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PRINTED WORKS BY JOHN H. KELLOGG OR
BATTLE CREEK SANITARIUM DOCTORS,
CA. 1890-1940

IRON RATION

THE IRON RATION
By J. H. Kellogg, M. D.

By the term, "iron ration", reference is not here made to what is known in military circles as the "iron ration" but to the necessary daily intake of food iron, or so-called organic iron found in ordinary foodstuffs in varying proportions.

Iron is one of the essential constituents of the body. It is found in all living organisms, both animal and vegetable. Its importance to the growing plant has long been recognized by scientists, and is evidenced by the fact that iron abounds in the germ of cereals and other seeds. It is for the same reason, doubtless, that iron is found in relatively large amount in the embryos of animals, as in eggs, particularly in the yolk of the egg. Iron is essential to life from the very outset.

In the animal body, the chief function of iron is to supply and maintain the hemoglobin of the blood, which is an organic iron compound peculiar to animals, and possesses a special chemical property by means of which it is able to absorb and condense oxygen, so as to give to it the active properties of ozone as an oxidizing agent.

This iron-containing hemoglobin is the chief constituent of the red blood corpuscles. Without iron, the body cannot make hemoglobin and hence cannot make blood cells, one of the most highly essential of all the bodily tissues.

The essential character of the blood seems to have been known from the most ancient times, even when the arteries were supposed to be carriers of air because they are always found empty after death. Said the old prophet, "The blood is the life," a dictum which John Hunter's famous experiment proved to be the expression of a profound scientific truth.

The twenty-five million million red corpuscles floating in the blood stream of a man of average size, have a combined area of about 35,000 square feet, or 3/4 of an acre. This great area of oxygen-loving hemoglobin travels back and fourth between the lungs and the tissues fifty or sixty times an hour, picking up oxygen in the lungs at one end of its journey and feeding it to the air-hungry cells at the other end.

The life of a red blood cell is only about six weeks; hence, of the 25,000,000,000,000 oxygen carriers, 7,000,000 die every second of our lives, and to keep the number intact, 7,000,000 new red corpuscles must be created by the living forces of the body every second, one of the most striking illustrations of creative power at work with which science has made us acquainted. We lose each second one and one half square inches of oxygen absorbing surface, which must be at once replaced.

For each one of these wonderful red cells, the precious hemoglobin is necessary. Without it, not a single one can be produced. And iron is absolutely essential for the making of hemoglobin. Without it there can be no blood making, and the blood cells rapidly diminish, the blood becomes thin and watery and loses the rich red color which paints the roses upon the cheeks and the rubies upon the lips of health.

"The Blood is the Life" because it feeds the sacred fire which burns in the secret places of the living temple, "the house in which we live." Upon the continuous activity of this vital combustion, all our life processes and the activities of mind and muscle depend.

When the iron supply is deficient and the blood is depreciated, the face, lips, gums and finger nails become pale because the red blood cells are reduced in number. In normal blood, a minute drop, half a line in diameter, contains not less than 5,000,000 red corpuscles. This number is greatly reduced in anemia, the blood count becoming 3,000,000 or 1,000,000 or in very pronounced cases falling as low as 500,000 or even lower. This means that the oxygen absorbing and carrying surface of the blood, that is, the hemoglobin, has been reduced in proportion. Instead of 35,000 square feet of oxygen-carrying surface, we have only 20,000 or 10,000 or even 3,500 square feet, a reduction to one-tenth the normal amount.

This explains why an anemic person is short of breath, even when there is no trouble with the heart or lungs. He pants when he goes up stairs. He cannot run or even walk fast for a short distance without getting out of breath. There is nothing wrong with his breathing apparatus. The air is taken into the lungs properly and it comes in contact with the blood, but the blood does not take up enough oxygen because it is deficient in hemoglobin and so cannot absorb the oxygen brought to it, the effect being just the same as though the air supply were in part shut off by disease or by injury to the lungs, or by a deficient air supply.

The anemic person lacks appetite because food is fuel and the oxygen which the iron-containing hemoglobin brings is necessary to burn up the incoming supplies of fuel and to prevent the accumulation of unused and clogging material in the tissues.

The anemic person becomes sallow and the skin is often pigmented as well as pale, because the oxygen supply is insufficient to burn up the wastes of the body and they accumulate in the tissues.

A person whose blood count is low feels languid and weak, because oxygen is needed to release the energy supplied by the food and stored up in the muscles and other organs.

In anemia all the life processes are depreciated, every vital function is crippled, and the whole body is depleted. Long continued anemia of a severe type may give rise to paralysis of the legs as the result of damage to the spinal cord.

In view of the great importance of iron in the life activities of the body, it would naturally be expected that it would figure large in amount among the constituents of the tissues. But the very opposite is true. It is the very smallest in amount of the twelve principal elements which enter into the composition of the body as shown in the following table:

THE BODY of an Average Man Weighing 154 Pounds Contains the Following Elements in the Amounts Named

	Pounds	
Oxygen	100.1	
Carbon	27.7	
Hydrogen	15.4	
Nitrogen	4.6	50
Lime (CaO)	3.0	
Phosphorus	1.5	
	Ounces	
Potassium	8.6	
Sulphur	6.0	
Sodium	3.7	
Chlorine	3.7	
Magnesium	1.2	
Iron	.1	
(Iodine, fluorin, silicon--traces)		

As will be seen by reference to the table the body contains only one part of iron in 24,000 parts by weight. This proportion is about the same as that of a teaspoonful of flour compared with a barrelful. There are hidden away in the bones 500 times as much lime as of iron in the whole body; and yet, this minute amount of iron scarcely one-tenth of an ounce avoirdupois, or 43 grains, is just as essential as the oxygen which forms two-thirds the total weight of the body or as the carbon and other elements which make up the balance.

We have already learned that practically all the three pounds of calcium, or 4.2 pounds of lime in the body is found in the bones. The precious modicum of iron is in like manner restricted almost wholly to a single structure, but to the blood, a fluid tissue, rather than the solids of the body.

Iron is found in the body almost exclusively in the form of hemoglobin. The blood constitutes about 7 percent of the body weight and contains about ninety five percent of the iron. The red color of a piece of raw beefsteak is due to the blood in it. By thorough washing in salt water the blood may be removed and the muscle tissue left will be found nearly white in color.

Iron is found, practically, only in the blood because it is through the circulation of the blood that the iron is made to do its peculiar and wonderful work in entrapping the life giving oxygen and circulating it throughout the body to every minute cell and tissue, bringing it in immediate contact with the most minute waste particles, and carrying back to the lungs the used up materials, the products of combustion in the form of carbon dioxide (CO_2) by far the most bulky and the most important of all our excretions, amounting to more than half a pound daily, or more than forty times the weight of the urea eliminated and four hundred times the weight of uric acid excreted.

And the elimination of this enormous mass of poisonous debris all depends upon those few little grains of iron in the blood. When a man falls into the water he drowns in three or four minutes if unable to keep his nose above the water surface, and the cause of his death is not the swallowing of water or the filling of his lungs with water, but the inability to get the carbon dioxide out of his blood, and so it becomes saturated and the body cells are asphyxiated.

Now, a man who has an insufficient amount of iron in his blood is like a half drowned man. The $Co\ 2$ accumulates in his blood and tissues and asphyxiates living cells so that they become paralyzed and incompetent.

An evidence of Nature's special care for her precious store of iron is found in a special provision for economizing its use. While the red cells carry oxygen from the lungs to the body cells, they return empty, so that they may be ready to catch a new load of oxygen the instant they reach the lungs, wasting no time in unloading. The carbon dioxide is carried from the tissues to the lungs by the sodium salts of the blood, a fact of very great physiologic significance in relation to diet, but which will be fully considered in another article.

THE DAILY REQUIREMENT OF IRON

The solid as well as the liquid materials which enter into the composition of the body are in a state of perpetual change. An eminent scientist defines an animal as, "A stream of matter flowing through a certain form." The fluids of the body change very rapidly. The soft parts, quickly, though less rapidly and the solid parts more slowly. For example, the daily loss of lime is only ten or twelve grains at which rate nine years would be required to exhaust the body's store of 4.6 pounds of lime (CaO). The blood, as already noted, loses all its red cells and replaces them by new ones about once in six weeks according to the estimate of physiologists. This would involve a loss and renewal of practically the entire iron store of the body every six weeks. But nature is less extravagant in her expenditure of iron than in the disposal of her store of lime. She hoards the precious metal wirh the greatest care.

The worn out bodies of thé seven million red cells which perish every second are carefully worked over and the iron contained in their hemoglobin is recovered and stored in the liver and spleen and used in the making of new cells to take the place of those which are lost. Of course there is some loss of iron but instead of losing a grain a day the actual loss of iron from the body is only about one-seventh of one grain.

We need food iron to make good this loss. Small though it is, it must be made good, or the direst consequences will follow. Animals fed on a diet which contains no food iron die in a month or less.

To make certain that the supply of iron is adequate, the psyiologists tell us that we require not less than.231 grains, practically one-quarter of a grain, per diom. The size of the iron ration for the maintenance of health may be said then to be one-quarter of a grain of food iron daily.

Women require a larger intake of iron than do men, and infants and children need much more than adults.

The average woman requires about 4/5 as much food as does the average man. Her lower food requirement is due to her smaller size and less vigorous muscular activity. But the functions associated with childbearing and nursing make a special demand for iron which requires an iron ration for the average woman fully equal to that needed by the average man.

An infant at birth has stored in its body, chiefly in the liver, such a quantity of organic iron that its total iron content is three times as great in proportion to its weight as is that of an adult. At the end of the nursing period, or when it has reached the age of a little more than one year, the body weight of the infant is three times as great as at birth, but the total amount of iron contained in its body remains the same. Mother's milk, like the milk of all animals, is rather poor in iron, containing only barely enough to make good the daily loss, supplying nothing for the increase in the volume of the blood. This is furnished by the liver. This storage iron is found in puppies, rabbits and kittens as well as in human infants. All these young beings must be suckled for some time before they become able to take ordinary food. It is interesting to note that the guinea pig begins to eat green leaves the same day it is born, and so nature does not supply it with a store of iron in its liver before birth.

The expectant mother must supply iron for the blood of her infant, as well as for storage in its liver, from her own blood. In other words, the mother must furnish from her own store of blood iron, iron enough for blood-making purposes to meet the needs of her infant not only before birth but for a whole year afterwards at the end of which time its blood volume and its weight are three times as great as at birth.

The monthly function of women invdlves a loss of iron which must be made good through a diet especially rich in organic iron, even before puberty, girls require food richer in iron in proportion to their size than do boys for two reasons:

(1) Because they grow faster than boys, becoming taller and heavier between the ages of 10 and 13 years than boys of the same age.

(2) Because they usually eat less than do boys of equal age.

It is perhaps for this reason that women, guided by instinct are notably more fond of green stuffs and salads and fresh vegetables than are men. This is a natural tendency that should be greatly encouraged.

Woman and girls should eat more freely of greens of various sorts and of all foods rich in iron than do men and boys, and expectant mothers and the mothers of nursing infants need a large extra supply of foods rich in organic iron.

The popular notion that cows milk contains everything needful for nutrition is an unfortunate and dangerous error, though one into which a person very naturally falls. Milk is a natural food and is intended for animal sustenance and is primarily intended to be used as an exclusive diet, but it must be remembered that it is only sufficient as a complete nutrient when fed to very young animals which have been supplied by nature with an extra supply of maternal iron stored up in their livers before birth.

A guinea pig would become anemic and starve on an exclusive diet of cows milk. The same thing would happen to a human adult. Neither the guinea pig nor the adult human has a reserve of iron suitable for blood making sufficient to last more than a few days.

This question becomes one of very great importance in the artificial feeding of infants. According to the best authorities to which we have access human milk contains twice as much iron as does cows milk. This fact insures the nursing infant an adequate supply of iron during the nursing period.

Just here it would be interesting to note a very striking illustration afforded by the difference in the composition of human milk and cows milk of the marvelously wise adaptations of means to ends in the economy of nature. Cow's milk contains nearly four times as much lime to the ounce as does human milk, but only half as much iron. The reason for this s--

striking peculiarity is found in the fact that the calf needs four times as much lime for the formation of bone because it reaches maturity in less than one-fourth the time of the human infant, while, on the other hand, it needs less iron in its maternal food supply because it begins to nibble grass, like its mother, a food very rich in iron, within a short time after its birth, whereas the human infant normally is nourished exclusively by its mother's milk until six months of age or older.

When infants are fed other food than mother's milk the management of their diet becomes a matter of exceeding delicacy. It is more than probable that few if any artificially fed infants escape injury more or less serious through an inadequate supply of iron or lime or vitamines or of all these elements, or from lack of balance in the bill of fare in some other particular.

In the feeding of infants experience has shown the necessity for the dilution of cow's milk and the best results are secured by diluting whole milk with water, sweetened with milk sugar or malt sugar. In feeding your infants, equal parts of milk and water are generally employed. An infant fed on such a mixture would receive only one-fourth the amount of iron normally found in human milk. On such a diet infants become anemic. Their resistance is lowered and they become subject to a great variety of disorders, the effects of which may remain with them through life. The free use of orange juice, the use of malt sugar instead of milk sugar and the use of barley meal, malt soup, lentil soup and soups prepared from spinach and other green vegetables in connection with milk feeding are measures, the value of which has been little appreciated until recent years. It is probable that the dificiency of iron in most infant dietaries is to some extent compensated by the excess of lime; at least some recent observations would indicate that this may be the case.

WHERE TO FIND THE IRON RATION

The next question, then, is, naturally, how may this tiny bit of iron be best secured. This would seem to be an extremely simple problem for no one of all the metals is so abundantly scattered over the face of the earth and in the earth and all about us, facing us at every turn, as is iron, and formerly it was supposed to be a matter of entire indifference in what form the iron was received so long as it was gotten into the body.

In the older materia medicas, such as were studied by the writer when a medical student, all sorts of chemical compounds of iron and even metallic iron in the form of iron filings or finely powdered iron were recommended for administration in cases of anemia in which an increase in the body's store of iron was required. The writer's belief in physiologic and biologic principles made him a sceptic as to the efficacy of these so-called remedies and during more than forty-five years of medical practice he has never relied upon them; but even at this late day when the principles of physiologic medicine have become fully recognized and are resting upon a sound scientific basis, the popular faith in iron tonics still survives, and enormous fortunes have been accumulated through the sale of "iron bitters," "blood tonics" and various other worthless chemical nostrums, to say nothing of the more respectable, if not more useful, "wine and iron" of the regular pharmacopoeia, in various combinations. If the public were acquainted with the scientific facts in relation to this question the whole tribe of iron nostrums would fall into discard over night and the druggists of the country would have to make a large entry on their loss and gain account.

More than a third of a century ago Bunge of Bale, Switzerland, one of the most eminent of those of the world's chemists who devote their lives to the study of the chemical problems relating to the human body, undertook, with the aid of his students, an extended series of experiments for the purpose of settling the question whether the ordinary iron with which we are familiar, the so-called inorganic iron or any of its compounds could be utilized by the body in keeping good its stock of iron for use in blood making.

First of all, Bunge showed that natural food stuffs contain iron in a peculiar state so different from that in which it is found in various chemical compounds andminerals that it cannot be recognized by the usual chemical tests for iron. This is known as organic iron. Bunge found in the yolk of eggs considerable quantities of this organic iron which was so similar to hemoglobin as to be easily converted by the body into the hemoglobin of the blood, one of the most remarkable of all organic substances. Similar compounds were found in milk, legumes (peas and beans) and in cereals, as well as in the yolk of eggs.

In experiments upon a large number of rats, rabbits and dogs conducted in Bunge's laboratory it was found that the animals supplied with foods rich in organic iron made twice as much hemoglobin as those which were supplied with inorganic iron. It was also noticed that foodstuffs contain iron only in the organic form, "built up by the life processes of plants." This organic iron, according to Bunge, is the source of the iron used by the body in the formation of hemoglobin. Those observations of Bunge have since been confirmed by numerous other observers.

It is doubtless true, as suggested by Von Noorden and others, that inorganic iron may temporarily stimulate the blood-making process, but it cannot be used, at least to any extent, in the construction of red blood cells, This stimulating effect of chemical iron preparations may be of some possible advantage in certain cases of disease, but the stimulation produced is of very short duration, and on this account such iron preparations should be employed only for very short periods, if at all. As a matter of fact, they are rarely useful and very seldom needed.

The long continued use of inorganic iron in the form of medicine or mineral waters is highly detrimental, causing constipation and other disorders.

To prevent injury to the tissues, the liver, exercising one of its most important protective functions, captures the inorganic iron and holds it in its own tissues until it can be disposed of. This unnecessary work demanded of the liver may seriously interfere with the performance of some of its highly important functions.

The long continued use of inorganic iron in mineral waters or medicine produces a very obstinate and highly damaging constipation. This may be one of the results of the injurious effects of inorganic iron upon the liver.

Science has thus clearly demonstrated that the iron ration must be drawn from organic sources; that is, it must be obtained from natural foodstuffs. Chemical, or inorganic iron, even though possibly of some limited service in certain cases of disease, is no proper substitute for food iron. As Sherman well says, in summing up the world's most eminent authorities, "Inorganic iron when absorbed is not utilized ....to any appreciable extent, but remains unused in the tissues." "Evidently, then, we should look to the food rather than to medicines or mineral waters for the supply of iron needed in normal nutrition."

Even in the treatment of anemia food iron is far better than inorganic iron, for Egers has shown that the regeneration of the blood after a severe hemorrage goes on much faster with a diet rich in food iron than when dependence is placed upon inorganic iron.

THE IRON CONTENT OF FOODSTUFFS

Foods differ greatly in their iron content, although the variation in the amount of iron present is less than is the case with lime. There are fewer foods which may be said to be very rich in iron than is the case in relation to the lime content, and perhaps fewer foodstuffs in which the deficiency is very ma deficiency is very marked.

Among the foods richest in iron are found some which we had not even suspected of being so rich in this essential metal food principle until this digest of technical data was made. Here are a few of the most important; the relative richness in iron being in the order named:

Romain, wheat bran, egg yolk, lentils, beans, peas, wheat, mustard greens, hazelnuts, barley, rye, beef, almonds, graham bread, spinach, turnip tops, and olives.

Each of the above named foodstuffs contain in one ounce more than 6 percent of the iron ration for one day, so that one pound of any of these foods, if eaten, would supply the necessary iron requirement.

In the case of several foods, the percentage of iron is so high that six to ten ounces is sufficient for a full day's ration. It is interesting to note that one vegetable product, the lentil, contains exactly the same percentage of iron as the yolk of egg and beans are not far behind, 6 ounces of lentils and 7½ of beans supplying iron for one day. Peas, mustard greens and whole wheat supply iron for a day with less than three-quarters of a pound of their substance.

Of the foods which are poor in iron, thirty-three, or one-fourth of the total number, contain less than one percent of the element. A larger number (36 percent) contain between two and three percent of iron per ounce, making a total of 69 foodstuffs (51 percent) which may be classed as very low in iron. Such foods as cane sugar, confectionery, olive oil, lard and suet contain no iron at all.

It is evident that when these foods with low iron content are made use of, they should be supplemented by suitable foods rich in iron which are found in Table I#a.

A study of the average iron content of the several classes of foodstuffs affords useful information.

When considered with reference to the amount of iron or the percentage of the day's iron ration contained in one ounce of material, we find the legumes on the average, far ahead of all others (11.35), greens come next (6.14). then eggs (5.67), meats (4.29), cereals (3.9), nuts (3.49), fruits (1.74). vegetables (1.46), milk products (1.05), and milk (.47).

When examined with reference to the percent of the iron ration contained in 100 calories, the order of precedence of the average is changed. First in the list is greens (46.4), then meats (15.6), legumes (13.7), vegetables (10.4), fruits (5.6), cereals (4.3), nuts (2.67), milk (2.56), and lastly eggs (1.36).

