.060	.050	.039
Lamb—See mutton				
Leeks	.037	.049	.110	.056
Lemons	.006	.018	.006	.012
Lentils, dried	.082	.392	.062	.123
Lettuce	.015	.032	.085	.014
Liver	.021	.327	.091	.258
Lobster	.022	.395	*	*
Macaroni	.038	.130	.077	.119
Milk, cow, fresh	.019	.088	.114	.031
evaporated	.038	.176	.228	.067
powder	.118	.580	1.029	.229
goat	*	.118	.163	*
human	.005	.017	.058	.142
Mushrooms	.012	.083	.026	.025
Mustard greens	.016	.053	.090	.142
Mutton	.033	.212	.069	.187
Oatmeal (rolled oats)	.143	.351	.027	.207
Oats, entire	.150	.318	.089	.187
Onions	.016	.039	.053	.065
Oranges	.011	.027	.006	.011
Orange juice	.014	.017	.008	.005
Parsnips	.038	.094	.038	.025

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 35 (Continued)

Food	Magnesium	Phosphorus	Chlorine	Sulfur
Peaches, fresh	.015	.019	.006	.005
dried	.087	.110	.035	.029
Peanuts	.169	.394	.040	.276
Pears	.005	.008	.004	.010
Peas, green	.035	.124	.049	.035
mature	.121	.369	.034	.178
Peppers, green	.025	.039	.031	.030
red	.013	.042	.014	.030
Persimmons	.005	.019	.009	.011
Pike	.031	.213	.032	.218
Pineapple	.014	.033	.038	.003
Plums	.010	.022	.002	.004
Pork	.027	.262	.040	.216
Potatoes	.027	.053	.048	.033
Prunes, dried	.032	.068	.004	.024
Pumpkins	.021	.026	.025	.016
Rabbit	.029	.244	.051	.184
Radishes	.014	.032	.056	.038
Raisins	.017	.126	.068	.043
Raspberries	.018	.013	.010	.012
Rhubarb	.015	.044	.070	.008
Rice, entire	.141	.310	.066	.121
polished	.033	.113	.056	.114
Rutabagas	.015	.035	.031	.069
Rye, entire	.136	.333	.043	.152
Sardines, fresh	.035	.550	*	*
Shrimps, dried, salted	.327	.480	(a)	.183
Soybeans, mature	.287	.633	.007	.269
Spaghetti—See macaroni				
Spinach	.048	.053	.118	.027
Squash	.006	.038	.018	.029
Strawberries	.019	.020	*	.013
Sugar beets	.041	.049	.180	.021
Sweet potatoes	.035	.039	.022	.014
Tomatoes	.016	.033	.048	.017
Turkey	.028	.205	.123	.234
Turnips	.019	.032	.054	.048
Turnip greens	.079	.040	.390	.051
Veal	.030	.235	.073	.199
Venison	.029	.249	.041	.211
Walnuts	.132	.309	.030	.120
Watercress	.010	.044	.059	.071
Watermelon	.006	.010	.006	.005
Wheat, entire	.163	.342	.088	.175
Wheat bran	.420	1.430	.042	.245
Yams	.015	.042	.037	.013

(a) Variable.

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 36

Trace Elements in Foods*

(Fresh basis)

Food	Milligrams per 100 grams of edible portion			Micrograms per 100 grams of edible portion
	Cu	Mn	Zn	Iodine
Abalone	.08	*	2.5	105.3
Almonds	1.2	1.2	1.9	*
Apples	.1	.11	.07	6.6
Apricots, fresh	.15	*	.04	*
dried	.32	.28	*	*
Artichokes	.32	.38	*	*
Asparagus	.11	.19	.34	6.9
Avocados	.21	.29	*	*
Bacon	.41	.08	*	16.0 cooked
Bananas	.21	1.1	.26	20.0
Barley, whole	1.2	1.6	2.3	9.1
pearled	.26	*	*	*
Bass	.14	*	*	15.5
Beans, navy, dried	.98	1.9	3.1	4.8
kidney, dried	.92	1.6	5.2	1.8
Lima, dried	.86	1.1	*	*
Lima, fresh	.53	.6	1.5	*
string	.13	.37	.09	6.9
Beef, chuck	.1	*	*	*
heart	*	*	*	30.0
kidney	.11	1.	2.4	9.0
liver	2.0	.32	3.5	14.0
"lean"	.05	.02	1.5	3.5
loin	.1	*	*	*
steak	.11	.02	*	9.1
sweetbreads	.08	.07	2.	*
Beets	.12	.62	.65	3.3
Beet greens	.12	1.2	.02	8.0
Blackberries	.15	.57	*	*
Blueberries	.11	3.4	*	*
Bluefish	.23	*	*	26.0
Brazil nuts	1.3	.94	*	*
Bread, rye	.28	1.3	*	9.
white	.25	.42	3.3	11.3
whole wheat	.33	3.2	*	11.
Broccoli	.20	.26	*	15.
Brussels sprouts	.11	.30	*	6.2

* From Peterson, W. H., Skinner, J. T. and Strong, F. M. Elements of Food Biochemistry, Prentice-Hall, Inc., New York, 1943.

