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ARTMENT OF THE ARMY TECHNICAL MANUAL

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NUTRITION

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QUARTERS, DEPARTMENT OF THE ARMY
APRIL, 1961

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TECHNICAL MANUAL
No. 8-501

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *28 April 1961*

NUTRITION

			Paragraph	Page
CHAPTER	1.	GENERAL	1–2	2
	2.	ESSENTIAL NUTRIENTS	3–9	4–12
	3.	CALORIES AND BODY WEIGHT CONTROL	10–18	15–22
	4.	DIETARY ALLOWANCES AND STANDARDS	19–23	23, 24
	5.	NUTRITION OF TROOPS IN VARIOUS ENVIRONMENTS		
Section	I.	Temperate climate	24–26	27–29
	II.	Arctic and subarctic climates	27–30	29–31
	III.	Tropical and desert climates	31–32	32
CHAPTER	6.	RATIONS AND FOOD PACKETS	33–36	34–37
	7.	FOOD CLASSIFICATION	37–40	39–43
	8.	NUTRITION ASSESSMENT	41–49	44–67
	9.	PSYCHOLOGICAL ASPECTS OF FOOD	50–54	69–71
	10.	SURVIVAL NUTRITION	55–57	72, 73
	11.	NUTRITIONAL REHABILITATION OF PERSONS SUBJECTED TO UNDER-NUTRITION	58–62	74–80
	12.	FEEDING POPULATIONS UNDER DISASTER AND RELATIVELY STABLE EMERGENCY CONDITIONS	63–71	82–95
APPENDIX	I.	CLASSIFICATION OF FOODS, AND FACTORS FOR CONVERSION OF UNIT PACKAGES TO POUNDS	———	96
	II.	RECAPITULATION TABLE	———	125
	III.	FOOD WASTE (SAMPLE FORM)	———	126
	IV.	RECIPE—FOOD PREPARATION (SAMPLE FORM)	———	127
	V.	EXAMPLE OF WORKSHEETS FOR RECIPE RECORD AND CALCULATIONS	———	128
	VI.	DIETARY QUESTIONNAIRE FOR FAMILY SURVEY (SAMPLE)	———	130

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CHAPTER 1

GENERAL

1. Purpose

This manual is designed primarily to serve as a guide for Army Medical Service officers in the performance of their responsibilities in the field of nutrition as prescribed by AR 40–564. These responsibilities are manifold, but the Army Medical Service officer is most commonly concerned with so-called "normal" or preventive medical nutrition whose objective is the maintenance of an adequate nutritional status among healthy troops. A large part of this manual, therefore, is devoted to basic nutritional information and certain values, equivalents, percentages, and procedures which are useful to any officer concerned with and responsible for maintaining an adequate troop-feeding program. A second purpose of this manual is to provide information on the feeding of civil populations under disaster conditions. Since World War I, during and after World War II and the Korean War, much additional experience has been gained in this field of nutrition. This experience must not be lost to future generations of Army Medical Service officers. Recommendations based on past experience, therefore, are included in this manual. In the event of a wide-scale attack on this country with nuclear weapons, the Military Forces will undoubtedly be called upon to aid in Civil Defense or may be called upon to assume total responsibility for the civil population in the event martial law is declared. The U. S. Army has had little experience in this field. The information provided on this subject in this manual has been obtained from the best available sources in this country and from foreign sources.

2. Scope

The following general subjects are discussed in this manual:

a. Essential nutrients, physiological function, and food sources.

b. Nutritional allowances to provide an adequate diet.

c. A discussion of Calories and the control of body weight.

d. Nutritional requirements of troops stationed in various climatic environments, engaged in various tactical situations and in various degrees of physical activity.

e. Description of the types and purpose of the various rations, food packets, and ration supplements.

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f. An explanation of the Army system of food classification.

g. Tables of food classification, nutrient composition of various food groups, food patterns for Army rations, and other data necessary for performing a quantitative nutritional evaluation of rations.

h. Methods of dietary and clinical evaluation of nutritional status.

i. Psychological aspects of food.

j. Nutritional requirements for survival.

k. Nutritional rehabilitation of starved persons.

l. Feeding populations under disaster and relatively stable conditions.

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CHAPTER 2

ESSENTIAL NUTRIENTS

3. General

a. Nutrition may be defined as "the body state resulting from food consumed" and involves all those processes by which an organism receives and utilizes the materials necessary for growth, replacement, or repair of worn-out or injured structures, reproduction, and transformation to energy. The science of nutrition is extremely intricate and is closely interrelated with all of the biological sciences. However, the fundamental rules of nutrition are not too complicated for the average individual to comprehend, and a thorough understanding of these fundamentals by all officers responsible for any phase of Army feeding is essential to good nutrition in the Army. The quantity of food required and the composition of the diet vary widely, dependent upon the degree of physical activity, body size, and the age of troops. Prolonged physical exertion demands the intake of quantities of food capable of furnishing the additional energy required by the body under these conditions. Similarly, young "teenage" soldiers require more food than adult males to provide for the increased metabolism and growth associated with this age group. Inactivity, on the other hand, lowers the energy requirements and may tend, in some cases, to reduce the appetite to such an extent as to interfere with adequate nutrition. The efficiency of troops depends in part upon the consumption of a nutritionally adequate diet under all conditions.

b. While palatibility of foods cannot be classed as a specific nutrient, it nevertheless exerts an influence upon consumption of the diet and, consequently, is of importance in any feeding system. The planning and provision of a diet, nutritionally adequate in every respect, will not assure adequate nutrition unless it is properly prepared and consumed by the troops. This was emphasized forcibly in some of the earlier operational rations of World War II where certain components of these rations, which were very important nutritionally, were not consumed because of unpalatability.

c. Gross nutritional deficiencies are rarely observed in the United States military personnel today. On the other hand, mild nutritional deficiencies, not recognizable by gross symptoms, may exist among Army troops. These mild or borderline deficiencies may cause a lack of stamina, decreased efficiency, lessened physical

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fitness, diminished resistance to disease, delay in recovery from wounds and illness and, in times of stress, may result in a rapid physical deterioration.

d. The basic essential nutrients are water, carbohydrate, protein, fat, minerals, and vitamins. These are available from a wide variety of foods. The kinds and quantities of individual foods can be varied within wide limits. A nutritionally adequate diet will contain all the essential nutritive substances in the amount and the proportions required to maintain health and physical efficiency.

4. Water

Water is of greater importance than any other single nutrient. The urgency of demand and the promptness with which disaster follows a lack of supply emphasizes its importance. The adult, healthy human body, depending on its size, contains between 35 to 50 liters of water. This is maintained by drinking, by water present in food, and by a mensurable, though not often appreciated, quantity of water gained through the skin and lungs from humid atmospheres. Water is lost chiefly in urine, by evaporation from the skin and lungs, in perspiration, in tears, in feces, by expectoration, in vomitus, and in milk secreted by nursing mothers. Ordinarily, the total inflow of water equals the total outflow and, consequently, the total body water is maintained close to an established volume which fluctuates slightly throughout the course of 1 day. The total intake of fluids should be such that the 24-hour urinary volume does not fall below 1000 ml. When, however, the intake is less than the output, the body becomes dehydrated. Healthy men suffer decidedly if there is a loss of only 2 or 4 liters of body water; their reaction time is slowed. In hot environments with strenuous muscular activity, they may or may not be aware of thirst, and hence will not drink enough to replenish the loss. Should the loss exceed 4 liters, the body temperature can rise abruptly and there is danger of fatal heat stroke. Diseases, such as cholera, result in excessive loss of water by defecation of as much as 10 liters in a single day. From the above, it is obvious that water balance of troops can become a problem requiring the attention of the nutrition officer and the medical officer. Generally, the outflow of water is regulated by the body, and by individual efforts, such as seeking the protection afforded by shade from the sun. Since there is scarcely any means of reducing the outflow, it is mandatory to supply an adequate intake. An example of how to accomplish this is shown in the following table which sets forth the routes of entrance and exit, together with the volumes of water handled daily by the body under ordinary circumstances in a temperate climate.

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Daily Water Balance (adult)

Entrance	*Inflow (liter per day)*	*Outflow (liter per day)*	
1. Drink	1.0	1. Kidneys	1.4
2. Food		2. Lungs	0.5
a. Its water content	1.2	3. Skin	1.2
b. Its oxidation	0.3	4. Bowels	0.1
3. Environment	0.5		
Total	3.0	= Total	3.0

Excessive drinking is handled by increased flow of urine and the water balance is zero, since the outflow equals the inflow. Conversely, should there be excessive loss of water, as by increased sweating, the only means of balancing this loss is to increase the intake, usually by drinking more water. In extreme heat, troops should be encouraged to drink small amounts of fluids frequently. Up to about 2.5 gallons of water may be consumed daily in a hot environment.

5. Carbohydrate

Carbohydrates are the most readily digested and quickly available of the nutrients furnishing the body's energy. Under normal circumstances, carbohydrates furnish about one-half of the total energy of the Army ration. The three main subdivisions of carbohydrates are sugars, starches, and celluloses; the latter are relatively indigestible and of little value as a direct source of energy in man. The sugars occur in the diet chiefly in such forms as sucrose, cane sugar, syrups, honey, and jam; starches, mainly in flour, bread, rice and other cereal products, and in potatoes. Both starches and sugars are converted into monosaccharides (simple sugars) in the digestive processes and are absorbed into the blood stream in this form. Glucose is the most important and most common of these monosaccharides in the blood. Sugars not used immediately as a source of energy are converted to fats or glycogen (animal starch) and then stored in the liver and muscle tissues. This serves as an energy reserve immediately available when needed. The capacity of the body to store glycogen is limited to about 350 grams. This quantity represents about one-half day's energy needs. When this source is exhausted, unless supplemented by dietary sources of energy, the body derives energy from its own tissues which results in loss of weight. On the other hand, if an excess of carbohydrate is consumed, the excess may be converted into fat and stored. This may lead to obesity. It is necessary, therefore, to maintain energy balance by supplying as much energy in the diet each day as is expended. The amount of carbohydrate in the diet is an important factor is maintaining this balance.

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6. Protein

a. Proteins, the principal organic constituents of body tissue, are essential components of all cells in the body and are constituents of the enzymes found in the body cells. The diet must contain sufficient protein to replace that broken down in normal body functions, to replace that destroyed as a result of injury, and to provide new body tissue for the growing individual. The intake of protein necessary to preserve equilibrium is never a fixed amount. The relative minimum requirement of protein is the smallest amount which, with a fixed quantity of other nutrients, will preserve nitrogen equilibrium and promote growth and repair. In the normal digestive processes, proteins are broken down into their constituent amino acids. They are absorbed as such and transported in the blood stream to be distributed to the various tissues. Part of the amino acids is combined with other amino acids to form the characteristic protein in the growth of tissue. Another portion of the amino acids is utilized to form the protein constituents of the body fluids. The remainder of the amino acids is broken down in the cells and the nitrogenous portion is converted into urea and excreted in the urine. The non nitrogenous portion is converted into sugar or fat and used either as a source of energy or stored.

b. For practical purposes protein is referred to as a single nutrient. Many types of protein exist, however, since they are composed of a large number of individual amino acids (building blocks) which vary both in kind and number. Of the approximately 22 amino acids known at present, 8 are known to be essential for adult man. These must be provided in the correct quantities and proportions. The remainder of the amino acids required to build specific proteins can be synthesized in the body from other substances. Consequently, we refer to a protein which contains all of the essential amino acids in approximately the proper ratio as a complete protein. A protein of high biological value is one which contains the essential amino acids in the quantities required by the body, and is efficiently utilized by the body. As a rule, protein from animal products such as milk, eggs, lean meats, fish, poultry, and cheese has the highest biological value, although some plant proteins contained in soybeans, peanuts, and other legumes are nearly as good. Cereal proteins are often deficient in certain essential amino acids, especially lysine, methionine and, perhaps, threonine. A good diet will supply protein from both animal and vegetable sources so that all essential amino acids will be available in adequate amounts. Health can be maintained on strict vegetarian diets if the quantity and variety of protein is sufficient. There is little or no capacity in the body for storage of protein or amino acids; therefore, there is need for a constant source of protein in

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the diet. Muscular work does not in itself result in an increased destruction of cellular protein unless there are insufficient carbohydrates and fats in the diet or body reserves to provide the necessary body energy. The protein requirements, therefore, do not increase with increase in physical activity.

c. After starvation, wasting diseases, and surgery, there is a special requirement for extra protein for restoration of damaged or destroyed tissues.

d. An intake of 1 gram of protein per kilogram (2.2 pounds) of body weight per day (11 to 13 percent of the food consumed) is regarded as a practical and realistic minimum when a large proportion of protein is furnished by nonanimal sources. Nitrogen balance can be maintained with diets providing as little as 20 to 30 grams of protein daily. However, nitrogen balance does not necessarily reflect all the functions of protein in maintaining normal metabolism and health. The dietary protein levels should provide some margin for variations in individual requirements and to facilitate repletion of body stores after injury, disease, or temporary inadequacies.

7. Fat

a. Fat is primarily an energy source contributing, weight for weight, more than twice as much energy as carbohydrate or protein. For this reason alone, it becomes extremely important in the military ration when maximum energy is required with minimum bulk and weight. It is generally recommended that, under normal conditions of physical activity, at least 20 to 25 percent of the calorie value of the diet be provided by fat. Although the requirements of fat for man are unknown, sufficient evidence exists to indicate that the above figure provides all that is required. The average diet of the civilian population in the United States provides 35 to 40 percent of the available calories from fat. Food consumption surveys have shown that the U. S. soldier on Field Ration A obtains 40 to 45 percent of his caloric requirements from fat. There is a limit, however, to the quantity of fat that can be included in the diet from both the practical and physiological standpoints. The burning of excessive amounts of fat in the body for energy will result in the appearance of acetone in the blood and urine (acidosis). For this reason, and because large quantities of fat are not acceptable to the average soldier, fat should not furnish more than 50 percent of the calories of the diet and never more than 2,000 calories per day.

b. In addition to its value as an energy source, fat also supplies essential unsaturated fatty acids, phospholipids, serves as a carrier for the fat soluble vitamins A, D, E, and K, and contributes flavor to the diet.

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c. Fat is more slowly digested than other food elements and contributes a satisfying quality to the diet. Fats are emulsified in the intestine and split into glycerol and fatty acids before being absorbed. If not required for immediate energy purposes, the fatty acids are resynthesized into body fat and stored for future needs. Fat-rich foods are butter, cream, lard and lard substitutes, vegetable oils, and fats of meats, all of which are included in the military diet in adequate quantities.

8. Minerals

a. General. While some minerals constitute only a small portion of the total body weight, they enter into the activities of the body to a much greater degree than their mere weight would seem to indicate. Minerals are the primary constituents of the teeth and the skeletal framework. In addition, they help maintain osmotic relations between body fluids and tissues; they are combined with many essential compounds such as hemoglobin, enzymes, and vitamin B_{12}; they form ionic complexes with proteins and other cellular constituents, thereby conferring special properties to these substances. To meet mineral needs satisfactorily, the consumption of each element must be sufficient to cover body losses and provide a reserve for the formation of new body tissue or to meet changing physiological needs due to growth or environmental stresses.

b. Calcium. Ninety-nine percent of the relative large amount of calcium in the human body is contained in the skeletal system (the bones, teeth, cartilage, etc.). In general, their weight of the skeleton increases to about age 25 in men. In addition to its predominance and necessity in the skeletal system, the remaining one percent of calcium in the body fluids and soft tissues plays an essential role in many physiological processes. It is necessary for normal coagulation or clotting of the blood. It is important in the physiology of nerve conduction and is essential in contraction and relaxation of muscle tissue, influencing the beating of the heart, as well as all other muscular movement. In addition, calcium also influences many other physiological processes. The calcium requirement is dependent upon a number of factors such as level of intake, individual variation in absorption and utilization of the calcium in the food ingested, presence of factors accelerating or depressing calcium utilization, excretion rate, balance of other minerals, and vitamin D nutriture. Certain vegetables such as spinach contain compounds, such as oxalic acid, which tend to prevent calcium utilization. On the other hand, vitamin D is essential for the utilization of calcium. The diet must provide a proper ratio of phosphorus in relation to calcium for bone formation (approximately 1.5 parts phosphorus to 1 part calcium). In Military personnel, the problem

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of additional skeletal development in the teen-age individual must be considered since, during this age period, the calcium requirement is much greater than the amount required for the normal male adult for maintenance. Even in adults, calcium of the bones is not immobile but is given up readily on demand and stored when the supply is great. Thus adults can suffer skeletal weaknesses if the intake of calcium is deficient over a prolonged period. In view of the variation in requirement, an intake of 0.8 gram of calcium per day for adult man or 1.4 gram for young growing men is desirable. Calcium balance can be attained with intakes of as little as 0.3 grams daily. Adaptation to low calcium (and high calcium) diets is a well-known phenomenon. Diet intake figures must be evaluated in the light of evidence of calcium inadequacy. In evaluating calcium intakes, consideration must be given to sources of calcium such as drinking water, salt, and calcium compounds used in processing foods. Milk and its products, other than butter and cream, are the main sources of calcium with lesser amounts occurring in eggs, cereals, legumes, and leafy and yellow vegetables.

c. Phosphorus. About eighty percent of the phosphorus in the body is combined with calcium in the formation of the skeletal structures, while the remainder is associated with protein, carbohydrate, fat, and various organic substances in the soft tissues. It forms an integral part of the nuclear structure of every cell and thus is intimately concerned in cell metabolism. It is essential in the metabolism of fats and carbohydrates, and participates in many other physiological processes. Like calcium, it is needed in relatively large quantities during growth. The recommended intake is about 1.5 times the calcium requirement. Phosphorus is so widely distributed in foods that, if the diet supplies adequate calcium and protein, there is little likelihood of a phosphorus deficiency. However, in a diet primarily of cereals, the calculated phosphorus intake may be misleading, since cereals contain most of the phosphorus in the form of phytin phosphorus which is poorly utilized. The best sources are milk products, eggs, meats, and cereals.

d. Iron. Iron is essential for the formation of hemoglobin, myoglobin, and certain respiratory enzymes. The total amount of iron in a normal individual is approximately 4 to 5 grams of which 70 percent is contained in the blood, principally in the hemoglobin of the red blood cells where it functions in the transportation of oxygen to all tissues of the body. A reserve store of iron is found largely in the liver, bone marrow, and spleen. In normal males, the daily loss of iron from all sources approximates 1 mg. Since the efficiency of absorption of dietary iron is usually about 10 percent, a daily intake of 9–12 mg. should be realistic. There is excellent evidence that normal males can be maintained on much lower intakes. However, in dealing with groups where parasitism may be

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high, and where the need to regenerate blood may be a matter of considerable practical importance (in military forces), the need for dietary iron may be increased. The National Research Council's recommended allowance for growing young men and women is 15 mg. per day. Iron is widely distributed in foods, the sources being organ means (liver, kidney, heart), eggs, molasses, dry legumes such as peas and beans, and green vegetables.

e. Iodine. Iodine is an essential component of the thyroid hormone (thyroxin), which is an important regulator of energy metabolism. Prolonged iodine deficiency results in the development of a simple goiter. The adult body contains 20 to 50 mg. iodine, of which 20 to 40 percent is found in the thyroid. Iodine is required in very small amounts, 0.2 milligrams daily, but in some areas this amount is difficult to provide by means of natural food-stuffs. Iodine occurs only in foods produced in iodine-containing soils or in seafood. The Army ration provides iodine in the form of iodized table salt containing 0.01 per cent of stabilized iodide.

f. Salt. Salt (sodium chloride) and water requirements (par. 4) are closely interrelated and depend, to a considerable extent, upon the climatic environment and the physical activity of the individual. The exact requirements of sodium chloride cannot be set. A daily intake of about 5 grams with an additional gram per quart of water consumed in excess of 1 gallon appears to be sufficient for moderate activities in a temperate environment. The average intake for the normal adult is 7 to 15 grams daily. During periods of acclimatization to high climatic temperature, an increased intake of water is a necessity and should be accompanied by an increased salt intake. This additional salt is necessary to compensate for that lost through sweating. Approximately 20 grams of salt per man per day may be required under conditions of profuse sweating. This should be consumed in food or, less preferably, in drinking water. If salt is added to drinking water, the concentration should not exceed one part per thousand (approximately 1 gm per quart). The ingestion of impregnated salt tablets should be permitted only if adequate supplies of water are available to approximate the one part per thousand (2 tablets per canteen) concentration. Heat exhaustion is relatively uncommon among troops stationed in hot climates if salt and water intake are maintained. After acclimatization, the need for salt beyond that usually contained in, or added to, food decreases.

g. Other minerals. Many other minerals are essential and important for adequate nutrition. One of these is copper which, although not a constituent of hemoglobin, plays a role in the process of hemoglobin formation. The quantities of copper necessary for adequate nutrition are very small, being approximately one-tenth that of iron. Fortunately, the foods that are the best sources of iron

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also are the best sources of copper so that a copper deficiency is extremely unlikely if the iron intake from the diet is adequate. Other essential minerals are potassium, magnesium, cobalt, manganese, molybdenum, zinc, and possibly fluorine and selenium. Man's nutritional requirement for these elements is not known. The quantities of these elements are believed to be sufficient in the foods of the American diet to preclude any special provision in military feeding.

9. Vitamins

a. General. Vitamins are extremely potent organic compounds, present in minute quantities in natural foodstuffs, which are essential for normal growth and for the maintenance of health and life. Vitamins are necessary and effective in very small amounts in the regulation of metabolism and transformation of energy from fat, protein, and carbohydrate. The distribution of vitamins in natural foodstuffs makes it possible to plan a well-balanced diet adequate in all the vitamins now recognized as essential. However, vitamin deficiencies may occur as a result of poor food habits, improper processing or preparation of foods, lack of proper foods because of low economic status, or disturbed metabolism due to disease or other causes. For a detailed clinical description of vitamin deficiency symptoms, see chapter 8.

Table I. Suggested Guide for Interpretation of Nutrient Intake

Nutrient	Deficient	Acceptable
	Less Than	
Niacin (mg/day)	5	10–14
Riboflavin (mg/day)	.7	1.2–1.4
Thiamine (mg/1,000 calories)	.2	0.3–0.4
Ascorbic acid (mg/day)	10	30–49
Vitamin A (I.U./day)	2,000	3,500–4,999
Calcium (gm/day)	.3	0.4–0.7
Iron (mg/day)	6.0	9–11
Protein (gm/kg body weight)	.5	1.0–1.4

b. Vitamin A. The natural vitamin A occurs only in animal tissues, whereas the provitamin (carotene) occurs predominately in vegetables and to a lesser extent in animal tissues. The main source of vitamin A or its precursors in the Army ration are the leafy green and yellow vegetables, sweet potatoes, butter, milk products, eggs, liver, and tomatoes. The availability of carotene in different types of foods varies considerably and its utilization may be influenced by the other dietary constituents such as the amount of fat.

c. Thiamine (Vitamin B_1). Thiamine is a water soluble and heat liabile compound; therefore, much of it may be lost from foods

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by overcooking or by the use of too much water in cooking and discarding the so-called "pot-liquor." Thiamine is associated intimately with carbohydrate metabolism in the body and plays a role in the regulation of the nervous system. *A severe deficiency results in the classical disease known as beri-beri.* In severe cases, the disease is characterized by bilateral polyneuritis, edema of the lower extremities, and heart failure. Thiamine deficiency may be common among rice-eating populations, particularly where the rice is highly milled. The main sources of thiamine are meats, particularly lean pork, and whole cereal products, or enriched flour and breads. Other sources are eggs, leafy green and yellow vegetables, and legumes.

d. Riboflavin (Vitamin B_2). Riboflavin is a water soluble yellow pigment that is destroyed by heat, especially in alkaline solution. It is also very sensitive to sunlight. This vitamin is concerned primarily with cellular oxidations and plays an important role in the metabolism of carbohydrates, proteins, and fats. Riboflavin deficiency is caused by a diet containing inadequate amounts of the protective foods (eggs, milk products, meats, fish, poultry, leafy greens, legumes), and it is thought that an excess of carbohydrates such as sugars and highly milled grains contribute to this condition.

e. Niacin (Nicotinic Acid). Niacin is soluble in water and fairly stable to heat under ordinary cooking processes. It functions primarily as part of the enzyme systems which regulate carbohydrate and protein metabolism. Niacin deficiency results from the consumption of a diet low in protein and high in sugars and unenriched cereals, particularly corn. Such a diet is low not only in niacin but also in tryptophan, an amino acid which the body can convert to niacin. Sixty mg. of tryptophan can be considered as roughly equivalent to 1 mg. of niacin.

f. Ascorbic Acid (Vitamin C). Ascorbic acid is water-soluble and very easily oxidized. Thus loss of this vitamin in the storage and preparation of food may be great. Vitamin C functions in, and assists maintenance of, the colloidal intercellular substances or cementing substances which form an intricate part of such structures as cartilage, matrix of bone, dentine of teeth, and all fibrous tissues. It also has a profound effect on wound healing. The main sources of ascorbic acid are citrus fruits, leafy green and yellow vegetables, potatoes, and tomatoes.

g. Vitamin D. Vitamin D activity is exhibited by a number of closely related sterols, fat-soluble compounds which occur only in animal products. Many related sterol compounds of animal and plant origin, "provitamins D" or vitamin D precursors, are converted to vitamin D in the skin in the presence of sunlight. These latter compounds provide most of the vitamin D requirement of

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man from natural foods. Vitamin D is necessary for the deposition of calcium and phosphorus in the bones and teeth. In the growing person, growth of bones ceases in the absence of vitamin D and malformation of the bones, such as is seen in rickets, occurs. The male adult has a very low requirement for vitamin D, and the amount formed in the skin by exposure to sunlight usually suffices. The principal sources of Vitamin D are butter, cream, eggs, irradiated milk, and fish. Provitamins D are found in leafy green and yellow vegetables.

h. Vitamin E. Requirements for this vitamin have not yet been determined for man. Vitamin E exerts an antioxidant effect in the intestinal tract and thus protects vitamin A and carotene from oxidative destruction. From what is known, it appears that any normal diet containing leafy green vegetables, legumes, meat, or milk products contains sufficient vitamin E to meet requirements.

i. Vitamin K. This substance is necessary for the formation of prothrombin, one of the factors important in the clotting of blood. In Vitamin K deficiency, excessive and prolonged bleeding may occur from trivial wounds. Normally, adequate amounts of vitamin K are synthesized in the intestinal tract. It is unlikely that this vitamin would be deficient in a dietary of natural foods. Green leafy vegetables, tomatoes, and liver are the best known sources.

j. Other Vitamins. Various other vitamins are known to be required by man for normal body functions. Some of these are concerned with blood formation, metabolism of proteins, fats, and carbohydrates, enzyme formation, maintenance of the central nervous system, and utilization of other vitamins. Among those may be listed biotin, choline, folic acid, pantothenic acid, pyridoxine (B_6) and vitamin B_{12}. Although they are essential, the quantitative human requirements have not been established. A diet of natural foods which provides the daily requirements of the other vitamins will also provide the above substances in adequate quantities.

k. Synthetic Vitamin Preparations. An optimum diet is defined as one that provides all nutrients essential for the maintenance of optimal health and efficiency. Wherever possible, the nutrients required should be obtained from natural foods rather than synthetic preparations. This is particularly true of the vitamins. Synthetic vitamin concentrates, tablets, and pills may not contain all of the known nutrients, either as such or in optimal proportion. Further more, they obviously may not contain lesser known or unknown nutrients which are, however, provided by natural foods. The use of vitamins over and above the daily requirements does not result in any improvement over the physiological state attained by an adequate diet obtainable from natural foods and might, in fact, result in undesirable reactions from excessive amounts of such vitamins as A and D.

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CHAPTER 3

CALORIES AND BODY WEIGHT CONTROL

10. General

a. Foods supply energy in the form of work and heat when oxidized in the body. Carbohydrates and proteins supply approximately four Calories per gram, and fat about nine Calories per gram. These values are based on the actual measurements of heat energy given off when average American foods are consumed.

b. The Calorie is one of the most common words heard in connection with foods. To the average person it means the weight-gaining potential of food; to the nutritionist or scientist it suggests heat energy and can be measured as heat. When it is said that an egg contains 77 Calories, this means that if burned in the body it would yield that many Calories of heat. There are large Calories or kilocalories as distinguished from the small calorie one may have encountered in the physics laboratory. When one uses the term Calorie in connection with food the large Calorie or kilocalorie is implied, and is spelled with a capital letter. By definition, a Calorie is the amount of heat required to raise the temperature of one kilogram (a little more than a quart) of water one degree centigrade. Thus, one egg (77 Cal.) produces enough heat when burned to raise a kilogram of water from a temperature of 23° C. to 100° C.

c. Approximately 3500 excess Calories are required to produce an increase of 1 pound in body weight. This is an important number to remember in predicting gain or loss of body weight.

11. Basal Metabolic Requirements

In some respects the human body may be compared to the gasoline engine of the automobile. Both burn fuel, both convert fuel into work (energy), and both give off heat as a byproduct. When the automobile engine is not running it burns no fuel. This is not true in the living human body, where calories (fuel) are used all the time, even during sleep. Numerous body functions continue while an individual is asleep, i.e. the constant production of heat, the beating of the heart, breathing, and other functions required merely to keep alive. About one half of the daily food ingested is used just for keeping alive or maintaining the body in a normal state. These are referred to as basal caloric requirements, since

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they represent the minimum amount of energy necessary to maintain life. We might refer to these as "idling calories," because these do similar work to fuel used by an automobile engine when idling. The healthy human cannot ordinarily alter his basic caloric requirements. Overactivity or underactivity of the thyroid or pituitary glands, and certain other abnormal conditions, such as starvation, may bring about changes in the basal rate. The following factors influence the basal caloric requirement: (1) Age (2) Body size or shape (3) Sex. Energy requirements decline progressively after the years of early adulthood, because of a decrease in metabolic rate as well as lessened physical activity. The National Research Council has proposed the following caloric reduction per decade of years: 3 percent between ages 30 to 50, 7.5 percent between 50 to 70, and 10 percent between 70 to 80. In general, basal caloric requirements increase with increasing body weight. Thus, an individual who is overweight requires more basal calories just to maintain the extra weight than one who has an ideal body weight. Also, an individual who continues to eat the same amount of food year in and year out will increase in body weight, since his basal requirements and his activity decrease as he grows older. Basal caloric requirement for females is about 10 percent lower than for males. Also, as mentioned, body shape influences basal caloric requirements. A tall slim person of a given body weight requires more basal calories than a short squat person of the same weight.