Table I shows all the essential facts in relation to the iron content of more than 100 common foods. The table presents seven columns, each of which deals with a special feature of the iron content. The several columns, numbered 1 to 7, present the following particulars:

1. The amount of food iron calculated as grains in metallic iron, in one ounce of foodstuff.

2. The percent of one day's iron ration (.213 grains) in one ounce.

3. The amount (ounces) of foodstuff required for one day's iron ration.

4. The percent of the iron ration found in 100 calories.

5. The weight in ounces of 100 calories.

6. The weight in ounces of an ordinary serving.

7. The number of calories in an ordinary serving.

By the use of this table it is possible to very easily determine the iron content of the food intake for a meal, a day, or any definite length of time.

TO DETERMINE THE IRON CONTENT OF A RATION OR A DIETARY BY THE USE OF TABLE I.

This determination may be made in several ways as follows:

1. The exact weight of the several articles which make up the ration or the bill of fare must be first ascertained. Then from the alphabetical table find in column 2 the figures representing the percentage of the iron ration found in one ounce. Multiply each of these percents by the weight in ounces eaten of the article. Add the results together and the sum will be the percentage of the iron ration found in the total food intake for the day. If the amount is 100, it exactly equals the normal requirement. If it is less than 100, there is a deficiency of iron, the amount of which is shown by the difference between the figures found and 100. If the figures are in excess of 100 the food intake comprises an excess of food iron. This is not a matter of consequence, however, as any excess will be carried off through the intestines, the channel through which waste iron is normally excreted, at least the greater part. If a deficiency is found it should be corrected at once by the addition of some article rich in food iron or by the substitution of some food stuff poor in iron by another which is rich in this element.

2. A determination can be equally well made by the use of columns 4 and 7. If the foods are served in 100 calory portions as at the Battle Creek Sanitarium, this can be done very quickly. It is only necessary to find in the table the several articles eaten and set down the figures found in column 4, which represent for each article the percent of the day's ration found in 100 calories, In case serving consists of more or less than 100 calories the figures found in column 4 could be increased or diminished accordingly.

The figures in columns 5 and 6 will sometimes be found of assistance in making the determinations by either of the above methods.

The figures given in column 3 are useful in showing at a glance the great difference in the iron content of different foodstuffs.

It is important to note that in the case of foodstuffs of which a very large quantity must be taken to supply a day's iron ration, the nature of the food is usually such that a large quantity may be taken without inconvenience so that, while the amount of iron per ounce may be small, it may be possible to take without inconvenience a sufficiently large quantity to more than balance the deficiency. This is particularly true in the case of fruit juices, milk and greens.

To facilitate the work of balancing the bill of fare for the iron content the writer has, at the cost of a great deal of painstaking labor, for which a little vacation afforded an opportunity, prepared the accompanying tables which include special tables for the different classes of foodstuffs, but before considering these and some of the individual foodstuffs of which they are made up in detail, let us note a group of foodstuffs in which the iron content may be rated as high.

FOODS RICH IN IRON

Table I a is made up from Table I but gives opposite each item only the figures found in columns (1),(2),(4), and (7). This makes possible the use of the table, in most cases, without referring to Table I.

Table Ia includes less than one-third of the foods included in Table I. Each foodstuff in this list supplies in one ounce more than three percent of one day's iron ration. With the exception of half a dozen foods the percentage is much higher than this, the average of the forty-three foods being 7.06 percent per ounce, and of the remainder 1.34 percent.

THE IRON CONTENT OF FRUITS (TABLE II)

We are so accustomed to think of fruits solely as sources of sugars and acids that we are naturally surprised at the discovery that these choice comestibles are really most valuable sources of food iron. It is true the average iron content per ounce is small, less than two percent of the daily ration (1.74); but then the food value is also low on account of the large percentage of water, so that the average percent of the ration of iron is more than three times as great (5.6). One can eat a larger bulk of fruit without risk of injury than of any other class of foodstuffs.

Besides, there are certain fruits which are exceptionally rich in iron (Table IIa), containing on the average twice as much [illegible] iron as the general average of fruits. Of less than a half dozen fruits in this class, dates (5.67, 6.0), figs (5.67, 6.3), Sante currants (4.72, 6.0), prunes (5.67, 7.0) and raisins (4.0, 9.2), the average percent per ounce is 5.2 and per 100 calories 6.8, considerably higher than the averages for all foodstuffs which are respectively per ounce, 3.25 and per 100 calories 6.38.

It will be readily seen how the fruits named may be usefully employed in balancing the ration for iron. A quarter of a pound of dates supplies nearly one-fourth of a total day's iron ration (4 x 5.67= 22.68 percent), and at the same time, furnishes a substantial amount of energy to support muscular work. Two ounces each of figs, olives and prunes, and an ounce o each of raisins, dates and currants would supply half a day's requirement of iron and one-third of a liberal day's food supply.

Taking into account the large amounts which may be eaten with impunity, together with their other good qualities, fruits may well be regarded as a most valuable source of food iron. The strawberry and the raspberry are especially worthy of mention.

THE IRON CONTENT OF NUTS (TABLE III).

The almond, hazelnut, chestnut, peanut, pecan and walnut, all contain a rich store of iron, the average iron content expressed as percent of the iron ration being 4.79, more than two and one half times that of fruits(1.74), three times that of vegetables (1.46) and greater than that of cereals and even superior to average meats. It is true that the extraordinary high food value of nuts renders them less available than fruits as prime sources of iron, for one would have to eat 5,000 calories of chestnuts or walnuts or more than 4,000 calories of pecans or peanuts to get a day's ration of iron; but three-quarters of a pound of almonds or hazelnuts would supply the needed quantum of iron with an energy intake of 2500 calories, on account of their unusually rich store of iron.

It is worth while to know that vegetable milk prepared from almonds, by adding five parts water to one part of blanched almonds made into smooth paste, supplies two and a half times as much iron as does cow's milk in equal quantity, and exactly the same amount of protein. It is worth noting just here, also, that the protein of the almond is, like that of milk, a complete protein, that is, a protein out of which human tissues may be readily formed, which is by no means true of all vegetable proteins. Such a milk, however, would be somewhat deficient in lime, a lack which could be supplied by lentil or soya bean soup.

A product commercially known as Malted Nuts, prepared from almonds or peanuts, has been found of very great service in meeting the needs of infants and some classes of invalids for an easily digestible liquid nourishment.

THE IRON CONTENT OF CEREALS AND BREADS (TABLE IV)

It is first of all worthy of remark that while cereals are as a class poor in lime, they are comparatively rich in iron. A pound and a quarter of graham bread will supply a day's ration of iron, while four times as much would scarcely furnish the lime required for one day to make good the body's loss of lime salts. Even corn, which is so deficient in lime as to require 8 pounds for one day's lime supply, contains sufficient iron for one day's needs is a little more than a single pound.

The average iron content of all the cereals and breads is sufficient to supply in one ounce or in 100 calories more than one twenty-fifth of a day's needs.

Of all the cereals, the highest in iron content is the entire wheat, of which 11 ounces supply a day's iron ration. Barley, rye, oatmeal, and graham flour come next and in the order named, supplying three-fourths as much.

Graham bread contains three times as much iron as white bread, twenty-five percent more than "pumpernickel", fifty percent more than entire wheat bread, rye bread and soda crackers.

Graham bread supplies in 14 ounces a whole day's iron ration or four times as much iron as polished rice and white flour, or hominy, more than five and a half times as much as cornmeal, four and two-thirds times as much as farina, three times as much as macaroni, buckwheat flour or rye flour, and twice as much as "pumpernickel", pearled barley, brown rice or tapioca.

Boston Brown Bread makes a better showing than any other of the breads because of the molasses in its composition, furnishing in a seven-ounce loaf iron enough for a day. As a practical source of food iron, oatmeal deserves special mention, 14 ounces supplying a day's ration of iron.

The cereal foods which show so great a deficiency in iron as to properly put them in a prescribed list only to be eaten when adequately supplemented by foods extra rich in iron, are white bread, cornmeal (new process) farina, hominy (toasted corn flakes are made from hominy grits), macaroni, buckwheat, polished rice, (toasted rice flakes and puffed rice) and tapioca.

THE IRON CONTENT OF VEGETABLES (TABLE V)

Vegetables are like fruits in their small average content of iron per ounce (1.46 percent of ration), but relatively large content per 100 calories. In this respect they are even more remarkable than fruits. Vegetables are like fruits also in the fact that their small nutrient value renders possible a bulky intake, so that in practical use fresh vegetables become a highly important source of food iron. The average iron ration percentage value per ounce for nineteen common vegetables is 10.4 per 100 calories.

The vegetable which provides the most iron in an ordinary serving as shown in Table V is the potato, which in a small serving of three ounces provides one-twelfth of a day's requirement. The Irish farmer, who daily eats several pounds of potatoes daily, evidently gets a full supply of iron, notwithstanding the fact that his chief article of food aside from the potatoe is buttermilk, which contains very little iron. The Scotch highlander finds an equally fortunate food combination in buttermilk, supplemented by oatmeal "brose" "bannocks" and "scones."

Brussels Sprouts and cabbage each furnish in a 3 ounce serving one-tenth of a day's supply of iron, and string beans, carrots, and turnips provide in a small serving, which in many cases might easily be doubled, more than half as much iron as a serving of potatoes.

The vegetables which contain so small an amount of iron as to be of compartively little value as sources of food iron, named in the order of their inferiority are, beginning with the cucumber which contains least of any of the common vegetables, eggplant, turnip, and sweet potato. The last named vegetable contains less than half as much iron as the Irish potato.

Onions have a special claim to notice because of the high value of the iron compound which they supply which, according to Stokless, contains more iron even than the hematogen of egg yolk, discovered by Bunge, and is equally well utilized by the body. So. at last, this often rejected , and by many much despised, vegetable is likely to be accorded a more honorable place in the galoxy of choice comestibles than it has heretofore enjoyed. It must not be forgotten, however, that not a little culinary skill is required to eliminate the offensive essential oil of the onion which is by no means its chief attraction, although it's most conspicuous feature. A peculiar saccharine substance which reveals itself only after the rank, blistering aromatic oil has been driven away by heat, gives to the onion its most valuable flavoring quality.

THE IRON CONTENT OF LEGUMES (TABLE VI)

The product of a most extraordinary class of plants, the legumes (beans, peas and lentils) are the richest of all vegetable foods in food iron. The lentil, richest of all, contains exactly the same amount of iron per ounce as the egg yolk, a percentage so great that a full day's ration is supplied by six ounces of the raw material. The lentil has been serving the human race as a blood builder from the most ancient time. It was the chief ingredient of the "red pottage" for which Esau sold his birthright. (The Egyptian lentil, popular in the Orient, is red).

Beans, both navy and lima, are almost equally rich in the blood-making element, seven ounces being sufficient for a complete iron ration for a day.

Peas furnish not quite two-thirds as much iron as do lentils, but nine ounces suffice for a day's ration. Even green peas are equally well stocked with iron if the estimate is based upon food values, one hundred calories furnishing one-ninth of a day's requirement of iron.

A knowledge of the high iron content of legumes will be comforting to lovers of beans whose enthusiasm for this New England favorite may have been dampened by the discovery of Prof. Maccollum that the protein of the bean is of low quality and by no means a substitute for an equal amount of animal protein as was formerly believed.

The ruddy and well-nourished condition of the famous Hebrew children who insisted on sticking to their accustomed fare of "pulse", rejecting the juicy venison and mutton chops of the King's table, must have been due, then, to the liberal ration of iron which they received, rather than to a high protein intake. Peas and lentils are just as good for the children of the present generation as for those of Nebuchadnezzar's day.

Legumes, particularly lentils, are deserving of a larger place in the dietary than has heretofore been accorded them. Their use has been restricted somewhat, perhaps, by the fact that much more time and skill are needed to render them an attractive feature of the bill of fare than is required for cereals and vegetables. Many breakfast foods are ready to serve straight from the carton. Oatmeal may be served in ten minutes if the water is already hot. Potatoes go into the oven and out again in half an hour, and other vegetables take care of them-selves in a fireless cooker. But beans need several hours exposure to full cooking heat under carefully regulated conditions to render them acceptable to both the palate and the stomach; and so the bean is not popular with the cooks except in the vicinity of Boston, unless supplied in tins ready cooked from the grocer.

The solution of the bean problem will be found in the pressure cooker, the next improvement needed to equip the complete modern kitchen. At a temperature eight or ten degrees above the boiling point of fresh water beans cook very quickly in an hour easily, and they are improved in flavor also. And still further, the tough woody hulls are so softened that they occasion less disturbance in the intestinal tract, being readily broken up.

And other vegetables such as the cabbage, turnips, and particularly greens of all sorts, are much improved by pressure cooking which they really need because of their large constituent of cellulose.

We cannot dismiss the subject of legumes without a word concerning the wonderful soya bean of Japan and China which is just becoming known in this country. This remarkable legume is three times as rich in mineral salts as our native bean, in addition to its other surprising excellencies its large content of fine oil, its complete protein equal to the fine protein of milk, and its store of the fat soluble, growth promoting vitamine, one of the most costly and precious, as well as most necessary of all food principles.

In Japan infants are sometimes nourished artificially on milk prepared from the soya bean by methods for a long time kept secret. Soya milk is now well known and quite extensively in use in France and England, and likely soon to be introduced into this country. The writer has prepared, experimentally, a quite palatable milk from the soya bean, and has for twenty-five years made use of milk prepared from the almond and other nuts.

Vegetable milks prepared from the soya bean or from the peanut and other nuts will sometime be much more freely used than at present. They render highly valuable service in cases in which there exists in either infants or adults an idiosyncracy against milk, a condition long recognized, and in recent years discovered to be due to the develepement of a sensitivity to the special proteins of milk as the result of which they behave as highly virulent poisons.

The soya will soon be with us in full bloom, and will win its place to the very forefront of our food plants, as soon as we learn how to cook and serve it in palatable ways. For this the pressure cooker is absolutely necessary.

And the soya will supply us also with cheese of fine quality, as well as with milk, and with both salad (sprouted beans) and salad oil.

In the meantime, while the patent pressure cooker is coming, any resourceful housewife may improvise a perfectly good and satisfactory pressure cooker from inexpensive materials close at hand. Get a stone jug or jar that can be hermetically closed. The little stone jars in which apple butter is sometimes sold are well adapted to the purpose. After soaking the beans over night put in the jug with a little salt and enough water to cover, seal up tight and secure the cover well, remembering that the pressure will be from within. Set the jug in a saturated solution of common salt, place over a smart fire and boil for one to two hours. The salt solution boils at a temperature above 220°F. and so the beans are exposed to a higher temperature than in ordinary boiling. This method is equally good for greens, cabbage, and ordinary beans. Cooking at the higher temperature not only softens the cellulose and so renders the foodstuffs tender, but greatly improves the flavor.

THE IRON CONTENT OF GREENS (TABLE VII).

Greens abound in salts, vitamines and cellulose. Their food value is almost wholly based upon these three food essentials. The amount of carbohydrates, protein and fats which they present to the consumer is so small as to be almost negligible. But they are invaluable as the best sort of roughage, a source of the fat-soluble vitamine, one of the most precious of all vitamines being the activator of growth, and lastly, a means of supplying to the tissues in a convenient and agreeable way, the essential requirement of iron and of lime.

Next to legumes, the greens show the highest iron content per ounce of any class of foodstuffs, the average being 6.56 percent of the daily iron ration per ounce. That is, approximately 16 ounces of a mixture of the ten different green-stuffs named in the table furnish iron sufficient for one day. This is of course, more than one could conveniently eat; but a quarter or even a third of this amount may be easily eaten.

Of the ten most valuable "greens", the ones richest in iron are romaine, mustard greens, spinach, turnip tops, and dandelion. As served, the largest proportion of iron is afforded by chard, dandelion, spinach, romaine and turnip tops.

One of the best of all the greens is spinach which supplies in 6 ounces of raw material iron sufficient for a day. Romaine is so richly stocked with iron that only four and a half ounces are needed to meet a day's requirement.

It is important to remark about foods in general and of greens in particular that care must be exercised in cooking to prevent the loss of the lime and iron salts and the equally valuable vitamines. Parboiling, or boiling in water and drawing off and discarding the water in which the greens have been cooked, results in the loss of the greater part of the useful elements of greens. Prolonged cooking at a high temperature is also damaging, and the same seems to be true of drying. It is important to make use of greens as soon as possible after gathering from the garden, while fresh and crisp, when wilted they become tough. Canned greens cannot be regarded as equal in value to freshly gathered material.

It is claimed for the newly perfected method of preparing "evaporated" vegetables that the process does not destroy the vitamines, although they may be somewhat damaged.

The Chinese make large use of greens, according to one authority, using four times as much per capita as is used in this country.

Hindhede of Copenhagen wrote the author some time ago that he had kept a man, subject of experiment, in good health for twenty-three months on a strict diet of bread and potatoes with an abundance of "greens." Without the aid of the greens, a man would soon become anemic on such a diet.

THE IRON CONTENT OF ANIMAL FOODS (TABLE VIII).

Of the three animal foodstuffs, eggs, milk and meats, the first is of highest value as a source for iron.

THE FOOD IRON OF EGGS

The iron of the egg is contained almost wholly in the yolk, where it is stored up for use by the developing chick in making its first outfit of red blood cells. The proportion of iron found in the yolk is one hundred times as great as that found in the white of the egg. This is due to the fact that the yolk is food specially prepared for the young chick while the white is the embryonic tissue which is destined, under favoring conditions, to grow and develop into the bones, muscles, nerves, feathers, and other structures of the full grown fowl.

In other words, the white of the egg corresponds to the flesh of animal which it is destined by nature to become by simple development, while the yolk is the food prepared by nature for the animal, That is, the white represents an Eater while the yolk is an Eatable. Nature makes a clear distinction between Eaters and Eatables which man has muddled and jumbled by indiscriminately consuming the Eater, animal foods, along with the Eatables prepared by Nature as food for both man and animals. The ox eats corn, and so does man. but man also eats the ox, although the ox does not return the compliment. The chicken eats egg yolk, and man does likewise, but when he eats the whole egg, he swallows both the embryo chicken and the stored food intended for it. Man has turned the order of nature topsy turvy in not a small number of ways.

In the case of mammals, the young animal remains connected with the body of the mother until the organs essential to life have been developed, obtaining its food directly from the blood of the mother before birth and in-directly through the mother's milk afterward until able to keep itself from nature's great storehouse of energy, the products of the field and forest.

But the fowl is oviparous, and the young organism in the egg is a prisoner sealed in from the outside world except from the air and heat which penetrate through the thin walls of its prison house. All the nourishment it can receive until developed sufficiently to begin life "on its own" is found in the yolk, which hence must contain everything the growing animal needs to stimulate the vital processes of development and to supply the material needed for building up the varied structures of its body. Everything is there, protein, fat, vitamines, lime,-supplemented by the lime of the shell, iron, a complete and perfect bill of fare,-a wonderful commissary department in which the little soldier of fortune may find ready to hand everything it needs, carefully assorted and stored by Mother Nature's skilled hand.

And so it was quite natural and sagacious for Professor Bunge, of Bale, the world famous expert in the chemistry of living organisms, to begin his studies of the nature of food iron by an analysis of the yolk of the egg.

Professor Bunge found in the egg yolk an iron compound so closely resembling the hemoglobin of the blood corpuscle as to be easily converted into it, and so he gave to the compound the name hematogen which means, in simple terms, generator of blood. Hematogen contains .3 percent of iron and yet all the ordinary laboratory tests for iron failed to reveal its presence. This remarkable fact clearly showed that food iron is a quite different thing from the ordinary metallic iron of the laboratory. The deft hand of Nature working in her secret laboratories, has, through the agency of vital activity, lifted the cold inert iron of the mine and the foundry into the realm of organic life, and has endowed it with marvelous properties by enormously enlarging, one might almost say glorifying one of its natural chemical properties, an affinity for oxygen, shown in the familiar process of "rusting." Ordinary rusting proceeds very slowly. When the oxygen hunger of iron is fully developed as in the hemoglobin of the blood, this oxygen, this rusting, or oxygen absorbing propensity operates with lightning rapidity. All the blood in the body, about five quarts, rushes through the lungs every minute or two, and yet the stream is not so rapid that the subtle hemoglobin does not have time to snatch for each tiny red cell its full load of oxygen, and to concentrate it into a state of such intense chemical activity that, as it circulates about the body, penetrating the most remote and intricate channels of the circulation, it seized with avidity the waste particles which result from wear and tear and burns them into urea and carbonic acid gas, and thus prepares them for quick removal from the body.