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 36 (Continued)

Food	Milligrams per 100 grams of edible portion			Micrograms per 100 grams of edible portion
	Cu	Mn	Zn	Iodine
Butter	.04	.04	*	8.6
Buttermilk	.05	*	*	*
Butternuts	1.2	*	*	*
Cabbage	.11	.21	.20	2.3
Calf's liver	6.3	.37	3.0	*
Cantaloupe	.05	.05	.09	2.3
Carrots	.12	.37	.35	4.4
Catfish	.17	*	12.4	9.4
Cauliflower	.27	.15	.22	1.6
Celery	.12	.17	.21	12.3
Celery cabbage	.06	.12	*	*
Chard	.11	.8	*	11.0
Cheese, hard	.09	.11	*	10.0
cottage	*	.05	*	6.4
Cherries	.13	.03	.15	.6
Chestnuts	.39	1.7	.19	*
Chicken	.54	*	.46	*
Chocolate	2.1	3.2	2.6	*
Citron	.57	*	*	2.1
Clams	0	*	3.6	124.0
Cocoa	2.4	3.5	2.6	*
Coconut, dried	.62	*	*	*
fresh	.53	1.3	.84	1.8
Codfish	.55	.01	*	31.4
Cod-liver oil	*	0	.9	860.
Coffee, beans	1.3	*	.5	8.6
water extract	*	*	*	.4
Collards	*	2.0	*	1.
Corn	.71	1.1	2.2	12.
Corn germ	.91	3.6	9.4	*
Corn meal, yellow	.19	.22	1.8	*
Corn, sweet	.08	.31	*	3.3
Cow peas	.17	1.5	*	5.7
Crab	1.3	0.3	2.5	30.2
Cranberries	.11	.38	*	3.3
Cream	.15	*	*	5.7
Cucumber	.13	.13	.12	.83
Currants, dried	.8	.31	*	*
fresh	.13	*	.2	*
Dandelion greens	.17	.34	1.2	*
Dates	.23	2.6	.32	*
Duck	.46	.03	.34	*
Eggplant	.09	.23	.28	.8

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 36 (Continued)

Food	Milligrams per 100 grams of edible portion			Micrograms per 100 grams of edible portion
	Cu	Mn	Zn	Iodine
Eggs, hen	.17	.04	1.3	12.
Egg white	.04	*	.01	6.8
Egg yolk	.25	.11	3.8	16.
Endive	.09	.23	.12	3.7
Escarole (chicory)	.14	*	.19	*
Figs, dried	.34	.34	.36	*
fresh	.06	*	.12	1.5
Filberts	1.2	*	1.0	*
Fish, general	.33	.02	.80	66.5 salt water 7.0 fresh water
Flounder	.22	*	.82	30.9
Flour, buckwheat	.72	2.1	1.	*
graham or whole wheat	.47	4.3	1.9	*
rye	.43	2.	*	2.3
white	.14	.54	1.2	3.6
Garlic	.26	.46	.92	2.7
Goose	.33	.05	*	*
Gooseberries	.10	.05	.1	*
Grapefruit	.45	.01	*	1.3
Grapes	.11	.08	.17	*
Grape juice	.02	*	*	.9
Haddock	.28	.02	*	83.4
Halibut	.23	*	*	27.7
Hazelnuts	1.2	3.6	.97	1.4
Herring	.27	*	3.6	21.4
Hickory nuts	1.4	*	*	*
Hominy	.18	.11	*	*
Honey	.15	.03	*	*
Huckleberries—See blueberries				
Kale	.52	.86	*	*
Kidney—See beef, lamb				
Kohlrabi	.14	.12	*	*
Kumquats	.09	.07	*	*
Lamb	.42	*	*	*
chop	.42	.04	*	15.
kidney	.31	*	1.9	*
Lard	.02	*	*	9.3
Leeks	.17	*	.23	*
Lemons	.04	.35	*	.5
Lemon juice	.13	*	.17	5.2
Lentils (dried)	.59	3.3	5.4	*
Lettuce, head	.11	1.0	.39	2.9
leaf	.14	.82	.44	2.7

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 36 (Continued)

Food	Milligrams per 100 grams of edible portion			Micrograms per 100 grams of edible portion
	Cu	Mn	Zn	Iodine
Liver—See beef, etc.				
Lobster	1.5	.04	.24	80.1
Loganberries	.14	*	.45	2.7
Macaroni	.07	*	*	*
Mackerel	.27	.02	*	16.3
Mangoes	.04	*	*	1.6
Milk, cow's	.04	.03	.36	3.8
Milk powder	.34	*	*	32.
Molasses	1.4	.44	*	*
Mushrooms	1.	.12	.4	0.0
Muskmelon—See cantaloupe				
Mussels	.35	.46	4.5	80.2
Mustard greens	.12	1.2	*	5.4
Mutton, leg	.4	*	2.2	1.8
chop	.16	*	*	*
liver	1.6	*	4.1	3.3
Nectarines	.06	*	*	*
Oatmeal	.38	3.3	*	4.2
Oats	1.4	5.	2.9	5.2
Okra	.14	.56	*	5.6
Oleomargarine	.04	*	*	7.4
Olives	.25	.12	.3	*
Onions	.11	.38	1.3	3.6
Oranges	.18	.03	.17	.6
Orange juice	.05	*	0	1.5
Oysters	3.4	.13	46.	74.2
Oyster plant—See salsify				
Parsley	.23	1.2	*	*
Parsnips	.12	.04	*	3.6
Peaches	.07	*	.02	1.3
dried	.27	.68	*	*
Peanuts	1.1	.86	1.6	.7
Pears	.16	.05	.16	.4
Peas, dried	1.1	1.8	4.0	*
fresh	.23	.3	1.1	2.1
Pecans	1.4	3.5	*	*
Peppers, green	.11	.15	.06	*
red	*	.19	*	2.3
Perch	.37	*	*	5.3
Pickerel	.34	*	*	.7
Pike	.17	*	*	*
Pimentos	.60	*	.23	.2
Pineapple	.09	1.5	.28	16.
Pistachio nuts	1.2	.67	*	*

