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VITAMINS

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How Do We Know That Vitamins Exist?

When the known constituents of foods are separated, each in pure form, and then these purified compounds mixed in the proportions proper for a good diet, what is known as a "synthetic" food is obtained. These synthetic foods will not support growth nor maintain health in animals. Although they contain proteins, fats, carbohydrates, and salts in proper amount, and are digestible and palatable, they lack something essential to natural foods.

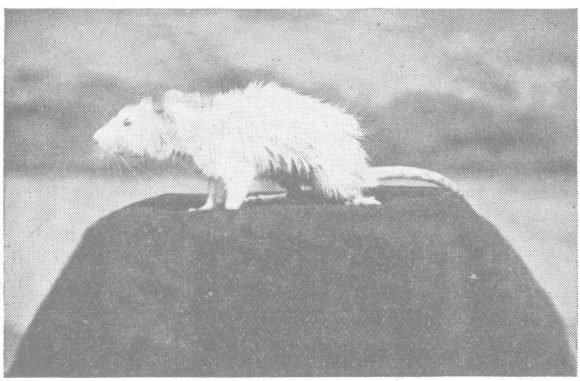

Fig. 1.—This rat and the one shown in Fig. 2 are litter mates. At weaning time they weighed 50 grams each. They were fed the same things and in the same proportions (meat, butter, and salts) but this rat was given polished ground rice as a cereal, which is deficient in vitamin B. It gained only 35 grams during the experiment.

The addition of certain natural foods or extracts from natural foods to "synthetic" diets has remarkable effects on the growth and health of animals. The natural foods or extracts added are sometimes so small in quantity that they could not add enough proteins, fat, carbohydrates, or salts to be of benefit. It follows, then, that they must contain another type of substance or substances. These substances are called vitamins.

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What Are Vitamins?

After many failures, scientists have succeeded recently in obtaining one of the vitamins from yeast. This vitamin is known as "bios." It has a wonderful effect on growth. "Bios" has not been obtained as yet in sufficient amount for its complete identification, but evidently it is an organic substance of rather simple chemical composition. This success in isolating one of the vitamins in a rather pure state has encouraged chemists in the expectation that before long each of the vitamins will be separated and their exact nature discovered.

At present, while we know little as to what vitamins **are**, we understand pretty well what vitamins **do**. Animals, including man, cannot live without vitamins. Without vitamins in the diet growth stops; disease and death result. Diets containing vitamins, but in insufficient amounts, produce more or less serious effects, depending on the degree of deficiency.

How Many Kinds of Vitamins Are Known?

When the discovery of vitamins was announced in 1912 it was thought possibly only one existed. From time to time since then different types of vitamins have been discovered. At present we recognize four types: fat soluble A vitamin, water soluble B vitamin, water soluble C vitamin, and fat soluble D vitamin. Water soluble B really seems to be a mixture of two vitamins which are called "bios" and anti-beriberi vitamin respectively. These two vitamins usually occur together.

It has been suggested, but not definitely proven, that still another vitamin exists. At present this is known as vitamin X, to indicate the uncertainty of our knowledge of it. This vitamin appears to be necessary for reproduction, and occurs in whole grains and in green leaves.

What Is Fat Soluble A Vitamin?

Fat soluble A vitamin is found in certain fats such as milk fat, egg-yolk fat, the tissue and body fats of animals. It also occurs in the green leaves of plants, the germs of seeds, and to some extent in fruits and yellow vegetables such as the tomato, sweet potato, carrot, and squash. Yellow corn contains some of vitamin A, but white corn is practically devoid of it.

When rations lacking in fat soluble A vitamin are used, growth stops; there is a loss of weight, and health is impaired. There is an increased susceptibility to certain infectious diseases,

notably an eye infection known as xerophthalmia, and finally death results unless the diet is corrected.

The amount of vitamin A in the food has been found to have a marked influence upon the capacity for reproduction and successful suckling of the young. There is some evidence that a deficiency of vitamin A may be a factor in tuberculosis.

What Is Water Soluble B Vitamin?