In the yolk of egg this wonderful potentized iron, the so-called organic iron, is found in such proportion that eleven yolks provide sufficient to make good to the body one day's iron waste.

Egg white, on the other hand, contains so little iron that the whites of four hundred and sixty eggs would barely supply the amount of organic iron needed for one day.

It is evident that yolk of egg possesses special merit as a source of food iron, although it must also be noted that the iron found by Stoklasa in onions and peas was of the same sort and equally valuable, and the same has been shown by others with reference to lentils, beans, cereals, and other vegetable foods.

It is well worth while to remember that when eggs are used as a source of food iron, to enrich the blood in anemia, it is the yolk only and not the whole egg that is useful. It is also important to note the fact rather recently made known that to be readily digested and utilized eggs must be cooked; not fried, hard boiled, or made into an omelette, but "curdled", that is, cooked at a low temperature, $170^{\circ}F.$ or below. A good plan is to put the eggs into a covered vessel, containing two or three quarts of hot, but not boiling, water and place in a fireless cooker for half an hour or on a sideboard wrapped up with a woolen blanket. The white should be opaque and jellied, but not hard and leathery. Raw egg undergoes very little digestion, but readily putrefies in the intestine. Egg nogg is unwholesome, and the white of egg almost poisonous when raw, sometimes rankly poisonous.

THE IRON OF MILK AND DAIRY PRODUCTS.

Milk, as we have already learned, is deficient in iron. Just why this is the case is one of the secrets of Nature's economy for which no good explanation has been offered. The deficiency is made good for the young animal by a store of iron, borrowed from the mother's blood and laid up in its liver before its birth. This store is sufficient to last during the nursing period or until the animal has become able to take ordinary food.

Evidently, milk is a food naturally adapted only to very young animals whose livers are able to supplement the iron of the food intake. An adult, fed upon milk exclusively, soon becomes anemic because of the exhaustion of his small reserve store of iron. It is not possible to obtain a full ration of iron from milk alone without taking a great excess of food. An ounce of milk contains less than half of one percent of a day's ration of iron (.47 percent), so that more than thirteen pints, or six and one half quarts of milk are barely sufficient to furnish one day's iron supply. This represents a food intake of 4,400 calories, or nearly twice an ordinary day's ration. For this reason, milk feeding should always be accompanied by an abundant supply of greenstuffs and fruits rich in iron but with a small food value.

The deficiency of milk in iron naturally raises the query whether it is by Nature designed to be a food for adult human beings. When man lived in his normal primitive state, subsisting upon his natural or biologic bill of fare, there was notoccasion for the use of milk by adults. Every-thing he needed was supplied to him by the vegetable kingdom, as is still true respecting some primitive forest dwelling men, but in his present artificial, so-called civilized state, man has so far departed from his normal environment and has changed and denatured his food supply to such an extent that his diet has become deficient in many particulars and dangerously unbalanced. This situation has created a pressing need for certain things which are found in milk in rich abundance, especially lime, complete protein, and growth stimulating vitamines. Hence, notwithstanding its deficiency in iron, cow's milk and dairy products are highly important ar articles of food and render invaluable service in balancing the bill of fare by contributing essential salts and vitamines which the cow collects from the wild grasses of the pasture and other foodstuffs rich in lime and vitamines.

And then there are those valuable dairy products, fresh cream cheese and cottage cheese, which contain four times as much iron as does milk, and thus make, when freely used, a distinct contribution to the iron intake.

THE IRON OF MEATS

Meats, fish, flesh, and fowl contain a considerable amount of iron, but it is of an inferior character. An ounce of lean beef contains one four-teenth of a day's iron supply, but of medium fat beefsteak one must eat a pound and a half to get a day's iron ration. And if fish is the sole source of supply, one would needs eat seven and three-quarters pounds to meet his daily iron need. Such quantities of meat would burden the body with a great excess of protein, two to five times the amount needed and safe.

Blood is naturally rich in iron because of the hemoglobin, the special iron-containing element of all animal life. An ounce of blood contains exactly the amount of iron which replaces the daily loss of the body. The red color of meat is due to the blood which it retains, and this is the source of its iron content.

These facts would seem to support the popular idea that red meats possess superior value as blood-making foods; but science does not support this view, but supplies evidence to the contrary.

Many years ago when the writer was a medical student at Bellevue Hospital Medical School. a patient was one day brought before a small class of special students of which the late Professor E. G. Janeway was the teacher. The patient was suffering from a very pronounced form of anemia. Under advice of his physician he had been making daily visits to one of the big city slaughter houses to drink a glassful of the warm blood caught as it gushed from the cut throat of a slaughtered animal. This he had done for several weeks as many others were doing at that time, but without any apparent benefit. In each glassful of blood the patient had taken six or seven times as much iron as his body needed to make good the daily waste, but no change for the better had been observed; and Professor Janeway remarked that this was the usual disappointing result.

The drinking of blood never became a popular fad, as might have been the case if it had been less repulsive; but the false and useless notion still survivesin the use of beef juice and a whole tribe of loathsome nostrums consisting chiefly of blood, such as bovinine and its various imitations.

Another form of survival of the idea that red meat makes red blood is found in the almost universal practice among physicians of urging their anemic and debilitated patients to eat freely of red meats, roast beef and beefsteak, and to make free use of beef juices. The Salisbury steaks are now seldom seen or heard of, but beef products and other meat preparations have in a measure taken their place.

The absurdity of these popular practices becomes fully apparent when the fact is known that science has demonstrated that the iron of the blood and of meat is not readily utilized by the body, or at least that it is less easily assimilated and made into blood than is the organic iron of eggs, milk and vegetable foods. In summing up the evidence upon this subject Sherman says that the iron of meats is " of distinctly lower nutritive value than the iron compounds of milk, eggs and foods of vegetable origin". The reason for this is apparent. Not long ago the writer when cruising along the Atlantic noted near the shore a stranded vessel that was being torn to pieces by the waves. On inquiry why the extensive quantities of precious materials which were used in the construction of the ship at a cost of many thousands of dollars were not removed and utilized, the answer came back, "Because it would cost more to convert them into usable form than they are worth." There has recently been much discussion about the disposal of the German war-ships. The opinion expressed by many great military and naval experts has been that it would be cheaper to sink the ships than to try to break them up and salvage the iron and machinery.

The same thing seems to be true of the iron of flesh. It has been used once and cannot be economically used again. Nature is a great economist and does not let a particle go to wante that can be salvaged. If blood iron could be utilized, there would be no occassion for worry about the iron intake, for practically all the iron waste is from the blood. Some of the blood iron is saved, but a portion cannot be utilized and hence is cast out of the body through the intestines.

If the blood were readily available for replenishing the wasting iron stores of the body, carnivorous animals would never suffer from anemia, and vegetable eating animals would be especially subject to blood impoverishment; but the very opposite is the case. Carniverous animals are far more subject to anemia than are herbivorous or grass eating animals (Sherman). And where does the ox find iron for making his rich red blood if not in the green grass on which he feeds. It seems that "original sources" are of as much consequence in the matter of iron supply as in so many other of our every day affairs.

Herter observed that the stools(bowel discharges) of flesh eating animals are highly putrescent and poisonous, whereas those of herbivorous and other vegetable eating animals are not. He also observed that persons suffering from anemia have highly putrescent stools, a fact which suggests a possible cause for the anemia of meat eating animals and flesh eating men and women --a common observation. Two causes are at work, the poisons absorbed from the intestines destroy the blood and disturb the blood-making processes, and the iron of the meat and blood eaten is of poor quality and hence is poorly utilized. The meat at the same time increases the putrefaction, the poisons become still more virulent, a vicious circle is formed, and rhe mischief multiplies.

Says the eminent Van Norden respecting the feeding of children, and the same principles apply with equal force to the feeding of adults,--

" The necessity of a generous supply of vegetables and fruits must be particularly emphasized. They are of the greatest inportance for the normal development of the body and of all its functions. As far as children are concerned, we believe we could do better by following the dietary of the most rigid vegetarians than by feeding the children as though they were carnivora, according to the bad custom which is still quite prevalent.....
If we limit most important sources of iron,--the vegetables and the fruits,--we cause a certain sluggishness of blood formation and an entire

lack of reserve iron, such as is normally found in the liver, spleen, and bone marrow of healthy, well-nourished individuals."

To this Sherman adds,--

"In an experimental dietary study made in New York City it was found that a free use of vegetables, whole wheat bread, and the cheaper sorts of fruits, with milk but without meat, resulted in a gain of 30 percent in the iron content of the diet while the protein, fuel value, and the cost remained practically the same as in the ordinary mixed diet obtained under the same market conditions." To which we may justly add that the iron from vegetable sources was not only cheaper in price, and hence more abundant, but superior in quality.

THE IRON CONTENTS OF SPECIAL FOOD PREPARATIONS (HEALTH FOODS).

All the gluten preparations are very rich in iron which is closely associated with the gluten of the wheat kernel. Pure gluten supplies, per ounce, four times as much iron as does egg yolk or lentils and more than ten times as much as lean beef. This places it far ahead of all other food products as a cource of food iron. Even 20 percent gluten contains more than double as much food iron as beef tenderloin, and of far better quality (Sherman). Gluten preparations deserve more consideration than they have heretofore received in the feeding of anemic persons.

Protose, a vegetable meat prepared from wheat, gluten and nuts, offers twice as much food iron per ounce as does beef, and three times as much per 100 calories.

Nuttolene, a vegetable meat prepared from peanuts, contains per 100 calories twice as much food iron as does beef.

Malt sugar contains much more iron than does any of the cereals, supplying in one ounce one-ninth of a day's iron ration while cane sugar contains no iron at all.

Malted Nuts supplies more than one-twelfth of a full day's iron ration in one ounce of dry product, while an ounce of dry milk contains less than half as much.

The glutens, Protose, Nuttolene, Malt Sugar, and Malted Nuts are all rich in iron and lime and are useful in balancing the bill of fare for these necessary food constituents.

TABLE I.

THE IRON CONTENT OF FOODSTUFFS

The following table shows in column (1) the amount of food iron calculated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration (.213 grains) in one ounce. (3) The amount (ounces) of foodstuff required for one day's iron ration. (4) The percent of the iron ration found in 100 calories. (5) The weight in ounces of 100 calories. (6) The weight in ounces of an ordinary serving. (7) The number of calories in an ordinary serving.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Almonds	.0171	7.35	13.6	4.0	.5	.5	10
Apples	.0013	.56	177.7	3.2	5.6	5.0	100
Apples, dried	.0065	2.80	35.5	3.2	1.2	1.2	100
Apple Juice	.0009	.39	256.6	3.0	6.0	6.0	100
Apricots	.0013	.56	177.7	3.5	6.1	3.0	50
Apricots, dried	.0061	2.64	38.0	3.5	1.1	.6	50
Asparagus	.0044	1.90	52.5	30.0	15.7	1.6	10
Bananas	.0026	1.12	90.0	4.0	3.5	3.5	100
Barley, entire	.0179	7.75	13.0	7.6	1.7		
Barley, pearled	.0088	3.80	26.2	3.8	1.0	3.5	100
Beans, dry	.0306	13.25	7.5	13.5	1.0	3.2	125
Beans, lima, dry	.0306	13.25	7.5	13.3	1.0	2.25	25
Beans, lima, fresh	.0088	3.80	26.0	10.7	2.9	4.0	25
Beans, soya	.0248	10.73	9.3	9.2	.86	.86	100
Beans, string, fresh	.0048	2.08	48.0	17.7	17.0	4.0	25
Beef, all lean	.0170	7.36	13.6	30.0	4.0	4.0	100
Beefsteak, med. fat	.0097	4.20	24.0	10.48	2.5	4.0	160
Beets	.0026	1.12	90.0	9.0	7.6	2.2	25
Blackberries	.0026	1.12	90.0	7.0	5.9	3.0	50
Bread, Boston Brown	.0131	5.6	17.5	9.0	1.2	1.2	100
Blood	.2301	100.0	1.0				
Blueberries	.0039	1.7	53.0	8.0	4.7	2.5	50
Bread, entire wheat	.0070	3.03	33.0	4.3	1.4	2.0	150
Bread, Graham	.0109	4.70	21.0	6.4	1.3	2.0	150

							b
Bread, rye	.0070	3.03	33.0	2.6	1.4	2.0	150
Bread, entire rye (pumpernickel)	.0088	3.81	26.8	6.5	1.7	2.0	120
Bread, white	.0039	1.70	58.0	2.3	1.3	2.0	150
Bread, fruit							
Brose	.0200	8.6	11.5	8.6	1.0	1.0	100
Brussels sprouts	.0048	2.08	48.0	23.4	11.3	,3	25
Buckwheat flour	.0053	2.30	43.6	2.3	1.0	1.0	100
Butter	.0009	.40	2256.6	.2	.46	.5	100
Buttermilk	.0011	.50	210.0	4.7	10.0	6.0	60
Cabbage	.0048	2.08	48.0	23.4	11.0	4.0	25
Cabbage greens	.0079	3.40	29.0	30.0	11.0	4.0	25
Cantaloupe	.0013	.56	178.0	4,7	9.0	7.0	75
Carrots	.0026	1.12	90.0	9.0	7.3	3.7	50
Cauliflower	.0026	1.12	90.0	13.0	11.0	3.0	25
Celery	.0022	.95	105.0	18.0	18.0	1.0	5
Chard	.0100	4.70	21.0	44.0	8.7	3.0	35
Cheese	.0057	2.42	40.5	2.0	.77	.5	65
Cheese, cottage	.0042	1.82	55.0	5.8	3.2	2.0	60
Cheese, yogurt	.0043	1.84	51.0	1.7	.93	.5	50
Cherries	.0018	.78	128.0	3.4	4.7	2.55	50
Cherry juice	.0013	.56	177.7	2.5	4.6	5.0	100
Chestnuts	.0031	1.30	77.0	2.0	1.4	1.5	100
Chicken	See beef.						
Cocoanut, fresh	.0051	2.21	45.5	2.0	.9	1.0	110
Corn, whole	.0127	5.50	18.0	5.0	1.0		
Cornmeal	.0039	1.70	58.0	2.0	1.0	4.5	75
Corn, sweet, fresh	.0035	1.50	66.0	4.8	3.5	2.7	75
Corn, sweet, dried	.0127	5.50	118.0	5.5	1.0	1.0	100
Cow peas							

Cottenseed meal							
Crackers	.0066	3.0	35.0	2.4	.9	1.0	110
Cranberries	.0026	1.12	90.0	9.0	7.5	33.0	40
Cream	.0010	.43	231.0	.7	1.8	2.2	125
Cucumbers	.0009	.40	255.6	8.0	20.0	2.0	10
Currants, fresh	.0022	.94	110.0	6.0	6.0	3.0	50
Currants, dried, zante	.0109	4.72	21.0	6.0	1.1	1.5	135
Dandelion greens	.0118	5.11	19.4	30.0	5.5	3.0	50
Dates	.0131	5.67	17.5	6.0	1.0	1.0	100
Eggplant	.0022	.95	110.0	12.3	12.3	1.5	10
Eggs	.0131	5.67	17.5	13.6	2.4	1.8	75
Egg, one(1.8 oz.)	.0244	10.54				1.8	75
Eggwhite	.0004	.17	580.0	1.3	4.7	1.0	12.5
Eggwhite of one egg (1.2 oz)	.0005	.20				1.2	15
Eggyolk	.0376	16.32	6.0	15.3	.94	1.0	100
Eggyolk of one egg (.6 oz)	.0226	9.8				.6	60
Endive	.0106	4.6	20.0	50.5	11.0	33.0	25
Farina	.0035	1.51	65.6	1.5	1.0	1.0	100
Figs, dried	.0131	5.67	17.5	6.3	1.1	2.0	180
Figs, fresh	.0044	1.47	52.5	6.3	3.4	2.0	60
Fish (haddock)	.0029	1.3	80.0	6.3	3.0	6.0	200
Flour, buckwheat	.0053	2.30	45.6	2.3	1.0		
Flour, entire wheat	.0110	4.72	21.0	4.7	1.0		
Flour, graham	.0162	7.0	15.5	7.0	1.0		
Flour, white	.0044	1.90	52.5	1.5	1.0		
Flour, rye	.0057	2.47	40.5	2.5	1.0		
Flour, rye entire	.0146	6.54	16.0	6.3	1.0		
Gooseberries	.0022	.95	105.0	6.0	6.0	2.5	40
Grapefruit	.0013	.56	177.0	4.0	6.7	3.5	50

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Grapes	.0013	.56	177.0	2.0	3.6	3.6	100
Grapejuice	.0013	.56	177.0	2.0	4.0	4.0	100
Guava							
Hazelnuts	.0179	7.75	13.0	4.0	.5	.5	100
Hominy	.0040	1.69	58.0	1.7	1.0	1.0	100
Honey	.0031	1.34	77.0	2.0	1.1	1.6	150
Huckleberries	.0039	1.69	58.0	8.0	5.0	2.5	50
Kehl-rabi	.0026	1.12	90.0	9.0	8.0	4.0	35
Lemon juice	.0026	1.12	90.00	9.0	8.0		
Lentils, dried	.0377	16.32	6.1	19.5	1.1	3.0	100
Lettuce	.0031	1.34	74.5	52.3	18.4	1.0	5
Linseed meal							
Maple Syrup	.0121	.57	17.5	7.0	1123	1.3	100
Malted Nuts	.0192	8.3	12.0	5.5	.7	1.3	200
Macaroni	.0053	.51	43.6	2.2	1.0	3.0	100
Meat (tenderloin)	.0131	6.00	17.6	7.0	1.2	2.4	200
Mango							
Milk, whole	.0011	.47	210.0	2.3	5.1	6.0	120
Milk, buttermilk	.0011	.50	210.0	4.7	10.0	6.0	75
Milk, skimmed	.0011	.47	210.0	4.5	9.6	6.5	65
Milk, Condensed sweetened	.0026	1.12	90.0	1.3	1.1	2.0	180
Milk, human	.0023		100.0	5.0		5.0	100
Milk, camels							
Milk, goats							
Milk, sheep							
Molasses	.0320	1.38	7.3	17.0	1.2	1.2	100
Millet							
Mushrooms							
Muskmelon	.0013	.56	175.0	5.3	8.8	7.0	75
Mustard greens	.0213	9.22	10.0			3.0	
Oatmeal	.0166	7.19	14.0	6.4	.9	4.2	75
Okra							
Olives	.0127	5.49	18.0	6.5	1.2	1.2	100

Onions	..0026	1.12	90.0	.0	7.2	2.5	35
Oranges	.0009	1.69	256.6	2.6	6.8	5.0	75
Orange juice	.0009	1.69	256.6	3.0	8.0	6.0	75
Paprika							
Parsnips	.0026	1.12	90.0	6.0	5.4	3.0	55
Peaches	.0023	.56	180.0	5.0	8.0	4.0	50
Peaches, dried	.0052	2.29	45.0	5.0	4.0	2.0	50
Pears	.0013	.56	180.0	3.1	5.5	4.0	75
Pear juice							
Peas, dry	.0249	10.78	9.2	11.0	1.0	3.0	100
Peas, green	.0074	3.16	31.0	11.3	3.5	3.5	100
peanuts	.0088	3.81	26.2	2.4	.6	.6	100
Pecan nuts	.0114	4.93	20.3	2.3	.5	.5	100
Persimmons							
Pineapple	.0022	.95	105.0	8.0	8.1	4.0	50
Plums	.0022	.95	105.0	4.0	4.1	4.0	100
Potatoes	.0057	2.47	40.5	10.4	4.2	3.0	75
Potatoes, sweet	.0022	.95	105.0	2.6	2.8	3.5	100
Protose	.0249	10.8	9.2	21.5	2.0	2.0	100
Prunes, dried	.0131	5.67	17.5	7.0	1.2	3.7	100
Pumpkin	.0035	1.51	66.0	8.7	13.6	3.5	25
Radishes	.0026	1.12	90.0	13.7	11.9	1.0	6
Raisins	.0092	4.00	25.0	9.2	1.0	1.0	100
Raspberries	.0026	1.12	90.0	6.0	5.3	4.0	75
Raspberry juice							
Rice, polished	.0039	1.68	58.0	1.7	1.0	4.0	125
Rice, brown	.0088	3.81	26.0	4.0	1.0	1.0	100
Romaine	.0525	22.73	64.0			3.0	
Rutabagas							
Rye flour	.0057	2.47	40.5	2.5	1.0	1.9	100
Rye, entire	.0171	7.40	13.4	9.6	1.3	1.3	100
Spinach	.0158	6.84	14.6	100.4	15.0	3.0	28