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 36 (Continued)

Food	Milligrams per 100 grams of edible portion			Micrograms per 100 grams of edible portion
	Cu	Mn	Zn	Iodine
Plums	.14	.11	.03	4.7
Pork, general	1.5	*	1.4	7.6
chop	.31	.06	*	*
liver	1.3	.38	.79	14.
Potatoes	.17	.41	.31	3.9
Prunes, dried	.29	.16	.05	.12
Pumpkin	.07	.04	.21	1.4
Quinces	.13	.04	*	*
Radishes	.22	.17	.16	6.4
Raisins	.23	.34	.20	*
Raspberries	.16	.67	.35	*
Red snapper	.16	.01	.28	31.
Rhubarb	.09	.16	.16	26.
Rice, entire	.26	1.9	2.1	25.
polished	.2	1.1	.22	5.1
Rutabagas	.12	.12	.30	6.7
Rye, whole	.63	9.0	1.8	6.7
flour	.43	2.0	*	6.8
Salsify (oyster plant)	.3	.41	.22	*
Salmon	.23	*	.8	29.1
Sardines	.04	.26	.94	27.
Scallops	.23	3.9	*	47.5
Shrimp	1.2	.23	1.4	35.5
Sirup	.09	*	*	*
Soybeans	1.1	2.9	1.8	6.3
Soybean flour	1.2	*	*	*
Spinach	.11	.73	.62	41.
Squash, summer	.08	.14	*	2.3
winter	.10	.22	.21	*
Strawberries	.07	.23	.09	*
Sweet potatoes	.15	.3	.23	2.4
Tangerines	.09	.04	*	*
Tapioca	.07	*	.04	*
Tea extract	*	*	*	16.
Tomatoes	.09	.13	.24	1.5
Trout	.33	.06	1.0	3.1
Tuna fish	.5	*	*	30.5
Turkey	.17	.03	*	*
Turnips	.08	.16	.08	7.5
Turnip greens	.08	1.9	.28	2.4
Veal, medium, lean	.20	.03	3.5	5.0
Vinegar	.04	1.0	*	*
Walnuts, black	3.2	*	*	*
English	.88	2.4	2.3	*

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 36 (Continued)

Food	Milligrams per 100 grams of edible portion			Micrograms per 100 grams of edible portion
	Cu	Mn	Zn	Iodine
Watercress	.1	.42	.56	3.6
Watermelon	.07	.02	*	*
Wheat	.8	4.2	5.4	7.6
Wheat bran	1.3	10.2	12.	*
Wheat germ	2.7	13.	14.3	*
Whitefish	.19	*	*	3.0
Yams	*	.05	*	4.7

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 37

Alcoholic Beverages[1]

Alcohol—7 Calories Per Gram

Kind	Amount	Gms.	C	P	F	Cal.
1. Distilled liquors (whisky, gin, rum, brandy)	3½ oz.	100	None or trace	0	0	. . .
2. Wines,* *dry* (carbohydrate range, trace to 3.6 per cent)	3½ oz.	100	0.3	0	0	64.0
sweet (carbohydrate range 0.1–40.7 per cent)	3½ oz.	100	8.0	0	0	95.8
3. Cordials** (crême de menthe, kümmel, benedictine, anisette, chartreuse)	3½ oz.	100	30.0	0	0	423.0
4. Beer† (average of several brands)	3½ oz.	100	5.0	0	0	52.0
5. Ale‡	3½ oz.	100	5.1	0	0	52.0
6. Malt extract, *commercial true*	3½ oz.	100	10.6	0	0	43.5
concentrated	3½ oz.	100	71.3	0	0	292.3
7. Cider§ (carbohydrate range 0–13.5 per cent)	3½ oz.	100	4.5	0	0	48.5
8. Carbonated drinks (bottled soda, sarsaparilla, birch beer, root beer, ginger ale)	3½ oz.	100	8.0	0	0	32.8

VITAMIN B COMPLEX CONTENT OF BEERS, ALES AND MALT TONICS

(Micrograms/100 grams)

	Thiamine	*Riboflavin*	*Niacin*	*Pantothenic Acid*
Beer	0.1–15	25–40	750–900	85–120
Ale	0.1–15	30–45	700–900	90–105
Malt Tonic	0–70	40–50	1000–1800	100–135

* Natural wines contain 6 to 12 per cent alcohol; "fortified" wines 15 to 20 per cent.

** Range of alcohol content, 35 to 50 per cent.

† Range of alcohol content for beer, generally 4 to 5 per cent.

‡ Range of alcohol content, same as for beer.

§ Range of alcohol content, generally 2.5 to 6 per cent.

[1] Schwarz Laboratories, Inc., Brewery Consultants and Engineers, New York City.