As mentioned before, vitamin B really consists of a mixture of two vitamins, bios and anti-beriberi vitamin. These two vitamins usually or perhaps always occur together. They are found abundantly in yeast, in the germs and seed coats of cereals and seeds, in leaves, and to a less extent in milk, fruits, roots, tubers, nuts, eggs, and meat. Lack of bios results in failure to grow, loss of weight, and death. Since in all the experiments on record in which bios was lacking, the anti-beriberi vitamin was lacking also, we do not know **exactly** the effects of a lack of each vitamin alone.

Diets lacking in anti-beriberi vitamin result in a disease known as beriberi, characterized in its incipient stages by fatigue and depression, numbness and stiffness of the legs, and more or less edema of the ankles and face. In dry or true beriberi there is a wasting of the tissues and paralysis.

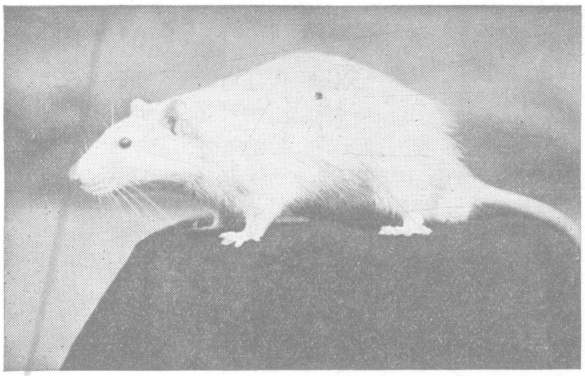


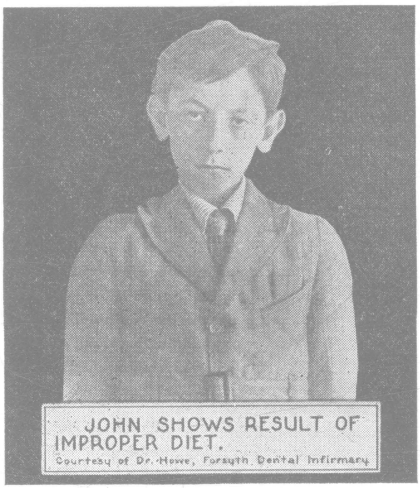
Fig. 2.—This rat was fed the same diet as the rat in Fig. 1, but whole wheat was substituted for the rice. This rat made a gain of 250 grams during the experiment.

In animals this disease is called polyneuritis. In the earlier stages of the disease there is a loss of appetite, and loss of weight, certain organs especially being affected. The reproductive and muscular systems particularly suffer degenerative changes. The muscles of the walls of the digestive system become incapable of functioning properly. The waste matter from the intestine is not promptly eliminated; excessive decomposition by bacterial action results. The toxic products of this decomposition are absorbed into the blood and the intestinal wall it-

self injured. In the last stages of polyneuritis coordinated muscular movements are impossible.

A partial but not complete deficiency of the anti-beriberi vitamin and of bios (vitamin B) leads to impaired growth, a derangement of the functions of the organs of digestion, and a general undermining of health and efficiency.

Babies fed diluted cow's milk probably often fail to make maximum growth because of a deficiency of vitamin B. This can be corrected by using a water extract of rolled oats instead of water for diluting the milk. The extract can be prepared by soaking two tablespoons of rolled oats in a pint of water overnight. In the morning strain through a tea strainer, bring the liquid to a boil, strain again, cool and dilute the milk with the liquid thus obtained. The usual formula for mixing the baby's food should be followed, except that the oat extract is used in place of water, lime water, or gruel. The writer has seen very excellent results.



JOHN SHOWS RESULT OF IMPROPER DIET.
Courtesy of Dr. Howe, Forsyth Dental Infirmary

What Is Water Soluble C Vitamin?

Vitamin C is found in fresh fruits, leaves, tubers, and roots, and to a less extent in fresh milk and meat. When the diet of man lacks vitamin C scurvy soon results. The symptoms are soreness of joints, soreness of the gums, and usually a loss of weight. Without change of diet, the symptoms grow worse and death results.

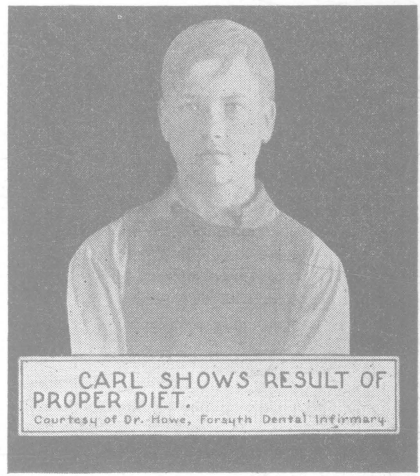
Scurvy attacks infants fed pasteurized milk unless fruit juice, such as orange juice or tomato juice, is also given. Adults who live exclusively on dried, canned, and cured foods also become afflicted with scurvy.