Squash	.0026	1.12	80.0		7.6	3.7	50
Strawberries	.0035	1.51	66.0	13.7	9.4	4.0	45
Tapioca	.0070	3.03	33.0	3.0	1.0	1.0	100
Tomatoes	.0018	.78	128.0	11.7	13.3	4.0	25
Tomato juice							
Turnips	.0022	.95	105.0	8.5	9.0	4.5	50
Turnip tops	.0152	6.56	14.0			3.0	
Walnuts	.0092	4.00	25.0	2.0	.5	.5	100
Watercress	.0083	3.60	28.0			1.5	10
Watermelon	.0013	.56	177.7	6.6	11.6	8.0	75
Wheat, entire	.0219	9,50	10.55	9.0	1.0	5.7	150
Wheat bran	.0341	14.76	6.7	17.7	1.2	.5	43
		Av. 3.25		Av. 6.38			

Iron - Table I--addendum

THE IRON CONTENT OF HEALTH FOODS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Protose	.0249	10.8	9.2	21.5	2.0	2.0	100
Nuttolene	.0172	7.4	13.5	14.8	2.0	2.0	100
Gluten, pure	.1437	61.3	1.5	64.3	1.0	.5	50
Gluten, 40%	.0600	26.0	3.85	26.0	1.0	1.0	100
Gluten, 20%	.0300	13.0	7.7	13.0	1.0	1.0	100
Savora	.0260						
Brose	.0200	8.6	11.5	8.6	1.0	1.0	100
Malt Sugar	.0214	9.3	10.8	9.3	1.0	2.0	200
Malted Nuts	.0192	8.3	12.0	5.5	.7	1.3	200
Nut Soup Stock	.0276						

Vita bread .0112

Iron--Table Ia

Foods Rich In Iron

The following table shows in column (1) the amount of food iron calculated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration(.213 grains) in oneounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Almonds	.0171	7.35	4.0	100
Barley, entire	.0179	7.75	7.6	100
Barley, pearled	.0088	3.80	3.8	100
Beans, dry	.0306	13.25	13.5	125
Beans, soya	.0248	10.73	9.2	100
Beans, lima, dry	.0306	13.24	13.3	25
Beans, lima, fresh	.0088	3.80	10.7	25
Beef, all lean	.0170	7.36	30.0	100
Beefsteak (Med. fat)	.0097	4.20	10.5	160
Bran, wheat	.0341			
Bread, Boston Brown	.0131	5.6	9.0	100
Bread, graham	.0109	4.70	6.4	150
Bread, entire wheat	.0070	3.03	4.3	150
Bread, entire rye (pumpernickel)	.0088	3.81	6.5	120
Cabbage greens	.0079	3.40	30.0	25
Chard	.0100	4.70	44.0	35
Corn, whole	.0127	5.50	5.0	
Corn, sweet, dried	.0127	5.50	5.5	100
Currants, dry, Zante	.0109	4.72	6.0	140
Dandelion greens	.0118	5.11	30.0	50
Dates	.0131	5.67	6.0	100
Eggs	.0131	5.67	14.0	70
Egg yolk	.0377	16.32	15.3	110
Endive	.0106	4.6	50.5	25
Figs, dry	.0131	5.67	6.3	180
Flour, entire wheat	.0110	4.72	4.7	

Bran, rye, .0140

Flour, graham	.0162	7.00	7.0	
Flour, rye entire	.0146	6.34	6.5	
Hazelnuts (filberts)	.0279	7.75	4.0	100
Lentils, dry	.0377	16.32	19.5	100
Molasses	.0320	1.38	17.0	100
Mustard greens	.0213	9.22		
Oatmeal	.0166	[illegible]	66.4	75
Olives	.0127	6.49	6.5	100
Peas, dry	.0249	10.78	11.0	100
Pecan nuts	.0114	4.93	2.3	100
Prunes, dry	.0131	5.67	7.0	100
Raisins	.0092	4.00	9.2	100
Rice, brown	.0088	3.81	4.0	100
Romaine	.0525	22.73		
Rye, entire	.0171	7.40	9.6	100
Spinach	.0158	6.84	100.4	20
Turnip tops	.0152	6.58		
Walnuts	.0092	4.00	2.0	100
Wheat, entire	.0219	9.50	9.0	150
Wheat bran	.0341	14.76	17.7	43

Iron-- Table II.

The Iron Content of Fruits.

The following table shows in column (1) the amount of food iron calculated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration (.213 grains) in one ounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Apples	.0013	.56	3.2	100
Apples, dried	.0065	2.80	3.2	100
Apple juice	.0009	.39	3.0	100
Apricots	.0013	.56	3.5	50
Apricots, dry	.0061	2.64	3.5	50
Bananas	.0026	1.12	4.0	100
Blackberries	.0026	1.12	7.0	50
Blueberries	.0039	1.7	8.0	50
Breadfruit				
Cantaloupe	.0013	.56	4.7	75
Cherries	.0018	.78	3.4	50
Cherry juice	.0013	.56	2.5	100
Cranberries	.0026	1.12	9.0	40
Currants, fresh	.0022	.94	6.0	50
Currants, dry, Zante	.0109	4.72	6.0	140
Dates	.0131	5.67	6.0	100
Figs		5.67	6.3	180
Figs, fresh	.0144	1.47	6.3	60
Gooseberries	.0022	.95	6.0	40
Grapefruit	.0013	.56	4.0	50
Grapes	.0013	.56	2.0	100
Grapejuice	.0013	.56	2.0	100
Guava				
Huckleberries	.0039	1.69	8.0	50
Lemon juice	.0026	1.12	9.0	

Table II.

				k
Mango				
Muskmelon	.0013	.66	5.3	73
Olives	.0127	5.49	6.5	100
Oranges	.0009	1.69	2.6	75
Orange juice	.0009	1.69	3.0	75
Peaches	.0013	.56	5.0	50
Peaches, dry	.0052	2.29	5.0	50
Pears	.0013	.56	3.1	75
Pear juice				
Persimmons				
Pineapple	.0022	.95	8.0	50
Plums	.0022	.95	4.0	100
Prunes, dry	.0131	5.67	7.0	100
Raisins	.0092	4.00	9.2	100
Raspberries	.0026	1.12	6.0	75
Raspberry juice				
Strawberries	.0035	1.51	13.7	45
Tomatoes	.0018	.78	11.7	25
Tomato juice				
Watermelon	.0013	1.74	5.6	75

Iron-- Table II a.

FRUITS WHICH HAVE THE LARGEST IRON CONTENT.

	(1)	(2)	(4)	(7)
Currants, dry, Zante	.0109	4.72	6.0	135
Dates	.0131	5.67	6.0	100
Figs, dry	.0131	5.67	6.3	180
Olives	.0127	5.49	6.5	100
Prunes	.0131	5.67	7.0	100
Raisins	.0092	5.2	6.8	100

Iron --Table IIIa.

THE IRON CONTENT OF NUTS

The following table shows the iron content of nuts. Column (1) gives the amount of food iron calculated as grains of metallic iron in one ounce of foodstuffs. (2) The percent of one day's iron ration (.213 grains) in one ounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Almonds	.0171	7.35	4.0	100
Chestnuts	.0031	1.30	2.0	100
Coconut, dry				
Coconut, fresh	.0051	2.21	2.0	110
Hazelnuts (filberts)	.0179	7.75	4.0	100
Peanuts	.0088	3.88	2.4	100
Pecan nuts	.0114	4.93	2.3	100
Walnuts	.0092	4.79	2.67	100

0 Iron--Table IV

THE IRON CONTENT OF CEREALS AND BREADS

The following table shows in column (1) the amount of food iron calculated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration (.213 grains) in one ounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Barley, entire	.0179	7.75	7.6	
Barley, pearled	.0088	3.80	3.8	100
Bread, Boston Brown	.0131	5.6	9.0	100
Bread, entire wheat	.0070	3.03	4.3	150
Bread, graham	.0109	4.70	6.4	150
Bread, rye	.0070	3.03	2.6	150
Bread, entire rye (pumpernickel)	.0088	3.81	6.5	120
Bread, white	.0039	1.70	2.3	150
Corn, whole	.0127	5.50	5.0	
Cornmeal	.0029	1.70	2.0	75
Cottonseed meal				
Crackers	.0066	3.00	2.4	110
Farina	.0035	1.51	1.5	100
Flour, buckwheat	.0053	2.30	2.3	
Flour, entire wheat	.0110	4.72	4.7	
Flour, graham	.0162	7.00	7.0	
Flour, white	.0044	1.90	2.5	
Rlour, rye	.0057	2.47	2.5	
Flour, rye entire	.0146	6.34	6.3	
Hominy	.0040	1.69	1.3	100
Linseed meal				
Macaroni	.0053	.51	2.2	100
Millet				
Oatmeal	.0166	7.19	6.4	75

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Rice, polished	.0039	1.68	1.7	125
Rice, brown	.0088	3.81	4.0	100
Rye flour	.0057	2.47	2.5	100
Rye, entire	.0171	7.40	9.6	100
Tapioca	.0070	3.03	3.0	100
Wheat, entire	.0219	3.9	4.3	150
Wheat, bran	.0341	4.2		
Wheat, germ				

Iron-- Table V

THE IRON CONTENT OF VEGETABLES

The following table shows in column (1) the amount of food iron calculated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration (.213 grains) in one ounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Asparagus	.0044	1.90	30.0	10
Beans, lima, fresh	.0088	3.80	10.7	25
Beans, string, fresh	.0048	2.08	17.7	25
Beets	.0026	1.12	9.0	25
Brussels Sprouts	.0048	2.08	23.4	25
Cabbage	.0048	2.08	23.4	25
Carrots	.0025	1.12	9.0	50
Cauliflower	.0036	1.12	13.0	25
Corn, sweet, fresh	.0035	1.50	4.8	75
Cucumbers	.0009	.40	8.0	10
Eggplant	.0022	.95	12.3	10
Kohl-rabi	.0026	1.12	9.0	35
Mushrooms				
Okra				
Onions	.0026	1.12	7.0	35
Parsnips	.0026	1.12	6.0	55
Potatoes	.0057	2.47	10.4	75
Potatoes, sweet	.0022	.95	2.6	100
Pumpkin	.0035	1.51	8.7	25
Radishes	.0026	1.12	13.7	6
Rutabagas				
Squash	.0026	1.12	.9	50
Turnips	.0022	1.47	11.4	50

Iron--Table VI

THE IRON CONTENT OF LEGUMES

The following table shows in column (1) the amount of food iron eql-culated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration (.213 grains) in one ounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Beans, dry	.0306	13.25	13.5	125
Beans, lima, dry	.0306	13.25	13.3	25
Beans, soya	.0248	10.73	9.2	100
Cow peas				
Cottonseed meal				
Lentils, dry	.0377	16.32	19.5	100
Linseed meal				
Peas, dry	.0249	10.78	11.0	100
Peas, green	.0074	11.35	13.7	100

Mineral Contents of Greens.

	H_2O	Ash		CaO		Fe		Lime		Iron	
	%	% dry	Moist	dry	moist	dry	moist	(1)	(2)	(1)	(2)
	First	Analysis		2.53		.015					
1 Mt Spinach	85.6	23.0	3.3	2.04	.29	.0135	.0019	1.27	8.5	.008	3.9
2 Lamb's Quarter	85.3	23.3	3.4	2.95	.43	.0142	.0021	1.90	12.5	.009	4.3
3 Red Root	81.9	17.6	3.2	3.94 4.08	.74	.036 .0347	.0063	3.24	21.6	.026	12.9
4 Purslane	91.1	16.9	1.7	1.65 2.06	.20	.0175 .0196	.0019	.88	5.8	.008	3.9
5 Rainbow Chard	90.9	20.3	1.8	1.8	.16	.0227	.0021	.70	4.7	.009	4.3
6 New Zealand Spinach	92.3	23.9	1.8	1.48	.11	.0264	.0020	.48	3.2	.009	4.1
7 Quinoa	88.7	23.5	2.7	1.45	.16	.011	.0012	.70	4.7	.005	2.7
8 Turnip Tops	93.3	19.1	1.3	3.59	.24	.0343	.0023	1.05	7.0	.010	4.7
9 Narrow Leaved Dock	86.6	14.5	2.0	1.66	.23	.0478	.0065	1.00	6.7	.023	13.8

Kale 80 .34 .0023

Iron--Table VII

THE IRON CONTENT OF GREENS

The following table shows in column (1) the amount of food iron calculated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration (.213 grains) in one ounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Celery	.0022	.95	18.0	5
Chard	.0100	4.70	44.0	35
Dandelion greens	.0118	5.11	30.0	50
Endive	.0106	4.6	50.5	25
Lettuce	.0031	1.34	52.3	5
Mustard greens	.0213	9.22		
Paprika				
Romaine	.0525	22.73		
Spinach	.0158	6.84	100.4	20
Turnip Tops	.0152	6.58		
Watercress	.0083	3.60		10
		Av. 6.56 Av	Av.46.4	

Iron--Table VIII

THE IRON CONTENT OF ANIMAL FOODS

The following table shows in column (1) the amount of food iron calculated as grains of metallic iron in one ounce of foodstuff. (2) The percent of one day's iron ration (.213 grains) in one ounce. (4) The percent of the iron ration found in 100 calories. (7) The number of calories in an ordinary serving.

Dairy Products

	(1)	(2)	(4)	(7)
Milk, whole	.0011	.47	23	170
Milk, skimmed	.0011	.47	4.5	65
Milk, condensed sweetened	.0036	1.12	1.3	180
Buttermilk	.0011	.50	4.7	75
Cheese	.0057	2.42	2.0	65
Cheese, cottage	.0042	1.82	5.8	60
Cheese, yogurt	.0043	1.84	1.7	50
Cream	.0010	.43	.7	125
Butter	.0009	.40	2.86	100
Whey				
Milk, Human	.0023	1.05	5.0	100

Eggs

	(1)	(2)	(4)	(7)
Eggs	.0111	5.67	1.36	60
Egg, one(1.86oz.)	.0244	10.54		80
Egg yolk	.0376	16.32	15.3	100
Egg yolk on one egg (6 oz.)	.0226	9.4		60
Egg white	10004	.17	1.3	14
Egg white, one egg (1.26 oz.)	.0005	.20		17

Meats

	(1)	(2)	(4)	(7)
Beef, all lean	10170	7.36	30.0	100
Beefsteak, med. fat	.0097	4.20	10.48	160
Chicken	See Beef.			
Fish	.0029	1.3	15.3	200
Blood	.2301	2.8		

THE NUTRITIVE VALUE OF LIME

by J. H. Kellogg, M. D.

Taken by itself, in its mineral form, lime possesses no food value, or at least only under exceptional circumstances, as when the body is deprived wholly of lime from other sources. Even then, mineral lime can beeutilized only in the very small quantities. It was, indeed, long a mooted question among physiologists whether inorganic lime ever could be utilized by the animal organism. In recent years carefully conducted experiments by Mendel and Osborn, as well as other investigators, have shown that when an anim al is fed with food from which lime has been excluded, the deficiency may be made up by feeding inorganic lime; but it is evident that this use of mineral lime is exceptional and the biologic law that vegetables feed upon mineral substances and animals upon organic matters build up by vegetable organisms working under the influence of the sun's rays, still holds good.

Recent experimental studies in the feeding of animals have placed in a very clear light the importance of lime as a constitutent of the food. The facts recently emphasized are not altogether new, but the need of giving constant and special attention to the lime content of foodstuffs is in the light of recent studies now more fully appreciated than ever before.

A few facts concerning the uses of lime in the body will be of interest.

The great importance of lime is suggested by the fact that this one element constitutes fully three-fourths of the total mineral content of the human body. The body of a man weighing 154# contains about 4½# of lime, or 3% of the body weight.

Nearly all the lime of the body (99%) is found in the bones, the soft parts containing only 1% of the total lime content of the tissues. This fact explains the deficiency of lime in flesh foods.

All the elements of the tissues are in a state of constant change. This is true of the salts and of the lime as well as of other food essentials. An adult loses two-thirds of a gram or about ten grains of lime, daily, the waste lime being excreted chiefly through the intestine, but to some extent through the kidneys. This loss of lime is constant, even during fasting. It is evident, then, that in order that the store of lime in the body should be kept intact, the daily food supply must contain not less than ten grains of lime. In fact, to provide for emergencies and the failure of the absorbents to take up all the lime contained in the food it is found to be necessary to supply in the food about fifty percent more than the actual requirements of fifteen grains of lime daily. Some authorities demand more than this.

Unfortunately, the food commonly eaten does not always contain this amount. Inddéd, Dr. Sherman of Columbia University calculates that at least half the people of the United States are suffering from lime starvation. Probably lime is more often deficient in the dietary of the average American than any other element with the exception of iron and cellulose, or woody fibre needed for roughage.

The fact that lime is found in every bodily tissue, bones, soft tissues, blood and other fluids, indicates its universal importance in the body.

1. To the bones it gives solidity. The bones of the adult are more than half lime. The amount of lime in the bones is so great that a burned bone retains its form even through the animal part has been wholly destroyed by fire.

2. The ability of the muscles to contract and to do work depends not alone upon their development and to the presence of fuel sugar in the blood and glycogen in the muscles, but also upon just the right proportion of lime in the blood.

3. The blood contains a very small proportion of lime, only about $5\frac{1}{2}$ grains to the pint (cow's milk contains fifteen times as much) but this small amount is absolutely essential to maintain the normal beating of the heart through its influence upon the heart muscle. The mammal heart has been kept beating for hours after removal from the body by passing through it a solution of lime and other blood salts.

4. Again it is known that the presence of this minute amount of lime in the blood is essential to enable the blood to coagulate as in clotting to stop the flow of blood from a wounded vessel.

A careful surgeon always examines the patient's blood and determines the coagulation time before undertaking a serious operation. When coagulation is delayed, lime is administered for a few days before the operation is performed.

The relation of lime to the development of the bones is well shown by an experiment upon puppies. Those fed on lean meat and fat only, had soft and flexible bones. Puppies to which bones were given, gnawed at the bones and thus obtained the necessary lime development normally.

Voit, an eminent physiologist who devoted his life to the study of food problems, fed pigeons for a year on foodstuffs which were greatly deficient in lime. There seemed to be no change in the birds which appeared to be in perfect health, but after they were killed, careful examination showed that while the leg and wing bones contained the normal amount of lime, the bones of the head were almost wholly deprived of lime being greatly thinned, and at some points actually perforated. Evidently the body had sought to maintain the normal blood content of lime by robbing those parts of the skeleton from which it could best be spared. The leg bones being spared because of the need of preserving their rigidity for purposes of locomotion.

Sherman, of columbia, repeated Voit's experiment, employing monkeys instead of pigeons. The results were the same. The leg and arm bones did not suffer m much, but the skull bones lost their lime almost altogether, becoming so thin that they could be crushed between the thumb and fingers as easily as an eggshell.

Some years ago the authorities in charge of the London Zoo observed that the lions were deformed, bowlegged, clubfooted, dwarfed and always died young, Treves, an eminent London surgeon, was consulted. He noted the evidences of rickets and asked about the food given them. He was informed that they were given the very best of meats. He suggested the feeding of bones and bone meal. His advice being followed, the deformities soon dissapeared, and the cubs ceased to die prematurely.