12. Caloric Requirements for Physical Activity

The energy expenditure of individuals may vary considerably. This is due to both a variation in the amount of work that they perform and in the individual variations in the caloric cost of such work. The calorie cost of any type of activity that involves the whole body, such as walking, varies with the size of the body and more specifically with total body weight (table II). Every movement of the body, no matter how slight, is work and requires calories. It follows that the greater the activity the more calories are required. Even shivering caused by cold is a form of physical exercise which heats the body and requires extra calories. Sedentary activities, such as watching television, require fewer calories than does walking, playing football, tennis, or golf. The inactive person may require no more than 20 to 30 percent additional calories over basal needs. On the other hand, the soldier doing hard physical work may require an increase of 100 to 300 percent. According to the Food and Nutrition Board of the National Research Council, an individual frequently may spend more energy away from rather than on his job. Increasingly, the modern American tends to expend most of his energy away from the job. He (or

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Table II. Energy Expenditure in Walking as Affected by Speed and Body Weight[1]

Speed, miles per hour	Body weight in pounds		
	120	160	200
2.0			
Calories/hour	156	192	228
Calories/mile	78	96	114
3.0			
Calories/hour	216	264	318
Calories/mile	72	88	106
4.0			
Calories/hour	282	348	420
Calories/mile	71	87	105

[1] Modified from article in JAMA, Vol. 167, No. 2, p. 218, May 10, 1958.

she) may spend, per week, 40 hours at work, 20 hours eating and going to and from work, and 50 to 60 hours in sleep, but there are still 50 to 60 hours for energy expenditure at a high or low rate as the case may be. In general, the pattern of the soldier's activity follows the same trend. The energy expenditure of the soldier of average size engaged in various activities is given in table III.

13. Specific Dynamic Action (SDA)

Specific dynamic action is the increase in heat production that follows the digestion and metabolism of food. The stomach and intestines move vigorously and secrete juices when transferring food to the body, and this requires the expenditure of energy. This is sometimes referred to as the expense of digestion. In other words, calories are required to use calories and these must be included in the total evaluation. The specific dynamic action (SDA) varies with different foods, that from proteins being the most, carbohydrates next, and fats least. On the average, the SDA of a mixed diet is about 10 percent of the basal calories.

14. Total Caloric Requirements

The total daily caloric requirement is the sum of the calories required for the basal needs, muscular and organic activities, and specific dynamic action for the full 24 hours. When the caloric value of the food intake equals the total requirements, and adequate water is drunk, the body weight will remain unchanged. Body weight will increase when the caloric intake is more than required and decreases when the intake is less than required.

a. Adjustment of Calories for Activity. The outstanding factor causing variability in caloric requirements is physical activity. The

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Table III. Energy Costs for Various Activities and Descriptions

Male, Body Weight (161 lbs)

Activity	Cal/Min	Description
BMR and Sleep	1.09	Basal metabolic rate—also sleep.
Sit, normal	1.29	Sit with minimum of movement except for talk.
Sit, read	1.29	Reading or writing but otherwise same as above.
Sit, eat	1.49	Involves all movements used in eating.
Sit, play cards	1.53	All movements used in playing normal card game.
Rest on bunk	1.26	Lying on bunk talking, reading, or writing.
Stand, normal	1.50	Stand with one foot in place at all times with minimum of movement.
Stand, light activity.	2.60	Mostly standing with some movement but not more than in a 10-foot area. Also standing using hand and arm movements such as dusting, arranging items on shelf, etc.
Personal toilet	2.02	Morning and evening activities including brushing teeth and hair, washing face and hands, and shaving.
Shower	3.40	Showering and drying after shower.
Dress	3.40	Dress and undress.
Make bunk	4.88	All movement involved in bunk making.
Shoe shine	3.20	All movement involved in shining shoes.
Sweep	3.91	Using either corn or push broom.
Mop	4.86	Using wet or damp mop.
Walk, inside	3.11	Slow normal gait of men in building. Occasional short stops.
Walk, outside	5.68	Normal fairly brisk walk of men outside on the street with someplace to go but ample time to get there.
Walk, upstairs	18.58	Normal one step at a time stair climb.
Walk, downstairs	7.14	Normal one step at a time descent on stairs.
Dism. drill	6.53	All normal basic movements used in dismounted drill for a training company.
Double time	19.43	180 steps per minute or trot.
Contest march	9.62	Cross country race over a 7-mile course with alteration between trotting and walking up and down hills and on level ground.
Step test	21.55	3 minute Harvard Step Test with 20-inch bench as described in MNL Report 160 (17).
PT test	5.95	5-part Army physical fitness test (pullups, pushups, squat jump, 2 minute situps, 1 minute squat thrusts).
Calisthenics	5.41	Army daily dozen.
Infiltration Course	11.31	Crawling through infiltration course under fire.
Kneel	1.42	Slight or no movement while on knees.
Squat	1.99	Same as kneel except man is in a squatting position.
Wash clothes	3.03	Wash and rinse clothes or boots by hand.
Football	10.06	Punting, passing, catching passes and punts, some running.

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Activity	Cal/Min	Description
Basketball	8.59	Half court game with usual movements.
Ping pong	4.77	Two man game.
Bowling	7.64	Walking to and from alley and rolling of ball.
Swimming	11.49	Normal recreational swimming in pool.

principles adhered to are: (a) that caloric allowances must be adjusted up or down to meet specific needs; and (b) the proper caloric allowance for an individual is that which over an extended period will maintain body weight at the level most conducive to well-being. The usual upper level for men at heavy work will be 3800–4000 Calories. For extremely heavy work the requirement may be up to 4800–5000 Calories; however, this level of activity is rarely encountered and usually represents a temporary need. Conversely, the caloric requirement of the sedentary individual will be around 2400.

b. Adjustment of Calories for Climate. Contrary to the usual conclusion that a 5 percent decrease in total caloric expenditure occurs for every 10° Centigrade increase in mean temperature from the base reference of 10° Centigrade, recent studies by the U. S. Army Medical Research and Nutrition Laboratories have adequately demonstrated that the energy requirement of men living in extreme heat (of approximately 40° Centigrade) is increased not decreased.[1] The measured caloric intake for men undergoing a constant exercise program outside in the sun at 40.5°C; outside in the shade at 40.3°C; and, indoors at 26°C averaged approximately 3550, 3500, and 3150 calories per man per day for the three conditions respectively. Using the same environmental temperatures the Food and Agriculture Organization (FAO) and the National Research Council (NRC) predicted intakes for the same size men at the various temperatures are 3025, 3025, and 3361 calories. The actual caloric requirements for men working and living in extreme heat were even greater than the approximate increase of 500 calories per day because of changes in body composition. It is suggested that a degree centigrade rise in environmental temperature over 25° Centigrade increases the caloric requirement by approximately 50 to 100 Calories per degree. The energy requirements in a temperate and a subzero environment are essentially the same, provided the men are adequately clothed.[2] The slight increased requirement for calories for men undergoing the same physical exercise in the Arctic is due primarily to the hobbling effect and weight of Arctic clothing, especially the heavy footgear.

[1] Reference: U. S. Army Medical Research and Nutrition Laboratory Report No. 246, 5 July 1960.

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c. Adjustment of Calories for Body Size. When men and women differ from the standard body size of 70 and 58 kilograms (154 and 127.6 lbs), respectively, the following formulas are applicable:

(1) Calorie allowance for men $0.95\ (815 + 36.6\ W^*)$

(2) Calorie allowance for women $0.95\ (580 + 31.1\ W^*)$

*W—desirable weight in kilograms.

See table IV for influence of body weight on caloric requirements.

15. Actual Versus Desirable Body Weight

In the United States the maximum height of an individual is usually reached by age 20 or shortly thereafter and the body weight continues to increase until close to 60 years of age. The most favorable health expectancy is associated with no increase in weight beyond that normally attained at age 25 or 30. Therefore, in making caloric allowances for adults, the allowance should be made, not on the basis of actual weight, but according to the desirable body weight (table V).

16. Time Required to Gain or Lose Weight

Since it takes about 3500 Calories to form 1 pound of body weight, the extent of excessive caloric intake can be easily calculated. For example, if an individual is 20 pounds overweight he has consumed 20 x 3500, or 70,000 Calories more than he required. Of course, it took some time to consume this excess—it wasn't done overnight. If one assumes that this individual ate 250 calories (one candy bar) above his requirement every day it would have taken 70,000 ÷ 250, or 280 days to gain 20 pounds. If the daily calorie excess had been 500 Calories (a hamburger and a glass of milk), it would have taken only 140 days. For this individual to lose the 20 pounds overweight he either must expend more calories than he eats or eat fewer calories than he expends. The latter is generally the easier course to follow. Since this excess weight was probably added over an extended period it is not wise to attempt to take it off too rapidly. In general, a reduction of about 2 pounds per week is considered to be a desirable rate; however, medical advice should be sought before attempting to lose more than a few pounds. In order to lose 2 pounds per week one must consume approximately 2 x 3500 or 7000 Calories *less* than required each week. This is equivalent to 1000 Calories deficit per day, and is not too difficult to attain. Frequently, this can be accomplished by omitting desserts or some of the snacks eaten between meals. *For example,* 300 Calories are provided by an average serving of each of the following: most pies, ice cream, milk shakes, chocolate eclairs, small hamburger sandwich, or peanut butter sandwich. Any

[1] Reference: U. S. Army Medical Research and Nutrition Laboratory Report No. 202, 22 March 1957.

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Table IV. Caloric Allowance for Individuals of Various Body Weights for Men and Women 25 Years of Age[1]

Men		Women	
Body weight	Caloric allowance	Body weight	Caloric allowance
110	2500	88	1750
142	2850	110	2050
164	3200	142	2350
176	3550	164	2600

[1] Weights include clothing usually worn indoors and, for males, shoes with 1-inch heels; and for females 2-inch heels.

Table V. Desirable Weights (Ages 25 and Over)

Weights in Pounds According to Frame (In Indoor Clothing)

MEN

Height (with shoes on) 1-inch heels		Small frame	Medium frame	Large frame
Feet	Inches			
5	2	112–120	118–129	126–141
5	3	115–123	121–133	129–144
5	4	118–126	124–136	132–148
5	5	121–129	127–139	135–152
5	6	124–133	130–143	138–156
5	7	128–137	134–147	142–161
5	8	132–141	138–152	147–166
5	9	136–145	142–156	151–170
5	10	140–150	146–160	155–174
5	11	144–154	150–165	159–179
6	0	148–158	154–170	164–184
6	1	152–162	158–175	168–189
6	2	156–167	162–180	173–194
6	3	160–171	167–185	178–199
6	4	164–175	172–190	182–204

WOMEN

Height (with shoes on) 2-inch heels		Small frame	Medium frame	Large frame
Feet	Inches			
4	10	92–92	96–107	104–119
4	11	94–101	98–110	106–122
5	0	96–104	101–113	109–125
5	1	99–107	104–116	112–128
5	2	102–110	107–119	115–131
5	3	105–113	110–122	118–134
5	4	108–116	113–126	121–138
5	5	111–119	116–130	125–142
5	6	114–123	120–135	129–146
5	7	118–127	124–139	133–150
5	8	122–131	128–143	137–154
5	9	126–135	132–147	141–158
5	10	130–140	136–151	145–163
5	11	134–144	140–155	149–168
6	0	138–148	144–159	153–173

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combination of three of the above would equal 900 Calories; two pats of butter contain 100 calories. If one followed the above pattern of a daily deficit of about 1000 Calories it would require about 70 days to lose 20 pounds. Once the ideal weight has been attained, the caloric intake should be adjusted to meet the requirements and no more. This will allow the individual to retain his ideal weight yet do his usual amount of work and both feel and look better.

17. Exercise and Weight Control

There is a tendency to overlook the importance of exercise in weight control on the assumption that increased activity causes an increase in food consumption and a gain in body weight. In general, food intake does increase with an increase in physical activity and decrease with decrease in physical activity; however, this generalization applies only to the normal range of activities. It does not apply for either sedentary or exhaustive levels of activity. In the sedentary individual the voluntary food intake usually does not decrease with decreasing activity to a level necessary to prevent an increase in body weight.

18. Adequacy of Diet

Although counting calories is important, care must be taken that the diet, reducing or otherwise, includes all required nutrients. In addition to energy foods it must provide adequate amounts of protein, minerals, and vitamins. These will be obtained from the regular menu served in an Army mess. These menus are carefully planned to provide all essential nutrients known to be required. Unless the person wishing to reduce has a fair knowledge of food composition, that is, what nutrients each food provides, he should not skip any one food just because it may be high in calories. It is better to reduce the caloric intake by reducing the quantity of all foods eaten than to omit specific foods on the menu. Such items as soft drinks, candies, and alcoholic beverages can be omitted without decreasing the nutritional adequacy of the daily food intake.

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CHAPTER 4

DIETARY ALLOWANCES AND STANDARDS

19. General

An adequate diet is one that provides all of the essential nutrients in sufficient quantities and proper proportion to maintain physical fitness, efficiency, and a feeling of well-being. Such criteria, however, are vague and not subject to quantitative evaluation. In order to determine quantitatively whether or not a ration is adequate, it is necessary to compare the amounts of individual nutrients provided by the ration with values of nutritional allowances set up by competent authority.

20. National Research Council Recommended Allowances

The Food and Nutrition Board of the National Research Council has compiled a table which would be adequate for maintenance of good nutrition in essentially all the populations of the United States. The term "recommended allowances" is used by the Board to avoid any implication of finality regarding minimal or optimal requirements. The *recommended allowances are not requirements,* since they represent, not merely minimal needs of average persons, but nutrient levels selected to cover individual variations in a substantial majority of the population. In addition, the values for each nutrient about the minimal level which will prevent deficiency are considered to provide for increased needs in times of stress and to permit other potential benefits. The nutritive intakes recommended are, in general, higher than average *requirements* and lower than the amounts which may be needed in pathologic states or in rehabilitation following depletion. The allowances are intended to serve as a guide for planning adequate diets for practically all normal, healthy persons of the ages indicated, in the United States. It is recognized that the normal consists of a wide range of values. The allowances are designed to provide for requirements in the high normal range as well as for the average. It is important to remember that the recommended nutrient allowances given in table VI are the amounts that should be *consumed* daily. Since food composition tables generally provide data on nutrient content of foods as purchased, it is essential that such data be corrected for nutrient losses in storage, preparation, cooking, and serving before the true consumption of the respective nutrients in a given ration can be determined.

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21. United States Army Minimum Allowances

AR 40–564 prescribes the minimum allowances of nutrients which the Army ration must supply in order to be considered adequate. These values, presented in table VI, were patterned after the recommendations of the National Research Council, but modified, in the light of previous experience, to meet the needs of the Army. A minimum of 3000 calories for sedentary males is prescribed with provisions made for higher or lower levels where indicated. It should be emphasized that the dietary standards given in AR 40–564 are intended to serve as a guide for use in planning adequate diets for the normal healthy soldier. It is not intended that every soldier have a caloric intake equal to or above these standards every day. Depending on the type and extent of physical activity and consequent expenditure of energy, some troops will require diets of higher or lower levels than those listed in AR 40–564. The caloric intake required in varying situations should be prescribed by local medical authority.

22. Variations in Requirements

There are considerable variations in the requirements for specific nutrients under various conditions. *For example,* the niacin requirement is decreased in a high-protein diet rich in its precursor, the amino acid, tryptophan, and increased in a low-protein diet. The thiamine requirement increases with an increase in the ratio of carbohydrate to fat in the diet. The requirements for both thiamine and niacin increase with increased caloric intake and, therefore, with physical activity, whereas the requirements for protein and other nutrients presumably remain constant. A certain amount of deviation from the recommended dietary allowances over short periods of time may be encountered without danger of nutritional deficiency.

23. Provision for Nutrient Losses

Nutrient losses vary with the method, temperature, and amount of water used in cooking food. The quantities of vitamins which may be expected to be lost during cooking as practiced in the Army are presented in table VII. In addition, allowances must be made for edible food waste in preparation and serving. Experience has shown that this may vary from 4 to 21 percent of the total ration. In order to be considered adequate, therefore, the ration as prescribed must provide sufficient quantities of all nutrients so that, after deductions for probable cooking losses and waste have been made, the recommended allowances still are met. Tables of food composition used by the Army consider normal preparation losses; therefore, no deductions should be made for such losses unless they are known to be excessive.

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Table VI. Recommended Daily Dietary Allowances
Food and Nutrition Board, National Research Council (Revised 1958)

Men	Age (yrs.)	Weight (pounds)	Calories	Protein (gm)	Calcium (gm)	Iron (mg)	Vitamin A I.U.	Thiamine (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascorbic acid (mg)
(69 inches tall)	16–19	139	3600	100	1.4	15	5000	1.8	2.0	25[4]	100
	25	154	3200[1]	70	0.8	10	5000	1.6	1.8	21	75
	45	154	3000[1]	70	0.8	10	5000	1.5	1.8	20	75
Women											
(64 inches tall)	16–19	120	2400	75	1.3	15	5000	1.2	1.9	16	80
	25	128	2300[1]	58	0.8	12	5000	1.2	1.5	17	70
	45	128	2200[1]	58	0.8	12	5000	1.1	1.5	17	70

Army Minimum Standard AR 40–564
(Avg. U. S. Soldier is 22–23 yrs. of age, Height 69.19 inches and 158.6 lbs. (nude))

Male physically active		3600[2]	100	0.7		5000	1.7	2.0	16[5]	75
Male relativly sedentary.		3000[3]	100	0.7		5000	1.5	2.0	16	75
Female		2400	75	0.7		5000	1.5	1.8	15	70

[1] Both man and woman are presumed to lead a vigorous, healthy life and to be moderately active physically, with occupations which could not be described either as sedentary or as hard physical labor. The man might be in light industry or employed as delivery man, painter, or outdoor salesman. The woman might be homemaker, saleswoman, or bench worker in a factory.
[2] Troops engaged in training activities both basic and advanced training, such as paratroops and ski troops.
[3] Troops engaged in such activities as clerical or guard duties, laboratory technicians, and headquarters staff personnel.
[4] Niacin equivalents. This includes niacin *per se* in the diet and niacin formed from tryptophan which is calculated on the assumption that 60 mg of tryptophan may be converted to 1 mg of niacin.
[5] Niacin standard. Expressed as Nicotinic Acid only, assumes an adequate intake of tryptophan.

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Table VII. Average Percentage of Nutrients Lost During Cooking
(As based on cooking practices in a well operated US Army Mess)

	Thiamine	Riboflavin	Niacin	Ascorbic acid
Meats[1]	35	20	25	----
Meats, plus drippings used	25	5	10	----
Eggs	25	10	0	----
Cereals	10	0	10	----
Legumes	20	0	0	----
Vegetables, leafy green and yellow	40	25	25	60
Tomatoes	5	5	5	15
Vegetables, other	25	15	25	60
Potatoes	40	25	25	60

[1] Meats, canned. Thiamine loss equals 60%.

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CHAPTER 5
NUTRITION OF TROOPS IN VARIOUS ENVIRONMENTS

Section I. TEMPERATE CLIMATE

24. Zone of Interior

a. The maintenance of an optimum state of nutrition is important in preserving the military effectiveness of troops at all times. In the zone of interior, this is relatively easy to accomplish, since the feeding of troops in garrison presents no problems different from those encountered in any type of mass feeding. The ration for the Army is described in the master menu published monthly, and is based on the food procurable. Before publication, this menu is subjected to nutritional evaluation to insure its nutritional adequacy. It then is distributed to posts, camps, and stations where the local menu board makes such modifications as are necessary to meet local conditions.

b. Table VIII shows the average nutrient composition of the field ration A as prescribed by two typical monthly master menus and the average as prescribed throughout 1 year. The nutritional adequacy is judged by comparison with the prescribed minimal dietary standards. The nutrients of the ration are calculated on the basis of the composition of food as issued and have been corrected for normal preparation discards, such as meat trimmings and bones, potato peelings, outer leaves of cabbage or lettuce or, more generally, the portions that are considered undesirable for consumption. The nutritive value of the ration actually consumed will be less than that shown in the table, because of nutrient losses during cooking and serving and to food discarded by the soldier.

c. The Military ration provides a liberal allowance of all the nutrients recognized to be essential in the human diet. The adequacy of the individual soldier's diet, however, depends upon the extent to which he consumes the components of the ration. He must be indoctrinated on the importance of eating such protective foods as dairy products, liver, and leafy green and yellow vegetables. The adequacy of the ration also is dependent upon the ability of the cooks to prepare the food, to conserve the nutrients, and to prepare palatable dishes from the less acceptable components of the ration. It is important, therefore, that the cooks not only be well trained in the art of cooking but also be trained in the scientific aspects of cooking so far as they pertain to the conservation of nutrients.

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Table VIII. Calculated Average Nutrient Content of Field Ration A as Prescribed in the Master Menu during months of February and August and Throughout Year 1960

Nutrient		*Army basic dietary standard	Master Menu, 1960		
			February	August	Twelve months
Calories		3600	4008	3918	4027
Protein	gm	100	124	124	125
Fat	gm		189	193	188
Carbohydrates	gm		475	419	445
Calcium	gm	0.70	.98	0.95	98.3
Iron	mg		24.6	24.6	24.6
Vitamin A	IU	5000	12763	14258	14534
Thiamin	mg	1.70	1.88	1.82	1.92
Riboflavin	mg	2.00	2.54	2.67	2.65
Niacin	mg	16.0	26.6	26.6	26.5
Ascorbic acid	mg	75	109	129	117

*Basic dietary standard of minimum nutrient *intake* per person per day, of physically active soldiers in a temperature environment (table VI).

25. Theaters of Operation

a. While the provision of an adequate diet for troops in the zone of interior is accomplished relatively easily, the problem becomes difficult in feeding troops overseas and may become acute during combat. In oversea theaters of operation it usually is necessary to subsist the troops initially, and sometimes for long periods of time, on the Standard Ration B for the Armed Forces. This is a complete ration composed of processed (canned and dehydrated) foods. It is nutritionally adequate for troops if it is properly stored and prepared. The use of this ration requires fixed messing facilities, or field kitchens and individual mess equipment.

b. Standard Ration B for the Armed Forces becomes monotonous when consumed as the sole diet for long periods of time. Under such conditions, the troops may restrict their food intake voluntarily; consequently, their caloric intake may be decreased to the extent that it lowers their operational efficiency. Experience has shown that supplementation of Standard Ration B for the Armed Forces with fresh foods will improve the acceptability of the ration, increase food consumption, and thereby promote the health of the troops. It is desirable, therefore, as soon as practicable to supplement the ration with fresh meats and produce procured from the zone of interior or from indigenous food procured locally.

c. In the local procurement of food, cognizance must be taken of the fact that many foods indigenous to or produced in foreign countries may not be nutritionally equivalent to the same foods produced in the United States. *For example,* the substitution of unenriched white flour in the ration for United States Army flour may contribute to a suboptional intake of thiamine and riboflavin

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in the diet. In the choice of indigenous vegetables, consideration should be given to the food habits of the American soldier, because it is well known that he prefers foods to which he is accustomed and which he has eaten most of his life.

26. Combat

a. In operations involving active combat, particularly assault, the problem of maintaining physical fitness through adequate nutrition is difficult. Under these conditions, it is of the utmost importance that the soldier consume sufficient calories each day to compensate for the energy he expends. Under conditions producing nervous and physical stress, the primary nutritional need for 1 to 2 days is for water and calories. In active combat the soldier may expend more calories of energy than he consumes in his food. Such an imbalance is not serious for 1 to 2 days; however, a gross caloric deficit for 2 or 3 days diminishes work output, efficiency, and alertness. It is necessary to furnish sufficient calories, and to furnish them in foods which are palatable and acceptable to the troops.

b. Whenever the tactical situation permits, hot food should be prepared as close as practical to the combat zone. There are occasions, usually not for more than 1 or 2 consecutive days, when the soldier must be provided with rations which he can prepare himself. On other occasions, it is necessary for small detachments to operate under conditions where it is impractical to provide kitchen facilities. For these occasions special operational rations have been devised. These and other rations are discussed in chapter 6.

Section II. ARCTIC AND SUBARCTIC CLIMATES

27. Influence on Dietary Requirements

a. Winter conditions in Arctic and subarctic areas introduce many complications in the feeding of troops. Freezing of food affects not only field utility and packaging but also palatability and acceptability. Maintenance of military efficiency, morale, general health, and physical performance also is more complex than in temperate climates. During World War II, the planning of rations for the Arctic was made difficult because of almost complete lack of satisfactory scientific data on nutritional requirements in the cold. There was a profusion of traditional and empirical lore regarding the supposed necessity for special foods for Arctic life. Subsequent study showed that much of this was erroneous as far as troop feeding was concerned.

b. Experience has shown that nutritional requirements for troops operating in cold climates are not much different from those

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of troops stationed in temperate climates, with the exception that more calories are required when troops are operating outdoors in the cold. (par. 14*b*).

c. There is no evidence at present that greater quantities of fat and protein are required in the Arctic than in temperate climates. Food requirements may be met by increasing the consumption of all components of the ration. Since fat is the most concentrated source of energy in all foods, the percentage of fat usually is increased in the formulation of light-weight, compact rations such as are used on Arctic trails. An extreme example of this is pemmican, a highly concentrated food recommended for years by Arctic explorers. Pemmican is composed of a mixture of dehydrated meat and fat, the composition of which may vary; usually about 70 percent of the calories are derived from fat and 30 percent from dehydrated meat. This food should be supplemented with a carbohydrate food to prevent ketonemia and ketonuria. Pemmican is usually not acceptable to unseasoned United States troops; and its extensive use may result in a voluntary restricted caloric intake which leads to physical deterioration and inefficiency. Large quantities of fat in the diet are not well tolerated by many men. It is not wise to depend upon fat for more than 50 percent of the calories derived from the ration.

28. Feeding Problems

a. Problems involved in feeding troops in extreme cold weather arise from the difficulty of providing hot meals and of procuring sufficient water for cooking purposes. Hot foods and drinks aid in maintaining body warmth. At subzero temperatures, deterioration, resulting from lack of food and water, is rapid and can completely cripple military efficiency, physical fitness, and morale in as short a time as 2 days. Group feeding raises special problems. Preparation of food and maintenance of kitchen equipment are difficult in freezing weather and the ability of the soldier to feed himself from the mess line is also hampered. The various factors which affect the efficiency of the kitchen and staff include cold, wind chill, heavy clothing and gloves, and difficulty in obtaining water, all of which cut down efficiency in handling, preparing, and cooking food, and in the maintenance and cleaning of cooking utensils and equipment. Fuel consumption for cooking food increases progressively with decreases in temperature, as does the time required to cook or heat food. Food cools rapidly when kept in ordinary types of dispensing containers, and even more rapidly when placed in metal mess gear.

b. To facilitate feeding the troops, an effort should be made to supply hot meals by means of mobile equipment. If the terrain does not permit the use of mobile kitchens, food should be trans-

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ported to the troops in insulated containers. Special details should be organized to procure water. In relatively fixed organizations, water may be procured through the ice from a lake or stream and transported in heated tanks. If this is not practicable, water may be procured by melting ice or snow. Ice should be used in preference to snow because it takes less time and fuel to provide a given amount of water. Troops required to produce their own drinking water often become dehydrated rather than take the trouble to melt ice. This may lead to dehydration exhaustion which is as dangerous in the Arctic as it is elsewhere. Troops should be indoctrinated to the necessity for drinking adequate amounts of water.

29. Ration Packet

a. When feeding from field kitchens is impracticable, feeding in small groups of about five men is desirable. The Ration, Trail, Frigid, Individual, was designed specifically for this purpose. Where this ration is unavailable the Meal, Combat, Individual may be used. Small, light 2-man gasoline stoves should be provided for cooking.

b. In order to maintain body warmth and provide a ready source of energy in cold weather, frequent feeding is desirable. Snacks, such as fruit or candy bars or biscuits, may be issued to the men to be eaten between meals so as to minimize interference with operations. Such items are included in the Ration, Trail, Frigid, Individual.

30. Canned and Fresh Foods

a. Whenever practicable, it is desirable to issue canned foods rather than dehydrated foods in the Arctic. Canned foods contain water and need only to be heated for serving, whereas dehydrated foods require water, which is scarce, and requires more time for cooking. On the trail however, when it is necessary for a small detachment to carry several days' rations with them, it may be necessary to sacrifice the convenience of canned foods for the lighter weight and smaller volume of dehydrated foods. In this case, foods should be chosen which have been precooked before dehydration. Foods which require much time for reconstitution and cooking should be omitted.

b. When fresh vegetables, such as potatoes, carrots, cabbage, etc., are available at an Arctic base of operations, they may be transported in the frozen state to outposts and kept indefinitely in the frozen state without spoilage. Once the vegetables have been allowed to thaw, they must be used quickly and not refrozen. Normally it is not necessary to thaw food before cooking.

c. In summary, the greatest nutritional problems in the Arctic are caloric deficiency and dehydration exhaustion.

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Section III. TROPICAL AND DESERT CLIMATES

31. Influence on Dietary Nutritional Requirements

a. The nutritional requirements of troops stationed in hot climates are not fundamentally different from those of troops stationed in cooler climates. There is no evidence to show that the ratio of protein-fat-carbohydrate should be any different from the normal diet in temperate climates. The provision of extra quantities of vitamins also is unnecessary because the amount lost in perspiration is negligible.

b. In general the amount of food provided the troops should be regulated largely according to their level of physical activity. Troops undergoing moderate physical activity in extreme heat (40° centigrade) expend an additional 500 to 1000 calories above that required in a temperate climate of 20°–25°C. (ch. 3).