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 38

WEIGHT—HEIGHT—AGE TABLE[1] FOR INFANTS[2]

Weight-Height-Age Table for White Boys from Birth to 1 Year (Without Clothes)

AVERAGE WEIGHT IN POUNDS FOR EACH MONTH OF AGE

Height in inches	*Less than 1 Month*	*1 Month but less than 2*	*2 Months but less than 3*	*3 Months but less than 4*	*4 Months but less than 5*	*5 Months but less than 6*	*6 Months but less than 7*	*7 Months but less than 8*	*8 Months but less than 9*	*9 Months but less than 10*	*10 Months but less than 11*	*11 Months but less than 12*
17	5½	..	..	..	..	..	..	..	..	..	..	..
18	6½	..	..	..	..	..	..	..	..	..	..	..
19	7½	7½	..	..	..	..	..	..	..	..	..	..
20	8	8½	9	..	..	..	..	..	..	..	..	..
21	9	9½	10	10½	10½	..	..	..	..	..	..	..
22	10	10½	11	11½	11½	11½	12	..	..	..	..	..
23	10½	11½	12	12½	13	13	13	13½	14	..	..	..
24	11½	12½	13	13½	14	14	14½	14½	15	15	15	..
25	12½	13½	14	14½	15	15½	15½	15½	16	16	16	16½
26	..	14	15	15½	16	16½	16½	17	17	17	17½	18
27	..	..	16	16½	17	17½	18	18	18½	18½	18½	19
28	..	..	..	17½	18	19	19	19	19½	19½	19½	20
29	..	..	..	..	19½	20	20	20½	20½	20½	20½	21
30	..	..	..	..	..	21½	21½	21½	21½	21½	22	22
31	..	..	..	..	..	..	22½	23	23	23	23	23
32	..	..	..	..	..	..	..	24	24	24	24	24
33	..	..	..	..	..	..	..	..	..	..	25½	25

[1] Reanalysis of the weight, height, and age of 20,299 white boys and of 19,493 white girls under 12 months of age, examined in Children's Year (1918–19). The number of negro boys and girls measured and weighed was not sufficiently large to provide comparable data.

[2] From *Infant Care, Children's Bureau Publication No. 8* (1940).

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 38 (Continued)

WEIGHT—HEIGHT—AGE TABLE[1] FOR INFANTS[2]

Weight-Height-Age Table for White Girls from Birth to 1 Year (Without Clothes)

AVERAGE WEIGHT IN POUNDS FOR EACH MONTH OF AGE

Height in inches	*Less than 1 Month*	*1 Month but less than 2*	*2 Months but less than 3*	*3 Months but less than 4*	*4 Months but less than 5*	*5 Months but less than 6*	*6 Months but less than 7*	*7 Months but less than 8*	*8 Months but less than 9*	*9 Months but less than 10*	*10 Months but less than 11*	*11 Months but less than 12*
17	5½	..	..	..	..	..	..	..	..	..	..	..
18	6½	6½	..	..	..	..	..	..	..	..	..	..
19	7	7½	8	..	..	..	..	..	..	..	..	..
20	8	8½	9	9	..	..	..	..	..	..	..	..
21	8½	9½	9½	10	10½	11	11	..	..	..	..	..
22	9½	10	10½	11	11½	12	12	12	12½	..	..	..
23	10	11	11½	12	12½	13	13	13	13½	13½	13½	..
24	11	12	12½	13	13½	14	14	14	14½	14½	14½	14½
25	11½	13	13½	14	14½	15	15	15½	15½	15½	16	16
26	..	14	14½	15	15½	16	16	16½	16½	16½	17	17
27	..	..	15½	16	16½	17	17	17½	17½	18	18	18
28	..	..	..	17	17½	18	18½	18½	19	19	19	19
29	..	..	..	..	19	19	19½	20	20	20	20	20
30	..	..	..	..	..	20	20½	21	21	21	21	21½
31	..	..	..	..	..	..	21½	22	22	22	22½	22½
32	..	..	..	..	..	..	..	..	23	23½	23½	23½
33	..	..	..	..	..	..	..	..	..	..	..	24½

[1] Reanalysis of the weight, height, and age of 20,299 white boys and of 19,493 white girls under 12 months of age, examined in Children's Year (1918–19). The number of negro boys and girls measured and weighed was not sufficiently large to provide comparable data.

[2] From *Infant Care, Children's Bureau Publication No. 8* (1940).

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 39

WEIGHT—HEIGHT—AGE TABLE FOR CHILDREN[1]

From One Year to School Age

(*a*) BOYS

Height (inches)	*Average Weight for Height (pounds)*	*12 mo.*	*18 mo.*	*24 mo.*	*30 mo.*	*36 mo.*	*48 mo.*
25	15	..	..	..	..	..	..
26	16½	18	..	..	..	..	..
27	18	19	..	..	..	..	..
28	19½	20	20	..	..	..	..
29	20½	21	21	..	..	..	..
30	22	22	22	22	..	..	..
31	23	23	23	23	24	..	..
32	24½	24	24	25	25	..	..
33	26	26	26	26	26	26	..
34	27	..	27	27	27	27	..
35	29½	..	29	29	29	29	29
36	31	..	..	30	31	31	31
37	32	..	..	32	32	32	32
38	33½	..	..	..	33	33	33
39	35	..	..	..	35	35	35
40	36½	..	..	..	..	36	36
41	38	..	..	..	..	..	38
42	39½	..	..	..	..	..	39
43	41½	..	..	..	..	..	41

Weight is stated to the nearest pound; height to the nearest inch; age to the nearest month.

Up to and including 34 inches the *weights are net*. Above this the following amounts have been added for clothing (shoes, coats and sweaters are not included):

35 to 39 in. 1¼ pounds   40 to 43 in. 1½ pounds

[1] From table prepared by Dr. Robert M. Woodbury and published by American Child Health Association.