The cave dwellers, who in prehistoric times were compelled by the rigors of the ice age to subsist on the flesh diet, rounded out their diet by splitting bones and eating portions of them, especially the marrow.

According to Cobez de Baca, one of the Spanish explorers of the Texas Coast in the sixteenth century, the natives of that region carefully saved the bones of fishes and other small animals and ate them after reducing them to powder in stone mortars.

The lack of lime in the food is no doubt one cause of the increasing prevalence of bone disease in civilized countries, and may be responsible for the early decay of the teeth which is becoming so nearly universal that the development of a toothless race is threatened. Evidently the teeth suffer loss of lime along with the other bony structures of the head.

Hart and Steenback showed that milch cows require food containing a large amount of lime. If such food is not supplied their bones are robbed of lime. Nature takes care to see that milk, the sole food of the very young animal, contains an adequate amount of lime, even at the expense of the mother.

This interesting observation explains the negative results of a very plausible theory advanced many years ago as the basis for a plan for securing painless childbirth. Expectant mothers were told to avoid milk, grains, and lime containing vegetables, and to make their diet consist chiefly of fruits and nuts which are very poor in lime. The idea was that in so doing the bones of the infant would contain less lime and the infant head, the chief cause of suffering would thus be less rigid and would easily mould itself to the outlet of the pelvis. Hundreds tried the food formula for "painless" childbirth, but the results were most disappointing. Experiments upon animals showed that no matter how much the lime in the mother's food was reduced, the bones of the offspring always contained the normal amount. The mother's bones were robbed to make good the deficiency of lime in the food.

Here also is found perhaps an explanation of the remarkable tendency to decay of the teeth which often appears in the last months of pregnancy, a fact long known but not explained. Recent studies conducted by members of the facult of the dental department of the University of Michigan show that the saliva becomes very deficient in lime during the last months of gestation.

Infants and young children require two or three times as much lime in proportion to their weight as do adults, since they need lime for building up and solidifying the skeleton as well as for making good the daily waste. A young nursing infant gets daily in its mother's milk, more than seven grains of lime, or half as much as the daily requirement for an adult.

The wonderful care which Nature takes to supply the young animal with an abundance of lime for building its skeleton is will illustrated in this interesting case of the egg. According to the annuls of the Pasteur Institute before incubating, the contents of an egg contains one-half grain of lime. During incubation, the amount steadily increases until when hatched the body of the chick contains three grains, of six times as much lime as at first. The growing chick has in some mysterious way, not yet determined, managed to steal from the shell the needed lime for stiffening its slender leg bones so as to enable them to support its body as soon as it emerges from its calcareous cell. It thus appears that the egg shell is not simply a container but also serves as a store house of lime to be drawn upon by the developing chick. Herbst has shown that between the ages of 6 to 14 boys require three or four times as much lime in proportion to their weight as do adults, since they must store up in their growing bones, 3 to 6 grains of lime daily, or about one-third of the adult lime ration.

It is evident, then, that the lime dontent of our daily food is a matter which needs most serious and unremitting attention.

The Lime Content of Foods

The proportion of lime found in different foodstuffs varies greatly. This fact is of much importance in view of the recent observations of Osborne and Mendel as well as of other investigators who have undertaken exhaustive experiments in animal feeding, and have shown that rats do not grow develop and reproduce normally unless supplied with a full quota of lime.

If the assertion of Professor Sherman that "half the American people are suffering from lime starvation" is true, and there is no reason to doubt it, the study of foods with reference to their lime content is highly essential to our understanding of rational dietetics. This study has heretofore been greatly neglected.

First of all it is interesting to note that in general, roots and the green parts of plants (greens) are richest in lime. The legumes (beans, peas and lentils) and certain nuts (almonds, hazelnuts and walnuts) are also rich in lime. Of the grains, oatmeal is the only one which presents a fair proportion of lime. Wheat and corn are both very deficient in lime, and rice contains no lime at all.

Of all natural food products, the richest in lime are the hazelnut, the almond and linseed meal. The last named product, though not commonly used as a food may be resorted to in emergency and is doubtless entirely wholesome.

Milk is so rich in lime that a pint and a quarter contains sufficient of this necessary element for a full day's supply. But an equal amount of lime would be furnished by half the weight of almonds, and eight or nine ounces of hazelnuts will supply the same quantity, or six ounces of linseed meal.

The foods which contain the largest proportion of lime and in the order named are,-- cheese, cottage cheese, hazelnuts, almonds, molasses, beans, chard, and other greens, eggyolk, wheat bran, milk, skimmed milk, olives. In milk the lime is closely associated with the caseine which forms the curd. Milk contains more lime than is found in lime water, a saturated solution of lime.

In cheese the lime is of course concentrated, the proportion being about six times as great as in milk.

Since skimmed milk contains practically as much lime as does whole milk, it is a highly useful article of food. Not a drop should be wasted. By combining with other foodstuffs as in bread and other cereal preparations, with the addition of fat, it may be very advantageously made a regular part of the daily bill of fare.

The feeding of skimmed milk to pigs is a foolish waste. Our growing boys and girls need every drop of milk which the country produces.

We are loosing our teeth and shrinking in stature because we need more lime and milk is one of our most important sources of food lime.

The amount of lime required by the average adult is three-fourths of a grain for each 100 calories of food or about 15 grains a day for a person taking a ration of 2000 calories. This amounts to 4/5 of a pound per anum for each man, woman and child in the United States aggregating a total lime requirement for the country of 40,000 tons per anum.

That the nation fails to get its full lime ration is due in part to the wasting of milk in our dairy industry and in part to the fact that we unwisely deprive ourselves of an essential food element by feeding the bran of our wheat and other foodstuffs rich in lime to hogs and cattle instead of making use of them ourselves. As a natural result, our domestic animals are steadily improving in physical development while as a nation we are declining in vigor and showing distinct indications of physical degeneracy.

It is interesting to note that our wide awake agricultural department at Washington is advising the people to buy milk instead of meat, pointing out that its nutritive value is far greater. Even whey contains a notable amount of lime, more than a third as much as whole milk, but less than a twentieth as much as cheese. However, the amount is so large that it should be utilized when possible. When fresh, or only slightly acid, whey is a wholesome food having about one third the value of whole milk.

Wheat bran contains as much lime as does milk, but of course it cannot be taken in so great quantities as milk hence is less available as a source of lime.

It is interesting to note that molasses contains a good proportion of lime, more than three times as much as is found in oatmeal, and nearly twice as much as in milk. In this respect molasses is superior to sugar, which contains no lime at all. In molasses, the lime found in the natural juices of the cane is concentrated; it is probable that the lime used in the manufacture of sugar may be the source of part of the lime in molasses. Maple syrup contains half as much lime as molasses.

A careful study of the accompanying tables # will develope a considerable fund of most useful and interesting information.

Table 1 shows, in column (1) the number of grains of lime (CaO) found in one ounce of edible substance. By the use of the figures given in this column one may easily calculate the amount of lime in his daily food, bearing in mind that the minimum requirement is one gram or 15.4 grains per diem.

It is only necessary to obtain for each serving the amount of lime by multiplying the weight in ounces by the figures of column (1). Adding together the figures obtained for all the different servings constituting the bills of fare for the day we find the number of grains of lime eaten, which should be 15 grains or more and never less. The writer recently listened to a lecturer, a young woman sent out by the state health department to instruct mothers in the fine art of feeding their households. Said the lecturer," do not spend one cent for meat until you have provided at least one pint of milk for every member of the family." This sensible instruction, endorsed by the highest authorities in the nation, is being spread broadcast over the country by lecturers sent out by state health boards and agricultural colleges and experiment stations, and great good is being accomplished by making them acquainted with the value of milk as an effecient means of balancing the bill of fare.

Column (2) of Table 1 shows the percentage of one day's lime ration (15.4 grains) found in one ounce. The figures in this column will be found most useful in balancing a bill of fare from the weight of the several items composing it. Multiply the ounce percentage given by the number of ounces of each food eaten. Add all the percentages together. If the sum is one hundred or more, then we know that the amount of lime is sufficient. A surplus does no harm, being easily disposed of with the excretory waste through the intestine and the kidneys.

#Foot note-- The accompaning tables are chiefly based upon the excellent tables of Sherman. See "Chemistry of Food and Nutrition" Macmillan Co.

Column (3) of Table (1) shows the amount of edible substance required to furnish 15.4 grains of lime. These figures may likewise be used in determining the amount of lime in one's daily ration, and sometimes more conveniently than the figures of column (1).

Column (4) shows the percent of the daily requirement supplied by 100 calories of the given foodstuff.

In column (5) is found the amount (ounces) of food necessary to supply 100 calories of edible substance, information of essential value in determining the lime content of servings.

Column (6) gives the weight of an ordinary serving, and column (7) shows the number of calories found in an ordinary serving. In estimating the lime content of a day's ration it is only necessary to set down and add up the figures representing the percents of the lime ration found in the several servings. These figures are easily found by comparing columns (4) and(7), remembering that the figures of column (4) are based upon portions of 100 calories each. These figures are increased or diminished according as the serving is more or less than 100 calories, and in proportion to the difference. When the serving is 100 calories, the figures found in column (4) are used directly. If the serving is 50 calories, then the figures of column (4) would be divided by two. If 25 calories, divide by four, etc. If the sum of all the values is 100, then the lime content of the daily ration equals 15.4 grains, the normal requirements.

A few simple examples will illustrate the use of Table 1.

Suppose, for example, that one takes with his breakfast, 2 eggs, 1 ounce of cottage cheese, 8 ounces of milk, 1 ounce of almonds, 2 ounces of oatmeal (weighed dry), an ounce of wheat bran and 1 ounce of molasses. Let us see what proportion of his daily need of lime will be supplied by these foods. The almonds will supply 1/10 the days lime ration, the oatmeal a little more than 1/20, the bran 1/20, the eggs 1/10, the cottage cheese 3/10, the molasses 1/10, making in all 7/10 of the total requirement, more than is needed , for 3/10 for breakfast would be quite sufficient if one eats three meals a day.

Evidently, it is easy enough to secure an adequate amount of lime by simply giving the matter the attention it deserves.

Foods Deficient in Lime

It is very instructive to note the great number of common foods which in the form in which they appear upon our tables are almost wholly lacking in lime. The table shows, in fact, more than fifty common foods which are so poor in lime that one would need to eat not less than six pounds to obtain an adequate amount of lime for a single day. In some instances the lime content is so small that the amount of foodstuff necessary to furnish a day's ration rises to ten, twenty, and even forty pounds.

Among the foods most deficient in lime may be mentioned the following: cane sugar, which contains no lime; honey, which supplies in one pound of wax-free material, only one fortieth of the lime needed for one day. Apples, bananas, beef and other meats, butter, also lard and oils of all sorts, most of the cereals and nearly all fruits are deficient in lime.

But now let us study more intensely the different classes of foodstuffs, milk, meat, eggs, cereals, and breads, vegetables, greens, legumes, fruits and nuts. For the readers convenience we have arranged these foods in separate tables.

First, let us notice the list of fruits. (See Table II)

A characteristic of fruits in general is their small lime content. The average amount of lime in 28 of our commonly used fruits is one-eighth gram(.123) per ounce, requiring 123 ounces for one day's supply of lime (15.4 grains), more than is demanded of any other class of foods with the exception of meats which require the consumption of 270 ounces, more than 17 pounds, and impossible amount for anyone but an Eskimo.

It is important to observe, however, that there are some very noteworthy exceptions to the general rule of low lime content in fruits. Zante currants are rich in lime, containing half a grain to the ounce, or four times as much as the average of all fruits. The olive affords three-quarters of a grain to the ounce and the fig, which has been a choice foodstaple for millions in the Orient from remote ages, supplies a whole grain of lime to each ounce, or a day's lime ration in less than one pound of the dried fruit, and one-third as much as in the same quantity of figs fresh from the tree.

Fruits Richest in Limes. (See Table IIa)

The following fruits are richest in lime content, containing double the general average for fruits: Each of the above fruits supplies a sufficient amount of lime in an ordinary serving to constitute a substantial contribution to the lime ration.

Especially noteworthy is the orange. An orange of average size (5 oz.) will supply one-tenth of the total lime requirement for a day, and an ordinary glassful of orange juice (6 oz.) supplies three fourths as much. The importance of the orange as a source of lime has heretofore been less appreciated than it deserves. It is quite possible that the great value of orange juice in infant feeding as a preventive of scurvy is in part due to its lime content. Four or five oranges a day will furnish more than one-third the necessary amount of food lime, and a glassful of orange juice at each meal will go far toward making good the deficiency of lime in the ordinary diet.

A large orange and a dish of prunes for breakfast, two ounces each of figs and ripe olives for dinner, and a liberal helping of fresh strawberries or rasberries for supper, will supply more than half the needful lime requirement for one day.

Fruits are thus seen to be really practical means for replenishing as well as maintaining the lime supply of the body, a need which our ordinary bills of fare wholly ignore.

And fruits have the advantage not only of being a most agreeable form of aliment, but a most reliable source of lime, since they are not likely to be robbed of their mineral constitutents by the misguided efforts of these experts in denaturing and sophisticating foodstuffs, the manufacturers, canners and cooks.

Before leaving theis interesting class of foodstuffs it may be well to note the fact that quite a number of our most commonly used fruits are very deficient in lime salts.*

For example, the apple contains so little lime that one would have to eat 22 pounds daily to get his supply if dependent on this source alone. The banana is almost equally deficient, requiring 17 pounds for a day's ration. The tomato yields a day's supply in 14 pounds, the watermelon in equal quantity, the pear and the peach in 10 pounds and the cantaloupe in 9 pounds. In other words, the proportion of lime in these fruits is so small that it may be ignored in estimating the lime content of rations or bills of fare.

THE LIME CONTENT OF NUTS. (Table III)

Nuts are botanically classed as fruits, but from a dietetic standpoint they are placed in a class by themselves.

Nuts are of all foods the most concentrated; that is, they furnish the largest amount of nourishment in the smallest bulk. No other foodstuffs are so rich in protein and fats. Fruits, with the exception of the olive, contain only very small proportions of either fat or protein, their chief food constitutent being carbohydrate,- sugar, starch, dextrine, and acids.

In proportion to their weight, nuts contain more lime than any other class of foodstuffs except legumes, the average being more than one-third grain to the ounde (.370 grs.). Certain nuts are surprisingly rich in lime. For example the almond offers nearly one and a half grains to the ounce, while the hazelnut or filbert affords one and three-quarters grains of lime to the ounce, or 11.3 percent of a day's ration of lime. The pecan and the walnut are also fairly rich in lime, as is also the peanut. The average weight of nuts required to supply a day's ration of lime, excluding the cocoanut, which is very poor in lime, is 28.7 ounces less than the average of any other class of foodstuffs.

An ounce and a half each of almonds and hazelnuts or filberts will supply one-third the total lime requirement for a day. In general, this addition to the ordinary bill of fare would be quite sufficient guarantee against any serious deficiency of lime.

By a combination of the proper nuts and fruits, the most delicious of all food combinations, the total needed supply of lime, or at least the major part of it, may be readily secured.

Here is a convenient example which may well serve as a model supplementary lime ration for general use. Take at one meal a large orange and an ounce and a half of almonds. At another meal, an ounce and a half of filberts and two ounces of figs. These nuts and fruits would supply sixty percent of the necessary lime and by adding for a third meal another orange and an ounce of walnuts more than four-fifths of the total lime requirement would be furnished.

Evidently there is no need of lime starvation if one only knows hos to make a right selection of foods.

THE LIME CONTENT OF CEREALS. (Table IV)

But we have only begun to explore the lime resources of our common foods. There are riches in abundance at our command when we once learn where to find them.

Let us now consider the great family of cereals and seeds from which we derive our breads and breakfast foods, and which serve as the staple foods for most of the members of the human family.

Of the six great cereals, wheat, corn, barley, rye, oatmeal, and rice, the last named feeds many millions more of human beings than any of the others. The countless millions of the Orient are fed chiefly upon riee. Both polished and brown rice are in use through out the densely populated countries of Asia, from Korea to Java. Of all the cereals and the several seeds which serve lime purposes, rice contains the least lime, only one-fourtbenth of a grain (.073grs) per ounce in brown rice and one eighteenth (.055 grs.). in polished rice. Wheat contains four times as much lime as brown rice, rye five times as much, and oatmeal six times. Corn is the only rival of rice in poverty of lime, having only a little more than one-fourth as much lime as oatmeal.

Instinct seems to have informed the Orientals of the deficiency of rice in lime salts, for they invariably combine with it a liberal amount of legumes of some sort or of greens or fresh or salted and dried turnips. All of which, as we shall see presently, are very rich in lime salts.

It is true, as stated above, that wheat contains four times as much lime as rice, but this is only true of "entire " wheat, that is of wheat, wheat meal, or graham flour, which includes the bran and "shorts." Fine white flour contains less than half as much lime as does entire wheat and only one-sixth as much as does wheat bran. Its lime content is but little above that of rice and is just equal to that of corn and pearled barley, one-eighth grain of lime to the ounce (.122 grs.) More than 7½ pounds of fine flour, whole corn or pearled barley, or 10½ pounds of fine flour bread, are required to furnish one day's ration of lime. But the polished rice in common use in this country is so poor in lime that 17½ pounds barely suffice to furnish the 15.4 grains required to meet our daily needs.

Evidently, a rice diet is highly deficient in bone making material and must greatly impoverish the blood and tissues in lime content when adhered to for more than very brief periods.

The U. S. Government has prohibited the importation of polished rice into the Phillipine Islands for the protection of the Phillipines from beri-beri and lime starvation, but no protection is afforded the loyal citizens of this country against the same danger. Every American citizen is permitted to indulge in lime starvation to the full extent of his ignorance and inclination.

The rice question is not, however, of such commanding importance in this country as in the Phillipines, because rice is here used rather as a delicacy or a luxury than as a food staple, as in the Phillippines. This may be due in part to the higher price of rice as compared with other grains, but is perhaps still more due to general lack of acquaintance with the many superior qualities of rice, a grain which aside from its deficiency in lime, is undoubtedly the finest of all the cereals. Nevertheless, the consumption in this country of billions of pounds of rice annually, involving a deficiency of thousands of tons of lime in the national bill of fare is one very real cause for the increasing prevälance of bone diseases and teeth decay in the United States, at least in certain sections.

A danger of identical character exists in certain sections of this country especially in the South where corn meal is almost as important a food staple for large groups of the population as is rice in the Philippines and in South China and the Malay Archipelago. Corn pone is the chief item in the bills of fare of some millions of negroes and small white farmers in Alabama, Tennessee, Georgia, Kentucky, Louisiana, Arkansas, and the Carolinas. A pound of cornmeal per capita is probably not an overestimate of the amount consumed by the classes indicated. The 16 ounces of corn should supply at least 12 grains of food lime, but actually does furnish one and three-fourths grains (1.76 grs.), or about one-seventh (.15) the amount required. In view of this fact, it is no wonder that those poorly fed people present many evidences of physical deterioration.

It is still a question with the physiologists who are making a study of pellagra, whether this disease may not be due in part, at least, to a deficiency of lime. The free use of molasses which containe more than a grain and a half of lime to an ordinary serving of 1¼ ounce, may to some degree mitigate the evils which might otherwise arise from the use of a foodstuff so greatly lacking in lime salts.

The same may be said for the use of milk in connection with both rice and cornmeal. The combination of either molasses or milk with cornmeal makes good its deficiency in lime, but milk adds also other essential elements and so is greatly preferable to molasses.

Still more deficient in lime is hominy, and also cornflakes which are made from grits, a corn product which represents the interior of the kernel wholly separated from the outer, lime-containing layers. Hominy is even more deficient in lime than is brown rice, containing, in fact, a little more lime than does polished rice. For a day's supply of lime one would have to eat more than 14 pounds of hominy or corn flakes. Instead of 12 grains of lime to the pound, hominy and corn-flakes contain only one grain.

Buckwheat flour is another defective food, containing but little more lime than polished rice, less than one-sixteenth of a grain per ounce (.061grs) . Fortunately, perhaps, the conventional buckwheat cakes served hot from the griddle as a breakfast dish are usually eaten either with molasses or maple syrup both of which saccarine appetizers are rich in lime salts.