32. Effects of Heat and Acclimatization

a. The most important nutritional consideration in the Tropics is the prevention of physical deterioration due to a caloric deficit often caused by lack of appetite. This is most noticeable during the acclimatization period. Many factors, some of them psychological, are involved in producing this condition. Much can be done to improve the appetite of the troops besides ameliorating the psychological factors. Packaged rations should be used only as a last resort in feeding troops in tropical climates. Meal times may be changed to the cooler hours of the day. Every effort should be made to provide as wide a variety of attractive dishes as possible from the available subsistence items.

b. Although the components of the standard B Ration and packaged rations are referred to as nonperishable, many of them undergo deterioration when stored at high temperatures such as occur in the Tropics or in hot desert areas. This deterioration adversely affects the palatability and acceptability of the ration and reduces its nutritive value. For this reason, the rations should be stored in the coolest place possible and protected from the sun. Caves or dugouts may be utilized for this purpose. If buildings or tents are used as shelters, adequate ventilation should be provided. Powdered whole milk and eggs are particularly susceptible to this reaction, even though they are vacuum packed. They rapidly become inedible when stored at high temperatures. If at all possible, powdered eggs and milk should be treated as perishable products and stored at a temperature below 50°F.

c. Of prime importance in maintaining physical fitness and efficiency in the Tropics or desert areas is the ingestion of adequate amounts of water and salt. NO AMOUNT OF ACCLIMATIZATION

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OR DISCIPLINE WILL ENABLE A SOLDIER TO REMAIN PHYSICALLY FIT IF HE DOES NOT DRINK AS MUCH WATER DAILY AS IS LOST FROM HIS BODY. Provided adequate quantities of water are available, more salt should be added to the diet of troops in hot climates than in temperate climates to replace the salt lost in perspiration (ch. 2). For further information on the prevention of heat exhaustion, see TB MED 175.

d. Diarrheal diseases, which are common in hot climates, have an adverse effect on the nutritional status of troops by interfering with absorption of nutrients in the intestinal tract, by causing dehydration, and by causing loss of nutrients in the excreta. Common sources of infection with such diseases are indigenous raw fruits and vegetables, particularly the latter. They should be disinfected by cooking or by chemical agents before consumption.

e. Again it is emphasized that, as in arctic regions, the greatest nutritional problem in hot climates is the prevention of physical deterioration caused by caloric deficiency and dehydration.

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CHAPTER 6

RATIONS AND FOOD PACKETS

33. Classification of Rations

a. Ration. A ration is the allowance of food for one person for one day.

b. Garrison Ration. The garrison ration is based on a monetary allowance for subsistence instead of an issue of subsistence in kind. The menus for this ration are prepared locally and the individual food items procured locally. It is used mainly in hospitals and small isolated units where it is impracticable to use the field ration.

c. Field Ration. The field ration is a ration in which all subsistence items are issued in kind. This ration is prescribed in time of war, national emergency, or at any time by Executive Order.

d. Operational Ration. The operational ration is that prescribed for individuals performing operational duty outside the Zone of Interior. It may be used within the Zone of Interior for emergencies, training, or for rotating stocks.

e. Nutrient Content. The average nutrient content of Field Ration B and of the operational rations is given in table IX.

34. Types of Field and Operational Rations

a. Field Ration A. This ration is issued in kind and is composed of fresh foods as far as practicable. Frozen, canned and, occasionally, dehydrated foods are used when fresh items are not available. This ration is preferred whenever circumstances permit. Its nutrient composition is given in table VIII.

b. Standard B Ration for the Armed Forces. This ration, designed for large group feeding, is used in situations where it is impossible to provide fresh or perishable foods because of lack of refrigeration facilities, but where kitchen and cooking facilities are available. The components of this ration correspond as nearly as practicable to those of the Field Ration A with the substitution of foods which require no refrigeration. This menu, prepared on a 15-day cycle, provides approximately 4400 Calories per man per day. The calorie content should be adjusted either upward or downward to meet the energy requirement according to the recommendations of local medical authority.

c. Unitized B Ration by Meals. The unitized "B" ration provides an austere ration designed for use under field conditions. It is modulated from items of the Standard B Ration into meals for

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Table IX. Overall Nutrient Composition of Operational Rations and Food Packets

Ration or food packet	Water (gm)	Calories	Protein (gm)	Fat (gm)	Carbohydrate (gm)	Calcium (mg)	Vitamin A I.U.	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Standard Ration B for the Armed Forces.	----------	4496	131	188	570	969	9985	1.9	2.7	28.7	100
Ration, Small Detach. (5 Persons).	843	3769	146	154	449	977	5460	2.2	2.9	33.0	134
Ration, Indiv. Combat	962	3662	148	136	468	829	5580	2.2	2.8	34.0	117
Meal, Combat, Individual (Menus 1 through 12).	212	1212	52	51	136	238	1530	0.7	1.0	12.3	41
Ration, Trail, Frigid, Individual.	185	4373	165	184	514	1924	1920	2.2	4.2	30.1	110
Food Packet Assault Individual.	103	816	36	35	90	116	220	0.34	0.66	6.0	30
Food Packet Survival ST–2.	13	546	0	0	136	8	----------	----------	----------	1.1	15

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25 men, for use in forward areas where large messing facilities are not available. The meal menus are patterned after the Standard B Ration with the exception of substituting crackers for fresh bread.

d. Ration, Small Detachment, 5 Persons. This ration was designed to provide sufficient food to sustain 5 men for 1 day. It is intended for use in feeding under conditions where organized messing cannot be accomplished but where feeding in small groups is possible. Such situations arise when gun crews, tank crews, patrols, or similar small groups deploy beyond the range of unit kitchens. The menus provide a nutritionally adequate diet, containing approximately 3600 Calories per ration, and is made of palatable, varied components. Since troops are sometimes required to subsist on this ration for several days, 5 different menus are provided to minimize monotony. The ration as issued weighs approximately 29 pounds per case of 5 rations, or 5.8 pounds per individual ration and is so packaged as to be easily distributed and carried when transportation is limited. Cooking equipment is required for its preparation since the ration was designed to be served hot.

e. Ration, Trail, Frigid, Individual. This ration was designed for use in extremely cold climates. It provides approximately 4,400 Calories. The foods are of high energy type, light in weight, compact, and acceptable under the conditions for which the ration was designed. This ration is intended for use by individual members of small patrols or trail teams for a short period of time (1 to 3 days) during which period resupply may be impossible or unfeasible. The ration is designed so that all components, with the exception of soups and beverages, may be eaten without preparation. The components are such that if heat is available, hot meals may be prepared. It is recommended that hot meals be prepared whenever possible, particularly for the breakfast and supper meals. Water is necessary for the preparation of several components that are provided in dehydrated form. The components provided for the dinner meals are especially adaptable for trail consumption, so that the soldier can readily consume them while wearing bulky protective hand coverings. This ration, as packaged, weighs approximately 4 pounds.

f. Meal, Combat, Individual (Menus 1 through 12). This ration may be issued one meal at a time, or as a complete ration of 3 meals. The ration is packaged as 3 individual meals, each of which will provide one-third (1200 Calories) of the daily requirement; thus, any combination of 3 meals will give a complete ration (3600 Calories). The food components are essentially the same as those used in the Ration, Individual, Combat, but have been rearranged to facilitate issuing as individual meals. Each meal is identical

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in the number and size of the units, but a variety of menus is provided. One meal, as packaged, weighs approximately 1.6 pounds and one ration 4.8 pounds. Because of its versatility, this ration may be used as a replacement for the Ration, Individual, Combat, and the Food Packet, Assault, Individual.

35. Food Packets and Ration Supplements

a. Food Packet. A food packet is composed of precooked or prepared foods which may be eaten either hot or cold. Minimum bulk and weight are of utmost importance to facilitate ease of carrying by the individual. Food packets are used where it is impracticable to provide kitchen facilities or complete rations.

b. Ration Supplements. Ration supplements consist of items (food, tobacco, and toilet articles) issued as supplements to designated field rations and are designed to provide for the health and comfort of the troops and to facilitate economical issue.

c. Nutritional Content. The average nutritional content of food packets is shown in table IX.

36. Types of Food Packets and Ration Supplements

a. Food Packet, Assault, Individual. This food packet provides food for the individual soldier in the initial assault phase of combat when food is required that is light weight, highly palatable, and convenient to carry. It may be used by an individual engaged in the initial phases of an amphibious assault, airborne assault, patrol action, or other similar situation. Though highly palatable, this packet is not considered a full meal, nor will any combinations of packets make a complete ration. It should be used in situations where messing facilities are unavailable and a complete ration cannot be carried by the soldier. It may be used to supplement the Ration, Individual, Combat, to provide additional food in Arctic areas or other situations where the ration provided is inadequate. Each food packet contains one menu; eight different menus are available. Although more palatable when heated, all of the food items in the packet are acceptable when cold. Each food packet weighs 1.1 pounds and provides approximately 800 Calories.

b. Food Packet, Individual, Survival. This food packet was designed as an item of personal equipment for personnel participating in active operations on land, sea, or air. It is intended to be carried on the person as a means of reassurance that, all other means failing, he has something upon which to rely. This packet is composed of six compressed food bars (described as fruit, potato chip, fruit cake, cereal, chocolate fudge, and meat flavored bars) soluble coffee, soluble tea, and sugar. The food bars are of uniform nutrient composition and one or more may be consumed with maxi-

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mum utilization of all nutritional elements. The packet provides 900 to 1000 Calories, most of which are supplied by carbohydrate and fat. The protein content is limited to seven percent to prevent the excessive loss of body fluids through the excretion of urinary nitrogen. The bars are individually packed in plastic laminated aluminum foil to prevent flavor transfer and moisture loss and the unit of 6 bars is packaged in a key-opening, 12-ounce can.

c. Ration Supplement, Sundries Pack. This pack was designed to provide such comfort items as toilet articles, tobacco, and candy in an area where post exchange facilities are not available. It serves as a supplement to the Standard B Ration for the Armed Forces, which is the only operational ration that does not contain such items in an accessory packet. This pack is not intended as a major contribution to the food supply, however, its candy bars and hard candy tablets do contribute materially to morale. It is designed to satisfy the requirements of 100 men for 1 day, and it is in a sense a portable post exchange.

d. Ration Supplement, Aid Station. This supplement was designed for use at forward Aid Stations to provide hot, stimulating beverages. It is not considered a ration or any part of a ration. The supplement consists of soluble coffee, soluble tea, soluble cocoa beverage powder, soluble milk, and sugar. Plastic drinking straws, and toilet paper are also included. It is intended to provide selected beverages for combat casualties, which may contribute to recovery by reducing the possibility of shock and by making the individual more comfortable. All components of this supplement are easily prepared, it being necessary only to add water according to the instructions on the container in order to prepare a palatable drink. It has been recommended that a high-calorie high-protein beverage base powder be added to this ration supplement to provide an item that will furnish protein and energy to the injured soldier in cases where the surgeon deems it advisable. The early provision of a beverage that furnishes needed nutrients is thought to be highly desirable. Such an item has been developed and it is expected that it will be available when required.

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CHAPTER 7

FOOD CLASSIFICATION

37. Advantages of Classification

It is well known that no single food is essential in the human diet and that many foods may be substituted for each other. While some foods such as sugar contribute only calories, others such as meats, milk, fruits, cereals, or vegetables contribute many of the essential nutrients of an adequate diet. A detailed study of the nutrient composition of various foods has shown that a certain similarity in composition exists within various classes of foodstuffs. The Army, therefore, has developed a system of food classification whereby all foods, whether fresh, canned, or processed, are grouped into 17 food categories. This classification is based on the similarity of certain foods as to nutritive content, special function in the ration, and unique contribution to the value of the ration. Thus, in considering the nutritional adequacy of a ration, only 17 entities or food groups have to be considered rather than each of the multitude of individual foods commonly used by the Army. If the proper quantities of each of the food groups are furnished by a ration, it may be assumed that the ration is adequate and well-balanced without consideration being given to individual components. The value of this system in menu planning is obvious. It also is useful in making nutritionally equivalent substitutions in the ration when certain components are unavailable. When the nutritional adequacy of a ration is in question and a detailed evaluation is indicated, this system allows weighted average values to be applied for specific nutrients and obviates the necessity of determining the quantities of nutrients furnished by each food. This is discussed in full in chapter 8. The 17 food groups and a detailed description of their particular contributions in the diet are covered in paragraph 38.

38. Food Groups and Values

a. Meats, Fish, and Poultry. This group includes not only muscle tissues of animals but also such organs as liver, kidney, and heart. It is the most important source of protein in the ration and also is a valuable source of iron, phosphorus, thiamine, riboflavin, niacin, and calories. Liver, kidney, and heart are richer in iron and the B vitamins than muscle meat and should be used whenever possible. Liver is an exceptionally rich source of riboflavin and vitamin A. Lean pork contains about 10 times as much thiamine

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as lean beef and should be included in the menu frequently for this reason. Fish may be used fresh, dried, salted, or canned. If meats, fish, or poultry are not available, eggs, cheese, beans, or peas may be substituted.

b. Eggs. Eggs are rich in high-quality protein, calcium, phosphorus, iron, vitamin A, riboflavin, and other essential nutrients. They are valuable because of their essentiality in the preparation of innumerable attractive dishes and because of their unique place on the breakfast table. If fresh eggs are not available, dried whole eggs may be used. Eggs also may be substituted for the meat group in cases of necessity.

c. Milk and Milk Products. This group includes whole milk, skim milk, buttermilk, cheese, dried milk, evaporated milk, and ice cream. Butter is not included in this group but is classified separately because of its different nutritional composition, i.e., primarily fat. Milk contains all of the known essential nutrients, but its most important contributions are calcium, riboflavin, and protein. It is very difficult to prescribe a ration adequate in calcium and riboflavin without including some form of milk or cheese. Cheese, because of its high content of good quality protein, may be used as a substitute for the meat, fish, and poultry group. When fresh milk is unavailable, evaporated or dried milk may be substituted by reconstituting (1 part dried milk and 7 parts of water). If these products have been properly stored, the reconstituted products have the same nutritional value as fresh milk, because very little loss of nutrients occurs during processing. If milk is not available, an adequate supply of calcium should be assured by increasing the consumption of cheese, green leafy vegetables, and beans.

d. Butter. The main value of butter, butter spreads, or oleomargarine in the diet is in increasing the palatability of other foods, mainly breads. They are a concentrated source of energy but do not make a major contribution in this respect since the quantities used are relatively small. Butter produced when cows are eating fresh green forage, commonly called summer butter, is an excellent source of vitamin A, as is oleomargarine fortified with vitamin A. Butter and many brands of oleomargarine also contain vitamin D.

e. Fats, Other. This group consists of lard, lard substitutes, vegetable oils, meat drippings, and salad dressings. They also are a concentrated source of energy and provide essential unsaturated fatty acids and vitamin E. Their use in cooking enhances the palatability of foods and, because they are slowly digested, have a greater effect than sugars or protein on the feeling of satiety. The use of rancid fat should be avoided because it has a deleterious effect on other nutrients and on the palatability of the diet.

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f. Sugars. In this group are included cane or beet sugar (sucrose) and other pure sugars such as glucose (dextrose) and lactose, as well as syrups, jams, preserves, honey, and dessert powders. They are a concentrated source of energy and are valuable in the ration to increase the palatability of other foods and to stimulate appetite. Pure sugars, beyond improving the taste of foods, do not contribute anything but energy. Crude sugars, such as molasses and sorghum, supply some minerals as well as energy and are, therefore, more valuable nutritionally.

g. Grain Products (Bread, Flour, Cereals, etc.). Cereals and breads have high caloric values and are, therefore, important sources of energy. Because of the quantity consumed they contribute appreciable amounts of proteins, minerals, and vitamins, thiamine, niacin, and riboflavin. Whole grain products, such as rolled oats, whole wheat, etc., are higher in food value from a vitamin and mineral standpoint than are unenriched refined products.

h. Legumes. Included in this group are the various peas, beans, and nuts. They are characterized by their high protein and fat content. They also are rich in calcium, phosphorus, riboflavin, thiamine, and niacin. They may be substituted for the meat, fish, and poultry group both from the nutritional and menu standpoints. This group is well liked by soldiers and has a high satiety value.

i. Vegetables, Leafy Green and Yellow. Such vegetables as leaf lettuce, cabbage, carrots, English peas, green beans, sweet potatoes, etc., which comprise this food group, play an important role in the diet and cannot be replaced by any other food group. This group contributes a large proportion of the Vitamin A and ascorbic acid of the ration, as well as considerable amounts of minerals and vitamins. They also contribute most of the vegetable fiber or bulk which is necessary in the diet. This group of foods should be represented at least once a day on the menu.

j. Tomatoes. Raw or canned tomatoes, tomato juice, catsup, or puree are important in the ration because they furnish large quantities of vitamin C. Because of the acid nature of these foods, the vitamin C is more stable in them than in the leafy green or yellow vegetables. Tomatoes are, therefore, the more reliable source of this factor. They also contribute considerable quantities of vitamin A.

k. Citrus Fruits. Oranges, lemons, limes, grapefruit, and their juices, either canned or fresh, are an important source of ascorbic acid in the ration. These fruits also are acid in nature and, therefore, are a reliable source of vitamin C.

l. White Potatoes. White potatoes are valuable in the ration because they usually are available in large quantities, are widely acceptable, and are inexpensive. They may be served daily since

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they are such a staple item in the American diet. In the quantities usually eaten, they supply important quantities of iron, thiamine, niacin, and ascorbic acid. If potatoes are not available, more of other vegetables should be provided. It should be noted that sweet potatoes are not classified nutritionally as potatoes but as a yellow vegetable because of the large quantity of pro-vitamin A which they contain and which is lacking in white potatoes. They also contain more vitamin C than white potatoes.

m. Vegetables, Other. Vegetables, such as beets, turnips, onions, rutabagas, parsnips, etc. are not especially important as sources of essential nutrients. They add to the vitamin and mineral content of the diet; however, their main value is in adding variety and attractiveness to the diet.

n. Fruits, Other. Fruits, other than citrus, have about the same nutritive value as root vegetables. Berries of all kinds, cherries, peaches, and pears add to the vitamin and mineral content of the diet. They also are a good source of bulk. If fresh fruits are not available, canned fruits may be substituted since they have approximately the same nutritional value. Fruits are a very popular component of the ration, especially of the Standard B ration for the Armed Forces, where they relieve the monotony of the ration.

o. Fruits, Dried. Dried prunes, apricots, peaches, apples, raisins, and dates may be substituted for fresh or canned fruits, although they will have lost some of their vitamins in drying. They are valuable because they are relatively nonperishable and furnish a large amount of energy for their weight and bulk. They are particularly useful in emergency, combat, or survival rations or Arctic trail rations where a concentrated and palatable source of energy is needed.

p. Beverages. Coffee, tea, and cocoa possess little nutritive value in themselves. They are a means, however, of encouraging the consumption of liquids which is important, particularly in the Tropics or desert areas. In Arctic or subarctic areas, they also are a means of providing hot stimulating drinks.

q. Miscellaneous. Spices, sauces, mustard, pickles, olives, vinegar, etc., have little nutritional value but are of great importance in adding to the palatability and attractiveness of the ration.

39. Conversion of Unit Packages to Pounds

In dealing with nutritional evaluations in the Army, the reduction of rations to a basis of pounds per man per day (PMPD) by classes of food has been found to be useful as a first approximation in nutritional accounting. In appendix I are presented weights, measures, and factors designed to aid in the conversion of the units, packages, or containers of commonly used foods to a single

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basis—the pound. Because of unavoidable variations in source, size, grade, and conditions of fresh, canned, or frozen fruits and vegetables, it has been necessary to prepare average figures from the best available sources as related to practical Army conditions. Any weight ascribed to a unit or its container, however, necessarily will be somewhat arbitrary and represent an average which, in actual practice, is subject to some degree of variability. The conversion factors as given in the tables may be of value as a close approximation; where exactness is desired, the actual net weight of the unit should be determined. Most foods are obtainable in pounds. It is advisable, however, to omit this unit in the interest of conserving space. The foods are listed, therefore, in their various unit sizes, with the tacit understanding that they usually will be available in single or multiple pound units. Variation of package size is not the only difficulty encountered in determining the PMPD of the various food groups. In order to obtain a common basis for comparison, it is necessary also to reduce certain food items to equivalents of what, for convenience, will be called the "parent" substance. Thus, *for example*, it is necessary to convert cheese, evaporated milk, dried milk, and ice cream to their equivalent quantity of fresh milk, which in this case, is the "parent" substance. Similarly, conversions must be made for dehydrated eggs to fresh eggs; the various seed beans (lima, kidney, etc.) to dry beans; dehydrated potatoes to fresh potatoes; all dehydrated items to the fresh "parent" substance; and all frozen items to the fresh basis. These conversions may be made by the use of factors indicated parenthetically under the food items listed in the tables, appendix I.

40. Food Equivalents

Tables of food equivalents are given in AR 30–15. These tables are useful when it is necessary to substitute one subsistence item for another on a weight basis, and as an aid in the selection of substitutes on a general nutritional basis. *For example*, if the menu lists beef, carcass, fresh, and this is unavailable, 30 other meat items are listed which may be substituted for one pound. Some of these are ham chunks, canned 0.75 lb., fish, canned 0.50 lb., fish, fresh fillet 0.60 lb., luncheon meat, canned 0.60 lb., and sausage, frankfurters 0.80 lb.

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CHAPTER 8

NUTRITION ASSESSMENT

41. Dietary Appraisal

a. Dietary studies constitute an essential part of any complete nutrition appraisal. Populations which, for extensive periods, subsist on diets which are marginal in protective nutrients may fail to reveal any recognized specific nutritional deficiency lesions and, at the same time, continue to have a relatively low life expectancy, lowered physical and mental health, increased disease rates, and other manifestations of ill health. Under such conditions where clinical observations are insensitive for detecting basic nutritional problems, nutrient intake studies are essential.

b. Dietary studies not only yield information on the adequacy of existing diets where other approaches fail, but also lead to the recognition of fundamental causes of inadequacy. The studies involve collection of information concerning food habits, food supply, ration allowances, menu preparation, food procurement and distribution, food waste, and nutritional adequacy of foods available and of those actually consumed. Medical officers frequently are called upon to assess the adequacy of a given ration, either as prescribed by the Master Menu, as issued to an Army mess, or as actually consumed by military personnel. It is desirable that the method of evaluation not only be reliable, but also simple and rapid. The following methods have been worked out by the Medical Service of the Department of the Army and have proven over a period of years to yield reasonably accurate data on the nutritional adequacy of a ration.

42. Methods of Ration Evaluation

a. Rapid Menu Evaluation by Food Groups. In a nutritional evaluation of the ration as prescribed by the menu published at a post, camp, or station, the first step is to compile a recapitulation table of all the food issued. Such a table is issued as a supplement to the master menu. The first page of a sample recapitulation table is shown in appendix II. On this table is recorded the daily prescribed issues for a 30-day period for each unit of food. The foods are classified into each of 15 food categories (table X) and the foods of a group are placed adjacent to each other on the form to facilitate calculations. The last two food groups, beverages (coffee, tea, and cocoa), and the miscellaneous (spices and condiments) are

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omitted because they do not contribute significant quantities of the nutrients. The horizontal columns (app. II) are then totaled to give the total number of units prescribed during the month. These units are then converted to total pounds, using appendix I. In this step of the procedure, not only are the packaged units converted into pounds but, where necessary, foods are converted into equivalents of the "parent" or most common substance of the food groups *(for example,* pounds of dried milk × 8 — pounds of fresh milk). The vertical column containing the total pounds of individual foods within a group is then totaled, yielding the total pounds of each food group. Since Army menus usually are formulated on the basis of 100 men, the total pounds of each food group, are then divided by 100 to give the average per man per month and, again, by the number of days in the month, which yields the pounds per man per day (PMPD) of each food group. The quantities of food prescribed, when so classified and reduced to a unit basis of PMPD, can be compared with table X, and a first approximate judgement made of the nutritional adequacy of the diet. Table X represents the 3-year weighted average 1952 through 1954, in PMPD, of each food group prescribed by the master menu as prepared. These food allowances represent an optimum food pattern and provide a liberal allowance of all the essential nutrients. If the amounts of food provided by the ration conform reasonably close (within 10 percent) to the values shown in table X, the ration may be considered to be adequate.

b. Menu Evaluation by Nutrients. When the procedure outlined above shows that one or more food groups fall considerably below the values prescribed, or if a deficiency of a specific nutrient is suspected, a more detailed method of evaluation of the ration is required. In this procedure, the quantity of each of the essential nutrients supplied by the ration is calculated for each of the food groups. Because of the variations in the vitamin content of lean pork and liver, these items are listed as separate subgroups within the general group "meat, fish, and poultry" and are evaluated separately. The nutrients contributed by each pound of food group, taking into account the average U. S. Army losses due to kitchen and plate waste, including fat not consumed and cooking losses, are listed in table XI. Multiply the PMPD for each food group by the nutritive values given in table XI. The total amount of each nutrient consumed is then determined by the addition of the respective nutrients contributed by each of the food groups. An example of the calculation is presented in table XII. The food loss and wastage values reported in table XIII are based on the amount of raw edible food available for consumption after preparation discard was deducted from the "as purchased" weight of the food.

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c. Evaluation of Ration as Issued. The ration issued to unit messes is often different from that prescribed by the post menu. This may be caused by substitutions because of nonavailability of certain components or because of inequality of the ration breakdown. In such instances, a more detailed nutritional evaluation may be made by evaluating the ration as actually issued to the mess. For this purpose, an accurate record of all subsistence supplies received by a mess for a period of 30 days is obtained from the issue slips. The PMPD of the various food groups are determined, based on the troop strength for which the rations were drawn. The nutritional evaluation is then completed as described above and the nutritional adequacy is determined by comparing the nutrient intake with the values given in table VI.

43. Procedures for Dietary Surveys

a. Definition of Terms Used.

(1) *"As purchased."* The form in which the food is issued to the mess, such as carcass beef, raw, untrimmed fruits and vegetables, etc.

(2) *"Nonedible refuse."* The portion of food that is not usually eaten, such as bones, fruit pits, rind and peel, egg shells, and outer leaves of vegetables. In practice, it is necessary to consider actual procedures in use in the mess being surveyed for estimating "nonedible refuse" rather than rely on "nonedible refuse" values found in food consumption tables.

(3) *"Edible portion."* As purchased weight minus refuse weight.

(4) *"Plate waste."* Weighed quantities of plate scrapings that are recorded by food item and divided as edible and nonedible portions.

(5) *"Kitchen waste."* Weighed quantities of food prepared but not served, *only* if discarded. Also food partially prepared but discarded, including cooking fats.

(6) *"Preparation loss."* All nonedible portions of food discarded during preparation.

b. Reason for Conducting Dietary Surveys. A ration may be adequate as prescribed or as issued but, if the troops do not eat all of it, their dietary intake may be deficient in one or more of the essential nutrients. If the food is prepared improperly or served in an unattractive manner, certain items may be unacceptable and as a result not consumed. There are some items, such as spinach, fish, or liver, which contribute a considerable quantity of the nutrients, but are generally disliked by the soldier and consequently are not eaten unless served in an attractive manner. On the other hand, if an item is served too frequently, it may not be eaten. The

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evaluation of the ration as issued, therefore, does not always reflect a true picture of the adequacy of the ration as consumed. A more accurate method of determining the adequacy of the soldier's dietary is a nutritional mess survey of the food consumed. During the period of such a survey, lasting between 7 to 10 days, all phases of the operation of the mess are observed. In some areas of the world where the number of food items is greatly restricted, surveys for 1 to 3 days may suffice.

c. Food Inventory Method. The accuracy of the method depends on strict accountability for all the food items entering the storeroom or the kitchen, the reliability of the standard tables of food composition, and the application of the tables to the food items in the diet.

(1) The evening before the study is to start, a complete inventory of all food items in the mess hall (kitchen, storage tent, etc.) is made. See fig. 1 for sample "Food Inventory Record."

(2) When a considerable number of cooking pots are used, it is usually desirable to weigh and mark all cooking vessels to be used in food preparation.

(3) During the period of the survey, all foods coming into the mess, including the daily issues of perishable foods and weekly issues of nonperishable items, are weighed and recorded. Foods should also be recorded as to the source of issue; that is, Quartermaster, local purchase, barter, etc.

(4) During the period of the survey, an accurate count must be recorded of all men eating the food at each meal, either in or outside the mess, including regulars, casuals, cooks, etc. If three meals are served and the number of men eating varies from meal to meal, the total number fed at the three meals is divided by three to give the average number of rations for the day. Where more than three meals are served, such as midmorning and afternoon teas, it is necessary to weigh the meals according to their relative importance in obtaining the total number of rations for the period.

(5) A measure must be obtained of the fat lost as waste grease and fat drippings *not subsequently consumed.* Unless this is an appreciable amount, several determinations may be made of the small quantity of fat drippings and fat in plate washings and this value may then be used in all subsequent computations. Nonedible kitchen waste such as vegetable peelings, bones, cores, and pits from fruit,

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FOOD INVENTORY RECORD			UNIT SURVEYED					DATES		AVERAGE NUMBER OF MEN FED PER DAY	
FOOD ITEM	UNIT OF ISSUE	UNIT WEIGHT (LBS OR KG)	INITIAL INVENTORY UNITS	UNITS ISSUED DURING PERIOD	TOTAL ISSUE UNITS	FINAL INVENTORY UNITS	TOTAL UNITS USED	TOTAL WT. OF UNITS USED (LBS OR KG)	AVERAGE WEIGHT OF FOOD "AS ISSUED" PER MAN PER DAY (LBS OR KG)	AVERAGE WEIGHT OF EDIBLE WASTE PER MAN PER DAY	AVERAGE WEIGHT OF FOOD "AS CONSUMED" PER MAN PER DAY

Figure 1. Food inventory record—sample.

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etc., is weighed and recorded. When this contains proportions of potentially edible food, it should be separated and recorded as edible waste.

(6) During the hours of mess operation, one or more members of the survey team must be present to record recipes, method of preparation, cooking time, temperature, pH of cooking water, amount of water and fat used, seasoning, etc., as well as the weights of all issued foods utilized by the cooks as a check on the inventory method.

(7) During the survey, when there is evidence of food waste, all plate and kitchen *edible food* which is discarded is collected, weighed, and recorded by food item (app. III and app. IV). This weight of the edible food waste must then be converted to the "as purchased" weight. This is done by use of the recipe and correcting for moisture gain or loss, fat loss, etc. (app. V).