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 39 (Continued)

WEIGHT—HEIGHT—AGE TABLE FOR CHILDREN[1]

From One Year to School Age

(*b*) GIRLS

Height (inches)	*Average Weight for Height (pounds)*	*12 mo.*	*18 no.*	*24 mo.*	*30 mo.*	*36 mo.*	*48 mo.*
25	15	..	..	..	..	..	..
26	16½	17	..	..	..	..	..
27	17½	18	..	..	..	..	..
28	19	19	19	..	..	..	..
29	20	20	20	..	..	..	..
30	21½	21	21	21	..	..	..
31	22½	22	23	23	23	..	..
32	24	23	24	24	24	25	..
33	25	..	25	25	25	26	..
34	26½	..	26	26	26	27	..
35	29	..	29	29	29	29	29
36	30	..	..	30	30	30	30
37	31½	..	..	31	31	31	31
38	32½	..	..	..	33	33	33
39	34	..	..	..	34	34	34
40	35½	..	..	..	..	35	36
41	37½	..	..	..	..	..	37
42	39	..	..	..	..	..	39
43	41	..	..	..	..	..	40

Weight is stated to the nearest pound; height to the nearest inch; age to the nearest month.

Up to and including 34 inches the *weights are net*. Above this the following amounts have been added for clothing (shoes and sweaters are not included):

35 to 39 in. 1 pound   40 to 43 in. 1½ pounds

[1] From table prepared by Dr. Robert M. Woodbury and published by American Child Health Association.

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 40

WEIGHT — HEIGHT — AGE TABLE FOR BOYS OF SCHOOL AGE[1]

Height (inches)	*Average Weight for Height (pounds)*	*5 years*	*6 years*	*7 years*	*8 years*	*9 years*	*10 years*	*11 years*	*12 years*	*13 years*	*14 years*	*15 years*	*16 years*	*17 years*	*18 years*	*19 years*	*Height (inches)*
38	34	34	34*	..	..	..	..	..	..	..	..	..	..	..	..	..	38
39	35	35	35	..	..	..	..	..	..	..	..	..	..	..	..	..	39
40	36	36	36*	..	..	..	..	..	..	..	..	..	..	..	..	..	40
41	38	38	38	38*	..	..	..	..	..	..	..	..	..	..	..	..	41
42	39	39	39	39*	39*	..	..	..	..	..	..	..	..	..	..	..	42
43	41	41	41	41*	41*	..	..	..	..	..	..	..	..	..	..	..	43
44	44	44	44	44	44*	..	..	..	..	..	..	..	..	..	..	..	44
45	46	46	46	46	46*	46*	..	..	..	..	..	..	..	..	..	..	45
46	48	47*	48	48	48	48*	..	..	..	..	..	..	..	..	..	..	46
47	50	49*	50	50	50	50*	50*	..	..	..	..	..	..	..	..	..	47
48	53	..	52	53	53	53	53*	..	..	..	..	..	..	..	..	..	48
49	55	..	55	55	55	55	55	55*	..	..	..	..	..	..	..	..	49
50	58	..	57*	58	58	58	58	58*	58*	..	..	..	..	..	..	..	50
51	61	..	..	63	61	61	61	61	61*	..	..	..	..	..	..	..	51
52	64	..	..	64	64	64	64	64	64	64*	..	..	..	..	..	..	52
53	68	..	..	66*	67	67	67	67	68	68*	..	..	..	..	..	..	53
54	71	..	..	..	70	70	70	70	71	71	72*	..	..	..	..	..	54

[1] Prepared by Bird T. Baldwin, Ph.D., and Thomas D. Wood, M.D., and published by the American Child Health Association. Age is taken at the nearest birthday; height at the nearest inch; and weight at the nearest pound. Weights are taken in indoor clothing without shoes or sweaters.

* In order to extend the range of the tables so as to include weights of children who are taller or shorter than those in these groups there have been added these estimated weights. All the other weights represent averages for each inch in height for age of the children observed in this study.

SCANNED AT VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

TABLE 40 (Continued)

WEIGHT — HEIGHT — AGE TABLE FOR BOYS OF SCHOOL AGE

Height (inches)	Av. Wt. for Ht. (pounds)	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years	18 years	19 years	Height (inches)
55	74	..	..	..	72*	72	73	73	74	74	74*	..	..	..	..	..	55
56	78	..	..	..	75*	76	77	77	77	78	78	80*	..	..	..	..	56
57	82	..	..	..	..	79*	80	81	81	82	83	83*	..	..	..	..	57
58	85	..	..	..	..	83*	84	84	85	85	86	87	..	..	..	..	58
59	89	..	..	..	..	..	87	88	89	89	90	90	90	..	..	..	59
60	94	..	..	..	..	..	91*	92	92	93	94	95	96	..	..	..	60
61	99	..	..	..	..	..	..	95	96	97	99	100	103	106*	..	..	61
62	104	..	..	..	..	..	..	100*	101	102	103	104	107	111	116*	..	62
63	111	..	..	..	..	..	..	105*	106	107	108	110	113	118	123	127*	63
64	117	..	..	..	..	..	..	..	109	111	113	115	117	121	126	130*	64
65	123	..	..	..	..	..	..	..	114*	117	118	120	122	127	131	134	65
66	129	..	..	..	..	..	..	..	..	119	122	125	128	132	136	139	66
67	133	..	..	..	..	..	..	..	..	124*	128	130	134	136	139	142	67
68	139	..	..	..	..	..	..	..	..	..	134	134	137	141	143	147	68
69	144	..	..	..	..	..	..	..	..	..	137	139	143	146	149	152	69
70	147	..	..	..	..	..	..	..	..	..	143	144	145	148	151	155	70
71	152	..	..	..	..	..	..	..	..	..	148*	150	151	152	154	159	71
72	157	..	..	..	..	..	..	..	..	..	..	153	155	156	158	163	72
73	163	..	..	..	..	..	..	..	..	..	..	157*	160	162	164	167	73
74	169	..	..	..	..	..	..	..	..	..	..	160*	164	168	170	171	74
Age — years			*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	
Average height (inches)	Short		43	45	47	49	51	53	54	56	58	60	62	64	65	65	
	Medium		46	48	50	52	54	56	58	60	63	65	67	68	69	69	
	Tall		49	51	53	55	57	59	61	64	67	70	72	72	73	73	
Average annual gain (lb.)	Short		3	4	5	5	5	4	8	9	11	14	13	7	3		
	Medium		4	5	6	6	6	7	9	11	15	11	8	4	3		
	Tall		5	7	7	7	7	8	12	16	11	9	7	3	4		