BREADS ARE DEFICIENT IN LIME.

All the breads, with the exception of Boston Brown bread and bread made made from the entire rye meal, the pumpernickel of Central Europe, are notably deficient in lime. Even graham bread contains only one-sixth the normal proportion of lime, (3/4 grain to 100 calories) and rye bread has scarcely half the ideal proportion.

As a class, the cereals are notably deficient in lime and must be supplemented by other foodstuffs rich in lime salts. Fortunately, such foods are not lacking. By the use of the nuts and fruits already mentioned as deserts, and by regular addition to the bill of fare of legumes, greens and milk products, any deficiency as we shall see later, may be easily made good.

But we must not close our discussion of the cereals without a further word concerning oatmeal, the richest of all the cereals in lime salts. An ounce of oatmeal supples a little less than half a grain of lime (.425 grs.). In Scotland, where from very ancient times oatmeal has been the great foodstaple of the peasantry, it constitutes so large a proportion of the total food intake that it becomes a highly important source of lime salts. The Scotchman eats oatmeal not only in the form of brose, a dish resembling mush made by pouring hot water on oatmeal which is thus scalded but not well cooked as in this country, but also in "bannocks" scones and other forms of bread.

What ever the oatmeal lacks of supplying the full quota of lime is made up by the cabbage greens, kale, and buttermilk which are universally and freely used by the shepherd farmers of the Scotch Highlands. In the Highlands, a common practice is to scald the oatmeal with the water in which cabbage, kale, or collards, have been cooked. When thus prepared, the porridge, known as kale brose, is extra rich in lime salts and affords another example of the instinctive demand for mineral food elements made by the natural appetites of human beings who have not lost their normal instinctive guides through the cultivation of unnatural tasts and appetites.

The good results of this liberal supply of food lime are well shown in the tall and brawny figures of the Scotch Highlanders and doubtless accounts for the world wide reputation for vigor and toughness enjoyed by these hardy grainfeeders; a fact recognized in the well known story of a contraversy between Dr. Samuel Johnson and a Scotchman who upbraided the lexicographer because in his dictionary he defined oatmeal as "food for horses in England and for men in Scotland."

"But is it not true?" said the learned doctor.

"Yes, it is true," said the Scotchman after hesitating a moment, then added, "And where do you find such foine horses as in England and such foine men as in Scotland?"

In the United States oatmeal is comparatively a new acquaintance. It was not until the "Centennial Exhibition" at Philadelphia where oatmeal was very adroitly exploited as "Avena" that this cereal came into favor as a breakfast food.

In more recent years, oatmeal has been largely displaced by toasted flakes and other breakfast foods made popular by adroit advertising. And unfortunately, when eaten, the actual amount of the dry material in an ordinary serving of cornflakes or rice flakes is little more than an ounce and hence the amount of lime supplied is too small to cut any figure of importance in the lime ration.

A cereal product which has long been used by farmers in the feeding of horses, cattle, pigs and chickens, but has only recently come into use by human beings, is wheat bran. While low in caloric value, as its chief constituent is cellulose, bran is a most valuable supplementary food, not only as a source of bulk to stimulate the intestines, but as a source of lime and iron. Every ounce of bran contains three quarters of a grain of lime, sufficient to balance one hundred calories of food principles. By the addition of sterilized bran in liberal quantity, the deficiency in lime of various cereal preparations, breads, mushes, etc. may be made up. Bran may also be added to potatoes and other vegetables which are deficient in lime.

Finally, it must be said concerning the cereals that while they are the world's staple foods for working animals as well as for working men, they are perhaps made to constitute a somewhat too large proportion of the bill of fare in most civilized countries. As pointed out by Bunge many years ago, and confirmed by other authorities, the cereals contain an excess of the fixed adids, particularly sulphuric acid, and on this account, when used too freely they upset the nice balance between acids and bases or alkalies in the body, and produce a relative acidosis to which numerous ailments are attributed. This tendency may be successfully combated by the liberal use of fruits and vegetables, especially potatoes, which contain an excess of bases, although greatly deficient in lime, a fact which must be born in mind and which requires compensation by the addition of a suitable amount of foods rich in lime salts.

The Lime Content of Vegetables

In studying vegetables with reference to their lime content, one is struck by the fact that among a dozen commonly used vegetables, omitting "greens" there is not a single one in which the lime salts are largely represented. The average lime content is one-tenth grain to the ounce, almost the same as that of dereals. Lime is found, however, in notable quantities in certain other vegetables.

Parsnips, onions, string beans and Kohl-rabi are comparatively rich in lime, supplying in an ordinary serving, respectively, 7.7, 3.4, 3.0 and 12.2 percents of the total day's needs.

Because of their bulky nature vegetables may be eaten in much larger quantity than the concentrated cereals, and so a liberal intake of lime may be made in eating vegetables in which the percentage of lime is comparatively small. The turnip, for example, contains less than .4 of a grain of lime to the ounce, but an ordinary serving is 4.5 ounces, which supplies more than one-tenth (11.4 percent) of a day's lime ration.

Hence nearly all the vegetables may supply a considerable amount of food lime, when in their natural state, or when cooked by steam or oven heat; but if boiled, when removed from the water in which they have been boiled they leave behind a large part of their content of lime and other food salts. Vegetables should always be steamed or baked rather than boiled, so as to preserve the so-called inorganic elements, which are as essential to animal and human life as to the lives of plants.

Of all the vegetables, the eggplant contains the least lime, so little in fact as to be hardly worth noting. The amount found in an ordinary liberal serving is only one-tenth of a grain. Next in order of deficiency is our most commonly used vegetables, the Irish potato which presents a lime content of only one-twelfth of a grain (.086 grs.) to the ounce, requiring the impractical amount of 11 pounds for a full lime ration. It is well to note just here, however, that the potato is rich in iron.

The sweet potato contains a little more lime than the Irish potato but is still very deficient in this essential element. Evidently the potato cannot be safely used as a staple without supplementing it by other foodstuffs, which are rich in lime. Prof. Hindhede, who has devoted his life to food research and with most extraordinary benefit to his country and the whole civilized world, has shown that human life and energy may be well sustained for an indefinite time on a potato diet. A private letter recently received from Professor Hinhede by the writer states that in his potato-feeding experiments which are still in progress he finds it necessary to add to the potato liberal quantities of greens. The greens supply not only a sufficient amount of lime, but also the essential fat-soluble vitamines which the potato lacks. If a days ration contains all of any one of the following groups of foods, rich in lime, the danger of lime starvation will be reduced to a minimum:-

A large orange,	Figs, 2½ ounces,
Almonds, 1½ ounces,	Olives, ripe, 2 ounces
Oatmeal, 2 servings,	Cracked wheat, 2 servings
Parsnips, liberal serving,	Boston Brown bread, 2 servings
Graham bread, 2 servings,	Onions,
Bran, 1½ ounces	Green peas,
	Bran, 1 ounce,
	Raspberries,

Dates, 2 ounces,
Strawberries, 2 servings,
Filberts, 2 servings,
Oatmeal, 2 servings,
Graham bread, 2 servings,
Kohl-rabi, 2 servings,
Bran, 1 ounce

Orange juice,
Orange, large
Walnuts, $1\frac{1}{2}$ ounces
Rye bread, entire, 2 servings
Shredded wheat, 2 ounces
String beans, 2 servings
Bran, 1 ounce.

THE LIME CONTENT OF LEGUMES (Table VI)

But, while we have found it possible to obtain from the foodstuffs already studied, fruits, nuts, cereals and vegetables, a bare sufficiency of lime, there are in other classes of foods rich supplies of lime salts adequate to furnish even a superabundance of this highly important, but most neglected of all food principles. The legumes and some other allied seeds, for example, furnish in small bulk so large a store of lime that they are most useful in balancing up the bill of fare. This may be clearly seen by reference to Table VI, which shows us that an ounce of beans contains a grain of lime. An ordinary serving represents about an ounce and a quarter of dry beans, which would supply 8 per-cent or one-twelfth of a day's ration.

Peas have a lime content about half that of beans and lentils, two-thirds as much as beans. When made a staple of the bill of fare, the size of servings may be increased to two or even three times the ordinary, making the bean supply nearly one-fifth of the day's ration.

Mention must also be made of two seeds which are not fully established as human foodstuffs, cottonseed meal and linseed meal. Both of these products are exceedingly rich in lime, cottonseed meal containing 1.6 grains of lime to the ounce and linseed 2.5 grains. Cottonseed meal has been much used in feeding stock, though not always without injurious effects. In time the objections to the use of this concentrated food by human beings may be overcome; but we have already a sufficient number of foods rich in lime to furnish an ample supply if a judicious selection is made, so that the use of cottonseed or linseed is not necessary.

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A word of caution must be said in relation to the use of legumes. The elaborate feeding experiments of McCollum have shown that the protein of beans is of inferior quality and by no means a substitute for the fine protein of milk. It has for some time been known that proteins differ greatly in value. This is particularly true of vegetable protein. The proteins of rice and of potato being of high quality, while those of most green vegetables are of low value. But it remained for McCollum to show by his most interesting and valuable experiments in the feeding of rats that the large protein content of beans is of inferior value. This discovery has deprived the bean of its high rank as a source of protein and as a substitute for high priced proteins. This fact is important in this connection because of the possible injury in making the diet consist so largely of beans as to overburden the body with the elimination of unusable protein. The proteins of peas and lentils are superior to those of beans; hence it is advisable to utilize these legumes more largely than beans as a source of food lime and its associated protein.

When the soya bean has become well established in this country as a food product, it will be doubtless recognized as a superior source upon which to draw for extra supplies of a fine quality, of both food lime and vegetable protein. The Soya bean possesses a percentage of mineral salts including lime more than double that of the ordinary bean.

THE LIME CONTENT OF GREENS.

There still remains to be studied one more class of vegetable food products as a source of lime salts, namely, greens. There seems to be in man as well as in lower animals an instinctive recognition of the important position held by these coarse and relatively innutritious products in Nature's scheme of nutrition. The craving for greenstuffs experienced by nearly everyone as Spring approaches, is the natural consequence of the widespread lime starvation imposed by a winter dietary from which foodstuffs rich in lime are largely excluded. It is true that this deficiency in lime, almost universally characteristic of winter dietaries, is not necessary, and may be easily prevented by a proper selection of readily accessible foodstuffs; but, unfortunately, the fundamental facts respecting the lime content of foods have only recently been brought to light through the researches, most laborious and painstaking, of the eminent Professor Bunge of Switzerland, and more recently by Dr. Sherman of Columbia University of New York. These facts are as yet practically unknown to the general public which is the reason for the present writing.

In proportion to their nurtitive value, there is no class of foodstuffs so rich in lime as are greens as shown in Table VII. For example, polished rice contains one part of lime in two thousand calories; cornmeal, one part to nine hundred calories; beans, one to six hundred; whole wheat, one to four hundred; hazelnuts one to one hundred; while in asparagus we find one part of lime to thirty calories; in cabbage one to twenty-four; cucumbers, one to fifty; dandelion, one to twenty-five; and in chard and celery, one to twelve.

Considered from the standpoint of bulk and weight, the the situation is decidedly different. With a few exceptions, the lime content per ounce is not greater in "greens" than in many other vegetables. Notable exceptions are, chard, with a grain to the ounce; mustard greens, with 3 grains; paprika, nearly 1½ grains turnip tops, 2 grains, and watercress with more than a grain.

As will be seen by a careful study of Table VII, there is a marked difference between the different species of greenstuffs. Brussels sprouts, cucumbers, lettuce and tomaine contribute to the diet no larger amounts of lime salts than string beans, green peas, onions, pumpkins and sauash. Lettuce, cucumbers and celery are of no more value as sources of lime in the quantities eaten than are potatoes, their content of lime being very low. The really valuable greens, as sources of lime, are mustard greens, turnip tops, chard, cabbage greens, endive and dandelion. Ordinary servings of three or four ounces of these greens will yield from 13 to 60 percent of the daily lime requirement, as shown in the following table.

It is clearly evident that greens are dependable sources from which lime salts may be obtained in almost any quantities desired. The small ordinary serving of 3 ounces may be easily doubled if occasion demands, as when it is necessary to replenish the depleted body stores of lime in a demineralized patient. By feeding greens twice a day and doubling the size of the serving, at the same time taking care to include in the bill of fare as many foods rich in lime as possible, one may easily increase his lime intake to three or four times the normal requirements and thus rapidly make good the deficiency in salts which is not infrequently the fundamental fault in cases of chronic disease.

THE LIME CONTENT OF ANIMAL FOODS.

There remains for study, three subclasses of foodstuffs which are included under the general head of animal foods in Table VIII, viz, Meats, Eggs and Dairy Products. Surprising as the fact may seem, butcher's meat stands near the head of foods poorest in lime salts. Only the tomato, the apple, polished rice, cornmeal, buckwheat flour, hominy and the banana contain less lime than does average lean beef, with its content of only one-fourteenth (.07) of a grain per ounce. The explanation is found in the fact well known to physiologists, that the lime content of an animal body is almost wholly contained in the hard tissues, the bones, only one percent of the total being found in the soft parts.

Blood contains even less than flesh meats, only one-twentieth of a grain to the ounce.

It seems to the writer quite evident that the flesh of animals is not by nature designed for the food of other than carnivorous animals, if indeed it was originally designed for them. And other food essentials besides lime are lacking in the flesh of animals. The previous vitamines are present only in small and inadequate amount in animal flesh, but are found in abundance in the marrow of bones and the liver. Carnivorous animals eat the bones and the liver as well as the fat and lean tissues of the soft parts. Men, when compelled to live upon a carnivorous diet, likewise find it necessary to eat bones, bone marrow and liver, as pointed out by Stephanson, the eminent Arctic traveler.

Fish contains a larger percentage of lime than does the flesh of warm blooded animals, nearly twice as much, in fact, but the lime content of fish is only about equal to that of white bread, which is poor in lime.

An eminent Scotch physiologist fed rats on lean meat and found that they soon showed evidence of marked deterioration. The marks of degeneracy were especially shown in the bones and the sex glands. The mammary glands degenerated and reproduction ceased. These results were doubtless due, in part at least, to a deficiency of lime.

It is interesting to note in this connection the fact that in vegetable foods the iron and lime are associated with the protein content while in flesh foods the iron is almost exclusively confined to the blood and the lime to the bones. Animal fat, like other fats, is wholly lacking in lime, hence fat meat contains less lime than does lean meat.

It is evident, then, that a high protein diet, especially a meat diet, is not indicated in conditions characterized by a deficiency of lime. Indded, there is reason to believe that such a diet, by increasing the acid wastes of the body, may cause an undue loss of lime, and so aggravate a condition which needs to be relieved.

THE LIME CONTENT OF EGGS.

In the egg we have an embryo animal, and the first impression might naturally be that the facts pointed out in relation to flesh foods would apply equally to eggs; but this is by no means the case. It is true that the egg contains the elements which by incubation and development are evolved into an animal, but the egg contents consist of two very distinct kinds of material, the white and the yolk. The white of the egg is pure protein and is destined to become the body of the chick. It is the part which undergoes the marvelous transformations which result in the development of a fully furnished animal. It corresponds to meat, but has no structure. The yolk, on the other hand, is a specially prepared food, designed by Nature for the nourishment of the young animal while it is in the shell. Being a food product specially prepared it must contain everything essential for the development and support of the chick until it leaves the shell.

The white of the egg, like the flesh of an animal, is not a complete food. It contains no fat, and is lacking in the essential vitamines and lime. The yolk, on the other hand, contains besides protein, a full store of all that is required for complete nutrition, lime and other salts, iron and vitamines.

A comparison of the lime content of the whole egg, the white and the yolk, as shown in Table VIII, is both interesting and instructive. As will be seen, the egg yolk contains, per ounce, nine times as much lime as the white. The figures for for the whole egg represent the combined composition of the yolk and white.

It is evident that eggs, and especially the egg yolks, are a most valuable source of food lime, but this is not true of the white taken by itself, which contains less lime per ounce than most of the cereals, scarcely more than rice, one of the poorest of all the cereals.

An egg yolk of average size weighs half an ounce and so contains a little more than 2/5 of a grain of lime (.420 grains) or 2.7 percent of a day's ration.

Egg yolk is very easily digestible. Most fats undergo digestion only after leaving the stomach and coming in contact with the bile and pancreatic juice of the small intestine. The fat of egg yolk, however, which is one third emulsified fat, quickly undergoes digestion in the stomach, as shown a few years ago by Roger of Paris.

The white of egg, on the other hand, is much less easily digestible. Eaten raw, it undergoes no digestion in the stomach and little in the small intestine; but it does undergo putrefactive changes in the colon and often interferes with the digestion of other foodstuffs. Sometimes, also, raw egg white exhibits toxic properties of a most disagreeable character. An eminent French chemist has recently demonstrated that egg poisoning is due to certain toxins sometimes present which he has studied and which he has shown are readily destroyed by the heat of cooking when the egg is cooked until well done. But hard boiled white of egg is digested very slowly and imperfectly and the fragments undergo putrefactive changes in the colon. In view of the above facts, the writer has for some years recommended in many cases the use of the yolk of the egg to the exclusion of the of the white when the object is to increase the intake of lime salts. To insure the utilization of the lime content of eggs it is necessary that they should be properly cooked. Fried eggs and omelets are hard of digestion, and the undigested fragments which appear in the stools carry away a considerable part of the precious lime which should be retained and absorbed. This difficulty may be obviated by cooking the egg at a low temperature, 150° to 160°. Cooked in this manner, the egg is soft and jelly like or "curdled," and is presented to the stomach in most digestible form.

Thus we see that unlike meats, the yolk of egg is a choice food product especially prepared to serve as a complete and perfect nutriment.

THE LIME CONTENT OF MILK AND CHEESE.

We now come to a group of foodstuffs of unrivalled value as sources of food lime; viz, the various dairy products, every one of which, with the exception of butter is very rich in salts of lime. Pure fat, is, of course, free from lime, which is chiefly associated with the protein of caseine of the milk. But butter is not pure fat. It retains a portion of the buttermilk and so has a small lime content which is, however, too insignificant to deserve consideration in the planning of a balanced bill of fare.

Milk, in some form, is perhaps the most convenient and reliable of all sources of food lime. Whole milk contains three-quarters of a grain of lime to the ounce. This is only half the amount found in almonds and filberts; but while these nuts can be utilized only to the extent of a few ounces daily, the milk intake may be raised to several quarts.

A pint of milk contains 12 grains of food lime of finest quality and 20 ounces of whole milk will supply a whole day's ration of food lime. Skimmed milk is a little richer in lime than whole milk, a fact which ought to put an end to the very common waste of skimmed milk in connection with creameries. Considering the great lack of lime in the national dietary it is even a question whether the feeding of skimmed milk to domestic animals should not be discontinued. Growing American boys and girls need every drop of milk the country produces to give them the material which they need for bone building.

We are rapidly becoming a toothless nation because of the lack of lime in our national bill of fare. This deficiency may be easily made up by the proper utilization of our dairy products and a suitable selection of foodstuffs. Cattle and hogs can easily obtain their lime from grass and other greenstuffs, to the utilization of which their digestive organs are specially adapted, so that they can consume the large bulk necessary.

In the use of milk, man adapts to his own use the choice lime salts which the mother cow has laboriously garnered from the fields and meadows and prepared in concentrated form for the feeding of her calf. Associated with the lime in whole milk is found also a choice collection of vitamines which promote growth, so that milk not only furnishes the material needed for building and maintaining the body frame work, but supplies an activating hormone which insures the proper utilization of the building material at hand.

It is interesting to note that a tablespoonful of milk supplies nearly the same amount of lime as an egg yolk and a little more than half a pint of skimmed milk (9 ounces) supplies as much lime or bone building material, as a dozen eggs.

While skimmed milk contains more lime than whole milk the vitamine content is somewhat less, a portion being held in solution by the butter fat which has been removed. But the chief values of milk are left after the fat has been removed, and the great economic waste and physiologic damage which have resulted from the past failure to utilize this by-product of our great dairy industry, should be stopped as speedily as possible.