(8) After the supper meal of the last day of the study, another complete food inventory is made.

(9) Calculations to be made are:

(*a*) Average weight of each food consumed per man per day. The gross quantities of food used for the period studied are calculated by subtracting the final inventory from the sum of the initial inventory plus the daily issues. From these gross values are subtracted all edible food items wasted or not consumed after conversion to equivalent weights of the foods as issued. This yields the total of each food item consumed.

Food item consumed =
(Initial inventory + issues or purchases) —
(final inventory + waste)

The average daily weight of each food item consumed per man per day is then computed as follows:

$$\text{Food item consumed per man per day} = \frac{\text{Total weight of item consumed}}{\text{No. of days in survey} \times \text{average number of men fed daily}}$$

(*b*) The average nutrient consumption data are computed by the use of food composition data applicable, Table of Food Composition for the Armed Forces, TM 10–405. U. S. Department of Agriculture Handbooks No. 8 (June 1950) and No. 34 (1952), and Food and Agricultural Organization Bulletin, Food Composition Tables for International Use (March, 1954) are most helpful. Where unusual foods are encountered, they should be identified and described.

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(*c*) After the nutrient evaluation of the diet has been made, correction for losses of some of the heat-labile or water-soluble vitamins should be calculated (table VII). Local data on nutrient cooking losses should be used when available. References and corrections applied should be documented.

(*d*) Where extra food may be obtained outside the mess, an estimate as to the amounts and nutritional contributions should be made by visiting the nearby post exchanges, canteens, etc., and by questioning the men on food purchased in nearby towns.

(10) Sample forms used to gather data:

(*a*) Food Inventory Record (fig. 1).

(*b*) Food Waste, (fig. 4) Appendix III.

(*c*) Recipe—Food Preparation, (fig. 5) Appendix IV.

d. Recipe Method (Also Called Food Preparation and Consumption Method). This method is very similar to the Food Inventory Method, except that the amount of food consumed is determined merely by weighing the amounts of each food item used in the preparation of each meal direct, rather than by difference, as is accomplished by the Food Inventory Method. The number of individuals consuming each meal is recorded and the average amount of each food item used in the preparation of each meal is determined for the survey period. From these data nutrient intake calculations are made in the same manner as described for the food inventory method. See appendix IV (Recipe-Food Preparation Form) and appendix V, (Example of Worksheet for Recipe Method). This method is suitable for any type of kitchen operation but is particularly well suited where little variety and relatively simple food preparation practices are involved. It also eliminates the need for survey personnel to record the food brought into or removed from the mess hall.

44. Nutritional Adequacy and Energy Requirements

The data obtained by the dietary survey procedures indicate the *average* nutrient intake of the troops during the relatively short period of the survey. The adequacy of the diet is judged by several criteria—by the nutrient intake in relation to the prescribed minimum standards; by maintaining body weight; and by maintenance of health, physical vigor, and high morale. A thorough study of the individual's nutrient intake and nutritional status in relation to his duties and environment, therefore, requires many types of observations, such as the mess survey, changes of body weight over a period of time, and health and physical fitness. The *average* caloric requirement may be calculated very simply from the survey data by adding to or subtracting from the average caloric intake

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in food from all sources an approximate caloric equivalent of 7 calories per gm. of body weight loss or gain. The requirement may be estimated also by indirect calorimetry of energy output; this is somewhat more complicated, but perhaps more reliable than the calculation from caloric consumption and body weight change.

45. Procedures for Civilian Dietary Studies

Obtaining reliable food and nutrient intake data in civilian populations is generally more difficult than in Armed Forces or institutional feeding situations. This is mainly because small family units, rather than a large mess unit, are involved. In general, a much longer survey period would be required to obtain reliable data for a small family unit than for a mess that was feeding a large number of people, if the same methods and procedures were employed in both situations. Another difficulty arises from the fact that different members of the family (adults, children, infants, and pregnant women) have different nutrient requirements and it would be desirable to measure the average nutrient intake for each category separately. Because of such factors, it has been necessary, in general, to give less emphasis to methods that give very precise information on a few individuals and adopt procedures that are inherently less accurate but which include large numbers of family groups. In any civilian situation the same rules of courtesy and protocol apply that are required in the Armed Forces. The population must be approached through the local government and public health authorities. Also it is necessary to enlist the cooperation and assistance of any and all civilian agencies related to social welfare, food rationing and distribution, etc. A satisfactory sample size will depend upon many factors, one of which is the magnitude of the total population of a country. It would be desirable to survey a sample representing not less than 0.1 to 0.2 percent of the people in a country with a total population of between 3 million and 5 million. A smaller percentage for a larger population and a larger percentage for a lower population might prove satisfactory. Experience in surveys of civilians has shown that a relatively small number of personnel can obtain sufficient data by more than one method of dietary survey to permit checking the results of one method against another.

a. Family Food Questionnaire and Record Procedure. In populations with an advanced social organization and educational level, housewives can be requested to fill in a detailed food use form which includes answers to questions on the age, sex, and food habits of each member of the family, and the amounts of food purchased during a weekly period. In some instances, this can include the use of a kitchen scale for the weighing of food portions by the

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housewife for each meal. The questionnaire method of survey has been used satisfactorily. See appendix VI for a detailed questionnaire.

b. Dietary Histories and Questionnaire Method.

(1) In areas where there is very little variety in food items, or severe food shortages, the skilled nutritionist can obtain a series of quite accurate daily dietary histories from housewives or cooks, in a relatively short time. The method requires a highly trained and competent nutritionist who first has had time to become completely informed on dietary customs, habits, cooking, language or local food names, and relative price and abundance, etc. of the foods.

(2) By use of actual food portions of different sizes or simulated food portions as visual aids and detailed questioning, it is possible to obtain good data on the kinds of food eaten the previous day and an approximation as to the amounts. (During World War II this was tested in Paris by skilled nutritionists where the diet was very simple and the results agreed within 10 percent of the values obtained by the inventory method. Where many kinds of food are eaten and at different times of day, however, the amounts consumed are almost impossible to estimate with any degree of accuracy).

(3) The numbers of individuals questioned in the course of a day are limited, as it often takes more than one-half hour to be sure the information from one interview is satisfactory; however, where trained observers are available in the home, food record forms can be filled in daily as food is served.

c. Recording of Actual Intake at Mealtime by Survey Personnel. (Weighed Food Inventory and Intake Methods).

(1) This procedure requires a large number of volunteer workers, usually women. Sample areas are selected and the survey personnel are assigned a specific number of homes. This is one of the most accurate methods and is recommended whenever sufficient personnel are available or may be trained. It requires a number of home visitors, perferably dietitians, public health visitors, social workers, or similar personnel who should be given a preliminary orientation and training in the use of kitchen scales, record forms, etc. A knowledge of local cooking procedures, typical foods, and food habits is also essential. Much more normal data will be obtained early if these home visitors are local personnel who have a thorough knowledge and the confidence of the population. In fact,

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this is sometimes the most important consideration in their selection.

(2) The home visitor at the start of the *first day* will weigh and record all quantities of food by kind or item in the home and as more food is acquired will weigh and record this. She will carefully question, observe, and record all other food eaten in the home as well as outside the home. She will weigh and record all food discarded either before or after preparation. (If after preparation, the waste food weight must be calculated back to "as purchased condition" before it can be deducted from the total of that food item acquired by the family). At the end of the *last day* of the period she will weigh all food remaining in the home. The duration of the period may be varied from 1 to 7 days, depending upon the simplicity and frequency of repetition of the diet items and the consistency of the family's food habits. In general, in the poorest and most undernourished populations which are of *primary interest*, the food tends to consist of a few staple items repeated each day and often, even at each meal, so that the data are reasonably accurate even for periods as brief as 2 or 3 days. After the end of the period, the amount of food wasted is added to the amount of food remaining in the home (by items) and these totals are subtracted from the total amounts of food in the home at the start and brought in during the period, thus yielding the amounts of each food consumed during the period. Dividing by the number of days then gives the *daily* food consumed by item or kind.

(3) If the family members are all adults, dividing by the number of adults gives the average daily food weight consumption *per person*. If, however, infants, children, pregnant or lactating mother, male or female adults, or other special consumer-categories are of interest, it is necessary to gather additional information during the period in the home. This may be quite simply done by weighing and recording the portions of food to be consumed by each member of the family before consumption and then *computing an average fraction of the whole* for adult male, for adult female, for child, for infant, etc., which can then be applied to the final daily total food consumed. Alternatively, the size portions for each consumer category may be weighed, computed back to "as purchased condition" on the basis of weights of food before and after cooking or other preparation, and then totaled for each separate member of the family by food item each day.

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After the daily food consumption weight figure for each different category of family member is obtained by food item, the intake of specific nutrients should be calculated, using the most appropriate food composition tables available. Sometimes these can be obtained from universities and other research workers in the country or region, and sometimes FAO or USDA tables are suitable. Corrections for vitamin losses during cooking must be made with caution unless actually determined.

d. Recipe Method. For the recipe method of survey, data are obtained for three consecutive meals. The dietitians weigh the food items that were included in a particular dish and weigh the cooked food after it is ready to serve. Any leftover food not served is also weighed. From the weights of the ingredients that went into a particular food and the weight of that food consumed by the members of the family, it is possible to determine the average weight of each food item or ingredient consumed per person per day. From these data the average intake of essential food nutrients is calculated, using appropriate food composition tables. Each dietitian should be able to collect data for the recipe and food composite analysis methods in as many as three families during 1 day. This requires considerable cooperation from the family being surveyed but such cooperation is usually not difficult to obtain wherever the dietitians can converse freely with the housewife.

Table X. Food as Prescribed by the Master Menu (1952 through 1954) and as Issued, Pounds Per Man Per Day

Food group	Prescribed by Master Menu	As issued [1]
Meat, fish, and poultry	0.956	0.874
Eggs	0.234	0.221
Milk or milk products	0.867	0.843
Butter Fats, other	0.200	0.214
Sugars	0.285	0.288
Cereals	0.576	0.545
Legumes	0.023	0.025
Vegetables, l, g, y	0.346	0.356
Vegetables, other	0.255	0.280
Potatoes	0.622	0.760
Tomatoes	0.128	0.124
Citrus Fruits	0.161	0.161
Fruits, other Fruits, dried	0.504	0.441
TOTAL POUNDS/MAN/DAY	5.151	5.154

[1] Based upon data obtained by U. S. Army Medical Nutrition Laboratory.

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Table XI. Nutrients per pound of food classes "as purchased"
(Corrected to yield nutrients consumed)[1]

Food group	Calories	Protein (gm)	Fat (gm)	CHO (gm)	Calcium (mg)	Iron (mg)	Vitamin A I.U.	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)
Meat, fish, and poultry	848	56	68	3	33	6.5	218	0.35	0.39	10.3	0
Lean pork	1036	56	90	0.21	29	7.8	0	1.93	0.50	10.1	0
Liver	471	70	12	21	28	43.2	68,380	0.63	8.00	43.0	77
Eggs, fresh	492	40	36	2	180	9.0	3,780	0.27	1.00	0.2	0
Milk products	459	20	27	34	735	0.5	1,200	0.12	0.90	0.6	5
Butter	2977	3	330	2	65	0.8	12,723	0.01	.04	0.4	0
Fats, other	3041	1	334	7	19	1.3	228	.03	.03	0	0
Sugars	1476	2		379	64	3.3	8	.01	.01	0.3	2
Cereals	1292	40	12	256	186	10.2	13	1.17	1.30	10.3	0
Legumes	1200	78	40	132	388	24.2	199	1.08	1.10	20.7	5
Vegetables, leafy green and yellow.	103	5	1	19	85	3.2	12,045	0.13	0.16	1.0	24
Tomatoes	161	5	1	33	43	2.5	4,970	.25	.15	3.6	59
Citrus fruits	301	4	1	69	68	1.1	297	.17	.06	0.6	140
Potatoes	233	5		54	43	2.8	69	.25	.12	3.4	24
Vegetables, other	190	6	2	37	74	1.5	215	.10	.14	1.0	13
Fruits, other	229	2	1	54	38	1.2	1,134	.12	.06	1.0	20
Fruits, dried	1132	10	2	269	243	16.8	6,293	.28	.52	5.9	29
Miscellaneous	408	12	20	45							

[1] This table contains corrections for observed preparation, kitchen and plate waste, and fat drippings where applicable. The vitamins are corrected for cooking loss, using the standards in table VII.

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Table XII. Nutritional Evaluation Form (Sample Calculation Based on Nutrient Values in Table XI)

Food groups	Pounds per man per day	Calcium	Protein (gm)	Fat (gm)	CHO (gm)	Calcium (mgm)	Iron (mgm)	Vitamin A I.U.	Thiamin (mgm)	Riboflavin (mgm)	Niacin (mgm)	Ascorbic acid (mgm)
Meat, fish and poultry.	0.87	738	49	59	3	29	5.7	190	.30	.33	9.0	----------
Lean pork	0.14	145	8	13	0	4	1.1	0	.27	.07	1.4	----------
Liver	0.02	9	1	0	0	1	.9	1368	.01	.16	.8	2
Eggs, fresh	0.185	91	7	7	0	33	1.7	699	.05	.18	0	----------
Milk products	1.237	568	25	33	42	909	.6	148	.20	1.21	.7	6
Butter	0.095	283	0	31	0	6	.1	1209	0	0	0	----------
Fats, other	0.07	213	0	23	0	1	.1	16	0	0	0	----------
Sugars	0.285	421	1	0	108	18	.9	2	0	0	.1	1
Cereal products	0.51	659	20	6	131	95	5.2	7	.59	0	5.2	----------
Legumes	0.038	46	30	15	50	147	9.2	8	.06	0	0	----------
Vegetables, leafy green and yellow.	0.440	45	2	0	8	37	1.4	5300	.06	.08	.5	11
Tomatoes	0.114	184	6	1	38	49	2.9	5666	.29	.17	4.1	67
Citrus fruits	0.225	677	9	2	155	153	2.5	668	.38	.14	1.4	32
Potatoes, Irish	0.526	123	3	----------	28	23	1.5	36	.13	.06	1.8	13
Vegetables, other	0.269	51	2	0	10	20	.4	58	.03	.04	.2	4
Fruits, other	0.422	97	1	0	23	16	.5	479	.05	.03	.4	8
Fruits, dried	0.015	17	0	0	4	4	.3	94	0	.01	.1	0
TOTAL (PMPD).	5.461	4367	164	190	600	1545	35.0	15948	2.42	2.48	25.7	144

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Table XIII. Weighted Average Percentage of Indelible (Preparation Discard) and Edible (Kitchen and Plate Discard) Portions of Food Groups During Preparation and Serving[1]

Food group	Preparation discard	Edible kitchen and plate discard
Meat:		
Fish and poultry	27.9	20.3
Lean pork		16.5
Liver		21.4
Eggs	15.8	17.6
Milk and milk products		4.1
Butter		10.4
Fats, other		16.9
Sugars		8.8
Cereals		12.5
Legumes		19.9
Vegetables, leafy, green and yellow	25.7	20.4
Vegetables, other	26.2	20.9
Potatoes	28.3	13.6
Tomatoes	8.7	8.5
Citrus fruits	29.3	7.0
Fruits, other	24.6	13.4
Fruits, dried		12.6
Miscellaneous		16.3

[1] Based on observations of the U. S. Army Medical Research and Nutrition Laboratory.

46. Clinical Appraisal of Nutriture

a. General. The simplest approach to the assessment of the actual nutritional status of a population group is by clinical examination of a properly selected sample of that population. The factors which demand the most careful control are—

(1) Selection of the sample for examination.
(2) Standardization of the criteria for diagnosis of individual lesions of nutritional significance.

b. Priority. In a situation where the food supply is limited, the order of priority of supply of the various nutrients, aside from water, is usually as follows: calories, protein, vitamin C, B complex vitamins, and the oil soluble vitamins (A, D, E, and K). Depending upon the circumstances requiring the nutrition survey, greater or lesser emphasis may be placed on those parts of the clinical examination dealing with the specific nutrients. A procedure for a very detailed nutritional examination (plus other information) is given in "Manual for Nutrition Surveys" by the Interdepartmental Committee on Nutrition for National Defense, published May, 1957, by the U. S. Government Printing Office, Washington, D. C.

c. Selection of Sample. Ideally, to determine the incidence of a certain lesion in a population group, one should examine the whole

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population. This may be possible with groups such as liberated prisoners of war, small military units, units that have been isolated for a period of time, or inmates of institutions. However, in most situations it will be necessary to select a group for examination that is as representative of the whole population as possible. If the finding of any condition in the population studied is to be compared with a normally expected 1 percent rate of findings and if the actual rate of occurrence is 3 percent, a properly drawn sample of 500 individuals would be more than adequate to establish the difference, no matter how large the population. The sample must be selected to include individuals from all subgroups, or strata, of the population, which may conceivably vary in nutritional state. The numbers of individuals selected for examination from each stratum need not be in the same proportion to the total sample, as the numbers in each stratum are represented in the total population, for the results can be adjusted, provided the fraction of the total population contributed by each stratum is known.

d. Military Sample.

(1) The selection of a sample from an organic military unit, such as an infantry division, is relatively simple. The following should be considered in selection of a sample in a division: rank, messing facilities, physical activity, and exposure to the elements or other stresses. Headquarters and service troops are frequently better fed than rifle companies. In the field operations the riflemen are likely to be more active and more exposed to the elements and, therefore, have a higher requirement for calories and other nutrients than service troops. Thus the riflemen, on whom ultimately the mission of the unit depends, are most likely to show evidence of nutritional deficiency; further, in operation they are the group that is most difficult to obtain for examination.

(2) A proper sample from an infantry division might be made up as follows: Assume the division is in operations with three battle groups on the line, supported by the Division artillery and two battle groups in reserve. The sample should include perhaps three-fourths combat and one-fourth supporting troops. Of a total sample of 600, the breakdown might be: combat troops, 200 infantry on the line and 100 infantry in reserve, 150 artillerymen and engineers; supporting troops, 150 headquarters, quartermaster, medical, etc., troops. Although it will be impossible to examine troops on the line, troops just withdrawn will provide the same information. Selection of the groups for examination should be done as follows: one of the three battle groups on the line is selected at random. If

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there is a whole infantry company within the battle group that has just been withdrawn from the line, this company should be examined preferentially; the troops of this company will thus provide the approximate total combat infantry required for the sample. If such a company is not available, an infantry battle group is selected at random, and reserve platoons of each company are examined. From a battle group in reserve the required sample is obtained by random selection of first, battle group; second, company; and then platoons as necessary to make up the required number. Random selection of the other troops is carried out in the same way. All troops are listed in groups of roughly equal size (e.g. battalions, QM, medical, etc.; separate companies are listed together as one group) and one group is selected at random. Random selection is then made of subgroups until a unit of appropriate size for the sample is obtained.

e. Civilian Sample.

(1) The sampling procedure of a civilian population group is more difficult and less exact. Some general factors which influence nutritional status, and which must be considered in the stratification of the sample are age, sex, economic status, occupation, location (i.e. rural vs urban), climate, availability of food, shelter, fuel, transportation, power, etc. Let us consider the selection of a representative sample from a small industrial city of 200,000 and its environs. Assume that only moderate destruction has occurred and that some industrial activity continues. Because the population of such a city is not homogeneous in many factors which may affect nutritional status, it will be necessary to examine a fairly large sample, probably several hundred. Estimates must first be made of the total numbers of individuals within each nutritionally meaningful stratum of the population. Figures on age distribution, economic status, and occupation may be available from local authorities. Without this, the age distribution may be approximated from table XIV which is based on the Bureau of Census reports, 1 July 1959. Sampling may be directed primarily toward more susceptible groups, but some estimate of the state of the less susceptible groups is necessary so that food allocation can be properly planned. An attempt should be made to examine samples from the following strata:

(*a*) Men engaged in heavy labor, e.g. miners, construction, heavy industry.

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(*b*) Men engaged in light work, e.g. light industry, office. This activity group may have to be subdivided into men and women, if significant numbers of women are engaged in such work.
(*c*) Housewives.
(*d*) Infants (up to 1 year).
(*e*) Preschool children (1 to 5 years).
(*f*) School children (5 to 12 or 15 years).
(*g*) Elderly men and women (over 60 years).
(*h*) Pregnant and lactating women.
(*i*) The sick.
(*j*) Institutionalized individuals (prisoners, inmates of old peoples homes, etc.) Such individuals are particularly susceptible during food shortages, since they are absolutely dependent on food brought to the institution.

(2) It is relatively easy to obtain groups for examination from factories, mines, hospitals, clinics, prisons, schools, etc. Infants and pregnant and lactating women can perhaps be seen at clinics. Housewives, preschool children, and elderly people are the most difficult to reach; house to house visits will be necessary to examine them. The numbers of individuals to be examined in each group will depend upon the estimates of the proportion of the total population within each group.

(3) During the near famine in Germany after World War II, an attempt was made to check at least caloric sufficiency by a program of measurement of height and weight of people on street corners. Although it was hoped to overcome the complete lack of proper sampling, by weight of numbers, it is doubtful if this program served any useful purpose, other than psychological, because the population measured obviously excluded a considerable number of the groups listed above. Also, the individual ill from malnutrition was much less likely to be on the streets than the well-nourished individual. For the proper assessment of the nutritional state of a population, there is no substitute for careful selection of the sample.

47. Physical findings as related to Specific Nutrients

a. General. In grading of physical findings, and in all clinical examinations, it is important to describe in considerable detail, before the survey is undertaken, the criteria that will be used to determine the presence or absence of the sign and its grading. It has been found that physicians differ in their criteria for diagnosis of individual physical signs, and that an individual's criteria

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Table XIV. Age Distribution of U. S. Population 1 July 1959[1]
(Percent of total per class)

Age in years	Percent		
Date and age	All classes		
	Total	Male	Female
JULY 1, 1959			
All ages	100.0	100.0	100.0
Under 5 years	11.2	11.5	10.9
5 to 9 years	10.6	10.9	10.2
10 to 14 years	9.3	9.6	9.0
15 to 19 years	7.3	7.5	7.1
20 to 24 years	6.3	6.4	6.2
25 to 29 years	6.2	6.3	6.2
30 to 34 years	6.8	6.7	6.8
35 to 39 years	7.0	6.9	7.1
40 to 44 years	6.4	6.4	6.5
45 to 49 years	6.2	6.1	6.2
50 to 54 years	5.4	5.4	5.5
55 to 59 years	4.6	4.6	4.7
60 to 64 years	4.0	3.9	4.2
65 to 69 years	3.2	3.1	3.4
70 to 74 years	2.4	2.2	2.6
75 to 79 years	1.7	1.5	1.9
80 to 84 years	0.9	0.7	1.0
85 years and over	0.5	0.4	0.6

[1] U. S. Dept. of Commerce, Bureau of Census Service P-25 No. 212, Jan. 1960.

will change markedly even from day to day during a survey. If at all possible the same physician should do all examinations in a survey. Otherwise all physicians involved should examine, separately and together, a series of at least 100 men to attempt to standardize a criteria for diagnosis of lesions. Certain lesions which are present in acute nutrition deficiencies are described in *b* through *i* below, and may serve as guides.

b. Calories. Caloric deficiency is measured by loss of body weight. Weight, however, must be adjusted for height to determine if the individual or a group is underweight. Age and sex also influence body weight. Table XV lists the "standard weights" for a series of heights and ages, together with simple correlations for sex. For each individual examined the weight, height, and age are recorded. The "standard weight" for age and height is found in the table, and the individual's actual weight is divided by the "standard weight" and expressed as the percent of standard weight. The reference table for calculation of percent "standard weight" is based on American Medico-Actuarial standards. Thus when applied to other population groups, interpretation of the data must recognize variations due to anthropologic characteristics. Recent nutrition surveys conducted in eight countries of the Near and Far East and Europe indicate that the reference table is applicable in most cases,

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especially up to age 25 years. Beyond this age the reference table allows an increase in body weight for age.

c. Other Methods. Another approach to assessment of caloric sufficiency is by measurement of skinfold thickness. For this purpose a number of calipers have been devised; one such type is shown in figure 2. A fold of skin and subcutaneous fat in a standard location is picked up off of the underlying muscle with the thumb and forefingers of one hand, and the thickness of this fold is measured with the caliper, at least 1 cm. away from where the fold is held and yet not too close to the muscle. The most satisfactory fold to measure is on the back of the upper arm midway between the shoulder and the elbow. Various formulas have been devised to permit calculation of body fat from one or more skinfolds, but none are satisfactory. A skinfold measured in this way includes a double thickness of skin and a double thickness of the subcutaneous layer of fat. Since the average skin thickness is 2 mm, a skinfold thickness of 4 mm indicates that very little, if any, subcutaneous fat is present. Even if all the skinfolds of an individual approach the 4 mm minimum, reasonable amounts of internal fat remain. Skinfold measurement has practical value in two ways. First, if an individual's skinfold is significantly greater than the minimum (more than 6-8 mm) he has very adequate stores of fat. Also, if less than 2–3 percent of a population show skinfold thicknesses below the minimum, the population may be considered to have adequate caloric stores. Second, repeated measurements on the same people will show whether the body fat stores are increasing or decreasing. A mean difference of 1 mm in the same group of individuals may be significant. Proper calibration of the calipers is necessary in these measurements. The tension at which measurement is made is of considerable importance; a tension of 10 gm. per square mm of jaw surface is standard for the caliper described here. Since the jaw tips are 3 mm in diameter, the spring must be adjusted so that, when the caliper is held vertically and the movable jaw is in an intermediate position, a 70-gram weight will balance the spring tension. In making skinfold measurements, the handle to which the spring and movable jaw is attached is squeezed so that the point of the handle is in line with the guide line on the movable jaw.

d. Protein. Signs that may be useful in evaluating protein nutrition are dependent edema and the general state of muscular development. Muscular development may be graded good, fair, or poor.

e. Vitamin C. Scorbutic gums are swollen, boggy, and friable, particularly the interdental papillae, and bleed spontaneously on minimal trauma such as a touch with a tongue blade. The gingival edges next to the teeth are frequently reddened. Perifolliculosis, a

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SKINFOLD THICKNESS CALIPER

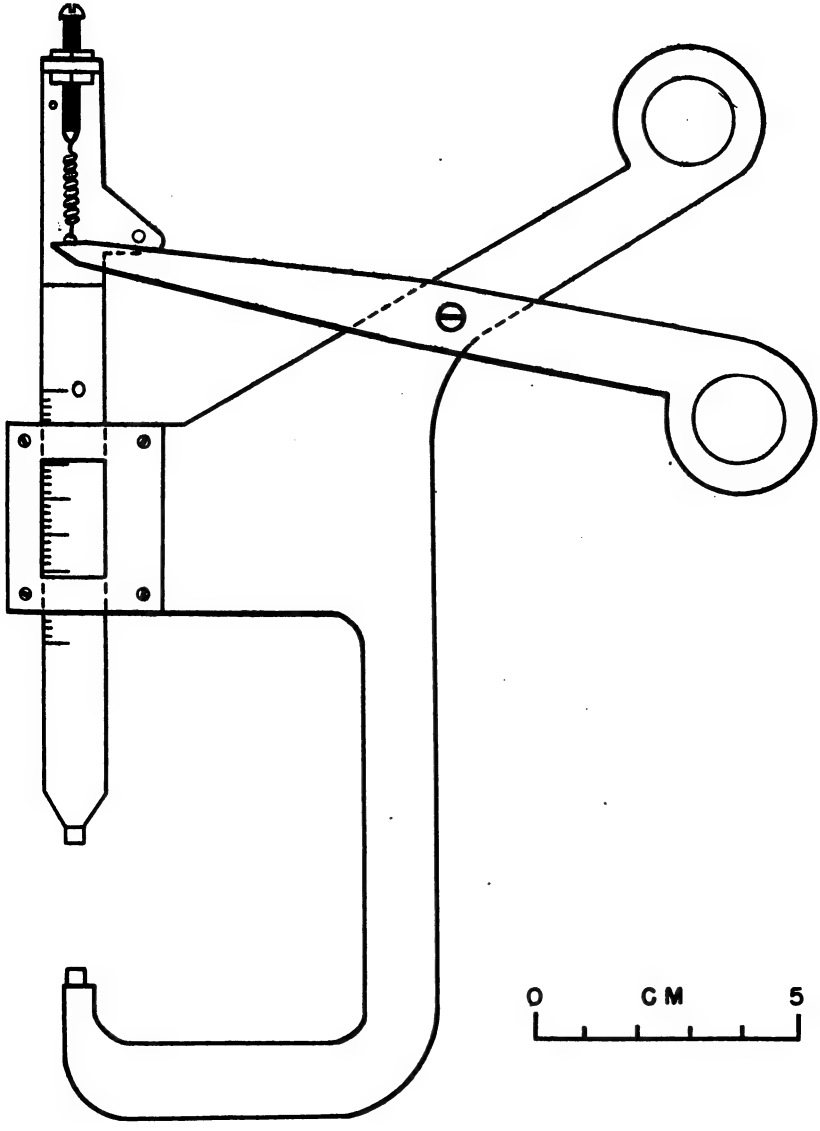


Figure 2. Skinfold thickness caliper.