What Is Fat Soluble D Vitamin?

Vitamin D usually is associated with vitamin A. Both are present in butter fat, egg-yolk fat, the glands of the body, as the liver, fresh green leaves, and cod-liver oil. Small amounts occur in other food materials, as in certain fruits and vegetables. Since the two vitamins occur together in nature there was doubt as to the

existence of vitamin D until Dr. E. V. McCollum of Johns Hopkins University, in 1922, removed the vitamin A fraction from cod-liver oil without destroying vitamin D. His method was to pass air through the hot oil. Vitamin A is rather easily destroyed by air or oxygen at the temperature of boiling water, while vitamin D appears to be less readily decomposed.

Vitamin D is essential for the proper growth of bones and teeth in the young, and for the maintenance of healthful bone and tooth conditions in the adult. When vitamin D is lacking in the diet of the child the disease called rickets results. Severe rickets is characterized by soft pliable bones resulting in malformations such as bow legs or knock knees, and mis-shaped ribs with a resultant constricted chest cavity. Along with a defective bone structure there is a disturbance of the musculature. The skeletal muscles are weak and flabby. The muscles of the intestinal wall also fail to function properly, resulting in the accumulation of waste products in the bowels with their accompanying evil effects. The rachitic child is nervous and irritable, or apathetic and disinclined to play. There is a lowered body resistance to infections. Colds are common. Frequently infections of the respiratory tract result in death.


CARL SHOWS RESULT OF PROPER DIET.
Courtesy of Dr. Howe, Forsyth Dental Infirmary

Diets somewhat low in this vitamin may produce bad effects without pronounced symptoms of rickets. The primary cause of decayed teeth has been found to lie in the faulty diets of the pregnant mother and of the young child. The diets used in America are too low not only in vitamin D but also in lime for proper reproduction and rearing of young. Authorities estimate that from 50 to 80 per cent of American children have rickets in a more or less severe form.

The prevalence of decayed teeth among children and adults, and the serious tooth deterioration among American mothers, indicates a deficiency of vitamin D and of lime in our common diets. Some authorities recommend that each expectant mother take cod-liver oil regularly, as a supplementary source of vitamin D. Bottle-fed babies are benefited by feeding something rich in vitamin D in

addition to milk. Dr. McCollum recommends 45 drops of cod-liver oil three times a week for each infant. Dr. A. F. Hess, professor of pediatrics, New York University, recommends that each bottle-fed infant under two months of age be given one-half of a raw egg yolk mixed in the day's food and a whole yolk for each baby over two months old.

There is good reason for believing that proper food for mothers and children would cause rickets to disappear completely in two generations. Bad teeth would disappear along with rickets.

How Much Vitamin Is Required By a Man Each Day?

This question can be answered only very roughly and in terms of the foods that contain vitamins. On the basis of experiments mostly with white rats, the vitamin requirements can be roughly estimated if we assume that the requirements of men are similar to those of rats.

If the entire amount of fat soluble A vitamin needed for one day by the average man had to be supplied by one article of food, any one of the following amounts would have to be consumed daily: 1 ounce of butter, 1 quart of milk, 12 ounces of spinach or lettuce, 2 pounds of cabbage or carrots, 1 pound of sweet potatoes, or 1½ pounds of tomatoes. Such foods as white bread (made with milk), white potatoes, and meat contain some vitamin A, but cannot safely be depended on to furnish the entire requirement of the body.

The necessary amount of water soluble B vitamin would be furnished by about 5 quarts of milk or any one of the following: 1.5 pounds of eggs, 1 pound patent flour, 4 ounces whole wheat flour, 4 ounces navy beans, 1 pound spinach, 1.75 pounds carrots, 1.25 pounds tomatoes, or 1.5 ounces compressed yeast. One and one-half pounds of meat per day probably would not supply enough vitamin B to maintain health. White potatoes are not a reliable source. Some of these figures are probably too low. It is doubtful if 1 pound of patent flour contains enough vitamin B to supply the needs of the body for one day. Dr. Grenfell finds that in Labrador, where the chief food is white bread, beriberi is a common disease.