Buttermilk has a lime value almost equal to that of whole and skimmed milk, a pint and a half affording a full day's supply of lime. Sour milk commonly sold as buttermilk, and under various trade names as "Bulgarian Buttermilk," is fermented or soured skimmed milk and hence has the same lime content as skimmed milk.

Cream is not by any means the equivalent of milk as a source of lime. An ounce of cream contains only two-thirds as much lime as the same quantity of whole milk. Nearly a quart of cream is necessary to supply a day's ration of lime on account of the larger amount of fat present.

But it is in cottage cheese that we find the cheapest and readiest means of increasing our lime intake. Milk solids constitute only about one-eighth of its bulk and weight. Consequently, the elimination of the greater part of the water in the process of cheese making results in a great concentration of the lime content. Ordinary cheese has a lime content of 5.7 grains per ounce, or eight times the amount in whole milk, more than any other foodstuff. An ounce of average cheese supplies as much lime as seven yolks or five entire eggs, or 5 pounds of beefsteak, or half a peck of potatoes.

But cheese is not easily digested by many persons. The butryic acid which it contains in considerable amount when old and strong, excites the gastric gland to secrete an excess of hydrochloric acid, and so gives rise to heart burn, a common symptom following the free eating of cheese. There are in old cheese various more or less toxic products the result of the activities of the numerous molds, yeasts and germs which co-operate in the production of cheese, to say nothing of the "mites" "skippers" (maggots) and other scavengers which are usually found in "ripe" specimens of cheese.

In view of these discouraging facts, it is pleasant to find that in the simple cottage cheese which the farmer's wife prepares on short notice in her own kitchen from the well skimmed sour milk of her "milk house," possesses all the good qualities of ordinary cheese while free from all its objectionable features. The only inconvenience is that it must be freshly prepared unless kept in an ice box.

Cottage cheese supplies 41/5 grains of lime (4.18 grs.) per ounce, and hence 3 3/4 ounces cheese will furnish a day's lime ration.

"Yogurt Cheese", a cream cheese prepared by a process modified by the writer from that employed in making the famous Cammembert cheese, omitting the green mold and using pure cultures of the Bulgarian bacillus, has all the advantages of cottage cheese and will keep for months with some care to keep cool. This dainty product is a complete satisfactory substitute for ordinary cheese for all but those who have developed a connoisseur's appetite for the putrescent aromas of limburger and gorgonzola.

Even whey a by-product of cheese making, which usually goes down the sewer, possesses no mean value as a source of nutritive lime salts. There are in the whole category of foodstuffs few, in fact, which are so rich in lime as is whey, which contains more than 1/4 grain to the ounce. The lime content of whey is greater than that of any cereal, three times as great as that of egg whites, and four times as much as that of cornmeal, or rice. A large glassful of whey contains as much food lime as two pounds of beefsteak and a pint is equal in lime content to two-thirds of a dozen eggs. Three pints a day, taken as a beverage in place of beer, for example, would supply nearly a day's lime ration, as much as would be furnished by a fifty gallon cask of beer. If the saloons about to be vacated as distributing stations for the breweries were converted into "whey stations" the result would be an enormous economic gain, not only in the utilization of a valuable nutrient which is wasted, but in the conservation of the health and a great increase in the productive power of great masses of the population.

THE LIME CONTENT OF SPECIAL FOOD PREPARATIONS (HEALTH FOODS)

Of these special products the most notable is wheat gluten which contains more than a grain of lime to the ounce. It is still richer relatively, in iron. This is due to the fact that the lime and iron compounds of vegetable foods are associated with the protein rather than the starch or fat constitutents. A single ounce of gluten contains one-fifteenth of a day's ration of lime. Forty per cent gluten contains two-fifths as much and twenty percent, one-fifth.

Brose, a mixture of oatmeal and sterilized bran, supplies three percent of a days lime ration in one ounce, which is double the amount found in graham flour.

Protose and Malted Nuts each furnish more than two-fifths of a grain of lime to the ounce, or about seven times as much as does lean meat, such as tenderloin.

Nuttolene, a pine nut product, contains more than twice as much lime as fine flour, and four times as much as Porterhouse steak.

Malt sugar contains as much lime as does barley or rye, and more than any other cereal, while cane sugar contains no lime at all and honey less than one-tenth as much.

 common

And now our survey of the lime value of our foodstuffs will be brought to a close, although it might be somewhat further extended. The writer hopes that he has at least succeeded in awakening an interest in this one of the most important and practical of problems in dietetics, and in showing how the facts which have been patiently wrought out in scientific laboratories by long years of toilsome effort, may be readily applied in the practical dietetics of the home, the hospital, the army cantonment and the construction camp.

In conclusion, let us see how easily the bill of fare for every day and every meal may be so enriched in lime salts that there can be no possible lack. A few nuts, a handful of greens, a pint of milk, a bit of cheese, an punce of bran, and the thing is done. Let us figure it out in percent of daily needs and see what the result will be. (See Tables I Colum 2).

1½ ounces of almonds	14
4 ounces chard	24
6 ounces milk	29
6 ounces of buttermilk	25
1 ounce cottage cheese	27
1 ounce bran	5
	124

A full day's lime ration and an overplus of 24 percent. Evidently we have been starving in the midst of plenty. Let us return to sane and biologic living. Our salvation from malnutrition is not to be found in beefsteaks and chops as the doctors have been telling us for a century, but in milk and greens, the ambrosia of the gods, with a little bran thrown in as penance for the sins of our youth and those of our forbears.

The Arab escapes the penalties of monotonous diet of wheat by adding date and camel's milk. In half a pound of dates he absorbs one-fifth of a lime ration and supplements this with a pint of camel's milk or a couple of ounces of camel's milk cheese which furnish him with more than a half ration of lime and furnish an adequate supplement for the lime content of his 20 ounces ration of boiled wheat.

One hot day in April the writer stood at the foot of the great pyramid of Cheops almost gasping for breath after a laborious forty minutes' climb to the top and back again with the help of two atheletic young Arabs reared on wheat, dates and camel's milk who had pulled and boosted him up the precipitious sides of the huge tombstone. Drawing a long breath, one of the young men said, "Give me four shillings, ($1.00) and I will climb old Cheops and get back in ten minutes; give me six shillings, and I will make it in eight minutes: or, eight shillings and I will do it in six minutes." Not wishing to see the young man kill himself by such violent exertion in the weltering heat of an Egyptian sun, and doubting his ability to come anywhere near accomplishing such an impossible feat, I showed him a four shilling piece. Away he shot, like an arrow, leaping up the great stone steps (about four feet high) like an antelope. In five minutes he was at the top, and then he came dashing down in a headlong fashion that made me shudder. He was back in just 7½ minutes.

The mountaineers of the Balkans, whose chief diet is boolgour (wheat boiled and dried then cooked with a fat of some sort) finds in the milk obtained from the hardy sheep, which he shepherds on the sweet grasses of his mountain pastures, a perfect protection against lime starvation. Half a pint of this very rich milk and a bit of sheep's milk cheese amply safeguard his lime requirement.

The writer many years ago, when traveling on the Mediterranean, watched with much interest a group of Greek sailors reclining on the deck and making their midday meal of rye bread (pumpernickel), figs and ripe olives. A pound and a half of bread, half a pound of figs and a quarter of a pound of olives, with a bit of dried cheese, made a liberal and well balanced ration, supplying the full lime requirement with 30 or 40 per cent to spare, and all the other good things neede to furnish them complete biologic diet, the good effects of which were evident in their their stalwart forms and the magnificent exhibition of energy and strength and endurance which they constantly displayed in their work.

It is interesting to note that the dietetic instinct of various primitive tribes has led them to add milk to foods containing very little lime, thus rendering complete a dietary otherwise so deficient in lime as to be incapable of sustaining life for any considerable period of time. For example the Jakuts of Northern Siberia who subsist almost wholly upon the boiled flesh of horses and cattle, add to this one sided and deficient diet liberal quantities of milk of cows and mares which they eat in the form of sour curd. They also prepare "Jakut butter" a sort of cream cheese.

The Kaffir eats large quantities of sour milk curd, which, together with millet and "mealies", a coarse cornmeal, constitutes their whole bill of fare. The milk supplies the lime which the corn lacks. One large meal of this simple food, eaten in the evening, suffices to produce and maintain the remarkable fine p. physical development for which the Kaffir race is known through the world.

In Caesar's time the Celts lived almost exclusively on pork, supplemented by milk.

Among the ancients, milk was little used as a beverage in its natural state, but was made into a sort of cheese, often referred to as butter in the Bible and other ancient writings.

The milk of many different species of animals was used by the ancients, including that of the dog, now seldom employed. At the present time, the milk of the cow and goat are practically the sole sources of milk in America. In some parts of Europe the milk of sheep and of the ass is used also. The milk of the reindeer is used in Lapland and Alaska , of the Yak in Tibet, of the mare in Tartary and to some extent in Russia, of the buffalo in Africa and of the camel in Arabia and Persia and of the vicuna and the llama in South America. In certain parts of Africa, according to Bigelow, the milk of negresses in sometimes provided for the sick.

Lime - TABLE I.

Nutritive Value of Lime.

THE LIME CONTENT OF FOODSTUFFS

The following table shows in column (1) the amount of lime (grains) contained in one ounce. Column (2) shows the percent of one day's lime ration in one ounce. Column (3) shows the amount of the foodstuff required to supply 15.4 grains of lime (CaO) the amount required for one day. Column (4) shows the percent of one day's requirement of lime found in 100 calories. Column (5) shows the weight of one hundred calories (ounces). Column (6) is the weight of an ordinary serving. Column (7) gives the number of calories in an ordinary serving.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Almonds	1.464	9.5	10.5	5.2	.5	.5	100
Apples	.043	.3	358.0	1.6	5.3	5.3	100
Apples, dried	.196	1.3	78.5	1.6	1.2	1.2	100
Apple juice	.049	.5	314.3	1.6	6.0	6.0	100
Apricots	.086	.6	180.0	3.3	6.1	3.0	50
Apricots, dry	.404	2.6	38.0	3.3	1.1		
Asparagus	.153	1.0	100.6	17.1	15.7	1.7	10
Bananas	.055	.4	280.0	1.2	3.5	3.5	100
Barley, entire	.263	1.7	58.5	3.0	1.7		
Barley, pearled	.122	.8	126.2	1.1	1.0	(3.5)	100
Beans, dried	.980	6.4	15.7	6.5	1.0	(3.2)	125
Beans, lima, dry.	.435	2.8	35.4	2.8	1.0	(2.3)	100
Beans, Lima, Fresh.	.171	1.1	90.0	2.8	2.9	3.0	100
Beans soya	2.000	13.0	7.7	11.2	.86	.86	100
Beans, string, fresh	.282	1.8	54.6	13.0	17.0	4.0	25
Beef, tenderloin	.057	.4	270.0	.45	1.29	2.5	200
Beets	.178	1.2	86.5	8.9	7.6	(2.2)	25
Blackberries	.104	.7	150.0	4.2	5.9	3.0	50
Blueberries	.122	.8	126.2	3.8	4.7	2.2	50
Blood	.049	.3					
Bran, rye	1,092						

Bran,Wheat	.735	4.8	21.0	5.7	1.2	.5	43
Bread,Boston Brown	.790	5.1	19.5	7.9	1.2	1.2	100
Bread, entire wheat	.133	.9	116.0	1.23	11.44	2.0	150
Bread, graham	.176	1.2	90.0	1.60	1.34	2.0	150
Bread, rye	.147	1.0	105.0	1.3	1.4	2.0	150
Bread, entire rye (pumpernickel)	.259	1.7	60.0	2.8	1.7	2.0	120
Bread, white	.091	.6	170.0	.8	1.3	2.0	150
Bread, fruit	.514	3.3	30.0				
Brussels Sprouts	.165	1.1	93.3	12.1	11.3	4.0	
Buckwheat flour	.239	1.6	64.4	5.9	1.0		
Butter	.092	.6	167.4	.3	.46	.5	113
Buttermilk	.643	4.2	24.0	41.1	10.0	6.1	75
Buttermilk Yogurt	.747	4.8	20.6	56.3	9.6	6.5	75
Cabbage	.276	1.8	56.0	20.0	11.1	4.0	25
Cabbage greens	.649	4.2	23.7	47.3	11.0	4.0	25
Cantaloupe	.104	.7	150.0	6.1	9.0	7.0	75
Carrots	.343	2.2	44.9	33.3	7.3	3.7	50
Cauliflower	.753	4.9	20.4	56.4	11.0	3.0	25
Celery	.478	3.1	32.2	58.9	18.0	1.0	6
Chard	.919	6.0	16.7	55.0	8.7	3.0	35
Cheese	5.702	37.0	2.7	29.7	.77	.5	70
Cheese, cottage	4.180	27.1	3.7	85.2	3.2	2.0	75
Cheese, Yogurt	4.285	27.8	3.6	26.0	.93	.5	50
Cherries	.116	.8	133.0	3.5	4.7	2.2	50
Cherry juice	.104	.7	150.0	3.1	4.6	4.6	100
Chestnuts	.208	1.3	75.0	1.9	1.4	1.5	100
Chicken, broiler	.066	.43	235.0	1.4	3.25	2.5	75
Coconut, dry	.361	2.3	42.6	.9	.6		
Coconut, fresh	.147	1.0	105.0	.9	.9	2.0	225
Corn, whole	.122	.8	126.2	.8	1.0	1.0	100

Cornmeal	.110	.7	140.0	.7	1.0	(4.5)	75
Corn, Sweet, fresh	.037	.2	416.0	.8	3.5	(2.7)	75
Corn, sweet, dry	.129	.8	114.4	.8	1.0		
Cow Peas	.612	4.0	25.1	4.1	1.0		
Cottonseed meal	1.622	10.5	9.5	9.2	.9		
Crackers	.135	.9	114.0	.8	.9	1.0	110
Cranberries	.110	.7	140.0	4.4	7.5	3.0	40
Cream	.527	3.42	29.2	7.2	1.75	2.2	125
Cucumbers	.098	.6	157.0	12.6	20.0	2.0	10
Currants, fresh	.159	1.0	96.8	6.3	6.1	3.0	50
Currants, dry, Zante	.502	3.3	30.7	3.6		1.5	140
Dandelion greens,	.643	4.2	24.0	24.1	5.5	3.0	
Dates	.398	2.6	38.6	2.6	1.0	1.0	100
Egg plant	.067	.4	230.0	5.7	12.2	1.5	10
Eggs	.450	2.9	34.2	6.3	2.4	1.9	80
Egg, one (1.8 oz)	.810	5.2	19.0			1.08	80
Egg White	.092	.6	167.4	2.8	4.7	1.0	14
Egg white of one(oz)	.116	.7	140.0			1.2	17
Egg yolk one egg	.839	5.4	18.3	5.0	.9	1.9	100
Egg yolk (.6 oz.)	.503	3.3	30.6			.6	60
Endive	.637	4.1	24.0	45. 5	11.0	(3.0)	25
Farina	.129	.8	119.4	.8	1.0		
Figs, dry	.992	6.4	15.6	7.2	1.1	2.0	180
Figs, fresh	.325	2.1	47.4	7.2	3.4	2.0	70
Fish	.134	8.7	114.6	2.6	3.0	6.0	200
Flour, buckwheat	.061	.4	252.5	1.5	1.0		
Flour, entire wheat	.190	1.2	81.0	1.2	1.0		
Flour, graham	.239	1.6	64.4	1.5	1.0		
Flour, white	.122	.8	136.2	.8	1.0		
Flour, rye	.110	.7	140.0	.7	1.0		
Flour, rye entire	.293	1.9	52.5	2.5	1.3		

Gluten Pure	1.025	6.6	15.0	6.6	1.0	.5	50
Gluten 40%	.400	2.6	38.0	2.6	1.0	1.0	100
Gluten 20%	.200	1.3	76.0	1.3	1.0	1.0	100
Gooseberries	.214	1.4	72.0			2.5	
Grapefruit	.129	.8	119.4	5.6	6.7	3.5	50
Grapes	.115	.7	133.0	2.7	3.6	3.6.	100
Grapejuice	.067	.4	230.0	1.5	4.0	4.0	100
Guava	.086	.6	180.0				
Hazelnuts (filberts)	1.758	11.4	8.8	5.7	.5	.5	100
Hominy	.067	.4	230.0	.2	1.1	1.6	150
Honey	.024	.2	263.6	.2	1.1	1.6	150
Kohl-rabi	.472	.3	32.6	34.9	11.5	(4.0)	35
Lemon juice	.147	1.0	105.0	8.4	8.9	.5	5
Lentils, dry	.655	4.3	23.5	4.3	1.1	(3.0)	100
Lettuce	.263	1.7	58.5	31.4	18.4	1.0	5
Linseed meal	2.530	16.4	6.1				
Maple syrup	.655	4.3	23.5	5.3	1.3	1.2	100
Macaroni	.135	.9	114.0	.8	1.0	(3.0)	100
Mango	.129	.8					
Milk, whole	.735	4.8	21.0	24.3	5.1	6.0	125
Milk, skimmed	.747	4.8	20.6	46.3	9.6	6.5	75
Milk, condensed, sweetened	1.837	11.9	8.4	15.3	1.1	2.0	180
Milk, human	.208	1.4	70.0	7.0	4.75	5.0	100
Milk, camels	.876	5.7	17.5				
Milk, goats	.784	5.1	20.0				
Milk, sheeps	1.266	8.2	12.2				
Molasses	1.292	8.4	12.0	10.2	1.2	1.2	100
Mushrooms	.104	.7	150.0				
Millet	.086	.5	180.0				
Muskmelon	.104	.7	150.0	6.0	8.8	7.0	75

Mustard Greens	3.013	19.6	5.1			3.0	
Oatmeal	.423	2.7	36.4	2.4	.9	(4.2)	75
Okra	.435	2.8	35.4	2.4	9.3	(4.5)	50
Olives	.747	4.9	20.6	5.7	1.2	1.2	100
Onions	.208	1.3	75.0	9.7	7.?	(2.5)	35
Oranges	.276	1.8	55.7	12.3	6.8	5.0	75
Orange Juice	.178	1.2	86.5	9.3	8.0	6.0	75
Paprika	1.401	9.1	11.0				
Parsnips	.361	2.3	42.7	12.8	5.4	(3.0)	55
Peaches	.098	.6	157.1	5.3	8.1	4.1	50
Peaches, dry	.208	1.4	75.0	5.3	4.0	2.0	50
Pears	.092	.6	167.4	3.3	5.5	4.0	75
Pear juice	.055	.4	280.0	1.4	3.9	6.0	150
Peas, dry	.514	3.3	30.0	3.6	1.0	(3.0)	100
Peas, green	.171	1.1	90.0	4.0	3.5	3.5	100
Peanuts	.435	2.8	35.4	1.8	.6	.6	100
Pecan nuts	.545	3.5	28.2	1.7	.5	.5	100
Persimmons	.135	.9	114.0				
Pineapple	.110	.7	140.0	5.8	8.1	4.0	50
Plums	.122	.8	126.2	3.3	4.1	4.1	100
Potatoes	.086	.5	180.0	2.5	4.2	(3.0)	75
Potatoes, sweet	.116	.7	133.0	2.3	2.8	(3.5)	200
Prunes, dried	.331	2.2	46.5	2.5	1.2	(3.7)	100
Pumpkin	.141	.9	109.2	12.5	13.6	(3.5)	25
Radishes	.129	.8	119.4	10.2	11.9	1.0	6
Raisins	.392	2.5	39.3	2.8	1.0	1.0	100
Raspberries	.300	2.0	52.3	10.4	5.3	4.1	75
Raspberry juice	.129	.8	119.4	3.0	3.4	5.0	150
Rice, polished	.055	.3	280.0	.3	1.0	(4.0)	125
Rice, brown	.073	.5	211.0			3.0	