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petechia-like rash, may be seen on the skin of the trunk and extremities. This consists of tiny rings of congestion or hemorrhage around individual hair follicles which do not fade on pressure.

f. Niacin. Pellagrous lesions are photosensitive and appear as broad patches on the parts of the skin which are exposed to the sun, such as backs of the hands and neck. Acute lesions consist of erythema and edma often accompanied by burning and itching, but as the lesions become chronic, the skin becomes thin, atrophic, reddish brown, and scaly. A diffuse glossitis, characterized by red and swollen tip and lateral tongue margins, may also indicate niacin deficiency.

g. Thiamine. Although the individual may have beriberi and manifest all the symptoms and signs of an acute or chronic polyneuritis, frequently accompanied by dependent edema, the best sign to look for is bilateral loss of the ankle jerks.

h. Riboflavin. There are three easily recognized signs of riboflavin deficiency; cracks at the angles of the mouth which may be surrounded by whitish macerated skin, true cheilosis of the lips which are swollen and edamatous and may be cracked and bleeding, and a reddish, macerated dermatitis, with raw areas, on the dependent portion of the scrotum. The purplish-red magenta tongue is also found in riboflavin deficiency; considerable caution must be used in recording this lesion, for most "magenta tongues" become normal when viewed in good light. Riboflavin deficiency may also be the cause of circumcorneal injection, perhaps with slight invasion of the margin of the cornea by tiny blood vessels. Circumcorneal injection must be distinguished from ordinary conjunctival injection due to exposure.

i. Vitamin A. Follicular hyperkeratosis should be looked for on the backs of the upper arms at least, and perhaps also on the back. This lesion is best perceived by touch; the skin feels dry and is roughened to the texture of fine sandpaper by the keratotic plugs. The main differential diagnostic problem is gooseflesh; the examining room must be comfortably warm if possible. Another lesion attributed to Vitamin A deficiency is Bitot's spots. These appear on the conjunctiva just lateral (occasionally medial) to the cornea along the line of lid closure. They are usually triangular in shape with the base against the limbus and apex pointing away from the cornea. They are 3 to 4 mm. in size and have a peculiar foamy appearance, although the whole conjunctival surface appears somewhat dry from the accompanying xerophthalmia. These spots must be distinguished from the very common pingueculae, which are yellowish fatty deposits of varying size, rather like xanthomata, in the same area, from thickened conjunctiva due to exposure, and from pterygia which invade the cornea.

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48. Recording of Data

a. Clinical examination may include a search for all the lesions described above (or more, as described in the Manual for Nutrition Surveys, referred to above) or may be more restricted. Caloric adequacy may be investigated by measuring weight and height alone, perhaps accompanied by measurement of one or more skinfolds. Next in importance are the few signs referable to protein deficiency. A brief examination for adequacy of vitamin intake

Table XV. Standard Weight in Pounds at Different Ages and Statures: Males[1]

Height inches	Age										
	12	14	16	18	20	25	30	35	40	45	50
59	89	97	104	108	112	117	121	123	126	128	129
60	92	98	106	110	114	119	123	125	128	130	131
61	96	102	109	113	117	121	125	127	130	132	133
62	101	106	112	116	120	124	128	130	133	135	136
63	106	110	115	119	123	128	131	133	135	138	139
64	109	114	119	123	127	132	135	137	140	142	143
65	114	118	123	127	131	136	139	141	144	146	147
66	____	122	127	131	135	140	143	145	148	150	151
67	____	127	131	135	139	144	147	150	153	155	156
68	____	131	135	139	143	148	151	155	158	160	161
69	____	135	139	143	147	152	156	160	163	165	166
70	____	139	144	148	151	157	161	165	169	171	172
71	____	144	149	153	156	162	167	171	175	177	178
72	____	____	154	158	161	168	173	177	181	183	185
73	____	____	159	163	166	174	179	184	188	190	192
74	____	____	164	168	171	179	185	190	195	197	199
75	____	____	169	173	176	184	191	196	201	204	206
76	____	____	174	178	181	189	196	202	207	210	212

At ages 12, 14 and 16 females average 3–4 pounds heavier than males at each height. Above age 18 females average 4.5 pounds lighter than males.

Between ages 2 and 12 the following weights may be considered standard for the listed weight.

Ht.	Wt.	Ht.	Wt.	Ht.	Wt.
32	25	41	38	50	58
33	26	42	39	51	61
34	28	43	41	52	64
35	29	44	44	53	67
36	30	45	46	54	70
37	31	46	48	55	73
38	33	47	50	56	76
39	35	48	53	57	80
40	36	49	55	58	84

The data for ages 16–50 are from the medical actuarial tables of 1912. Data for ages 6–16 are from the tables of Baldwin and Wood. Data from ages 2–6 are based on average growth curves published by the State University of Iowa in 1943. A few interpolations have been made.

[1] Adjusted to nude weight, no shoes.

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might include a search only for scorbutic gums, pellagrous lesions, loss of ankle jerks, and angular lesions of the mouth.

b. The performance of a survey is facilitated by preparing a series of cards, one for each subject, with blank spaces for identifying data, age, height, weight, percent standard weight, and skinfold thickness. A series of boxes is provided, one for each lesion searched for; a check mark in the box indicates that the lesion is present. A sample card (Clinical Nutrition Survey Data) is pictured in figure 3. Although the examining physician himself can perform everything required on the card, the work can profitably be divided as follows: one corpsman fills in the identifying data, a second measures and records height, weight, and skinfold thickness, and the physician records the remainder. The second corpsman and the physician will each benefit by the assignment of clerks to record information on the card. A physician and two corpsmen, after a few days' experience, should be able to examine 40 or more men per hour.

c. After a day of examination, the standard weight (from table XV) is recorded, and the percent of standard weight calculated and recorded. It is also worthwhile to tabulate each day's findings at the day's end. This is particularly important in order to try to maintain the same diagnostic criteria throughout the survey. Tabulations are much facilitated if punch cards can be used for recording the data. For the individual lesions, one hole on the card suffices. If the lesion is present, the hole is punched. Data such as age, height, and weight may be recorded in 10 separate categories using 4 holes by the following code:

CLINICAL NUTRITION SURVEY DATA

DATE	NAME	☐ M ☐ F ☐ F ☐ L CARD
LOCATION	AREA OF ORIGIN	☐ RURAL ☐ URBAN ACTIVITY
UNIT	TIME IN SERVICE	SERVICE NUMBER RANK
AGE YEARS	HEIGHT IN. WEIGHT LB.	STANDARD WEIGHT PERCENT STANDARD WEIGHT

EYES	TONGUE	LOWER EXTREMITIES
1. ☐ BITOT'S SPOTS	7. ☐ FILIFORM PAPILLARY ATROPHY ☐ SL ☐ MOD. ☐ SEV.	14. ☐ BILATERAL EDEMA
SKIN, FACE & NECK	8. ☐ GLOSSITIS	15. ☐ LOSS OF ANKLE JERK ☐ R ☐ L
2. ☐ NASOLABIAL SEBORRHEA	9. ☐ MAGENTA COLORED	16. ☐ CALF TENDERNESS
LIPS	GLANDS	OTHER
3. ☐ ANGULAR LESIONS	10. ☐ THYROID ENLARGED *(Visible)*	17. _____
4. ☐ ANGULAR SCARS		_____
5. ☐ CHEILOSIS, GENERAL		18. _____
GUMS	SKIN, GENERAL	_____
6. ☐ SWOLLEN RED PAPILLAE ☐ LOCALIZED ☐ DIFFUSE	11. ☐ FOLLICULAR HYPERKERATOSIS ☐ ARMS ☐ BACK ☐ THIGHS	19. STUDIED FURTHER
	12. ☐ SCROTAL DERMATITIS	CARD
	13. ☐ PELLAGROUS DERMATITIS	EXAMINER'S INITIALS

Figure 3.

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Category	Punch
1	1
2	2
3	1+2
4	3
5	1+3
6	2+3
7	4
8	1+4
9	2+4
10	3+4

If punch cards are used, a procedure, as follows, should be used in coding the cards to insure accuracy: One man checks each hole to be punched, a second man checks this recording, and a third man punches the holes. Punched cards are sorted by stacking the pile together and inserting a "knitting needle" in the proper hole. The pile is lifted on the needle and gently shaken. By sighting along the cards over the needle, it can easily be seen if all cards punched at that hole have fallen out. Frequency distributions of, for example, age, are best compiled by sorting the cards from the highest number downwards, as follows: Start sort on hole 4. Of the cards with hole 4 punched, sort successively on 3, 2, and 1 to obtain the groups 4+3, 4+2, 4+1, and 4. Then sort on hole 3, etc.

49. Interpretations

If more than about 5 percent of the sample has a standard weight below 80 percent, caloric insufficiency is probably present. However, if the adult male population averages only 60–64 inches in height, the percent below 80 percent of standard weight probably must be 20 percent or more to indicate caloric insufficiency. If more than a few percent of the population has overt edema, the population may be markedly undernourished yet show a normal distribution of percent of standard weight. The skinfold data can be helpful in both of these situations. If there is a large percent below 80 percent of standard weight, yet the skinfolds show only 5 percent with folds at the 4-mm minimum, it is unlikely that the population is underweight, but if 20 to 30 percent or more have skinfolds at the minimum, caloric insufficiency is likely to be present, whatever the distribution of the population by percent of standard weight. The clinical data in regard to vitamin deficiency must be interpreted very cautiously, since all these lesions, or at least similar lesions, may be produced by other causes. The most specific lesion is the scorbutic gum. An incidence of 2 to 3 percent of scorbutic gums in a population is very good evidence of a low vitamin C intake. Pellagrous lesions have the same meaning as regards niacin intake; however, the niacin intake must be very low for a long time to produce them. If the lesions of riboflavin

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deficiency are present at the level of 5 percent or more of the population, the finding of riboflavin deficiency is warranted. Bilateral loss of ankle jerks may be present in 3 percent of normal people, particularly if the population is weighted by people over age 40. Follicular hyperkeratosis may be diagnosed in a normal population with an incidence as high as 5 percent. Bitot's spots are not always due to vitamin A deficiency. Nevertheless, in spite of these limitations, judicious interpretation of survey results can point out likely nutritional deficiencies. If necessary, these problems can be attacked further by dietary surveys, by biochemical investigations, or by therapeutic trials. Further, changes in standard weight, skinfold thickness, or incidence of signs of vitamin deficiency, when the same sample is surveyed a second time, are much more reliable indicators of nutritional status than is a single survey.

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CHAPTER 9

PSYCHOLOGICAL ASPECTS OF FOOD

50. General

Psychological factors may have a profound effect on the adequacy of an individual's diet. A person may be provided all the components of an adequate diet but, if these are presented *ad libitum*, he may satisfy his Caloric requirements with foods inadequate in protein or in one or more of the other essential nutrients. Faulty food habits may be the result of lack of training in the family, religious beliefs, or due to the influence of food faddists of cultists. These habits are difficult to change and it must be attempted with patience and tact. Some foods which are relished by some are repulsive to others. In this chapter are discussed some of the most common psychological problems encountered in feeding one diet to a large number of people.

51. Military Personnel

a. Zone of Interior. Troops inducted or recruited into the Army vary greatly as to their backgrounds. Factors contributing to these differences are economic status of the family, religion, and the geographical location. The first factor is easily overcome; the soldier with a low economic background readily adapts to the more expensive foods to which he is unaccustomed because they are usually very acceptable. Most religions relax dietary restrictions for the person of their faith entering military service. There remains the factor of geographic background which presents a problem in feeding of troops. Regional food idiosyncrasies are well known. Such foods as turnip greens, black-eyed peas, corn bread, grits, and okra are relished by Southern troops; hominy and scrapple are well liked by men from the Eastern part of the United States. These foods are generally disliked by troops from other parts of the country. Seafoods, such as shrimp, lobster, and crab are unfamiliar to, and often disliked by, troops originating in the Midwest, particularly in rural areas. Such foods should be used on only limited occasions in the feeding of troops except where a preponderance of the men originate from areas where these foods are well-liked. There are some foods which are almost universally disliked by soldiers. Examples of such foods are liver and spinach, which are highly nutritious. These foods were placed on the Master Menu relatively often during World War II to raise the

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riboflavin and vitamin A content of the ration. Nutritional surveys, revealed, however, that very little of these foods was consumed by the troops; most was discarded as waste. It became obvious, therefore, that liver and spinach contributed little to the nutritional value of the ration as consumed. Today the use of these items are held to a minimum in the Master Menu. Much can be done by the cooks to overcome the prejudices against certain foods by preparing the dishes in a variety of attractive ways. The importance of the proper training of cooks cannot be overemphasized.

b. Theaters of Operations. Before going overseas, troops should be thoroughly indoctrinated in the value, use, and the high quality and wide selection of foods in the operational rations. The modern operational rations are greatly improved over those used in World War II. There is a prejudice against these rations, however, even among recruits, which is passed on from veterans whose knowledge of operational rations dates back to World War II. This was shown in mess surveys conducted among troops in training who received such rations twice a month in order to rotate existing stocks. On these days, food consumption dropped markedly although the rations were of high quality. The quality of dehydrated foods in the standard B ration, for the Armed Forces, has been greatly improved since World War II. Thre have been reported instances where troops who had never eaten dehydrated vegetables refused to eat them because they were convinced they would not like them. Such prejudices must be actively combated by commanders at all echelons, and the troops must be oriented as to the use of operational rations before they embark for a theater of operations. The psychological effects of monotony of operational rations are hard to overcome except by limiting their use to the length of time for which they were designed and by supplementing them with fresh items. Much time is lost during combat by troops foraging the countryside for such fresh foods as eggs, chickens, etc., to supplement the operational rations. Commanders should make an earnest attempt to secure such fresh foods as are available to minimize these practices.

52. Experience of U. S. Personnel as Prisoners of War

It has been reported that in World War II and the Korean conflict, many of the U. S. personnel died in prison camps because of self-inflicted starvation. Food was available which could have saved their lives, but, because it was unfamiliar, unacceptable, or repulsive, they refused to eat it. Others who survived the same regimen did so by virtue of their having eaten anything which would prolong their life. INDOCTRINATION ON THIS SUBJECT IS JUST AS IMPORTANT TO TROOPS GOING INTO COMBAT AS IS

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INDOCTRINATION ON WHAT INFORMATION SHOULD BE GIVEN WHEN TAKEN PRISONER.

53. Civilian Populations Under Military Control

Food can be used as a powerful psychological weapon to control populations in occupied territories. It can be used to persuade the population to collaborate and as an incentive to greater productiveness. On the other hand, inadequacy of food may cause such civil unrest and rioting as to seriously interfere with military operations. The military commander must decide how much effort should be diverted from his primary mission to the procurement of food for the population so that the military operation can proceed with the most efficiency.

54. Prisoners of War

It is the policy of the United States to treat prisoners of war according to the provisions of the Geneva Convention. It is necessary, therefore, to provide a diet which is nutritionally adequate and will maintain health. From the psychological standpoint, however, it is necessary to provide these nutrients in foods which conform to the prisoner's native food habits. If foods foreign to the prisoners' taste are forced upon them, they may develop nutritional deficiencies because of failure to eat essential items. Certainly, such a situation would lead to unrest and rioting. Every effort should be made, therefore, to provide prisoners of war with foods which they would normally eat at home.

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CHAPTER 10
SURVIVAL NUTRITION

55. General

The term survival has been loosely used to define a number of situations. A common situation in which the term is used is that of a person suddenly separated from available sources of food for an indefinite period of time. He is then faced with the dilemma of deciding whether he should strike out and forage for food or whether he should conserve his energy and body tissues by remaining inactive and await rescue. In the latter case he may survive many days provided he has access to potable water. In either instance a discussion of nutrition is impracticable because survival depends upon the food obtainable and the willingness of the individual to eat that which is available. The discussion in this chapter will be confined to situations where a limited amount of food is available which must be rationed to prolong life to the maximum extent. Such a situation must be envisioned in the formulation of survival rations. The type of food recommended under these circumstances depends upon the availability of potable water.

56. Physiological Requirements for Food

a. General. In a survival situation the main consideration is to provide sufficient calories to minimize wastage of tissues, and to provide energy so that the individual will have the strength and will to help himself. If is important psychologically for the individual to know that some food is available, no matter how little. The type of food most appropriate for a particular situation depends upon the number of calories, the amount of water which will be available, and the composition of the food. In prescribing food for survival in a possible emergency situation, logistics usually determine the caloric and water ration.

b. Calories. The caloric level prescribed for survival under various conditions has varied from 400 to 1500 Calories depending upon logistics. The number of Calories allowed per day will depend upon the weight and volume of food that the situation will permit. The Calories provided by one gram each of fat, protein, and carbohydrate are approximately 9, 4, and 4 respectively. Thus, it would appear that fat would be the ideal ration under severe weight and volume limitations. In the absence of carbohydrate, however, such a ration would cause ketonuria resulting in the loss of Calories in

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the urine and increased urine volume which is detrimental if there is severe water restriction. Furthermore, there is the problem of preventing rancidity from developing in foods containing fats. Since the main reason for the provision of Calories is to minimize tissue atrophy, it might appear on the surface that protein would be the food of choice. At a low caloric intake, however, the nitrogen is not utilized to replace that lost from the tissues. After deaminization, the nitrogen from the amino acids is converted into urea which is excreted in the urine and the rest of the molecule is oxidized. The additional urea excretion increases the obligatory urine volume which is undesirable under conditions of water restriction. Carbohydrate, however, is completely oxidized to carbon dioxide and water, and thus does not increase the water requirement.

c. Food for Survival. It is generally accepted that 400 is the minimum number of Calories daily that will have any sparing effect on the nitrogen in the tissues. At this caloric level the food should consist solely of carbohydrate. This can most simply be provided in the form of 100 grams of sugar or starch. Foods containing protein should be avoided if water intake is restricted. Survival at this level is somewhat better than at starvation level and the length of time depends upon the individual. As the number of calories provided in the ration is increased, the nitrogen sparing action increases and time of survival increases correspondingly. It is not advisable to introduce protein in a ration of less than one thousand calories if water is restricted. Between 1000 and 1500 Calories, some protein in the ration will increase nitrogen retention above that produced by the carbohydrate. High quality protein such as contained in eggs and milk are recommended, although any protein will be beneficial. A combination of carbohydrate and fat may be used if a concentrated ration is desirable. Not more than 50 percent of the ration, however, should be comprised of fat. At higher levels ketonuria will result. A ration containing 1500 Calories and 50 gm of protein should allow a well-nourished adult to survive several months if energy expenditure is limited. For instructions on how to live off the land on wild plant and animal foods, the reader is referred to FM 21–76, Survival.

57. Water

No simple directions can be given for minimum water requirements for drinking purposes, because of the numerous environmental factors involved. Unusual sources of water which may be available in a survival situation are described in FM 21–76. (See also ch. 2, this manual, and TB Med 175).

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CHAPTER 11

NUTRITIONAL REHABILITATION OF PERSONS SUBJECTED TO UNDERNUTRITION

58. General

This chapter deals with the initial nutritional rehabilitation of persons under military control who have been subjected to various degrees of undernutrition or starvation. Included in this category are civilian populations of occupied territories, liberated prisoners of war, and civilian internees who have not been treated in accordance with the Geneva Convention, and isolated military units denied their normal supply channels. Such persons upon their release from these circumstances may exhibit various degrees of undernutrition depending upon the length of time and degree of caloric restriction. Those who have survived long periods of caloric deprivation will have made a physiological adjustment whereby their metabolism is in approximate equilibrium at the decreased level of caloric intake. If this equilibrium is abruptly disturbed by a sudden increase in calorie intake, the results may be fatal. Many persons will be suffering from gastroenteritis as a result of infections or nutritional deficiency which will limit the types of food they may tolerate. Persons subjected to food restriction for a short time, on the other hand, may need only to be provided with food in excess of their normal requirements until body weight has returned to normal. Since the primary purpose of rehabilitation is to restore normal metabolism and body weight as soon as possible, the initial decision which must be made is to determine the caloric level at which nutritional rehabilitation may safely be started.

59. Triage

When large numbers of emaciated individuals are recovered simultaneously, it is difficult to make a complete diagnosis of each one and to individualize therapy. Under these circumstances it becomes necessary to set up broad criteria for classification into groups for nutritional therapy. Experience has shown that for initial screening, classification into the following three groups is useful:

a. Group I—Extreme Deficiency. These people are living only by virtue of their adaptation to low levels of metabolic equilibria. They may have suffered a loss of as much as 40 percent or more

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of their initial body weight, the greater part of the remainder is contributed by the comparatively inert tissue, the skeletal structure. Their daily caloric expenditure at this stage may range from 500 to 800. The patient is emaciated, usually lies quietly and is very apathetic. The legs are flexed on the abdomen. The position of the arms and legs may be maintained even when the patient is rolled from side to side. With much effort and persuasion, the patient can extend his extremities indicating no true ankylosis. The skin is dry, coarse, and cold to the touch. Pigmentation over the pressure points is almost universal. This is usually bilateral and symmetrical and is seen over the ischial tuberosities, sacrum, and the spines of the crest of the ilium. The extensive atrophy of all muscles is one of the most striking signs. The skin can be seen to follow the contours of the bony structure; the buttocks are concave and follow the contours of the ilium and ischium; the skull prominences are easily identified; winged scapulae are almost invariably present. The eyes show a characteristic enophthalmus. The scelera presents an opaque, porcelain-white appearance and few blood vessels can be seen in that tissue. The blood pressure is usually very low with systolic readings about 70 mm of mercury. The diastolic pressure is difficult to record. There is a pronounced bradycardia with a pulse rate as low as 30 beats per minute while the patient is sleeping. Excitement and activity precipitate dyspnea and tachycardia.

b. Group II—General Deficiency. This group is characterized by a weight loss of about 20 to 40 percent of their original body weight. In contrast to Group I, who are usually bedridden, this group may be ambulatory and somewhat restless and volunteer a whole group of subjective complaints more or less in proportion to the degree of starvation. Hunger, fatigue, weakness, sensitivity to the cold, mental depression, and dizziness when changing position are common symptoms. An early complaint is nocturia and polyuria and a later complaint is explosive diarrhea. The physical appearance of this group can be summarized as follows: they have an apathetic expression, are dirty, show complete neglect of personal appearance, and are indifferent as to what impression they may make on others. Their reaction time is extremely slow and they give the impression of stupidity. Pigmentation of the skin is usually visible in blotchy areas; edema may or may not be present. The skin is similar to Group I, dry, cold, and rough.

c. Group III—Mild Deficiency. Mild starvation of short duration, with loss of from 10 to 20 percent of body weight characterizes this group. It presents no real nutritional problems and is indicated by a voracious appetite.

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60. Therapy

a. General. All initial food distribution must be rigidly controlled for the protection of the patients from themselves. Consideration must be given to the fact that many of these people are weak, easily fatigued, have polyuria and diarrhea, and lack resistance to cold. Adequate warmth and protective clothing for the ambulatory patient must be provided. Quarters must be close to latrine facilities and kept at one level, as stair or hill climbing is difficult. These patients must not be kept waiting or standing in lines, or syncope may occur. Night lights should be made available as some cases of night blindness usually are found in such groups of people. Diarrhea, vomiting, and other symptoms of gastroenteritis are commonly encountered in these patients and the cause should be promptly determined. If infection is the cause, specific chemotherapy should be initiated simultaneously with nutritional therapy. Intolerance to food is frequently caused by nutritional deficiency. When diarrhea occurs after initial feeding, the possibility that this is caused by milk should be considered, since this food is the principal ingredient of the diets used in the rehabilitation regiman. The first impulse upon recovering people from starvation conditions is to feed them immediately and as much as possible. This natural inclination must be guarded against and the patient must be indoctrinated with the concept that initial uncontrolled refeeding is dangerous. It is better to underfeed (not to exceed 1500 calories) than overfeed all patients in the initial phase of nutritional rehabilitation. Poor selection of foods and large portions will result in distension, diarrhea, and at times circulatory failure. The ambulatory patient may become a bed patient under these circumstances. An initial feeding of a hot milk soup or ground meat soup may be supplied at once to all the patients. While they are consuming this simple dish, the triage and separation of categories can be accomplished. The extremely ill or moribund patient should get special medical attention immediately.

b. Group I. Persons in this group with extreme deficiency require immediate hospitalization and must be treated as critically ill. Emphasis cannot be placed too strongly on the clinical valuation of the gastrointestinal and circulatory aspects of these patients; they are in a precarious state of balance. Circulatory collapse, resulting in death, can be precipitated by violent retching and vomiting. The injudicious use of intravenous fluids particularly saline solutions can be fatal. These concepts are most important to bear in mind when starting therapy. The adjustment of the circulatory system and other physiological processes is delicate and the maintenance of life depends upon not upsetting this balance too suddenly. Aggressive and enthusiastic therapy abruptly started in an

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attempt to restore these patients to their previous state may result in a breakdown of the compensatory mechanisms. For these reasons therapy in this group must be started cautiously. It is best, if possible, to calculate the approximate daily calorie intake of the group for the immediate past. If this has been of the order of 1000 Calories daily, refeeding should be started with an increase of about 50 percent or 1500 Calories for the first 3–5 days. This should be provided in liquid or soft form given in five or more feedings during the day. Foods should be limited to milk, well-cooked ground meat, eggs, cereals (preferably cooked), and bread and butter. Crackers should not be substituted for bread unless they are salt free. Experience has shown that the majority of patients can take fluids by mouth. The use of a stomach or nasal catheter, however, may at times be necessary. Blood and plasma should be administered where patients are anemic and hypoproteinemia is present. Transfusions, when necessary, should be given at a rate of about 2 cc per minute and limited to 500 cc the first 24 hours. Dyspnea, precordial discomfort, and apprehension are danger symptoms that should lead to immediate discontinuance of the transfusion. The parenteral administration of amino acid mixtures, protein hydrolysates, normal saline, and glucose is *DISTINCTLY CONTRAINDICATED* except under the most unusual circumstances. The heart muscle has undergone the same type of atrophy as is visible on the surface of the body and occurs in the large striated muscle masses, which means that the cardiac reserve has been decreased. The circulatory embarrassment which can occur during intravenous therapy at this time may lead to pulmonary edema and heart failure. The advisability of the introduction of table salt into the diet of these people for at least several weeks, must depend upon careful clinical evaluation. There is sufficient sodium and chloride in most of the foods available to supply the physiological needs. Any excess leads to the production of edema in even mild, simple starvation and to heart failure in the more advanced cases of the starvation syndrome. After 3–5 days of feeding, food intake should be gradually increased as tolerated. As soon as possible protein intake should be raised to 150 grams daily. When intake has reached the 2000 Calorie level, the patient then may be treated as described in *c* below.

c. Group II. The program should be geared to increasing the nutrient intake slowly at first and subsequently to the maximum rate at which the body can metabolize the food. No attempt should be made in the first 24 to 48 hours to do more than to recondition the gastro-intestinal tract to the acceptance of the foods. The initial response to oral feeding frequently determines the speed of convalescence. The ambulatory patient who presents a moderate to moderately severe degree of starvation requires no more than 2000

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Calories daily for about the first 5 days of the first week. If there is evidence of gastro-intestinal disturbance and infection has been eliminated as a cause, it may be assumed that increased food is the cause and the quantity should be reduced again. After the first week the Calories may be increased up to a maximum of 3500 daily with a protein content of about 150 grams. Salt should be restricted for several weeks as with Group I. Simple foods which are physically smooth, low in undigestible residue, rich in protein, low in salt, and without too positive a flavor, should be selected. Mixed vitamin preparations should be administered orally and, where specific vitamin deficiencies are encountered, the pure vitamins may be given in increased amounts. If a gastroenteritis is provoked, convalescence will be unnecessarily prolonged. The patient who is responding in a normal manner will demand more food and at times will be very troublesome. The personnel in charge of feeding must be warned not to relax the discipline under these pressures. Changes in body weight for the first few weeks are not to be used as criterion of progress. The total body weight may fluctuate in both directions. A progressive weight loss may merely indicate loss of edema due to improved nutrition. The reverse is also true, for rapid gains in body weight may indicate an accumulation of fluid which is commonly due to excessive salt intake or heart failure.

d. Group III. This group presents no particular nutritional problems and with the exception of salt should be allowed food *ad libitum* if no gastrointestinal disturbances are encountered. Patients exhibiting gastroenteritis should be placed on a bland diet until this condition has been remedied through proper diagnosis and treatment.

61. Recommended Foods

a. General. A mistaken belief may exist among the patients and even some staff personnel, that special foods, vitamin pills, and patented preparations are required. There is no need of predigested or hydrolyzed foods. Oral protein hydrolysates are distinctly dangerous because of their tendency to provoke diarrhea and vomiting. The specific foods selected should include milk and certain milk products, eggs, potatoes, bread or crackers, barley, rice, fish, simple meats, and sugar. Vegetables, beans, and legumes are bulky and slow to digest and should be avoided in the early menus. Salted, smoked, or pickled meats, and fish must be strictly forbidden until the danger of edema is past.

b. Milk. The value of milk products cannot be overemphasized. When fresh or recombined fluid milk is not available, dried milk powder can be used in a variety of ways which are valuable both nutritionally and for flavor. It can be added to soups, gravies, stews,

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puddings, and coffee. Mixed as thick suspension with water, sugar, and flavor, such as coffee powder, it can be drunk or spoon fed in amounts that supply a substantial quantity of protein and calories. Undernourished patients will be found to tolerate up to 100 grams daily. (A pound tin will supply five people for 1 day.) Evaporated milks are valuable too. A palatable drink is made by diluting the evaporated milk with equal parts of water and using this as a vehicle for the powdered milk. The quality of the powdered milk is most important in its acceptability. Every effort must be made to supply a high grade, spray dried, fresh product. The whole milk powders have the disadvantage of developing off flavors on standing.

c. Eggs. Powdered eggs, when fresh eggs are not available, can be a very important item of the diet. They can be used advantageously in the preparation of egg-nogs. About two-thirds dried milk powder and one-third egg powder shaken with water, sugar, and flavor has a very high acceptability, is extremely nutritious, and conforms to the bland, low residue characteristics required. Egg powders, however, must be handled with due regard to sanitation and the mixtures, if not refrigerated, must be consumed within 4 hours of preparation.

d. Fats. Butter and margarine are useful. The total fat content of the diet should not exceed 35 percent.

e. Protein Rich Beverage. A suggested formula which has been found acceptable and can be prepared from foods usually available is as follows:

Evaporated milk	3000 ml 7½–14 oz. cans
Water	2500 ml 3½ canteen cups
Eggs, fresh, 10 large or 12 medium size	600 gm ¾ canteen cup
Powdered skim milk	450 gm 1 canteen cup
Sugar	60 gm 15 teaspoons

Coffee extract or vanilla flavor.

A canteen cup of the formula will supply approximately 600 calories and 40 gm of protein. As a supplement, one-half canteen cup between meals is suggested. When the entire subsistence is to be this type of liquid feeding, one-fourth canteen cup every 2 hours will usually be adequate for instituting a refeeding program.

f. Menus. The following menus are suggested for ambulatory patients who can be given a liberal diet. The approximate caloric equivalent and protein content are given for each meal.