The necessary amount of vitamin C would be furnished in all ordinary diets containing potatoes, fresh fruits, and vegetables in moderate amounts. A lack of this vitamin is probably rare in ordinary American dietaries. Infants fed exclusively on sterilized, dried, or condensed milk are likely to suffer from scurvy unless a little fruit juice is fed. Formerly, soldiers and sailors suffered

greatly from scurvy, but in modern times this disease has been largely eliminated even in warfare, by the provision of proper anti-scorbutic foods. In all cases it seems wise to have a reasonable excess of vitamins in the food. A moderate excess will do no harm, while a deficiency will be disastrous.

Experiments have not determined, as yet, the amount of vitamin D required by adults. From studies that have been made, it appears that we must rely principally on milk, eggs, and green leafy vegetables for a supply of this vitamin. Cod-liver oil is the richest source of vitamin D, and it may be used to advantage in the diets of expectant mothers, infants, and invalids.

What Is the Effect of Cooking on Vitamins?

Vitamins A and B may be destroyed by heat, but ordinary cooking probably has only a slight destructive effect.

Vitamin B is soluble in water, and a considerable loss may occur in cooking when the water in which vegetables are boiled is poured off.

Vitamin C also is rather easily destroyed by heat except in some of the acid fruits and vegetables. Stewed tomatoes, canned tomatoes, and boiled potatoes retain a considerable part of this vitamin.

The effect of cooking on vitamin D is unknown. Probably it is resistant to ordinary cooking.

Do Children Require More Vitamins Than Adults?

A diet low in vitamins produces in the child more immediate effects than in the adult. The reasons for this are:

1. The adult has more or less vitamin stored in the body and this may be drawn on to tide over temporary shortages in the diet.

2. A deficiency of vitamins produces in the child a decreased rate of growth and an underweight child is the result. In adults the result of a deficiency of vitamins is not so apparent. The individual may be below par in many ways; but there is no abnormality that can be readily measured.

3. It is probable that the diet of the child should be richer in vitamins than that of the adult in order to meet the extra needs for growth.

How Can Foods Be Chosen So That the Diet Will Contain Sufficient Vitamins?

The following rules, if followed, will tend to increase vitamins and to improve the diet generally:

1. A quart of milk a day for children up to 12 years; a pint a day for all older people should be used.
2. Fresh fruits and vegetables should be used liberally. Fruit or salad should be served once each day.
3. Green leafy vegetables such as spinach, lettuce, cabbage, or pot greens should be eaten three to five times a week.
4. A large part of the highly milled cereal products, such as white flour, should be replaced by products that more nearly represent the whole grain, such as whole wheat flour and rolled oats.

How Would More Vitamins Improve Our Diets?

In Ohio there are not many who **die** of xerophthalmia, beriberi, scurvy, or rickets. These diseases, particularly the last one, are frequently noted by physicians, but they are not commonly the direct cause of death. Sufficient vitamins in the food would entirely eradicate these diseases, but it would do more than this. We like to think of Ohio as the garden spot of the world, and of Ohio people as the best fed people in the world. In spite of modern progress, or rather perhaps because of it, the average Ohio citizen today is not as well fed, his food is not as nutritious, as was that of the primitive Indian who roamed the forest before the white man came.

Dr. R. McCarrison, surgeon in the British Army residing in India, speaking of a primitive tribe in the mountainous region of India, says that their diet consists of unbolted flour, vegetables, fruits, and dairy products. Such foods as granulated sugar, patent flour, and refined vegetable oils are unknown. In 12 years' experience in that region he has never seen a single case of chronic gastrointestinal disease. Appendicitis, gastric ulcer, dyspepsia, and constipation are entirely absent. In Ohio all of these disorders are common. The larger use of those foods rich in vitamins, of coarser texture, and higher in the essential mineral salts will go far to correct, if it does not entirely correct, these ailments.

What About Vitamin Tablets?

Such medicinal preparations may be of great value in cases of illness; but in normal health, they should never be necessary. A properly selected diet can be depended on to provide all the vitamins required for normal development and good health.