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TABLE 41

WEIGHT — HEIGHT — AGE TABLE FOR GIRLS OF SCHOOL AGE[1]

Height (inches)	Average Weight for Height (pounds)	5 years	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years	18 years	Height (inches)
38	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..	38
39	34	34	34	..	..	..	..	..	..	..	..	..	..	..	..	39
40	36	36	36	36*	..	..	..	..	..	..	..	..	..	..	..	40
41	37	37	37	37*	..	..	..	..	..	..	..	..	..	..	..	41
42	39	39	39	39*	..	..	..	..	..	..	..	..	..	..	..	42
43	41	41	41	41	41*	..	..	..	..	..	..	..	..	..	..	43
44	42	42	42	42	42*	..	..	..	..	..	..	..	..	..	..	44
45	45	45	45	45	45	45*	..	..	..	..	..	..	..	..	..	45
46	47	47*	47	47	48	48*	..	..	..	..	..	..	..	..	..	46
47	50	49*	50	50	50	50	50*	..	..	..	..	..	..	..	..	47
48	52	..	52	52	52	52	53*	53*	..	..	..	..	..	..	..	48
49	55	..	54	54	55	55	56	56*	..	..	..	..	..	..	..	49
50	58	..	56*	56	57	58	59	61	62*	..	..	..	..	..	..	50
51	61	..	..	59	60	61	61	63	65	..	..	..	..	..	..	51
52	64	..	..	63*	64	64	64	65	67	..	..	..	..	..	..	52
53	68	..	..	66*	67	67	68	68	69	71*	..	..	..	..	..	53
54	71	..	..	..	69	70	70	71	71	73*	..	..	..	..	..	54

[1] Prepared by Bird T. Baldwin, Ph.D., and Thomas D. Wood, M.D., and published by the American Child Health Association. Age is taken at the nearest birthday; height at the nearest inch; and weight at the nearest pound. Weights are taken in indoor clothing without shoes or sweaters.

* In order to extend the range of the tables so as to include weights of children who are taller or shorter than those in these groups there have been added these estimated weights. All the other weights represent averages for each inch in height for age of the children observed in this study.

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TABLE 41 (Continued)

WEIGHT — HEIGHT — AGE TABLE FOR GIRLS OF SCHOOL AGE

Height (inches)	*Average Weight for Height (pounds)*	*5 years*	*6 years*	*7 years*	*8 years*	*9 years*	*10 years*	*11 years*	*12 years*	*13 years*	*14 years*	*15 years*	*16 years*	*17 years*	*18 years*	*Height (inches)*
55	75	..	..	..	72*	74	74	74	75	77	78*	..	..	..	..	55
56	79	..	..	..	..	76	78	78	79	81	83*	..	..	..	..	56
57	84	..	..	..	..	80*	82	82	82	84	88	92*	..	..	..	57
58	89	..	..	..	..	..	84	86	86	88	93	96*	101*	..	..	58
59	95	..	..	..	..	..	87	90	90	92	96	100	103*	104	..	59
60	101	..	..	..	..	..	91*	95	95	97	101	105	108	109	111*	60
61	108	..	..	..	..	..	..	99	100	101	105	108	112	113	116	61
62	114	..	..	..	..	..	..	104*	105	106	109	113	115	117	118	62
63	118	..	..	..	..	..	..	..	110	110	112	116	117	119	120	63
64	121	..	..	..	..	..	..	..	114*	115	117	119	120	122	123	64
65	125	..	..	..	..	..	..	..	118*	120	121	122	123	125	126	65
66	129	..	..	..	..	..	..	..	..	124	124	125	128	129	130	66
67	133	..	..	..	..	..	..	..	..	128*	130	131	133	133	135	67
68	138	..	..	..	..	..	..	..	..	131*	133	135	136	138	138	68
69	142	..	..	..	..	..	..	..	..	..	135*	137*	138*	140*	142*	69
70	144	..	..	..	..	..	..	..	..	..	136*	138*	140*	142*	144*	70
71	145	..	..	..	..	..	..	..	..	..	138*	140*	142*	144*	145*	71

Age — years		*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*
Average height (inches)	Short	43	45	47	49	50	52	54	57	59	60	61	61	61
	Medium	45	47	50	52	54	56	58	60	62	63	64	64	64
	Tall	47	50	53	55	57	59	62	64	66	66	67	67	67
Average annual gain (lb.)	Short	4	4	4	5	6	6	10	13	10	7	2	1	..
	Medium	5	5	6	7	8	10	13	10	6	4	3	1	..
	Tall	6	8	8	9	11	13	9	8	4	4	1	1	..

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TABLE 42A

WEIGHT AND HEIGHT FOR MEN AT DIFFERENT AGES[1]

In ascertaining height, measure in shoes; stand erect, and press measuring rod down against scalp. Weigh yourself in indoor clothing and shoes. Subtract the height of heel. Weights are given in pounds.