Breakfast—900 calories, 30 gm protein:
- Stewed fruit, ¾ cup
- Cereal, cooked or dry
- Eggs, boiled or poached, 2.
- White bread, 1½ slices, plain or toasted
- Milk with tea or coffee, half milk
- Butter, 2 teaspoons.

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Lunch and dinner	1300–1500 calories, 45–50 gm protein at each meal:
	Meat, 4 to 6 oz. beef, chicken, or turkey, roasted, baked, or broiled
	Bread, 1½ slices, white only
	Potatoes, boiled, baked, or mashed
	Butter, 2 teaspoons
	Fruit, ¾ cup, stewed
	Tea or coffee with half milk
	Pudding, or custard, ¾ cup.

Supplements: Between meal nourishments of egg-nogs in one-third canteen cup quantities, or 1 small dish of plain ice cream or 1 glassful of whole milk. The formula for egg-nog, which contains approximately 50 gm protein and 700 calories per canteen cupful, is as follows:

Evaporated milk, seven 4 oz. cans
Water, 2½ canteen cupfuls
Eggs, 10 large or 12 medium size, fresh
Powdered skim milk, 1 pound or 1 canteen cupful
Sugar, 8 teaspoons
Flavoring.

g. Calories. The following approximate table of calories may be used as a guide in calculating the caloric content of the foods.

Food	*Quantity*	*Calories*
Milk, fresh whole	1 quart	650
Milk, evaporated	1 can, 14 oz.	570
Milk, skim milk powder	1 pound	1600
Milk, skim milk powder	1 tablespoon	25
Eggs, fresh	1 medium size, 50 gm	80
Eggs, fresh	1 large size, 60 gm	95
Bread, white	1 slice, 1 oz.	80
Cereal, cooked	½ cup	60
Cereal, dry, prepared	1 cup, 25 gm	95
Sugar, granulated	1 teaspoon	15

62. Convalescence

The nutritional restoration of a person who has been severely undernourished requires many months before the prestarvation status can be recovered. The mere restoration of body weight is not the end to be sought; it is essential to restore the mass of muscles and glands, which takes much longer than the simple deposition of fat. An early return to normalcy of blood constituents is an important goal in accomplishing this. A person whose body weight has been restored by a dietary rich in carbohydrate and fat but low in protein may suffer from circulatory collapse upon physical exertion because insufficient protein had been provided to rebuild the myocardium. With proper dietary management, however, nutritional rehabilitation is promoted by a graduated program of physical activity which should be continued and even intensified after the prestarvation body weight has been regained. The character of the diet during the later period is not critical and, with the

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exception of protein, the simple requirements of any adequate dietary apply. For the adult male 100 to 120 grams of protein daily, including at least 20 grams from animal sources, i.e., meat, eggs, milk, cheese, etc., should be provided. As soon as the body weight begins to approach the prestarvation level, or the ideal weight, the caloric content of the diet should be reduced. Poststarvation obesity is a common and undesirable phenomenon. The prognosis for full recovery from even severe caloric restriction is good, once definite improvement begins, and the chances of permanent sequelae are small. The consumption of dietaries grossly deficient in vitamins as well as in calories for long periods of time may result in permanent or at least long-persisting lesions. Such changes may be irreversible. The effects of simple caloric undernutrition in the adult, however, appear to be fully reversible, at least in the great majority of cases.

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CHAPTER 12

FEEDING POPULATIONS UNDER DISASTER AND RELATIVELY STABLE EMERGENCY CONDITIONS

63. General

a. During a disaster, the military may be called upon to feed the civilian population until such a time as civil defense agencies can assume this function. These occasions may arise when local government officials seek aid from local commanders or when a state of martial law is declared and the Army is directed to assume civil functions. Since it is assumed that the period involved will be relatively short, quantities of vitamins, minerals, and other nutrients except water, calories, and protein, need not be considered except for the vulnerable groups. The immediate need for instituting a feeding program is to boost morale, prevent panic, and supply energy for the population to start reconstruction.

b. Occasions have arisen in the past which necessitated the formulation of plans and initiation of programs under which military commanders were responsible for the adequate feeding of civilian populations. Similar occasions may arise in the future. These might result in activities ranging from simple military, medical, technical, and administrative advice to actual provision for and control of mass feeding programs.

c. Aside from humanitarian considerations the provision of adequate food for the civilian population is necessary to prevent civil unrest and disorder, which would impede military operations, and to furnish incentive and energy necessary for reconstruction. Such assistance should be held to a minimum consistent with the above objectives without diverting effort from primary military missions. To accomplish this a very careful analysis of the situation must be made in order to determine whether adequate food can be provided from indigenous sources and if not, how much shipping and effort would be required to accomplish the objective.

64. "Disaster" Feeding

A disaster feeding program for civilian populations during the emergency phases should make use, wherever possible, of preexisting emergency feeding stations or facilities such as relief markets, mobile canteens, soup kitchens, school cafeterias, or communal kitchens. Foods stored for such emergencies should be utilized first.

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Local civil defense officials should be able to furnish information on the above. If kitchen facilities are not available, Army field kitchens should be used. Since most families will have several days' supply of food stored in the home, no attempt should be made initially to distribute food to homes; efforts should be directed to mass feeding of people whose homes have been destroyed, relief workers, and transients. After emergency stores of food have been exhausted, all local supplies should be used, such as foods in restaurants, hotels, retail stores, warehouses, and on the farms. The primary sources of food stored in most parts of the country are surplus grains such as wheat, corn, and rice which may be boiled or parched and eaten as such. When local food is exhausted and transportation has not been restored, the Army may be called upon to furnish trucks to transport food from more distant areas.

65. Assessment of Situation

a. Initial Assessment of Nutritional Status. The first step in establishing a feeding program in a newly occupied territory is to determine the nutritional status of the population at that time. There are several methods which can be employed in this situation (ch. 8). Each situation must be considered individually. Statistics on food production, exports, and imports may be available for peacetime. What happened to this agricultural economy during the conflict or disaster is the important determination to be made on the site. Not only must consideration be given to food on the farms and in storage but also that in transit, in stores, restaurants, hotels, homes, and in hoarding. On this basis an estimate must be made of the calories which will be available from indigenous sources on a per capita basis for the immediate future and projected for monthly intervals for the anticipated feeding period.

b. Duration of Restriction. Having established the number of calories per capita available from indigenous sources, the problem of establishing the caloric level at which the population will be fed becomes one of military logistics. Of prime importance in establishing this level is the length of time it is estimated will be necessary to impose caloric restriction on the population. Factors to be considered are types of supplemental foods required, distance from source of supply, availability of transportation, and the potential of the country to become self-sufficient in its food supplies. The goal is to provide sufficient food to prevent a loss in body weight of not more than 10 percent from the expected normal. If the population sustains a loss of more than 10 percent of its normal weight, civil unrest and revolt may be expected. Thus, if it is expected that normal food supply will be restored in 6 months, the initial restriction imposed on the population may be much more severe than in a situation when the restriction must be imposed over a period

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of 1 or more years. It is obvious, therefore, that minimum nutritional allowances for populations must be established for various periods of time which may be expected to provide sufficient food to prevent starvation and civil unrest.

66. Minimum Nutritional Allowances

a. General. In determining minimum requirements for an entire civilian population innumerable variables must be considered such as anthropological characteristics of the population, age and sex distribution, number of lactating and pregnant women, physical activity, climate, previous dietary history, prevalence of diseases, and effectiveness of food distribution. Since it is impossible, on the basis of our present knowledge, to determine accurately the minimum nutritional *requirements* for an entire population, it is necessary for *planning* purposes to establish minimum *standards* or *allowances* of nutrients. These minimum allowances do not denote actual requirements, but represent average per capita levels of nutrient intake below which the maintenance of the health of a population cannot be assured. The minimum nutritional allowances for planning rations for survival and disaster situations are given in table XVI.

b. Application of Minimal Nutritional Allowances. The four phases referred to in table XVI are based on the premise that food will be in critical supply, and that tactical and other circumstances will dictate a need for variable priorities. The time limits set herein are arbitrary and indicate the length of time in a particular phase after which serious consequences may be anticipated. The phases for which minimum allowances have been indicated are defined as follows:

(1) *Phase I.* This is the bare existence level for a nonactive, sedentary population and indicates the minimum food necessary to meet the physiological needs. Little or no productive labor may be expected from the population. It is anticipated that the food supply will be increased after one month at this level.

(2) *Phase II.* This level should prevent serious undernutrition or potential serious civil unrest due solely to food deficiencies. Some productive work may be expected, but over a period of more than 2 months a significant loss of body weight may occur and production may be expected to fall off.

(3) *Phase III.* At this level the population may be expected to remain in good health and be productive for many months. This level, however, will not allow maximum production or reconstruction.

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Table XVI. Minimal Nutritional Allowances for Planning Rations for Survival and Disaster

May 1959

The purpose of these nutritional allowances is to serve as a guideline in the planning for feeding population groups to insure that the rations planned will at least meet these minimal allowances. It does not prescribe that the rations need to be this restricted.

It is recognized that for those individuals planning such a ration, there are many other factors which must be kept in mind, such as economics, acceptability, the logistics of storage, preparation, et cetera.

TABLE OF ALLOWANCES[1]

As Consumed Per Capita Per Day[2]

	Phase I—Survival		Phase II—Austere	Phase III—Near normal	Phase IV
	2 weeks	2–4 weeks	8 weeks	8 weeks	Indefinite
Water, Quarts	2	2	2	4[3]	4
Calories	1500	1500	1800	2000	2400
Protein, gm	———	35	50	65	65
Thiamine	———	———	0.4	0.6	0.7
Vitamin C, mg	———	———	10	30	30
Niacin, mg	———	———	5	8	10
Riboflavin, mg	———	———	0.7	1.0	1.2
Calcium, gm	———	———	0.3	0.4	0.4
Vitamin A, International Units	———	———	———	———	3500

[1] The OCDM Interdepartmental Ad Hoc Advisory Group on Research and Development for Food for Shelters recommends the following nutritional allowances for planning rations for shelters, for Phases I and II. These allowances represent also, the opinions of the Food and Nutrition Board, Consultants to and staff members of the Interdepartmental Committee on Nutrition for National Defense, and representatives of the Department of Health, Education, and Welfare.

[2] To meet physiological needs. Based on the population, age, distribution in the United States, July 1959.

[3] Includes water for cooking and drinking.

(4) *Phase IV.* This is the goal which should be attained in helping a population "get back on its feet." It is not the optimum or rehabilitation level but is the level beyond which the military authorities should not divert further effort from their primary military missions.

c. Allowances for Essential Nutrients.

(1) The time phases described above are based mainly on caloric considerations and indicate the time limit for Phases I and II beyond which a body weight loss of 10 percent may be expected. The allowances for vitamins and minerals established for Phases II to IV are based on our present knowledge of nutrition. No minimum amounts of vitamins and minerals are indicated for Phase I because at such a low caloric level it is difficult and probably unnecessary to furnish normal amounts of these nutrients.

(2) Although minimum allowances are recommended for some of the vitamins and minerals during Phases II to IV, it may be impracticable for military authorities to

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furnish these levels to the population at all times. Efforts should be made for an equitable distribution of local sources of these vitamins. Although the allowances listed in table XVI are probably sufficient to meet the nutritional requirements of all categories of the population, special foods such as milk and fruit juices should be diverted to infants and pregnant and lactating women.

d. Determination of Nutrient Intake. Experience has shown that constant surveillance of the distribution of food must be maintained. This can best be accomplished by determining the food intake of individuals or groups in different locations of the disaster area. Several methods may be used, as listed in chapter 8.

(1) *Inventory method.* If bulk allotments of food are received at one depot for distribution to an area the population of which is known, determination of food consumption is relatively simple. The average amount of food distributed per day determined over a period of a week or month is divided by number of persons. The *per capita* nutrient intake is then determined as described in chapter 8.

(2) *Questionnaire method.* This method is widely used to estimate dietary intake in civilian populations. The investigator asks the housewife how much of each food she served her family the previous day. In disaster conditions this method is open to criticism on the basis that the findings are subjective, and may be colored by the subjects interviewed in order to obtain more food. A more precise method is to have the investigator actually weigh the food prepared for a period of 1 or more days in a household. This is time-consuming, requires a large staff and, therefore, can be applied only to a limited number of families.

67. Determination of Nutritional Status

a. The Minimum Daily Nutritional Allowances given in table XVI are intended for planning purposes only; after they have been put into effect in a specific area, adjustments must be made, based on frequent evaluation of nutritional and health status of the population.

b. Since the immediate aim of a feeding program is the provision of sufficient calories to prevent undue loss of body weight, change in body weight is the best criterion of the adequacy of the program. Two methods have been used by the U. S. Army in the past and a combination of the two is recommended.

(1) *Random sample weighing.* This method, also called street weighing, consists of setting up clinical scales in a populous area and weighing the population at random. If a

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degree of privacy is possible, the persons weighed should strip to a minimum of clothing. A very large sample of the population must be weighed in representative areas of the territory. Errors are introduced in this method because of variations in clothing and because the most severely malnourished people will probably not be walking the street. Where feasible a search for clinical signs of malnutrition should accompany the weighing program.

(2) *Select group weighing.* This method consists of weighing groups representative of a cross section of the country such as factory workers, school children, housewives, and inmates of institutions. This method has the advantage of requiring a smaller sample.

(3) *Criteria.* Regardless of the method used, the weighings should be repeated monthly and the trend in body weight changes noted.

68. Provision for Vulnerable Groups

a. General. Additions of food to increase the caloric intake should be permitted in most instances. The amount, in calories, that a basic diet could be increased would depend mainly on available food supplies. Calories should be increased first to groups doing heavy labor. Foods in the following list will be available in most areas, but it is unlikely the complete list will be available in every area.

Cereals	Legumes (pulses) dry, peas and beans
Flour	Meat, canned
Evaporated and dehydrated milk	Meat and vegetable stew
Cheese, cheddar	Peanut butter
Coffee	Salt
Fats and oils	Soup, dehydrated
Fish, canned	

b. Diets for Infants and Children Through 4 Years.

(1) *Under 1 year.*

	Ounces
Evaporated milk	5
Flour	4
Dehydrated soup	1
Sugar	0.5

Food substitutions:

Cheddar cheese 0.5 oz. for dehydrated soup, 1 oz.

Oatmeal and prepared cereals for flour

Canned meat, pulses, peanut butter, etc., can be used to supplement the diet or as a partial substitute for milk. *For example,* 1 oz. of pulses, plus 0.5 oz. cheddar cheese and 1 oz. of canned meat can replace 3 oz. of evaporated milk plus 1 oz. of dehydrated soup.

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(2) *1 through 4 years.*

	Ounces
Evaporated milk	1
Flour	8
Dehydrated soup	1
Peas	1
Cheese	0.5
Meat and vegetable stew	2.25
Sugar	0.5

Food substitutes:

	Allowance per day
Beans, dry	1.25 oz.
Fish	1 oz.
Oatmeal	4 oz.

Meat and vegetable stew can be replaced with extra evaporated milk, beans, and cheese.

(3) *Additional suggestions.*

(*a*) *Dehydrated soup.* Dehydrated soup is especially useful as a milk substitute in infants' and children's diets, because of its high protein and riboflavin content. It is also a good source of iron. It has been demonstrated that infants will take it and gain well on it.

(*b*) *Milk.* If a plan should be adopted whereby milk would be distributed on the basis of 2 ounces per capita for all children under 14, milk allotments for infants in each country might be increased by withholding part of the milk from the school children. *For example,* school children could be given their 2 ounces of milk only three times a week, and the rest of their allowances could be distributed to the infants.

(4) *Preschool children's diets.* In planning for the utilization of the items included in the diets of children from 1 to 4, it is assumed that children of this age group will consume the items in whatever form they are prepared for adult consumption.

c. Children 5 Through 13 Years. Children in this age group would consume a total basic ration. In prolonged periods for children over 9, there would possibly be caloric deficits. For the children over 12, there would be protein deficits as well. In addition, there would continue to be the calcium, vitamin A, and riboflavin deficits for the group as a whole. For the older children, these deficits would be somewhat greater, and there would be deficits in iron and niacin. Vitamins, when indicated, should be obtained from accessible drug stocks.

d. Pregnant and Nursing Mothers. Pregnant and nursing mothers should be allotted the entire basic ration, augmented by items not consumed by infants or the sick or aged. In addition, when possible, vitamins A and D should be provided for pregnant

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women. Iron and calcium should be provided from available medical supplies.

e. Extra Food for Laborers. The minimum nutritional allowances listed in table XVI for Phases I and II are not applicable to male adults expected to perform hard work. The caloric requirements will usually vary from 3000 to 3600 calories, depending upon the strenuousness of the labor. This can be provided in the form of extra rations of bread and potatoes if the latter are available locally. Experience has shown that this supplement should be provided at the place of work and not in the home, otherwise the worker will share it with his family.

f. Inmates of Institutions. These are placed in the category of vulnerable groups because their food intake is usually restricted to the official ration. Experience has shown that in spite of careful surveillance and control of the total available food supply, the population as a whole is able to supplement the ration from hidden supplies and black market sources. Persons in institutions are usually denied these sources. They must be carefully observed and the ration increased if undue weight loss occurs.

69. Instructions for Preparation and Storage of Foods

a. Army Measures.

Mess kit or canteen cup	1½ pints
No. 56 dipper	1 quart
No. 55 dipper	1¾ quarts or 7 cups
Mess-kit spoon	Slightly less than 1 T, but may be used as 1 T.

b. Dry Skim Milk. Dry skim milk is in powder form and is made from high grade skimmed milk. It has practically the same value as fresh whole milk except for the fat and vitamin A and D content. When reconstituted, it can be used in any way that fresh milk is used, and is especially suitable for infant feeding because it can be kept in the dry powdered form and reconstituted as needed. The reconstituted liquid milk sours as does fresh milk, and may be used in the same way as other sour milk or buttermilk.

(1) *Preparation.* One measure of powdered milk to four measures of boiled water (size of measure makes no difference). This makes milk comparable to fresh skimmed milk. Measure water into a bowl, sprinkle milk powder over the surface, and stir until the powder dissolves. Considerable beating and stirring may be necessary to eliminate lumps. Strain if necessary. The milk powder and water may be put in a tightly closed glass or jar and shaken vigorously. Another method is to make a smooth paste with a small amount of water and then add the remaining water.

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(2) *For individual and group feeding.*

	1 quart	*6 gallons*
Milk, dry, powdered	¼ pound	6 pounds
Cold water (previously boiled, if for infant feeding)	1 quart	6 gallons
Vanilla (if available, adds to palatability)	½ teaspoonful	6 tablespoonfuls
Salt	½ teaspoonful	3 tablespoonfuls (level)

For coffee, tea, or cereal, use double amount of milk powder in same amount of water. For use of dry milk in cooking, for every cup of milk called for, use 4 level tablespoonsful of powdered milk and 1 cup of water. Add water slowly.

(3) *Storage.* If properly stored in unbroken containers, dry skim milk can be kept without refrigeration for a long period of time. It will readily absorb foreign odors, however, and should thus be stored away from other foods or products which give off odors. If exposed to air, it readily absorbs moisture, becomes lumpy, and the flavor changes.

c. Evaporated Milk. Evaporated milk is sterile milk from which approximately one-half the water has been evaporated. When reconstituted with equal parts of water, it has practically the same value as whole milk. If there is inadequate evaporated milk, it should be used only for feeding small infants. It can be used, however, in any way fresh milk is used for a beverage or for cooking.

(1) *Preparation.* One measure evaporated milk to one measure of potable water (water previously boiled if for infant feeding). This makes milk comparable to whole milk. The size of the measure makes no difference. It is often convenient to use on can of milk and one can of water. For preparing evaporated milk for infant feeding, appropriate dilutions of milk and water are made, depending on the age, weight, and appetite of the infant to be fed. Consequently, no attempt will be made to outline formulas for various ages of infants.

(2) *Formula for infants in arms.* One part evaporated milk to two parts of water. (If sugar is available, add 2 tablespoonfuls to 1 quart of water-milk mixture). This is a rough method of devising a young infant's milk formula.

(3) *Storage.* Evaporated milk will keep indefinitely in unopened cans. Cans should be kept in a dry place away from water, drainage, heating, and refrigeration pipes. If cans get wet, they will rust and leak. If they get wet, they should be dried by wiping. Inspection should be made at intervals for "swells" and "leakers." "Swells" are cans which bulge because they contain gas. "Leakers" are cans

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which leak. "Swells" and "leakers" should not be used. Once in 60 days the cans should be turned upside down to prevent separation of butter fat. Occasionally, evaporated milk in cans will contain a calcium curd; this milk is perfectly suitable for use. After a can has been opened, it should be kept refrigerated or in a cold place. Without refrigeration, it may not keep more than 3 hours. Sour evaporated milk may be used as sour fresh milk is used.

d. Condensed Milk. This will not be found in Army supply but may be found on hand in certain areas where it has been used extensively for infant feeding. Condensed milk is canned milk from which approximately half the water has been removed and sugar has been added to act as a preservative. In general, its use for infant feeding should be discouraged unless no other milk is available.

e. Legumes (Dried Peas and Beans Known as "Pulses or Lentiles"). A wide variety of beans is used, but certain varieties (white navy or pea beans) are used more widely than other. Legumes are a good vegetable protein food and are often used as a main dish. Dry legumes should be stored in a dry, well-ventilated place. Inspect at intervals for mustiness or mold. If legumes are moldy, they should be emptied from bags and turned with a shovel to dry. When legumes are musty, they are usually infected with weevils and should be fumigated if at all usable.

f. Dehydrated Soup Powder. A puree soup is made of dried beans or peas, dry skim milk powder, seasoning, soybeans, and with or without brewers yeast. This soup is high in protein, minerals, and vitamins, and is well accepted. It is suited for the addition of any locally available vegetables. It can be used for central feeding or in the home.

(1) *Preparation.*

(*a*) *Two or three servings.* One-half cup (2 ounces) of soup powder with 2 cups (16 ounces) cold water. Add water slowly to powder, stirring until there are no lumps. Add remaining water. Heat to boiling point.

(*b*) *One hundred servings.* To 9 pounds of soup powder, add 8 gallons of water. Add water slowly to soup powder, stirring until there are no lumps. Add remaining water; heat to boiling point. Scorching occurs very easily, and care must be exercised to prevent it.

(2) *Storage.* Store in a dry, well-ventilated place. Unbroken packages will keep well for from 6 months to a year, and the powder is usable as long as it is palatable. If it becomes wet, it can be dried and used.

g. Cheese (Cheddar). Cheese is a concentrated source of protein and calcium. Cheese in tins will keep better than that packaged

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in paper and cellophane. In a cool, well-ventilated place, the cheese in cans should last from 6 to 9 months; in boxes and packages, from 3 to 6 months.

h. Meat and Vegetable Stew. Made of beef, beans, potatoes, carrots, tomato puree, and seasoning, it is high in protein and minerals. This makes a good soup by adding water. Additional seasoning may be needed.

i. Canned Corn Beef or Hash. This is high in minerals and proteins, and only requires heating to use. Canned corn beef or hash, and meat and vegetable stew (*h* above) should be stored in a dry, well-ventilated place, and should keep for 2 years or more. Cans should be kept dry, away from water, drainage, heating, and refrigerating pipes. Dampness causes rust and leaks. If cans are wet, they should be dried by wiping. Regular inspection should be made for "swells" and "leakers." "Swells" and "leakers" should not be used.

j. Oils and Fats. Solid fats will be the form usually shipped (lard, hydrogenated fats). Where there is an abundance of olive oil, no other type of fat or oil will be supplied. Fats and oils add satiety value as well as calories to the diet, and will usually be in great demand and strictly rationed.

(1) *Preparation.* When fats are scarce, the most economical use is for seasoning and not for frying. Local cooking customs should be followed, if possible, in any central kitchen food preparation.

(2) *Storage.* Fats are usually shipped in sealed containers and will keep without refrigeration until opened. If not satisfactory (rancid) for human consumption, do not discard, as fat can be used for other purposes.

k. Flour—White and Dark. Dark (whole wheat) flour contains more nutrients than highly milled unenriched white flour. If available, enriched white flour should be used. Flour should be kept in a dry, well-ventilated place, and preferably on raised platforms.

l. Sugar (Granulated). Used primarily to sweeten or improve flavor. It is included especially for morale value. Underfed people usually crave sugar. Should be stored in a dry, well-ventilated place on raised platform.

m. Whole Dried Eggs. When reconstituted with water alone for use as in liquid eggs (as in scrambled eggs) mix thoroughly with water and allow about 1 hour for complete absorption. Use the reconstituted liquid eggs exactly as fresh eggs. One pound of dried whole eggs, with 1½ quarts water (3 pounds), added, is equal to approximately 36 liquid eggs. Add egg powder slowly to water, and beat until mixed and free from lumps.

n. Canned Bacon. Flavor of this type of bacon can be improved by cutting in seven or eight slices per inch, and soaking in a solu-

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tion of sugar and cold water (1½ pounds sugar to 1 gallon water) for 1 or 2 hours before frying. When frying the bacon, care should be taken not to overcook, as overcooking causes a more salty taste.

70. Sanitation of Food Serving Units

a. General. Food may be served to civil populations under a variety of situations and by several methods. The following suggestions are for the sanitation of a semipermanent type of "soup kitchen" or communal feeding arrangement. Numerous modifications, because of lack of availability of facilities, utensils, and personnel, may have to be made in any specific circumstance. The officer supervising a feeding unit should take the responsibility of selecting the building which, in location, construction, layout, and equipment, would facilitate the maintaining of sanitary conditions. The locations of the kitchen and dining room should be carefully determined to insure light and ease in ventilation.

b. Building. The structure should be made as near vermin proof as possible by elimination of holes and cracks. Surfaces, such as floors and food tables, should be kept in good repair in order to eliminate ledges harboring insect pests, and present smooth surfaces which facilitate thorough cleaning. Screening should be used on doors and windows to keep out flies. Shelving under tables should be a minimum of 8 inches from the floor to permit ease of cleaning. Adequate cabinet space should be provided. Proper food storage is essential in all situations. A well-ventilated common storage room located in a cool part of the building should be provided and should be equipped with shelving. Metal storage cans are the best containers for many bulk commodities such as rice, coffee, beans, etc.

c. Laundry Facilities. If a laundry room for kitchen cloths is needed, it should be adjacent to the kitchen. Under no circumstances should personal laundry be done in this laundry room or in the kitchen.

d. Toilet and Hand Washing Facilities. Should be readily accessible and maintained in a sanitary manner.

e. Liquid Kitchen Waste Disposal Facilities. Should be provided in a convenient location.

f. Drinking Water. Frequent bacteriological examinations should be made. Boil or chlorinate all drinking water in accordance with FM 21–10.

g. Food. The food itself may be a source of disease if it is improperly cared for.

(1) The cooks' hands should not come in contact with the food when it can be handled in any other way. Whenever it is necessary to handle food, the hands must be scrupulously clean.

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(2) All foods eaten raw (such as lettuce, celery, cabbage) should be thoroughly washed before serving.

(3) Foods must either be kept hot until used or cooled rapidly and completely. Every effort should be made to avoid preparing more food than is required for the number to be served. The problem of leftover materials will thus be minimized and costs reduced as well. Only in exceptional circumstances should leftovers be used. In handling leftovers the following practices should be observed:

(*a*) Short-time storage of all leftovers should be the rule.

(*b*) Hold materials unground or unchopped until the time of preparation.

(*c*) Recook leftovers thoroughly in whatever form used whether in soup or stews. When there is any doubt concerning contamination of food or presence of enteretoxius, discard the food.

h. Refrigeration. For the most part it is unlikely that any type of refrigeration will be available, but every effort should be made to secure some type of cool storage even if underground. See FM 21–10.

i. Garbage. Daily removal and sanitary disposal of garbage should be provided. Garbage containers should be watertight, easily cleaned, and of metal if possible, with tight fitting covers.

j. Dishwashing. Order of dishwashing:

(1) Glassware.

(2) Silverware.

(3) China dishes.

(4) Cooking utensils.

Wash in hot soapy water, rinse in clear hot water, and air-dry all dishes and utensils. (One cup of soap powder or soap chips for 15 to 20 gallons of water. If hot water and soap are not available utensils may be disinfected by procedures outlined in FM 21–10.

k. Cleaning Procedure. (See FM 21–10.) The most effective means of promoting standards of cleanliness is to develop pride in the appearance of the food unit and to make each attendant feel a responsibility in the maintenance of that standard.

(1) Rodents and insects should not be tolerated. Insecticides are effective in destroying flies and roaches, but should not be applied when food is being prepared.

(2) For cleaning and scrubbing, pails, mops, and brushes should be provided. Brushes and mops should be washed in clean, hot, soapy water, rinsed in clear water, and dried after each using.

(3) Floors should be scrubbed daily with hot soapy water and a deck brush, and rinsed by mopping with clear water.

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71. Cleanliness of Personnel

The most common source of contamination of food is dirty hands. The hands should be kept scrupulously clean at all times, but it is especially important that they be washed thoroughly in hot, soapy water on leaving the toilet. As soon as it is possible, a thorough examination of food handlers should be made. (See FM 21–10 for planning the sanitation of a feeding unit.)