Romaine	.276	1.8	57.0				
Rutabagas	.453	2.9	24.0	25.9	8.8	(4.0)	25
Rye, entire	.337	2.2	45.7	3.0	1.3		
Spinach	.410	2.7	33.6	39.3	15.0	(3.0)	20
Squash	.116	.7	133.0	5.5	7.6	(3.7)	50
Strawberries	.251	1.6	61.3	14.6	9.4	4.7	50
Tapioca	.141	.9	109.2	.6	1.0	1.0	100
Tomatoes	.067	.4	230.0	7.0	15.3	4.0	25
Tomato juice	.037	.2	418.0				
Turnips	.392	2.5	39.3	22.6	9.0	(4.5)	50
Turnip tops	2.125	13.8	7.2			3.0	
Walnuts	.545	3.5	28.3	1.8	.5	.5	100
Watercress	1.153	7.5	13.4	135.0	18.0	1.5	10
Watermelon	.067	.4	230.0	5.3	11.6	8.0	75
Wheat, entire	.276	1.8	56.0	1.8	1.0	(5.7)	150
Wheat, bran	.735	4.8	21.0	5.7	1.2	.5	43
Wheat, germ	.435	2.8	35.4	2.8	1.0	1.0	100
Whey	.269	1.9	57.2	22.7	13.0	7.0	50

.612

Lime- TABLE I addendum

THE LIME CONTENT OF HEALTH FOODS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Protose	.416	2.7	37.0	5.4	2.0	2.0	100
Nuttolene	.263	1.7	58.5	3.5	2.0	2.0	100
Gluten, pure	.498	3.1	32.2	3.1	1.0	.5	50
Gluten, 40%	.191	1.2	80.0	1.2	1.0	1.0	100
Gluten, 20%	.095	.6	160.0	.6	1.0	1.0	100
Meltose (Malt Honey)	.122	.8	126.2	1.5	1.2	2.4	200
Savora	1.207						
Brose (oatmeal and bran)	.485	3.1	32.0	3.0	1.0	1.0	100
Malt sugar	.262	1.7	60.0	1.7	1.0	2.0	200
Malted Nuts	.433	2.3	35.5	1.9	.7	1.3	200
Nut Soup Stock	.171						
Vita Bread	.194						

Lime - TABLE 1 a

FOODS RICH IN LIME SALTS

The following table of foods which are richest in lime salts shows in column (1) the amount of lime (CaO) in one ounce. (2) the percentage of the lime ration (15.4) grains) found in one ounce. (3) the amount required to supply the lime ration, 1 gram (15.4 grains) for one day. (4) The percentage of the lime ratio found in 100 calories. (5) Weight of 100 calories (ounces). (6) Weight of an ordinary serving (ounces). (7) The number of calories in an ordinary serving.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Almonds	1.464	9.5	10.5	5.2	.5	.5	100
Beans, dry	.980	6.4	15.7	6.5	100	(3.2)	125
Beans, soya	2.000	13.0	7.7	11.2	.86	1.7	200
Bread, Boston brown	.790	5.1	19.5	7.9	1.2	1.2	100
Brose	.485	3.1	32.0	3.0	1.0	1.0	100
Buttermilk	.645	4.2	24.0	41.1	10.0	6.0	60
Cabbage greens	.649	1.0	23.7	47.3	11.0	4.0	25
Cauliflower	.753	4.0	20.4	56.4	11.0	3.0	25
Celery	.478	3.0	32.2	58.9	18.0	1.0	6
Chard	.919	6.0	16.7	55.0	8.7	3.0	35
Cheese	5.702	37.0	2.7	29.7	.77	.5	70
Cheese, cottage	4.180	27.1	3.7	85.2	3.2	2.0	75
Cheese, yogurt	4.285	27.8	3.0	26.0	.93	.5	50
Cow peas	.612	4.0	25.1	4.1	1.0		
Cottonseed meal	1.623	10.5	9.5	9.2	.9		
Currants, dry, Zante	.502	3.3	30.7	3.6	1.1	1.5	140
Dandelion greens	.643	4.2	24.0	24.1	5.5	3.0	60
Dates	.400	2.6	38.6	2.6	1.0	1.0	100
Eggs	.450	2.9	3.2	6.3	2.4	1.3	70
Egg Yolk	.839	5.4	18.3	5.0	.9	1.0	110
Endive	.637	4.1	24.0	45.5	11.0	3.0	25
Figs, dry	.992	6.4	15.5	7.2	1.1	2.0	100
Gluten pure	1 .025	6.6	15.0	6.6	1.0	.5	50
Gluten 40%.	.400	2.6	38.0	2.6	1.0	1.0	100

Hazelnuts (filberts)	1.758	11.4	6.	5.7	.5	.5	100
Kohl-rabi	.472	3.0	32.6	34.9	11.5	4.0	35
Lentils, dry	.655	4.3	23.5	4.3	1.1	(3.0)	100
Linseed meal	2.530	16.4	6.1				
Maple syrup	.655	4.3	23.5	5.3	1.3	1.3	100
Milk, skimmed	.747	4.8	20.6	46.3	9.6	6.5	75
Milk, whole	.735	4.8	21.0	34.3	5.1	6.0	125
Milk, condensed, sweetened	1.837	11.9	8.4	15.3	1.1	2.0	100
Molasses	1.292	8.4	12.0	10.2	1.2	1.2	100
Mustard greens	3.013	19.6	5.1			3.0	
Oatmeal	.423	2.7	36.4	2.4	.9	(4.2)	75
Okra	.435	2.8	35.4	2.4	9.3	4.5	50
Olives	.747	4.9	20.6	5.7	1.2	1.2	100
Paprika	1.401	9.1	11.0			1.0	
Peas, dry	.514	3.3	30.0	3.6	1.0	3.0	100
Peanuts	.435	2.8	35.4	1.8	.6	.6	100
Pecan nuts	.545	3.5	28.2	1.7	.5	.5	100
Protose	.416	2.7	37.0	5.4	2.0	2.0	100
Raisins	.392	2.5	39.3	2.8	1.0	1.0	100
Rutabagas	.435		34.0	25.9	8.8	(4.0)	25
Spinach	.410	2.7	33.6	39.3	15.0	(3.0)	20
Turnips	.392	2.5	39.3	22.6	9.0	(4.5)	50
Turnip tops	2.125	13.8	7.2			3.0	
Walnuts	.545	3.5	28.3	1.8	.5	.5	100
Watercress	1.153	7.5	13.4	135.0	18.0	1.5	10
Wheat, bran	.735	4.7	21.0				
Wheat, germ	.435	2.8	35.4	2.8	1.0	1.0	100
Whey	.269	1.0	57.2	22.7	13.0	7.0	50

Lime - Table II

THE LIME CONTENT OF FRUITS

The following table shows the lime content of uncooked fruits. Column (1) gives the amount of lime found in one ounce. Column (2) shows the percentage of the lime ration (15.4 grains) found in one ounce. Column (4) shows the percentage of the lime ration found in 100 calories. Column (7) gives the number of calories in an ordinary serving. (See Battle Creek Sanitarium Diet List.)

	(1)	(2)	(4)	(7)
Apples	.043	.3	1.6	100
Apples, dried	.196	1.3	1.6	100
Apple juice	.049	.5	1.6	100
Apricots	.086	.6	3.3	50
Apricots, dry	.404	2.6	3.3	
Bananas	.055	.4	1.2	100
Blackberries	.104	.7	4.2	50
Blueberries	.122	.8	3.8	50
Breadfruit	.514	3.3		
Cantaloupe	.104	.7	6.1	75
Cherries	.116	.8	3.5	50
Cherry juice	.104	.7	3.1	100
Cranberries	.110	.7	5.4	40
Currants, fresh	.159	1.0	6.3	50
Currants, dry, Zante	.502	3.3	3.6	140
Dates	.398	2.6	2.6	100
Figs, dry	.992	6.7	7.2	180
Figs, fresh	.325	2.1	7.2	70
Gooseberries	.214	1.4		
Grapefruit	.129	.8	5.6	50
Grapes	.115	.7	2.7	100
Grape juice	.067	.4	1.5	100
Guava	.086	.6		
Lemon juice	.147	1.0	8.4	5

	(1)	(2)	(4)	(7)
Mango	.129	.8		
Muskmelon	.104	.7	6.0	75
Olives	.747	4.9	5.7	100
Oranges	.276	1.8	12.0	75
Orange juice	.178	1.2	9.3	75
Peaches	.098	.6	5.3	50
Peaches, dry	.208	1.4	5.3	50
Pears	.092	.6	3.3	75
Pear juice	.055	.4	1.4	150
Persimmons	.135	.9		
Pineapple	.110	.7	5.8	50
Plums	.122	.8	3.3	100
Prunes, dry	.331	2.2	2.5	100
Raisins	.392	2.5	2.8	100
Raspberries	.300	2.0	10.4	75
Raspberry juice	.129	.8	3.0	150
Strawberries	.251	1.6	14.6	50
Tomatoes	.067	.4	7.0	25
Tomato juice	.037	.2		
Watermelon	.067	.4	5.3	75

Lime - TABLE 11a

FRUITS WHICH HAVE THE LARGEST LIME CONTENT

	(1)	(2)	(4)	(7)
Currants, dry Zante	.502	3.3	3.6	140
Dates	.400	2.6	2.6	100
Figs, dry	1.000	6.4	7.2	180
Olives	.750	4.9	5.7	100
Oranges	.276	1.8	12.0	75
Prunes	.231	2.2	2.5	100
Raisins	.392	2.5	2.8	100
Raspberries	.300	2.0	10.4	75
Strawberries	.250	1.6	14.6	50

Lime - Table 111

THE LIME CONTENT OF NUTS

The following table shows the lime content of nuts. Column (1) gives the amount of lime found in one ounce. Column (2) shows the percentage of the lime ration (15.4 grains) found in one ounce. Column (4) shows the percentage of the lime ration found in 100 calories. Column (7) gives the number of calories in an ordinary serving.

	(1)	(2)	(4)	(7)
Almonds	1.464	9.5	5.2	100
Chestnuts	.208	1.3	1.9	100
Cocoanut, dried	.361	2.3	.9	
Hazelnuts (filberts)	1.758	11.4	5.7	100
Peanuts	.435	2.4	1.8	100
Pecan nuts	.545	3.5	1.7	100
Walnuts	.545	3.5	1.8	100

Lime- TABLE IV.

THE LIME CONTENT OF CEREALS AND BREADS

The following table shows in column (1) the amount of lime found in one ounce. Column (2) gives the percentage of the lime ration (15.4 grains) in one ounce. Column (4) gives the percentage of the lime ration found in 100 calories. Column (7) shows the number of calories in an ordinary serving. (See Battle Creek Sanitarium Diet List)

	(1)	(2)	(4)	(7)
Barley, entire	.263	1.7	3.0	
Barley, pearled	.122	.8	1.1	100
Bread, Boston Brown	.790	5.1	7.9	100
Bread, entire wheat	.133	.9	1.23	150
Bread, graham	.176	1.2	1.6	150
Bread, rye	.147	1.0	1.3	150
Bread, entire rye (pumpernickel)	.259	1.7	2.8	120
Bread, white	.091	.6	.8	150
Buckwheat flour	.239	1.6	5.9	
Corn, whole	.122	.8	.8	100
Cornmeal	.110	.7	.7	75
Cottonseed meal	1.623	10.5	9.2	
Crackers	.135	.9	.8	110
Farina	.129	.8	.8	
Flour, buckwheat	.061	.4	1.5	
Flour, entire wheat,	.190	1.2	1.2	
Flour, graham	.239	1.6	1.5	
Flour, white	.123	.8	.8	
Flour, rye	.110	.7	.7	
Flour, rye entire	.293	1.9	2.5	
Hominy	.067	.4	.2	100
Linseed meal	2.530	16.4		
Macaroni	.135	.9	.8	100
Millet	.086	.5		
Oatmeal	.423	2.7	2.4	75

Rice, polished	.055	.3	.3	125
Rice, brown	.073	.5	.4	100
Rye, entire	.337	2.2	3.0	
Tapioca	.141	.9	.6	100
Wheat, entire	.276	1.8	1.8	
Wheat, bran	.735	4.7		
Wheat, germ	.435	2.8	2.8	100

Lime - TABLE V.

THE LIME CONTENT OF VEGETABLES

The following table shows in column (1) the amount of lime found in one ounce. Column (2) shows the percentage of the lime ration (15.4 grains) found in one ounce. Column (4) gives the percentage of the lime ration found in 100 calories. Column (7) shows the number of calories in an ordinary serving. (See Battle Creek Sanitarium Diet List).

	(1)	(2)	(4)	(7)
Asparagus				
Beans, lima, fresh	.171	1.1	2.8	100
Beans, string, fresh	.282	1.8	13.0	25
Beets	.178	1.2	8.9	25
Brussels sprouts	.165	1.1	12.1	
Cabbage	.276	1.8	20.0	25
Carrots	.345	2.2	33.3	50
Cauliflower	.753	4.0	56.4	25
Corn, sweet, fresh	.037	.2	.8	75
Cucumbers	.098	.6	12.6	10
Eggplant	.067	.4	5.7	10
Kohl-rabi	.472	3.0	34.9	35
Mushrooms	.104			
Okra	.435	2.8	2.4	50
Onions	.208	1.3	9.7	35
Parsnips	.361	2.3	12.8	55
Potatoes	.086	.5	2.5	75
Potatoes, sweet	.116	.7	2.3	200
Pumpkin	.141	.9	12.5	25
Radishes	.129	.8	12.2	6
Rutabagas	.453	2.9	25.9	25
Squash	.116	.7	5.5	50
Turnips	.392	2.5	22.6	50

Lime - TABLE VI.

THE LIME CONTENT OF LEGUMES

The following table shows in column (1) the amount of lime found in one ounce. Column (2) gives the percentage of the lime ration (15.4 grains) found in one ounce. Column (4) shows the percentage of the lime ration in 100 calories. Column (7) gives the number of calories in an ordinary serving. (See Battle Creek Sanitarium List).

	(1)	(2)	(4)	(7)
Beans, dry	.980	6.4	6.5	125
Beans, lima dry	.435	2.8	2.8	100
Beans, soya				
Cow peas	.612	4.0	4.1	
Cottonseed meal	1.623	10.5	9.2	
Lentils, dry	.655	4.3	4.3	100
Linseed Meal	2.530	16.4		
Peas, dry	.612	3.3	3.6	100
Peas, green	.171	1.1	4.0	100

Lime - TABLE VII

THE LIME CONTENT OF GREENS

The following table shows in column (1) the amount of lime found in one ounce. Column (2) gives the percentage of the lime ration found in one ounce. Column (4) gives the percentage of the lime ration found in 100 calories. Column (7) shows the number of calories in an ordinary serving. (See Battle Creek Sanitarium Diet List).

	(1)	(2)	(4)	(7)
Asparagus	.153	1.0	17.1	10
Celery	.478	3.1	58.9	6
Chard	.919	6.0	55.0	35
Dandelion greens	.643	4.2	24.1	
Endive	.367	4.1	45.5	25
Lettuce	.263	1.7	31.4	5
Mustard greens	3.013	19.6		
Paprika	1.401	9.1		
Romaine	.276	1.8		
Spinach	.410	2.7	39.3	20
Turnip tops	2.125	13.8		
Watercress	1.153	7.5	135.0	10

Mineral Contents of Greens.

	H2O	Ash		CaO		Fe		Lime		Iron	
	%	% dry	Moist	dry	moist	dry	moist	(1)	(2)	(1)	(2)
1 Mt Spinach	First 85.6	Analysis 23.0	3.3	2.53 2.04	.29	.015 .0135	.0019	1.27	8.5	.008	3.9
2 Lambs Quarter	85.3	23.3	3.4	2.95	.43	.0142	.0021	1.90	12.5	.009	4.3
3 Red Root	81.9	17.6	3.2	3.94 4.08	.74	.036 .0347	.0063	3.24	21.6	.028	12.9
4 Purslane	91.1	16.9	1.7	1.65 2.06	.20	.0175 .0196	.0019	.88	5.8	.008	3.9
5 Rainbow Chard	90.9	20.3	1.8	1.8	.16	.0227	.0021	.70	4.7	.009	4.3
6 New Zealand Spinach	92.3	23.9	1.8	1.48	.11	.0264	.0020	.48	3.2	.009	4.1
7 Quinoa	88.7	23.5	2.7	1.45	.16	.011	.0012	.70	4.7	.005	2.2
8 Turnip Tops	93.3	19.1	1.3	3.59	.24	.0343	.0023	1.05	7.0	.010	4.7
9 Narrow Leaved Dock	86.6	14.5	2.0	1.66	.23	.0478	.0065	1.00	6.7	.023	13.4

Lime - TABLE VIII

THE LIME CONTENT OF ANIMAL FOODS

The following table shows in column (1) the amount of lime found in one ounce. Column (2) gives the percentage of the lime ration (15.4 grains) in one ounce. Column (4) shows the percentage of the lime ration found in 100 calories. Column (7) gives the number of calories in an ordinary serving. (See Battle Creek Sanitarium Diet List.)

Dairy Products

	(1)	(2)	(4)	(7)
Milk, whole	.735	4.8	24.3	125
Milk, skimmed	.747	4.8	46.3	75
Milk, condensed, sweetened	1.837	11.9	15.3	180
Buttermilk	.643	4.2	41.1	75
Cheese	5.702	37.0	29.7	70
Cheese, cottage	4.180	27.1	21.2	75
Cheese, yogurt	4.285	27.8	26.0	50
Cream	.527	3.42	7.2	125
Butter	.092	.6	.3	113
Whey	.269	1.0	22.7	50
Milk, human	.208	1.4	7.0	100

Eggs

	(1)	(2)	(4)	(7)
Eggs	.450	2.9	6.3	60
Eggyolk	.839	5.4	5.0	110
Egg white	.092	.6	2.8	20

Meats

	(1)	(2)	(4)	(7)
Beef, tenderloin	.057	.4	.45	200
Chicken, broilers	.066	.43	1.4	75
Fish	.134	8.7	2.6	200
Blood	.049	.32		

Lime and Iron TABLE IX

FOODS RICH IN IRON AND LIME

The following table shows the amount of lime and iron per ounce (1). The percentage of the day's ration of iron and of lime in one ounce (2). The percentage of the iron ration and the lime ration in 100 calories (4). The number of calories in an ordinary serving. (7)

	(1)		(2)		(4)		(7)
	Iron	Lime	Iron	Lime	Iron	Lime	
Almonds	.0171	1.464	7.3	9.5	4.0	5.2	100
Beans, dry	.0306	.980	13.8	6.4	13.5	6.5	125
Beans, soya	.0248	2.000	10.7	13.0	9.2	11.2	100
Bread, Boston Brown	.0131	.790	5.6	5.1	9.0	7.9	100
Cabbage greens	.0079	.649	3.4	4.2	30.0	47.3	25
Chard	.0100	.919	4.7	6.0	44.0	55.0	35
Currants, dry zante	.0109	.502	4.7	3.3	6.0	3.6	140
Dandelion greens	.0118	.643	5.1	4.2	30.0	24.1	50
Dates	.0131	.398	5.7	2.6	6.0	2.6	100
Eggs	.0131	.450	5.7	2.9	14.0	6.3	70
Eggyolk	.0377	.839	16.3	5.4	15.3	5.0	110
Endive	(.0106)	.637	4.6	4.1	50.5	45.5	25
Figs, dry	.0131	.992	5.7	6.4	6.3	7.[illegible]	180
Hazelnut	.0179	1.758	7.75	11.4	4.0	5.7	100
Lentils, dry	.0277	.655	16.3	4.3	19.5	4.3	100
Mustard greens	(.0213)	3.013	9.2	19.6			
Oatmeal	.0166	.423	7.2	2 7	6.4	2.4	75
Olives	.0127	.747	6.5	4.9	6.5	5.7	100
Peas, dry	.0249	.514	10.8	3.3	11.0	3.6	100
Pecan nuts	.0114	.545	4.9	3.5	2.3	1.7	100
Raisins	.0092	.392	4.0	2.[illegible]	9.2	[illegible]	100
Spinach	.0158	.410	6.8	2.7	100.4	33.3	20
Turnip tops	.0152	2.125	6.6	13.8			
Walnuts	.0092	.545	4.0	3.5	2.0	2.0	100
Wheat bran	.0341	.735	14.8	4.7			