Height	Age 19 yrs.	20	21–22	23–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59
5 ft. 0 in.	111	112	114	118	122	126	128	131	133	134	135
5 ft. 1 in.	116	117	118	121	124	128	130	133	135	136	137
5 ft. 2 in.	122	123	124	125	126	130	132	135	137	138	139
5 ft. 3 in.	127	128	128	129	131	133	135	138	140	141	142
5 ft. 4 in.	130	131	132	134	135	136	138	141	143	144	145
5 ft. 5 in.	134	135	136	137	138	140	142	145	147	148	149
5 ft. 6 in.	139	140	141	142	143	144	146	149	151	152	153
5 ft. 7 in.	142	143	144	145	146	148	150	153	155	156	158
5 ft. 8 in.	147	148	149	150	151	152	155	158	160	161	163
5 ft. 9 in.	152	153	154	155	156	158	160	163	165	166	168
5 ft. 10 in.	155	156	157	158	159	162	165	168	170	171	173
5 ft. 11 in.	159	160	161	162	164	166	170	174	176	177	178
6 ft. 0 in.	163	164	165	166	168	172	176	180	182	183	184
6 ft. 1 in.	167	168	169	171	173	178	182	186	188	190	191
6 ft. 2 in.	171	172	174	176	179	184	189	193	195	197	198
6 ft. 3 in.	175	175	178	181	184	190	195	200	202	204	205
6 ft. 4 in.	178	180	183	186	189	196	201	206	209	211	212
6 ft. 5 in.	183	185	188	191	194	201	207	212	215	217	219

[1] From *Personal Health Standard and Scale*, by Thomas D. Wood, M.D., Bureau of Publications, Teachers College, Columbia University.

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TABLE 42 (Continued)

PROPOSED RANGE OF "IDEAL" WEIGHTS FOR MEN[1]
AGES 25 AND OVER

HEIGHT (with shoes)*		WEIGHT IN POUNDS (AS ORDINARILY DRESSED)		
		Small Frame	Medium Frame	Large Frame
Feet	Inches			
5	2	116–125	124–133	131–142
5	3	119–128	127–136	133–144
5	4	122–132	130–140	137–149
5	5	126–136	134–144	141–153
5	6	129–139	137–147	145–157
5	7	133–143	141–151	149–162
5	8	136–147	145–156	153–166
5	9	140–151	149–160	157–170
5	10	144–155	153–164	161–175
5	11	148–159	157–168	165–180
6	0	152–164	161–173	169–185
6	1	157–169	166–178	174–190
6	2	163–175	171–184	179–196
6	3	168–180	176–189	184–202

[1] From *Statistical Bulletin*, Metropolitan Life Insurance Company, June 1943.
* Subtract the height of heel.

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TABLE 43A

WEIGHT AND HEIGHT FOR WOMEN AT DIFFERENT AGES[1]

In ascertaining height, measure yourself in shoes; stand erect, and press measuring rod down against scalp. Weigh yourself in indoor clothing and shoes. Subtract the height of heel. Weights are given in pounds.

Height	Age 19 yrs.	20	21–22	23–24	25–29	30–34	35–39	40–44	45–49	50–54
4 ft. 10 in.	104	106	108	110	113	116	119	123	126	129
4 ft. 11 in.	106	107	109	112	115	118	121	125	128	131
5 ft. 0 in.	112	112	113	115	117	120	123	127	130	133
5 ft. 1 in.	116	116	116	118	119	122	125	129	132	135
5 ft. 2 in.	118	118	119	120	121	124	127	132	135	138
5 ft. 3 in.	120	121	122	123	124	127	130	135	138	141
5 ft. 4 in.	123	124	125	126	128	131	134	138	141	144
5 ft. 5 in.	126	127	128	129	131	134	138	142	145	148
5 ft. 6 in.	130	131	132	133	135	138	142	146	149	152
5 ft. 7 in.	135	135	135	137	139	142	146	150	153	156
5 ft. 8 in.	138	138	139	141	143	146	150	154	157	161
5 ft. 9 in.	142	142	142	145	147	150	154	158	161	165
5 ft. 10 in.	144	144	145	148	151	154	157	161	164	169
5 ft. 11 in.	146	147	149	151	154	157	160	164	168	173
6 ft. 0 in.	150	152	154	156	158	161	163	167	171	176

[1] From *Personal Health Standard and Scale*, by Thomas D. Wood, M.D., Bureau of Publications, Teachers College, Columbia University.

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TABLE 43 (Continued)

PROPOSED RANGE OF "IDEAL" WEIGHTS FOR WOMEN AGES 25 AND OVER[1]

HEIGHT (with shoes)*		WEIGHT IN POUNDS (AS ORDINARILY DRESSED)		
		Small Frame	Medium Frame	Large Frame
Feet	Inches			
4	11	104–111	110–118	117–127
5	0	105–113	112–120	119–129
5	1	107–115	114–122	121–131
5	2	110–118	117–125	124–135
5	3	113–121	120–128	127–138
5	4	116–125	124–132	131–142
5	5	119–128	127–135	133–145
5	6	123–132	130–140	138–150
5	7	126–136	134–144	142–154
5	8	129–139	137–147	145–158
5	9	133–143	141–151	149–162
5	10	136–147	145–155	152–166
5	11	139–150	148–158	155–169
6	0	141–153	151–163	160–174

[1] From *Statistical Bulletin*, Metropolitan Life Insurance Company, October 1942.
* Subtract the height of heel.