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APPENDIX I

CLASSIFICATION OF FOODS, AND FACTORS FOR CONVERSION OF UNIT PACKAGES TO POUNDS

General Information

Individual cereals

	Pounds
1 package	0.06
25 packages	1.56
50 packages (case)	3.13
100 packages (1 case)	6.26
200 packages (1 case)	12.25

Average net weight of canned foods

	Pounds
No. 300, 15½ oz.	0.943
No. 303, 1 lb.	1.00
No. 1, tall, 16 oz.	1.00
No. 2, 1 lb. 4 oz.	1.25
No. 2½, 1 lb. 13 oz.	1.81
No. 3, 2 lb. 2 oz.	2.13
No. 3, Cylinder, 40 oz.	2.38
No. 10, 6 lb. 10 oz.	6.63

Conversion Table

Ounces	Pounds	Ounces	Pounds	Ounces	Pounds
1	0.06	8	0.50	14	0.88
2	0.13	8.5	.53	14.5	0.91
3	0.19	9	.56	15	0.94
4	0.25	10	.63	16	1.00
5	0.31	11	.69	21	1.31
5.5	0.34	12	.75	26	1.63
6	0.38	13	.81	36	2.25
7	0.44				

Common units of weight

1 gram	0.035 ounces
1 kilogram	2.21 pounds
1 ounce	28.35 grams
1 pound	453.59 grams
1 gram	1000.0

Common units of volume

1 teaspoon	5 milliliters
1 tablespoon	3 teaspoons
1 cup	16 tablespoons 8 fl. ounces
1 quart	946.4 milliliters
1 liter	1000 milliliters, or 1.06 quarts

Composition of Typical Mixed Foods

Meat and vegetable stew

	Percent
Beef	50
Potatoes	15
Carrots	15
Beans, dry	8
Tomato juice or pulp	12

Meat and vegetable hash

	Percent
Beef	40
Pork	10
Potatoes	46
Onions	4

Chile con carne

	Percent
Type I (w/o beans):	
Beef	60
Fat	20
Cereals	8

Type II (w/beans):
50 percent of type I.
35 percent beans (after soaking)

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Succotash

	Percent
Corn	50
Lima beans	25
Bacon	75
Flour	4

Sponge cake

	Percent
Sugar	25
Egg yolk	10
Flour	25
Cornstarch	5

Scrapple

	Percent
Pork	35
Cornmeal	11

Pie (fruit)

	Percent
Flour	12
Lard	6
Fruit	70
Sugar	6

Corn beef hash

	Percent
Meat	51
Potatoes	46
Onions	3

Boned meat

0.7 x Carcass meat

Carcass meat

1.4 x Boned meat

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Foods	Unit	Weight of unit	Weight in pounds
Meats, fish, and poultry			
Practically all meats and meat products are sold by the pound and, therefore, only those customarily sold in packages or cans are listed below.			
Beef—corned	No. 1 can	12 oz.	0.75
Beef—corned	Can	6 lb.	6.00
Beef—corned	No. 10 can	6 lb. 10 oz.	6.625
Beef—corned, hash (C.F.[1] No. cans x 0.76 = lb. meat)	Can	1 lb. 8 oz.	1.50
Beef—corned, hash (C.F.[1] No. cans x 1.76 = lb. meat)	Can	3 lb. 8 oz.	3.50
Beef—corned, hash (C.F.[1] No. cans x 2.80 = lb. meat)	Can	5 lb. 8 oz.	3.50
Beef—dried	Can	7 oz.	0.438
Beef—dried	Can	6 lb.	6.00
Beef—speced, with sauce	300 x 200 can	5½ oz.	0.344
Beef—with gravy	Can	30 oz.	2.125
Beef—with gravy (C.F.[1] No. cans x 0.75 = lb. meat)	Can	34 oz.	2.125
Beefsteak—canned	300 x 200 can	6 oz.	0.375
Chicken—boned	300 x 200 can	5¾ oz.	0.359
Chicken—boned with broth	30 oz. can	30 oz.	1.875
Chicken—boned with gravy	401 x 411 can	30 oz.	1.875
Chile con carne (type 1) (C.F.[1] No. 1 cans x 0.57 = lb. meat)	No. 1 can	15¾ oz.	0.985
Chile con carne (type 1) (C.F.[1] No. 2 cans x 0.75 = lb. meat)	No. 2 can	1 lb. 4 oz.	1.25
Chile con carne (type 1) (C.F.[1] No. 10 cans x 4 = lb. meat)	No. 10 can	6 lb. 10 oz.	6.625
Chile con carne (type 2) (C.F.[1] No. 10 cans x 2 = lb. meat)	No. 10 can	6 lb. 10 oz.	6.625
Clams	No. 10 can	6⅔ lb.	6.667
Clams	Gallon	9 lb.	9.00
Crabmeat	Can	6½ oz.	0.406
Ham—chunks	Can	30 oz.	1.875
Ham—chunks	Can	34 oz.	2.125

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Ham—with gravy	401 x 411 can	30 oz.	1.875
Ham—sliced and fried	300 x 200 can	6 oz.	0.375
Hamburgers—with gravy	Can	11½ oz.	0.719
Hamburgers—with gravy	Can	15¼ oz.	0.953
Hamburgers—without gravy	300 x 200 can	4½ oz.	0.281
Hamburgers—without gravy	300 x 200 can	5½ oz.	0.344
Hamburgers—without gravy	300 x 308 can	8¼ oz.	0.516
Hamburgers—without gravy	Can	11¼ oz.	0.703
Luncheon meat—pork and beef	Loaf	12 oz.	0.750
Luncheon meat	Loaf	6 lb.	6.00
Meat bar—dehydrated	3⅛ x 1⅛ x 1-1/16	3 oz.	0.188
Meat bar—dehydrated	3⅛ x 2 x 1-1/16	4 oz.	0.250
Oysters	No. 10 can	6⅔ lb.	6.667
Oysters	Gallon	9 lb.	9.00
Pork, sausage—Links	Can	23 oz.	1.438
Pork, sausage—patties w/gravy	300 x 308 can	11½ oz.	0.719
Pork, sausage—patties without gravy	300 x 200 can	4½ oz.	0.281
Pork, sausage—patties without gravy	300 x 200 can	5½ oz.	0.344
Pork, sausage—patties without gravy	300 x 308 can	8¼ oz.	0.516
Pork, sausage—patties without gravy	Can	11¼ oz.	0.703
Pork, steak	300 x 200 can	6 oz.	0.375
Pork, steak—w/barbecue sauce	401 x 411 can	29 oz.	1.813
Pork, steak—w/gravy, cubes	Can	30 oz.	1.875
Salmon	Can	7 oz.	0.438
Salmon	No. 1 can	1 lb.	1.00
Sardines	No. ¼ can	3½ oz.	0.203
Sardines	No. 1 can	15 oz.	0.938

[2] C. F. means conversion factor. Weight equivalence is based chiefly on relative protein content and does not imply complete nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Sardines	No. 1 oval can	15 oz.	0.938
Sardines—with tomato sauce	Can	3¼ oz.	0.203
Sausages, Vienna	Can	1 lb. 8 oz.	1.50
Shrimp	No. 1 can	5 oz.	0.313
Shrimp	Can	7 oz.	0.438
Shrimp	Gallon	6 lb.	6.00
Tuna	No. ¼ can 211 x 109	3⅛ oz.	0.219
Tuna	No. ½ can	7 oz.	0.438
Tuna	No. 1 can 401 x 206	13 oz.	0.813
Tuna	No. ½ can	6¾ oz.	0.422
Turkey—boned	300 x 200 can	5¾ oz.	0.359
Turkey—boned	Can	30 oz.	1.875
Turkey—loaf	300 x 200 can	6 oz.	0.375
Eggs			
Eggs	Dozen	1 lb. 8 oz.	1.50
Eggs	Each	2 oz.	0.125
Eggs	Case (30 doz.)	45 lb.	45.00
Eggs—dried (C.F.[1] No. lb. x 4 = lb. fresh eggs)	Pound	1 lb.	1.00
Fats			
Butter	Tub	63 lb.	63.00
Fats, other			
Lard	Tierce	375 lb.	375.00
Lard—substitute	Can	3 lb.	3.00
Lard—substitute	Carton	4 lb.	4.00
Mayonnaise	Gallon	8 lb.	8.00

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Mayonnaise	Quart	2 lb.	2.00
Oils	Gallon	7 lb. 11 oz.	7.688
French dressing (C.F.[1] No. bottles x 0.35 = lb. oil)	Bottle	8 oz.	0.50
French dressing (C.F.[1] No. bottles x 5.25 = lb. oil)	Gallon	7 lb. 14 oz.	7.875
Sugars and syrups			
Candy, dessert pudding powder, and sugar—brown, confectioners, granulated, powdered—are sold by the pound and are not listed below.			
Apple butter—canned	Jar	28 oz.	1.75
Apple butter—canned	Jar	2 lb.	2.00
Apple butter—canned	Jar	1 lb. 12 oz.	1.75
Apple butter—canned	No. 10 can	7 lb. 8 oz.	7.50
Gelatin dessert powder	Package	3½ oz.	0.203
Gelatin dessert powder	Can	6 oz.	0.375
Gelatin dessert powder	Can	24 oz.	1.50
Gelatin dessert powder	No. 10 can	5 lb.	5.00
Honey	No. 10 can	6 lb. 9 oz.	6.563
Honey	No. 5 can	5 lb.	2.00
Jam (preserves)	Jar	2 lb.	2.00
Jam (preserves)	No. 2 can	1 lb. 8 oz.	1.50
Jam (preserves)	No. 2½ can	2 lb. 5 oz.	2.313
Jam (preserves)	No. 10 can	8 lb. 8 oz.	8.50
Jelly	Jar	7 oz.	0.438
Jelly	Jar	2 lb.	2.00
Jelly	No. 2 can	1 lb. 8 oz.	1.50
Jelly	No. 2½ can	2 lb. 5 oz.	2.313
Jelly	No. 10 can	8 lb. 6 oz.	8.375
Junket Tablet	Each		0.002

[1] Variable.

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Foods	Unit	Weight of unit	Weight in pounds
Marmalade	No. 2 can	1 lb. 8 oz.	1.50
Marmalade	No. 2½ can	2 lb. 5 oz.	2.313
Marmalade	No. 10 can	8 lb. 6 oz.	8.375
Eggs			
Eggs—frozen, whole (C.F.[1] No. lb. x 1.12 = lb. fresh eggs)	Pound	1 lb.	1.00
Eggs—whole, dried	No. 10 can	3 lb.	3.00
Milk and milk products			
Cheese, American (C.F.[1] No. lb x 7 = lb. fresh milk)	Pound	1 lb.	1.00
Cheese, American, Processed	300 x 200 can	6¼ oz.	0.391
Cheese, American, Processed	300 x 106 can	4 oz.	0.250
Cheese, Philadelphia Cream (C.F.[1] No. lb. x 10.66 = lb. fresh milk)	Pound	1 lb.	1.00
Cheese, Cottage (C.F.[1] No. lb. x 5.65 = lb. fresh milk)	Pound	1 lb.	1.00
Cheese, Cottage (C.F.[1] No. lb. x 5.65 = lb. fresh milk)	Gallon	8 lb. 8 oz.	8.50
Cheese, Parmesan (C.F.[1] No. lb. x 10. 66 = lb. fresh milk)	Pound	1 lb.	1.00
Cheese, Grated, Parmesan	Can	4 oz.	0.250
Cheese, Swiss (C.F.[1] No. lb. x 7 = lb. fresh milk)	Pound	1 lb.	1.00
Ice Cream (C.F.[1] No. gal. x 3.75 = lb. fresh milk)	Gallon	4 lb. 7 oz.	4.44
Ice Cream (C.F.[1] No. qt. x 0.9 = lb. fresh milk)	Quart (8 cuts)	1 lb. 2 oz.	1.11
Ice Cream (C.F.[1] No. lb x 0.78 = lb. fresh milk)	Pound	1 lb.	1.00
Whipping cream	Quart	2 lb.	2.00
Milk, chocolate	½ pint	½ lb.	0.50
Milk, fresh	½ pint	½ lb.	0.50
Milk, fresh	Quart	2 lb.	2.00
Milk, fresh	Gallon	8 lb. 10 oz.	8.625
Milk, evaporated (C.F.[1] No. cans x 1.812 = lb. fresh milk)	Can (No. 1)	13½ oz.	0.844
Milk, evaporated (C.F.[1] No. cans x 17.25 = lb. fresh milk)	No. 10 can	8 lb. 10 oz.	8.625
Milk, dried (C.F.[1] No. lb. x 8 = lb. fresh milk)	Pound	1 lb.	1.00

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Milk, buttermilk	Quart	2 lb.	2.00[3]
Milk, stabilized	Gallon 8	8 lb. 10 oz.	8.60
Molasses	No. 2 can	1 lb. 9 oz.	1.563
Molasses	No. 2½ can	2 lb. 6 oz.	2.375
Molasses	No. 10 can	8 lb. 13 oz.	8.790
Molasses	Gallon	11 lb. 12 oz.	11.75
Syrup, corn (table, light)	No. 10 can	8 lb. 13 oz.	8.790
Syrup, Karo	No. 10 can	9 lb. 10 oz.	9.640
Syrup, maple	Can	1 lb. 8 oz.	1.50
Syrup, maple	1 pt. bottle	1½ lb.	1.50
Syrup, blended	No. 10 can	8½ lb.	8.50
Cereals and grain products			
Barley, cornstarch, crackers, rice, tapioca, and vermicelli are sold by the pound and are not listed below.			
Bread, Boston Brown	Can	1 lb.	1.00
Bread, all kinds	Loaf	1 lb.	1.00[4]
Bread, all kinds	Case	30 lbs.	30.00
Buns, sandwich	Each	1½ oz.	0.09
All bran	Individual package	1 oz.	0.0625
All bran	Package	10 oz.	0.625
All bran	Family package	16 oz.	1.00
Bisquick	Package	1 lb. 14 oz.	1.875
Bisquick	Package	40 oz.	2.50
Branflakes	Individual package	1 oz.	0.063
Branflakes	Family package	8 oz.	0.50
Cornflakes	Individual package	1 oz.	0.063
Cornflakes	Family package	8 oz.	0.50

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Cornflakes	Package	11 oz.	0.688
Cornflakes	Package	1 lb. 8 oz.	1.50
Corn meal	Package	1 lb. 8 oz.	1.50
Cream of Wheat (Farina)	Package	1 lb. 12 oz.	1.75
Cookies	Each		0.05
Cookies	Package	1 lb.	1.00
Cookies	Package	26 oz.	1.625
Cup cakes	Each		0.08
Doughnuts	Each	26 oz.	0.09
Dutch Rusk	Package	5 oz.	0.313
Flour, buckwheat	Package	1 lb. 4 oz.	1.25
Flour, buckwheat	Package	1 lb. 8 oz.	1.50
Flour, buckwheat	Package	3 lb. 8 oz.	3.50
Flour, cake	Package	1 lb. 4 oz.	1.25
Flour, cake	Package	2 lb. 8 oz.	2.50
Flour, pancake	Package	1 lb. 4 oz.	1.25
Grapenuts	Individual package	1 oz.	0.063
Grapenuts	Family package	12 oz.	0.75
Grapenuts flakes	Individual package	1 oz.	0.063
Grapenuts flakes	Family package	7 oz.	0.438
Hominy grits	Package	1 lb. 4 oz.	1.25
Hominy grits	Package	1 lb. 8 oz.	1.50
Hominy, lye (C.F.[1] No. 2½ cans x 0.33 = lb. dry hominy)	No. 2½ can	1 lb. 13 oz.	1.813
Hominy, lye (C.F.[1] No. 10 cans x 1.25 = lb. dry hominy)	No. 10 can	6 lb. 9 oz.	6.563
Krumbles	Package	9 oz.	0.563
Macaroni (C.F.[1] No. 300 cans x 0.25 = lb. dry macaroni)	No. 300 can	15¾ oz.	0.985
Macaroni	Box	20 lb.	20.00

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Muffets	Package	1¼ oz.	0.078
Noodles	Package	6 oz.	0.375
Noodles	Package	8 oz.	0.50
Oatmeal (oats, rolled)	Package	1 lb. 4 oz.	1.25
Oatmeal	Package	3 lb.	3.00
Pettijohns	Package	1 lb. 6 oz.	1.375
Ralston	Package	1 lb. 8 oz.	1.50
Ralston	Package	2 lb. 8 oz.	2.50
Rice Krispies	Individual package	1 oz.	0.0625
Rice Krispies	Family package	5½ oz.	0.344
Rice, puffed	Individual package	⅝ oz.	0.039
Rice, puffed	Family package	4 oz.	0.25
Rolls	Each		0.08
Spaghetti	Box	20 lb.	20.00
Wheaties	Family package	8 oz.	0.50
Wheat cereal. (See Farina)			
Wheat cereal, whole. (See Ralston)			
Wheat krispies	Package	½ oz.	0.031
Wheat krispies	Package	8 oz.	0.50
Wheat, puffed	Family package	4 oz.	0.25
Wheat, shredded	Individual package	1¼ oz.	0.078
Wheat, shredded	Family package	12 oz.	0.75
Wheatena	Package	1 lb. 6 oz.	1.1375
Beans, other legumes, dry, and nuts, etc.			
Beans, Kidney, dry; beans, navy, dry; cocoanut; lentils; nuts; peas; black-eye, dry and peas, split, dry, are sold by the pound and are not listed below.			
Beans Kidney—canned (C.F.[1] No. 2 cans x 0.30 = lb. dry beans)	No. 2 can	1 lb. 4 oz.	1.25

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
			1.
Beans, kidney—canned (C.F.[1] No. 2½ cans x 0.50 = lb. dry beans)	No. 2½ can	1 lb. 14 oz.	1.875
Beans, kidney—canned (C.F.[1] No. 10 cans x 1.75 = lb. dry beans)	No. 10 can	6 lb. 12 oz.	6.75
Beans, lima—dry	Bushel	56 lb.	56.00
Beans, lima—canned (cooked, dry) (C.F.[1] No. 2 cans x 0.33 = lb. dry beans)	No. 2 can	1 lb. 3 oz.	1.188
Beans, other—dry	Bushel	60 lb.	60.00
Beans, other—dry	Sack	100 lb.	100.00
Beans, soy—dry	Pound	1 lb.	1.00
Beans, with pork—canned (C.F.[1] No. 2½ cans x 0.65 = lb. dry beans)	No. 2½ can	1 lb. 15 oz.	1.938
Beans, with pork—canned (C.F.[1] No. 10 cans x 2.29 = lb. dry beans)	No. 10 can	6 lb. 14 oz.	6.875
Chili con carne (type M) (C.F.[1] No. 10 cans x 0.6 = lb. dry beans)	No. 10 can	6 lb. 11 oz.	6.688
Peanut butter	Jar	9 oz.	0.563
Peanut butter	Jar	1 lb.	1.00
Peanut butter	Jar	1 lb. 9 oz.	1.563
Peanut butter	Jar	2 lb.	2.00
Peanut butter	No. 10 can	6 lb. 12 oz.	6.75
Soup, dehydrated, navy bean	Pound	1 lb.	1.00
Soup, dehydrated, pea	Pound	1 lb.	1.00
Vegetables, leafy green and yellow			
Asparagus—canned	No. 300 can	14½ oz.	0.906
Asparagus—canned	No. 2 can	1 lb. 3 oz.	1.188
Asparagus—canned	No. 2½ can	1 lb. 12 oz.	1.75
Asparagus—canned	No. 10 can	6 lb. 5 oz.	6.312
Asparagus—fresh	Bunch	2 lb.	2.00
Asparagus—fresh	Crate (1 doz. bun.)	28 lb.	28.00
Asparagus—fresh	Crate (loose)	33 lb.	33.00
Beans, snap—canned	No. 2 can	1 lb. 3 oz.	1.188

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

Foods	Unit	Weight of unit	Weight in pounds
Beans, snap—canned	No. 2½ can	1 lb. 12 oz.	1.75
Beans, snap—canned	No. 10 can	6 lb. 5 oz.	6.313
Beans, snap—fresh	Bushel hamper	30 lb.	30.00
Beans, snap—fresh	Crate	40 lb.	40.00
Broccoli—fresh	Crate	63 lb.	63.00
Broccoli—fresh	Bunch	2 lb.	2.00
Brussels sprouts—fresh	Bushel hamper and drum	35 lb.	35.00
Brussels sprouts—fresh	Crate	30 lb.	30.00
Cabbage, Chinese—fresh	Basket (Fla. 6–8 hd.)	20 lb.	20.00
Cabbage, Chinese—fresh	Crate (1⅓ bu., 3 baskets)	60 lb.	60.00
Cabbage, Chinese—fresh	Head	4 lb.	4.00
Cabbage, green—dehydrated (C.F.[1] No. lb. x 20 = lb. fresh cabbage)	Pound	1 lb.	1.00
Cabbage, green—fresh	Crate	[80 lb.	80.00
Cabbage, green—fresh		[100 lb.	100.00
Cabbage, green—fresh	½ crate	49 lb.	49.00
Cabbage, green—fresh	Sack	50 lb.	50.00
Cabbage, savoy—fresh	Crate	65 lb.	65.00
Carrots, bunched—fresh	Crate (6–7 doz. bun.)	60 lb.	60.00
Carrots, without tops—fresh	Bushel or sack	50 lb.	50.00
Carrots, dehydrated (C.F.[1] No. lb. x 10 = lb. fresh carrots)	Pound	1 lb.	1.00
Carrots—canned	No. 2 can	1 lb. 4 oz.	1.25
Carrots—canned	No. 10 can	6 lb. 9 oz.	6.563
Chard, bunched—fresh	Crate (5 doz. bun.)	40 lb.	40.00
Chard, bunched—fresh	Crate (1-3/16 bu.)	42 lb.	42.00
Chicory, bunched—fresh	Crate (4–5 doz. bun.)	40 lb.	40.00

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

Foods	Unit	Weight of unit	Weight in pounds
Chicory—fresh	Head	13 oz.	0.80
Collards, bunched—fresh	Bushel	23 lb.	23.00
Endive—fresh	Crate (3–5 doz. bun.)	48 lb.	48.00
Endive—fresh	Head	13 oz.	0.80
Escarole, bunched—fresh	Crate (2½–5 doz. bun.)	25—40 lb.	40.00
Escarole—fresh	Head	11 oz.	0.70
Greens, leafy	Pound	1 lb.	1.00
Kale—fresh	Bushel	18 lb.	18.00
Kohlrabi—fresh	Crate (3 doz. bun. 4–6 roots each)	40 lb.	40.00
Lettuce, iceberg—fresh	Crate (4–6 doz. head)	50 lb.	50.00
		70 lb.	70.00
Lettuce, iceberg—fresh	Head	¾ lb.	0.75
Lettuce, Boston—fresh	Head	⅔ lb.	0.66
Mustard greens, bunched—fresh	Crate (2½ doz. bun.)	25 lb.	25.00
Mustard greens, bunched—fresh	Crate (5 doz. bun.)	50 lb.	50.00
Okra—canned	No. 2 can	1 lb.	1. 1.188
Okra—canned	No. 2½ can	1 lb. 11 oz.	1.688
Okra—canned	No. 10 can	6 lb. 3 oz.	6.188
Okra—fresh	Lug (loose)	20 lb.	20.00
Parsley—fresh	Bunch	⅛ lb.	0.125
Parsley—fresh	Crate (6–10 doz. bun.)	23 lb.	23.00
Parsley—fresh	Crate (2½–5 doz. bun.)	25 lb.	25.00
		50 lb.	50.00

[2] C. F. means conversion factor. Weight equivalence is based chiefly on relative protein content and does not imply complete nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Parsley, dehydrated	Can	3 oz.	0.188
Parsley, dehydrated	Can	8 oz.	0.50
Peas—canned	No. 2 can	1 lb. 4 oz.	1.25
Peas—canned	No. 10 can	6 lb. 9 oz.	6.563
Peas—fresh	Bushel or crate	30 lb.	30.00
Peppers, green—fresh	Bushel	29 lb.	29.00
Peppers, green—fresh	Crate (Fla.)	48 lb.	48.00
Peppers, green—fresh	Crate (1⅑ bu.)	44 lb.	44.00
Peppers, green—fresh	Each	1/6 lb.	0.16
Peppers, green—fresh	Lug	20 lb.	20.00
Pimiento—canned	Can	4 oz.	0.25
Pimiento—canned	No. ⅛ can or jar	7 oz.	0.438
Pimiento—canned	Can	15 oz.	0.938
Pimiento—canned	No. 2⅛ can	1 lb. 11 oz.	1.69
Pimiento—fresh	Each	1/5 lb.	0.20
Potatoes, sweet—canned	No. 3 can	1 lb. 2 oz.	1.125
Potatoes, sweet—canned	No. 2 can	1 lb. 3 oz.	1.188
Potatoes, sweet—canned	No. 2⅛ can	1 lb. 13 oz.	1.813
Potatoes, sweet—canned	No. 10 can	6 lb. 6 oz.	6.375
Potatoes, sweet—fresh	Bushel	50 lb.	50.00
Potatoes, sweet—dehydrated (C.F.[1] No. lb x 6 = lb. fresh sweet potatoes)	Pound	1 lb.	1.00
Pumpkin—canned	No. 2 can	1 lb. 4 oz.	1.25
Pumpkin—canned	No. 2⅛ can	1 lb. 13 oz.	1.813
Pumpkin—canned	No. 10 can	6 lb. 10 oz.	6.625
Romaine—fresh	Crate (5 doz. bun.)	40 lb.	40.00
Romaine—fresh	Head	12 oz.	0.75
Spinach—canned	No. 303 can	15 oz.	0.938

[1] Estimated weight of unit.

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Foods	Unit	Weight of unit	Weight in pounds
Spinach—canned	No. 2 can	1 lb. 2 oz.	1.125
Spinach—canned	No. 2½ can	1 lb. 11 oz.	1.688
Spinach—canned	No. 10 can	6 lb. 2 oz.	6.125
Spinach—fresh	Bushel	18 lb.	18.00
Spinach—fresh	Crate	45 lb.	45.00
Squash—canned	No. 2 can	1 lb. 4 oz.	1.25
Squash—canned	No. 2½ can	1 lb. 13 oz.	1.813
Squash—canned	No. 10 can	6 lb. 10 oz.	6.625
Squash—fresh, Hubbard	Barrel	100 lb.	100.00
Squash—fresh, Hubbard	Crate (4 baskets)	19 lb.	19.00
Squash—fresh, Hubbard	Lug (loose)	50 lb.	50.00
Squash—fresh, Hubbard	Sack (loose)	30 lb.	30.00
Squash—fresh, Hubbard	Sack (loose)	83 lb.	83.00
Turnip greens—fresh	Bunch	1 lb.	1.00
Turnip greens—fresh	Crate	40 lb.	40.00
Water cress—fresh	Crate (3 doz. bun.)	20 lb.	20.00
Water cress—fresh	Bunch	9 oz.	0.55
Water cress—fresh	Crate (6 doz. bun.)	40 lb.	40.00
Tomatoes			
Catsup	Bottle	14 oz.	0.875
Catsup	Quart	1 lb. 14 oz.	1.875
Catsup	No. 2 can	1 lb. 5 oz.	1.313
Catsup	No. 2½ can	1 lb. 14 oz.	1.875
Catsup	No. 5 can	3 lb. 11 oz.	3.688
Catsup	No. 10 can	6 lb. 15 oz.	6.938
Tomato paste	No. 2½ can	1 lb. 15 oz.	1.938
Tomato paste	No. 10 can	7 lb. 2 oz.	7.125

[a] Variable.

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Foods	Unit	Weight of unit	Weight in pounds
Tomato puree	No. 2 can	1 lb. 3 oz.	1.188
Tomato puree	No. 10 can	6 lb. 9 oz.	6.563
Tomato sauce	Can	7½ oz.	0.469
Tomatoes—canned	No. 303 can	1 lb.	1.00
Tomatoes—canned	No. 2 can	1 lb. 3 oz.	1.188
Tomatoes—canned	No. 2½ can	1 lb. 12 oz.	1.75
Tomatoes—canned	No. 10 can	6 lb. 9 oz.	6.375
Tomatoes—fresh	Bushel	51 lb.	51.00
Tomatoes—fresh	Crate (4 basket)	20 lb.	20.00
Tomatoes—fresh	Each	½ lb.	0.33
Tomatoes—fresh	Lug	32 lb.	32.00
Tomato juice	Can	8 oz.	0.50
Tomato juice	No. 2 can	1 lb. 9 oz.	1.56
Tomato juice	No. 2½ can	1 lb. 12 oz.	1.75
Tomato juice	No. 3 cyl.	3 lb.	3.00
Tomato juice	No. 10 can	6 lb. 3 oz.	6.267
Citrus fruits			
Grapefruit—canned	No. 303 can	1 lb.	1.00
Grapefruit—canned	No. 2 can	1 lb. 4 oz.	1.25
Grapefruit—canned	No. 3 cyl.	3 lb. 2 oz.	3.125
Grapefruit—canned	No. 10 can	6 lb. 9 oz.	6.563
Grapefruit—fresh	Crate (Calif. and Ariz. 1⅗ bu.)	67 lb.	67.00
Grapefruit—fresh	Crate (Fla.)	80 lb.	80.00
Grapefruit—fresh	Crate (Tex., 1-3/5 bu.)	77 lb.	77.00
Grapefruit—fresh	Each	1 lb.	1.00

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Grapefruit juice—unsweetened	No. 3 cyl.	3 lb. 1 oz.	3.063
Grapefruit juice—unsweetened	No. 2 can	1 lb. 2 oz.	1.125
Grapefruit juice—unsweetened	No. 2½ can	1 lb. 7 oz.	1.44
Grapefruit juice—unsweetened	No. 3 can	2 lb. 14 oz.	2.875
Grapefruit juice—unsweetened	No. 10 can	6 lb. 8 oz.	6.50
Grapefruit and orange juice	Can	5½ oz.	0.375
Grapefruit and orange juice	No. 2 can	1 lb. 3½ oz.	1.229
Grapefruit and orange juice	No. 3 cyl.	3 lb. 2½ oz.	3.142
Lemons—fresh	Crate (packed)	75 lb.	75.00
Lemons—fresh	Crate (loose)	60 lb.	60.00
Lemons—fresh	Each	¼ lb.	0.25
Limes—fresh	Box	80 lb.	80.00
Limes—fresh	Each	1/5 lb.	0.20
Lime juice	No. 2 can	1 lb. 4 oz.	1.25
Oranges—fresh (220's)	Crate (Calif. and Ariz.)	76 lb.	76.00
Oranges—fresh (220's)	Crate (Fla.)	90 lb.	90.00
Oranges—fresh (220's)	Crate (Tex.)	86 lb.	86.00
Oranges—fresh (200's)	Each	2/5 lb.	0.40
Orange juice—canned	No. 2 can	1 lb. 2 oz.	1.125
Orange juice—canned	No. 3 can	2 lb. 14 oz.	2.875
Orange juice—canned	No. 5 can	3 lb. 4 oz.	3.25
Orange juice—canned	No. 10 can	6 lb. 8 oz.	6.50
Tangerines—fresh	Lug	28 lb.	28.00
Tangerines—fresh	Orange box	53 lb.	53.00
Tangerines—fresh	Each	¼ lb.	0.25

[2] C. F. means conversion factor. Weight equivalence is based chiefly on relative protein content and does not imply complete nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Potatoes			
Potatoes, Irish—fresh	Bags	100 lb.	100.00
Potatoes, Irish—canned	No. 2 can	1 lb. 4 oz.	1.250
Potatoes, Irish—canned	No. 10 can	6 lb. 5 oz.	6.375
Potatoes, Irish—fresh	Bushel	60 lb.	60.00
Potatoes, Irish—fresh	Crate	50 lb.	50.00
Potatoes, Irish—fresh	Lug	30 lb.	30.00
Potatoes, Irish—dehydrated (C.F.[1] No. lb x 8 = lb. fresh potatoes)	Pound	1 lb.	1.00
Potatoes, Irish—dehydrated	No. 10 can	6 lb. 2 oz.	6.125
Vegetable, other			
Artichokes, French—fresh	Box (48's, 60's, 72's)	40 lb.	40.00
Artichokes, French—fresh	Box	25 lb.	25.00
Artichokes, Jerusalem—fresh	Bushel	50 lb.	50.00
Artichokes, hearts—canned	No. 2 can	1 lb. 2 oz.	1.125
Bean sprouts	No. 10 can	6 lb. 10 oz.	6.625
Beets, bunched—fresh	Crate (4 doz. bun.)	57 lb.	57.00
Beets, bunched—fresh	Sack	90 lb.	90.00
Beets, without tops—fresh	Crate (6 doz. bun.)	50 lb.	50.00
Beets, without tops—fresh	Bushel	52 lb.	52.00
Beets—canned	No. 2 can	1 lb. 4 oz.	1.00
Beets—canned	No. 2½ can	1 lb. 12 oz.	1.75
Beets—canned	No. 10 can	6 lb. 8 oz.	6.50
Beets—fresh—dehydrated (C.F.[1] No. lb. x 12 = lb. fresh beets)	Pound	1 lb.	1.00
Cauliflower—fresh	Crate (9's, 10's, 12's)	25 lb.	25.00
Cauliflower—fresh	Crate	58 lb.	58.00
Cauliflower—fresh	Crate, pony	57 lb.	47.00
Cauliflower—fresh	Each	1 lb. 4 oz.	1.25

[1] Estimated weight of unit.

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Foods	Unit	Weight of unit	Weight in pounds
Celery, bleached—fresh	Crate	45 lb.	45.00
Celery, bleached—fresh	Crate	62 lb.	62.00
Celery, bleached—fresh	Crate, pony (Calif.)	55 lb.	55.00
Celery, bleached—fresh	Stalk	1 lb.	1.00
Corn—canned, cream or whole grain	No. 2 can	1 lb. 4 oz.	1.25
Corn—canned, cream or whole grain	No. 10 can	6 lb. 10 oz.	6.625
Corn—cream style—canned	Can	15 oz.	0.938
Corn—cream style—canned	No. 3 cyl.	3 lb. 2 oz.	3.125
Corn—cream style—canned	No. 1 picnic can	10 oz.	0.688
Corn—whole grain—canned	Can	12 oz.	0.750
Corn—whole grain—canned	No. 303 can	1 lb.	1.00
Corn—whole grain—canned	No. 2 can	1 lb. 4 oz.	1.250
Corn—fresh	Ear	⅔ lb.	0.66
Corn—fresh	Bushel	35 lb.	35.00
Corn—fresh	Crate (2½–3 doz. ears)	28 lb.	28.00
Corn—fresh	Crate (5–6 doz. ears)	50 lb.	50.00
Corn—fresh	Sack	97 lb.	97.00
Cucumbers—fresh	Bushel	43 lb.	43.00
Cucumbers—fresh	Each	½ lb.	0.50
Cucumbers—fresh	Lug (3–5 doz.)	30 lb.	30.00
Eggplant—fresh	Crate (1⅑ bu. 36–60)	48 lb.	48.00
Eggplant—fresh	Lug (8's, 10's, 12's)	20 lb.	20.00
Eggplant—fresh	Each	1 lb.	1.00
Lima beans, green—canned	No. 2 can	1 lb. 4 oz.	1.25
Lima beans, green—canned	No. 10 can	6 lb. 9 oz.	6.563

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Lima beans, green—fresh	Bushel hamper	35 lb.	35.00
Mushrooms—fresh	Crate (4 baskets)	10 lb.	10.00
Mushrooms—fresh	Basket (4 qt.) (Also ½ and 1 lb. baskets and crates)	8 lb.	8.00
Mushrooms—canned	Can	4 oz.	0.25
Mushrooms—canned	Can	8 oz.	0.50
Mushrooms—canned	No. 2½ can	1 lb. 12 oz.	1.75
Mushrooms—canned	No. 10 can	6 lb. 7 oz.	6.438
Onions—fresh	Sack	50 lb.	50.00
Onions—fresh	Sack	100 lb.	100.00
Onions, green—fresh	Bunches	½ lb.	0.50
Onions, green—fresh	Crate (5 doz. bun.)	25 lb.	25.00
Onions, green—fresh	Crate	33 lb.	33.00
Onions, green—fresh	Crate (10–15 doz. bun.) (8–12 roots each)	53 lb.	53.00
Onions, green—fresh	Lug (not bunched)	23 lb.	23.00
Onions, dehydrated flakes	Envelope	¼ oz.	0.016
Onions dehydrated (C.F.[1] No. lb. x 10 = lb. fresh onions)	Pound	1 lb.	1.00
Onions, dehydrated, flakes	No. 10 can	2½ lb.	2.50
Onions, young—shallots	(Same as other groups)		
Parsnips—fresh	Bushel (bunched)	48 lb.	48.00
Peas—black eye	No. 2 can	1 lb. 4 oz.	1.125
Peas—black eye	No. 10 can	6 lb. 9 oz.	6.56

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Radishes—fresh	Bunches	⅓ lb.	0.33
Radishes—fresh	Crate (10–15 doz. bun.) (15–20 roots each)	48 lb.	48.00
Rutabagas—fresh	Bushel	56 lb.	56.00
Rutabagas—fresh	Crate	68 lb.	68.00
Rutabagas—fresh	Sacks (topped)	90 lb.	90.00
Rutabagas—dehydrated (C.F.[1] No. lb. x 16 = lb. fresh rutabagas)	Pound	1 lb.	1.00
Turnip roots—fresh	Bushel	54 lb.	54.00
Turnip roots—fresh	Crate (bunched)	70 lb.	70.00
Sauerkraut—canned	No. 2½ cans	1 lb. 11 oz.	1.688
Sauerkraut—canned	No. 10 can	6 lb. 3 oz.	6.188
Soybeans, green—fresh	Bushel	60 lb.	60.00
Soybeans—canned	No. 10 can	6 lb. 9 oz.	6.56
Succotash—canned	No. 2 can	1 lb. 4 oz.	1.25
Succotash—canned	No. 10 can	6 lb. 12 oz.	6.75
Vegetables, mixed—canned	No. 2 can	1 lb. 4 oz.	1.25
Vegetables, mixed—canned	No. 10 can	6 lb. 8 oz.	6.50
Vegetables, LaChoy—canned	No. 10 can	6 lb. 6 oz.	6.375
Fruits other than citrus			
Apples—fresh	Box	44 lbs.	44.00
Apples—fresh	Bushel	48 lbs.	48.00
Apples—fresh	Each	⅓ lb.	0.33
Apples, sliced—dehydrated	Can	1¾ lb.	1.75
Apples—dehydrated	No. 10 can	2 lb.	2.00
Apples, sliced—canned	No. 2 can	1 lb. 2 oz.	1.125
Apples, sliced—canned	No. 2½ can	1 lb. 10 oz.	1.625

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Apples, sliced—canned	No. 10 can	6 lb.	6.00
Apples, whole—canned	No. 2 can	1 lb. 2 oz.	1.125
Apples, whole—canned	No. 2½ can	1 lb. 10 oz.	1.625
Apples, whole—canned	No. 10 can	5 lb. 15 oz.	5.938
Apple juice—canned	Can	5½ oz.	0.375
Apple juice—canned	No. 330 cyl.	3 lb. 2 oz.	3.108
Applesauce—canned	No. 2 can	1 lb. 4 oz.	1.25
Applesauce—canned	No. 303 can	1 lb. 1 oz.	1.0625
Applesauce—canned	No. 2½ can	1 lb. 13 oz.	1.813
Applesauce—canned	No. 10 can	6 lb. 11 oz.	6.688
Apricots—canned	300 x 200 can	6 oz.	0.375
Apricots—canned	No. 2½ can	1 lb. 14 oz.	1.875
Apricots—canned	No. 10 can	6 lb. 12 oz.	6.75
Apricots—fresh	Box	40 lb.	40.00
Apricots—fresh	½ box	26 lb.	26.00
Apricots—fresh	Crate (Calif. 4 baskets)	20 lb.	20.00
Apricots—fresh	Each	1/6 lb.	0.166
Apricots—fresh	Lug	30 lb.	30.00
Avocados—fresh	Box (Calif.)	13 lb.	13.00
Avocados—fresh	Each	½ lb.	0.50
Avacados—fresh	Lug	25 lb.	25.00
Bananas—fresh	Box	25 lb.	25.00
Bananas—fresh	Bunch (8–9 hands each)	45 lb.	45.00
		65 lb.	65.00
Bananas—fresh	Each	2/5 lb.	0.40
Blackberries—canned	No. 2 can	1 lb. 4 oz.	1.25

[8] Estimated weight of unit.

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Foods	Unit	Weight of unit	Weight in pounds
Blackberries—canned	No. 2½ can	1 lb. 13 oz.	1.813
Blackberries—canned	No. 10 can	6 lb. 9½ oz.	6.625
Blackberries—fresh	Crate (24 qt.)	36 lb.	36.00
Blueberries—canned	No. 2 can	1 lb. 4 oz.	1.25
Blueberries—canned	No. 10 can	6 lb. 9 oz.	6.563
Blueberries—fresh	Crate (24 qt.)	36 lb.	36.00
Cherries, R.A.—canned	No. 2 can	1 lb. 4 oz.	1.25
Cherries, R.A.—canned	No. 10 can	1 lb. 14 oz.	1.875
Cherries, R.A.—canned	Crate (24 qt.)	6 lb. 12 oz.	6.75
Cherries, sour, pitted—canned	No. 2 can	1 lb. 4 oz.	1.25
Cherries, sour, pitted—canned	No. 2½ can	1 lb. 13 oz.	1.813
Cherries, sour, pitted—canned	No. 10 can	6 lb. 7 oz.	6.438
Cherries, maraschino	Bottle	15 oz.	0.938
Cherries, fresh	Flat box	15 lb.	15.00
Cranberries—fresh	¼ barrel box	25 lb.	25.00
Cranberries—fresh	Barrel (approx. 85 qt.)	100 lb.	100.00
Cranberries—fresh	Bushel	36 lb.	36.00
Cranberries—dehydrated (C.F.[1] No. lb. x 10 = lb. fresh cranberries)	Pound	1 lb.	1.00
Cranberry sauce—canned	No. 2 can	1 lb. 6 oz.	1.375
Cranberry sauce—canned	No. 2½ can	1 lb. 14 oz.	1.88
Cranberry sauce—canned	No. 10 can	7 lb. 5 oz.	7.313
Dewberries—fresh	1 qt.	1 lb. 8 oz.	1.50
Dewberries—fresh	Crate (24 qt.)	36 lb.	36.00
Figs—canned	No. 303 can	1 lb. 1 oz.	1.0625
Figs—canned	No. 2 can	1 lb. 4 oz.	1.25

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Figs—canned	No. 2½ can	1 lb. 14 oz.	1.875
	No. 10 can	7 lb.	7.00
Figs—fresh	Box (single layer)	6 lb.	6.00
Fruit cocktail—canned	300 x 200 can	6 oz.	0.375
Fruit cocktail—canned	211 x 304 can	8 oz.	0.547
Fruit cocktail—canned	No. 2 can	1 lb. 4 oz.	1.25
Fruit cocktail—canned	No. 2½ can	1 lb. 14 oz.	1.875
Fruit cocktail—canned	No. 10 can	6 lb. 12 oz.	6.75
Fruits for salad—canned	No. 2 can	1 lb. 4 oz.	1.25
Fruits for salad—canned	No. 2½ can	1 lb. 14 oz.	1.875
Fruits for salad—canned	No. 10 can	6 lb. 12 oz.	6.75
Fruit puree—canned	Can	4½ oz.	0.281
Gooseberries—canned	No. 2 can	1 lb. 4 oz.	1.25
Gooseberries—canned	No. 10 can	6 lb. 9 oz.	6.563
Gooseberries—canned	No. 2½ can	1 lb. 13 oz.	1.813
Grapes—fresh	Lug (loose or packed) (Also wire handled basket, 5-, 6-, 12-, 18-lb.)	28 lb.	28.00
Grape juice	No. 10 can	6 lb. 10 oz.	6.625
Grape juice	Quart No. 3	2 lb.	2.00
Grape juice	No. 3 cyl.	3 lb. 3½ oz.	3.217
Guava (tropical fruit)	Each	5 oz.	0.33
Loganberries—canned	No. 2 can	1 lb. 5 oz.	1.313
Loganberries—canned	No. 2½ can	1 lb. 14 oz.	1.875
Loganberries—canned	No. 10 can	6 lb. 14 oz.	6.875

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Melons, cantaloup	Crate (Calif.)	63 lbs.	63.00
Melons, cantaloup	Each	1–3 lb.	1.00
			3.00
Melons, casaba	Crate (6–8)	40–47 lbs.	40.00
			47.00
Melons	Each	5 lb.	5.00
Melons, honeydew	Pony (pack 9, 12, 15)	30 lb.	30.00
	Standard (pack 9, 12)	40 lb.	40.00
Melons, watermelon	Each	30 lb.	30.00
Peaches—canned	211 x 304 can	8 oz.	0.50
Peaches—canned	No. 2½ can	1 lb. 13 oz.	1.813
Peaches—canned	No. 10 can	6 lb. 12 oz.	6.75
Peaches—fresh	Bushel	48 lb.	48.00
Peaches—fresh	Box (Calif. also 4, 5 lb. baskets in crates)	23 lb.	23.00
Peaches—fresh	Each	⅓ lb.	0.33
Pears—canned	211 x 304 can	8 oz.	0.50
Pears—canned	No. 2 can	1 lb. 4 oz.	1.25
Pears—canned	No. 2½ can	1 lb. 13 oz.	1.813
Pears—canned	No. 10 can	6 lb. 10 oz.	6.625
Pears—fresh	Bushel	50 lb.	50.00
Pears—fresh	Box	46 lb.	46.00
Pears—fresh	Each	2/5 lb.	0.40
Pears—fresh	Lug	43 lb.	43.00

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Pears, spiced—canned	No. 10 can	6 lb. 10 oz.	6.625
	No. 10 can	6 lb. 13 oz.	6.785
Pineapple, broken slices—canned	No. 2½ can	1 lb. 13 oz.	1.813
Pineapple, broken slices—canned	No. 10 can	6 lb. 11 oz.	6.688
Pineapple, sliced—canned	No. 2 can	1 lb. 4 oz.	1.25
Pineapple, sliced—canned	No. 2½ can	1 lb. 14 oz.	1.875
Pineapple, sliced—canned	No. 10 can	6 lb. 12 oz.	6.75
Pineapple, fresh	Crate	70 lb.	70.00
Pineapple, fresh	Each	3 lb.	3.00
Pineapple juice, unsweetened—canned	No. 2 can	1 lb. 4 oz.	1.25
Pineapple juice, unsweetened—canned	No. 3 cylinder	3 lb. 2½ oz.	3.167
Pineapple juice, unsweetened—canned	No. 10 can	6¾ lb.	6.75
Plums—canned	300 x 200 can	6 oz.	0.375
Plums—canned	No. 2 can	1 lb. 4 oz.	1.25
Plums—canned	No. 2½ can	1 lb. 14 oz.	1.875
Plums—canned	No. 10 can	6 lb. 12 oz.	6.75
Plums—fresh	Each	⅛ lb.	0.125
Plums—fresh	Lug (loose)	28 lb.	28.00
Plums—fresh	Box (packed)	20 lb.	20.00
Plums—Italian—canned	No. 10 can	6 lb. 4 oz.	6.25
Prunes—fresh	Basket (½ bu.)	29 lb.	29.00
Punch, fruit (Use 4.2 lb. to a gallon. If citrus, place in that class)			
Raspberries, red—canned	No. 2 can	1 lb. 4 oz.	1.25
Raspberries, red—canned	No. 2½ can	1 lb. 14 oz.	1.875
Raspberries, red—canned	No. 10 can	6 lb. 12 oz.	6.75
Raspberries, black—canned	No. 2 can	1 lb. 4 oz.	1.25
Raspberries, black—canned	No. 2½ can	1 lb. 13 oz.	1.813

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Raspberries, black—canned	No. 10 can	6 lb. 10 oz.	6.625
Raspberries—fresh	Crate (24 qt.)	36 lb.	36.00
Rhubarb—canned	No. 2 can	1 lb. 4 oz.	1.25
Rhubarb—canned	No. 2½ can	1 lb. 13 oz.	1.813
Rhubarb—canned	No. 10 can	6 lb. 9 oz.	6.563
Rhubarb—fresh	Box	15–20 lb.	[15.00 [20.00
Rhubarb—fresh	Box	40 lb.	40.00
Rhubarb—fresh	Lug	23 lb.	23.00
Strawberries—canned	No. 2 can	1 lb. 4 oz.	1.25
Strawberries—canned	No. 2½ can	1 lb. 14 oz.	1.875
Strawberries—canned	No. 10 can	6 lb. 12 oz.	6.75
Strawberries—fresh	Quart	1 lb. 8 oz.	1.50
Strawberries—fresh	Crate (24 qt. also 16, 20, 22, 96 qt. crates)	36 lb.	36.00
Dried fruits			
Apples, apricots, cherries, dates, figs, peaches, pears, and dried prunes are sold in 1 = lb. cartons and 25 = lb. boxes.			
Prunes, prepared, dried, cooked (C.F.[1] No. 2 cans x 0.33 = lb. dry prunes)	No. 2 can	1 lb. 4 oz.	1.25
Prunes, prepared, dried, cooked (C.F.[1] No. 2½ cans x 0.44 = lb. dry prunes)	No. 2½ can	1 lb. 14 oz.	1.875
Prunes, prepared, dried, cooked (C.F.[1] No. 10 cans x 1.80 = lb. dry prunes)	No. 10 can	6 lb. 14 oz.	6.875
Prune juice, unsweetened—canned (C.F.[1] No. cans x 1.70 = lb. dry prunes)	No. 10 can	6 lb. 8 oz.	6.50
Raisins	Package	15 oz.	0.938
Raisins	No. 10 can	6 lb.	6.00

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Beverages			
Cocoa, coffee, tea, Postum, and Ovaltine are sold in single and multiple pounds.			
Tea bags	Each	½ oz.	0.03
Miscellaneous			
Baking powder, baking soda, celery seed, chili powder, chocolate, food coloring, garlic, gelatin, meringue powder, paprika, pepper (black, red, and white) salt, spices (allspice, cinnamon, ginger, nutmeg, etc.) and yeast are sold in pounds and fractions thereof, and are not listed below.			
Bouillon Powder	Envelope	1 oz.	0.022
Bouillon cubes	Each		0.022
Chili Sauce	Bottle	8 oz.	0.50
Chili Sauce	Jar	12 oz.	0.75
Chow chow	No. 10 can	7 lb.	7.00
Flavoring extracts	Bottle	2 oz.	0.125
Flavoring extracts	Bottle	8 oz.	0.50
Flavoring extracts	Bottle	16 oz.	1.00
Horseradish	Jar	8 oz.	0.50
Horseradish	Jar (qt.)	2 lb.	2.00
Mince meat	No. 10 can	8 lb. 8 oz.	8.50
Mustard, mixed	Jar	9 oz.	0.563
Mustard, mixed	Jar (1 pt.)	1 lb. 1¼ oz.	1.078
Mustard, mixed	Jar (1 qt.)	2 lb. 2⅛ oz.	2.156
Mustard, mixed	Gallon	9 lb. 8 oz.	9.50
Olives, green, ripe, stuffed	No. 1 can	1 lb. 1 oz.	1.0625
Olives, green, ripe, stuffed	No. 2½ can	1 lb. 15 oz.	1.938
Olives, green, ripe, stuffed	No. 10 can	6 lb. 13½ oz.	6.844

[1] C. F. Means conversion factor. Weight equivalence does not imply nutritional equivalence.

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Foods	Unit	Weight of unit	Weight in pounds
Olives, green, ripe, stuffed	Gallon	9 lb.	9.00
Pickles, dill, gherkin, sour, sweet, etc.	Gallon	9 lb. 13½ oz.	9.844
Pickle relish	Jar	4 oz.	0.25
Pickle relish	Jar	8 oz.	0.50
Pickle relish	Jar	16 oz.	1.00
Pickle relish	Jar	32 oz.	2.00
Pickle relish	Gallon	8 lb.	8.00
Sauces: A–1, Soy, Worcestershire etc.	Bottle	6 oz.	0.375
Sauces: A–1, Soy, Worcestershire	Bottle	12 oz.	0.75
Sauces: A–1, Soy, Worcestershire	Bottle	8 lb.	8.00
Vinegar	Quart	2 lb.	2.00
Vinegar	Gallon	8 lb.	8.00
Yeast	Cake	6½ oz.	0.39

Note. For complete listing of subsistence items with container sizes and weights see, SM 10–1–C1.

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APPENDIX II
RECAPITULATION TABLE

RECAPITULATION TABLE STATION_____PERIOD_____

Unit	1	2	3	4	5	6	7	8	*	*	24	25	26	27	28	29	30	Unit Total	Pound
MEATS, FISH, AND POULTRY:																			
Lean pork:																			
Boston butts lb.	60												60					240	240
Ham, SC lb.								55							55			220	220
Loin lb.						55						55						220	220
Shoulder lb.			55													55		220	220
Subtotal																		900	900
Liver lb.					30										30			120	120
Meats, other:																			
Bacon lb.		10	15		20	10		15				20	10		15	20	10	290	290
Beef, carcass lb.		60	45			45	60				60		45			60	45	840	840
Beef, boneless lb.	35											35						140	140
Chicken lb.				80				80						80				400	400
Fish, frozen lb.		30				30						30						180	180
Frankfurters lb.				30									30					120	120
Sausage, pork lb.	30			30			30				30			30				300	300
Veal, carcass lb.					60												60	240	240
Subtotal																		2510	2510
TOTAL MEATS																		3530	3530
EGGS, FRESH doz.	22	4	20	5	5	20	15	20			4	20	22	5	20	15	20	434	651

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APPENDIX III

FOOD WASTE (sample form)

FOOD WASTE					
MEAL	NUMBER SERVED	DAY	UNIT SURVEYED		
FOOD ITEM	TOTAL WASTE		INGREDIENT LIST (FROM RECIPE)	CONVERSION FACTOR TO "AS PURCHASED"	TOTAL FOOD WASTED (LBS OR KGS) AS PURCHASED
	PLATE (KGS)	KITCHEN (KGS)			
TOTAL FAT AND GREASE LOSS DISCARDED =					

Figure 4.

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APPENDIX IV

RECIPE—FOOD PREPARATION (sample form)

RECIPE - FOOD PREPARATION					NAME OF FOOD NATIVE	
MEAL	DAY	UNIT			UNITED STATES	
INGREDIENTS	WEIGHT					CONVERSION 1/ FACTOR COOKED WEIGHT TO "AS PURCHASED"
	AS PURCHASED	REFUSE WEIGHT %	RAW	EDIBLE	COOKED	

DESCRIPTION OF PREPARATION (Give actual recipe, include cooking time, method of cooking, time prepared, time served, number of men prepared for, etc)

1/ SEE SAMPLE CALCULATION IN APPENDIX V

Figure 5.

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APPENDIX V

EXAMPLE OF WORKSHEETS FOR RECIPE RECORD AND CALCULATIONS

Notes on Calculations

In both the (a) Food Inventory Method and the (b) Food Preparation and Consumption Method, it will be necessary at times to convert cooked foods to the "raw" or "as purchased" basis and to determine the quantities of the ingredients in various cooked mixed foods. For single food items, this can be calculated from the raw and cooked weights. For mixed dishes, the recipe giving the quantity (weight) of each item used and the final cooked weight must be obtained.

The following example illustrates the type of calculation which may be required:

Potatoes, hashed brown	Grams	Pounds	Percent in cooked product
Weight of unpeeled potatoes	36,350	80.07	
Weight of peeled potatoes	27,310	60.15	91.5
Weight of fat drippings	2,550	5.61	8.5
Total weight (uncooked)	29,860	65.76	
Total weight (cooked)	25,630	56.50	

Simple Calculation

Total amount cooked (25,630 gms.) was served.

Plate waste and leftovers discarded = 5,090 gms. or 11.21 lbs.

New equivalent of discards is obtained by:

Total weight (uncooked), 29,860 x wt. of cooked discards, 5,090 = 5,930 gms. or 13.1 lbs.

Total weight (cooked), 25,630

Weight of raw, peeled potatoes discarded = 5,930 x .915 = 5,425 gms. or 11.9 lbs.

Weight of raw fat drippings discarded = 5,930 x .035 = 504 gms. or 1.1 lbs.

Factor for converting raw peeled potatoes to "as purchased" is 36,350 or 1.33.

27,310

Weight of potatoes (as purchased, discarded) is 11.9 x 1.33 or 15.8 lbs.

Prepared dishes containing more ingredients are calculated in the same manner.

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WORKSHEET FOR RECIPE METHOD	MEAL	NO. OF PERSONS	DATE	UNIT

MENU ITEMS	WEIGHT OF PREPARED FOOD											PRECENT OF PREPARED FOOD ACTUALLY CONSUMED
	TOTAL PREPARED			NOT SERVED			PLATE SCRAPINGS			TOTAL CONSUMED		
	GROSS	TARE	NET	GROSS	TARE	NET	GROSS	TARE	NET	POUNDS	GRAMS PER PERSON	

Figure 6.

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APPENDIX VI

DIETARY QUESTIONNAIRE FOR FAMILY SURVEY (sample)

DIETARY QUESTIONNAIRE FOR FAMILY SURVEY		DATE INVESTIGATOR NO.
FAMILY NAME	TOWN	PROVIDENCE
ETHNIC GROUP	RELIGION	
FATHER'S OCCUPATION		

NUMBER IN HOUSEHOLD		
TOTAL	ADULTS	CHILDREN

MALES OVER 16 YEARS	NUMBER	AGES
PREGNANT WOMEN	NUMBER	AGES
LACTATING WOMEN	NUMBER	AGES
OTHER WOMEN	NUMBER	AGES
CHILDREN UNDER 16 YEARS	NUMBER	AGES
BABIES UNDER 1 YEAR	NUMBER	BREAST FED YES_____ NO_____
OTHER BOYS	NUMBER	AGES
OTHER GIRLS	NUMBER	AGES

QUESTIONS

1. WHAT IS THE TOTAL CASH INCOME FOR THE FAMILY PER WEEK?
2. HOW MUCH IS SPENT ON FOOD PER WEEK?
3. HOW MANY TIMES PER WEEK DO YOU BUY FOOD?
4. DO YOU PREPARE YOUR FOOD ON OPEN FIRE__ OR STOVE__? TYPE OF FUEL USED?
5. HOW LONG DOES IT TAKE TO COOK A MEAL? _____ HOURS.
6. DO YOU BREAST FEED YOUR BABIES? YES_____ NO_____
7. IF THERE IS NO MOTHER'S MILK WHAT IS THE YOUNG BABY FED?
8. AT WHAT AGE ARE YOUR BABIES WEANED? _____ MONTHS.
9. AT WHAT AGE ARE OTHER FOODS GIVEN TO THE BABY? _____ MONTHS.
10. WHAT FOODS WOULD A BREAST FED BABY RECEIVE AT:
    6 MONTHS OF AGE?

    12 MONTHS OF AGE?

Figure A.

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11. WHAT DO YOU FEED A WEANED CHILD WITH DIARRHEA?

12. ARE ANY OF YOUR CHILDREN IN SCHOOL AT ANY TIME DURING THE YEAR?
YES_____ NO_____.
IF YES, DO THEY RECEIVE MILK AT SCHOOL? YES_____NO_____.

ANY OTHER FOODS?

13. WHAT FOODS DID YOUR FAMILY EAT YESTERDAY? (DAY OF WEEK).
*P - PURCHASED; H - HOME GROWN OR GATHERED; F - FREE GIFTS OR SUPPLEMENTS

MEALS	MENU ITEMS	FOOD ITEMS KINDS	AMOUNTS IF KNOWN	*PHF	COMMENTS
BREAKFAST					
LUNCH					
SUPPER					
AT OTHER TIMES					

NUMBER OF GUESTS PRESENT	BREAKFAST	DINNER	SUPPER
NO. FAMILY MEMBERS ABSENT	BREAKFAST	DINNER	SUPPER

14. HOW OFTEN DOES YOUR FAMILY EAT THE FOLLOWING FOODS?

FOOD	NO. OF MEALS PER DAY	WEEK	MONTH	REMARKS
CEREALS AND CEREAL PRODUCTS				
CORN				
RICE				
WHEAT				
BARLEY				
OATS				
BREAD				
OTHER				

Figure B.

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14 (Continued)

MILK PRODUCTS	NO. OF MEALS PER DAY	WEEK	MONTH	REMARKS
MILK, FLUID				
MILK, POWERED				
MILK, EVAPORATED				
CHEESE				
OTHER				
EGGS				
MEATS				
BEEF, ETC.				
FATS AND OILS				
LEGUMES				
VEGETABLES, LEAFY GREEN AND YELLOW				
OTHER VEGETABLES				
CITRUS FRUITS				
OTHER FRUITS				
MISCELLANEOUS				
SUGAR				
COCOA				
COFFEE, ETC				

Figure C.

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BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

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ARADCOM (2)
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EUSA (1)
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(2 each)
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8–571
8–581
8–590
8–667

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For explanation of abbreviations used, see AR 320–50.

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