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TABLE 44

Composition of Human Blood*

CONSTITUENT	NORMAL RANGE MG PER 100 ML.†	PATHOLOGICAL CONDITIONS IN WHICH INCREASES (UNLESS OTHERWISE NOTED) MAY BE ENCOUNTERED
Total solids, per cent	19–23	Anhydremia. Low in hydremic plethora and anemia
Total proteins (serum), per cent	6.5–8.2	Low in nephritis with edema (nephrosis)
Albumin (serum), per cent	4.6–6.7	Low in nephrosis
Globulin (serum), per cent	1.2–2.3	Nephrosis, anaphylactic conditions, malignancy, infections, muscular activity
Fibrinogen (plasma), per cent	0.3–0.6	Pneumonia, infections. Low in cirrhosis of liver, chloroform or phosphorus poisoning, typhoid fever
Hemoglobin, per cent (Haden)	15.6	Polycythemia. Low in primary and secondary anemia, chlorosis
Iron, as Fe	52	See Hemoglobin
Copper	0.05–0.25	
Total nitrogen, per cent	3.0–3.7	Varies chiefly with proteins (albumin, globulin, hemoglobin)
Nonprotein N	25–35	Nephritis, eclampsia, etc. See Urea N
Urea N	10–15	Chronic and acute nephritis, metallic poisoning, cardiac failure, intestinal or prostatic obstruction, some infectious diseases. Relatively low in nephrosis
Uric acid	2.0–3.5	Nephritis, gout, arthritis, eclampsia
Creatinine	1–2	Nephritis
Creatine	3–7	Terminal nephritis
Amino-acid N	5–8	Leukemia, acute yellow atrophy of the liver, severe nephritis
Ammonia N	0.1–0.2	Terminal interstitial nephritis
Undetermined N	4–18	Eclampsia
Glucose	70–100	Diabetes, pregnancy, severe nephritis
Total fatty acids	290–420	Diabetes, nephritis
Cholesterol	150–190	Diabetes, nephritis, nephrosis, biliary obstruction, pregnancy. Low in pernicious anemia
Lipid phosphorus	12–14	Diabetes, nephritis, pregnancy. In anemia, low in plasma, high in cells
Total acetone bodies (as acetone)	0.8–5.0	Diabetes
Acetone + acetoacetic acid (as acetone)	0.3–2.0	Diabetes

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TABLE 44 (Continued)

CONSTITUENT	NORMAL RANGE MG PER 100 ML.†	PATHOLOGICAL CONDITIONS IN WHICH INCREASES (UNLESS OTHERWISE NOTED) MAY BE ENCOUNTERED
β-Hydroxybutyric acid (as acetone)	0.5–3.0	Diabetes
Bilirubin	0.1–0.25	Biliary obstruction, hemolytic anemias. Low in secondary anemia
CO_2 capacity (plasma) vol. per cent	55–75‡	Respiratory diseases, tetany. Low in diabetes, nephritis
CO_2 content (arterial blood) vol. per cent	45–55‡	Respiratory diseases, tetany. Low in diabetes, nephritis.
CO_2 content (venous blood) vol. per cent	50–60‡	Respiratory diseases, tetany. Low in diabetes, nephritis.
O_2 capacity vol. per cent	16–24‡	Polycythemia, anhydremia. Low in cardiac and respiratory diseases, anemia
O_2 content (arterial blood) vol. per cent	15–23‡	Polycythemia, anhydremia. Low in cardiac and respiratory diseases, anemia
O_2 content (venous blood) vol. per cent	10–18‡	Polycythemia, anhydremia. Low in cardiac and respiratory diseases, anemia
Ascorbic acid	0.8–2.4	Low in scurvy
Lactic acid	5–20	Exercise, eclampsia
Phenols (free)	1–2	Intestinal obstruction, pernicious anemia, nephritis
Chlorides as NaCl	450–500	Nephritis, cardiac conditions, prostatic obstruction, eclampsia, anemia. Low in diabetes, fever, and pneumonia
Sulfates, inorganic as S (serum)	0.9–1.1	Nephritis
Phosphorus inorganic as P (plasma)	3–4	Nephritis. Low in rickets. Normal values 1–2 mg. higher in children
Calcium (serum)	9.0–11.5	Low in infantile tetany, severe nephritis, parathyroidectomy
Magnesium (serum)	1–3	No changes noted in disease
Sodium (serum)	330	Low in cases of alkali deficit
Potassium (serum)	16–22	Pneumonia, acute infections, occasionally in uremia
Iodine, γ per 100 ml.	8–15	Hyperthyroidism. Low in cretinism

* From Hawk, Oser, and Summerson: Physiological Chemistry, ed. 12, Philadelphia, 1949. The Blakiston Company.

† Figures express concentration in mg. per 100 ml. of whole blood unless otherwise indicated in the first column.

‡ Figures represent weighted averages of the observations of several investigators.

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TABLE 45

Physiological Constituents of Urine*

Normal urine varies widely in composition, being influenced by diet and other factors. The following represents the composition of *average* normal daily excretion of the constituents:

Constituents	Amount in grams	Constituents	Amount in grams
Water	1200	Chloride as NaCl	12.0
Solids	60	Sodium	4.0
Urea	30	Potassium	2.0
Uric acid	0.7	Calcium	0.2
Hippuric acid	0.7	Magnesium	0.15
Creatinine	1.2	Sulfur-total as S	1.0
Indican	0.01	Inorganic sulfates as S	0.8
Oxalic acid	0.02	Neutral sulfur as S	0.12
Allantoin	0.04	Conjugated sulfates as S	0.08
Amino acid nitrogen	0.2	Phosphate as P	1.1
Purine bases	0.01	Ammonia	0.7
Phenols	0.2		

* From Hawk, Oser, and Summerson: Physiological Chemistry, ed. 12, Philadelphia, 1949. The Blakiston Company.

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