

## THE VITAMINS AS NECESSITIES OF LIFE

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THE most obvious reasons for which we take food are (1) for the production of energy to carry on the functions associated with living, (2) to make good "wear and tear" in the body machine, and (3), during growth, to provide material for new tissues.

For the production of energy we require a certain quantity of starch or sugar and some fat. For making good "wear and tear" and for growth we need, in addition, some of the nitrogen containing foodstuff, protein. In addition we must have water and certain mineral salts.

At the beginning of this century it was generally considered by students of nutrition that if one consumed the necessary amounts and right proportions of carbohydrates (*i.e.*, starch and the sugars), fats and proteins of good quality, together with the necessary amounts and kinds of mineral salts and water, one had all that was required for maintenance and health.

There had been suggestions that besides these substances something else was necessary for a full and complete diet. These suggestions, however, were not taken seriously.

Towards the end of last century a Dutch physician, Eijkman, working in Java, noticed that a disease that was extremely prevalent in the East (called beri beri) was associated with the continuous consumption of polished rice as a main article of diet. He noted further that fowls fed on polished rice developed a condition very like beri beri in man, while fowls fed on unpolished rice remained healthy. These results were confirmed in the Malay States; and from these observations commences the fascinating history of the discovery of the vitamins.

The investigation was taken up in London by Casimir Funk, who in 1912 made the revolutionary suggestion that beri beri, scurvy and pellagra were deficiency diseases; that is, that they were brought about by the absence of something from the food and not, as was considered to be the case, by the presence of some poison or toxin.

Funk isolated a crystalline material from rice polishings which, on administration to pigeons suffering from the "beri beri like" condition, cured them with dramatic quickness. He called this substance Vitamine. The actual curative substance was present as an impurity in his crystalline material, and indeed has only recently been obtained in pure condition.

Other investigators in England and America, at about the same time, found that if rats were fed on a carefully purified diet they did not grow; but that they did grow when a little milk was added to that diet. Very soon it was found that, in addition to Funk's vitamine, at least one other accessory food substance had to be present in the diet. Funk's vitamine was soluble in water, while this second substance was not; but it was soluble in fats and oils, and was present in certain animal fats such as butter. Then was started the alphabetical naming of these substances. This was done because nothing was known as to their chemistry and, rather than give a name which might later prove unsuitable, they were called by the letters of the alphabet: fat soluble A food accessory, water soluble B food accessory. Later the term vitamin was used as a group name with the letter of the alphabet, so vitamin A and vitamin B.

In 1918 Prof. Mellanby demonstrated that rickets was associated with a deficiency of something which was present in certain oils like cod liver oil, and gradually it became obvious that what had been called vitamin A was really two substances, vitamin A proper, and the substance which prevented rickets. This latter was called vitamin D.

Meanwhile the fact that scurvy was caused by a food deficiency was proved by experiment; and we thus had vitamin C.

An enormous amount of work has been done in all parts of the world during the past 20 years on the vitamins, and we are now beginning to get a clearer idea of what these substances are, and what they do.

We now recognize definitely vitamins A, B1, B2, C, D and E, and have considerable evidence for the occurrence of several others.

The only things common to the vitamins are that they are all essential for proper body functioning, and that only extremely small amounts of them are necessary. They differ considerably chemically and in their functions in the animal body; so we must treat them individually.

Vitamin A is found particularly in certain animal fats and oils, especially in liver oils, butter and egg yolk. The green and yellow parts of plants form a rich *source* of this vitamin, but the vitamin, as such, probably does not exist in the plant. It is there represented by the red colouring matter called "carotin", which gives the reddish colour to carrots (whence the name). This is present in greater or less amounts in all vegetables and is converted in the animal body into vitamin A. Young animals fed on a diet deficient in this vitamin soon cease to grow, then show a rapid decline in weight, and soon die. With the loss in weight are associated various infections, particularly of the eyes. There is strong presumptive evidence that the partial disturbances of vision summed up under the term "night blindness" are due to a certain deficiency of vitamin A.

Substances rich in vitamin A have been used with considerable success in the treatment of certain infections.

Under ordinary conditions there should be no shortage of vitamin A in human diets. Butter, eggs, cabbage, spinach, carrots are abundant sources of this vitamin. It keeps well in foods under good conditions and is not readily destroyed by ordinary cooking. Cod liver oil is the richest common source.

Vitamin D is, like vitamin A, soluble in fats and oils. It is very richly present in fish liver oils, also in egg yolk, butter and, to some extent, in other animal fats; but not in lard. Milk is *not* a rich source. Vegetables do not contain appreciable amounts of this vitamin. It is not easily destroyed by storage or by cooking.

It is an interesting fact that we can do without this vitamin in the food if the body be exposed for short intervals to direct sunlight. The ultraviolet radiations in the sunlight act on a substance contained in the skin and convert it into vitamin D. If the sunlight pass through ordinary glass it will lose its power of acting in this way.

As infants, in particular, require this vitamin, and since milk is a poor source, the advisability of exposing them to sunlight as opportunity offers is apparent.

Exposure of the body to ultra violet radiations from special lamps is used for the same purpose in places where sunlight is deficient; but such is not necessary in Australia, with its abundant sunlight. The general high standard of health in Australian children is undoubtedly in part due to the beneficent action of sunlight.

Deficiency of vitamin D in the infant leads to the deforming disease rickets. Other things (as deficiency of lime salts and of phosphorus) play a part in the causation of rickets, but the vitamin deficiency is the principal factor. In adults a condition called osteomalacia results, where there is softening of the bones and resultant deformities. This is rare in civilized communities, but is common among the women in India, where the custom of "purdah" is maintained, the women getting no sunlight and a diet poor in vitamin D.

It is interesting to note that when cereals form an important part of the dietary more vitamin D is necessary than in their absence. Of the cereals, oatmeal is by far the worst in this respect. This knowledge is important, for cereals are becoming more and more the staple foods of large sections of the community, because of their cheapness. Provided ample supplies of vitamin D are also available, no harm will result from this; but unfortunately it is among the poorer people that cereals bulk so largely in the diet, and there foods rich in vitamin D are not generally available. Here fortunately we have lots of sunlight; but in Europe the position is likely to be more serious.

Vitamin D is an extraordinary potent substance; one grain of the pure material is equivalent to about 6 gallons of a good quality cod liver oil. But remember that sunlight is the cheapest and most easily obtained source of vitamin D.

Vitamin B1 is the original vitamine of Funk, and I have already drawn attention to its relation to the disease beri beri. Beri beri is not common among wheat eating people; not because of the wheat, but because people who eat wheaten bread belong to the richer countries where diet is varied. It can occur, however, among such people: as was seen by its occurrence among the British white troops during the siege of Kut-el-Amara: it cleared up when the coarsely milled flour of their Indian comrades was given to the white troops.

When there is a relative deficiency of this vitamin, insufficient to cause beri beri, there are observed loss of weight and certain nutritional disturbances.

It is doubtful whether there is, except in rare circumstances, any shortage of this vitamin in the dietaries of civilized people. It is very widespread and has been detected in most natural foodstuffs.

Yeast, eggs, liver, and the embryos of cereals are the richest known sources. Green vegetables are also rich. Milk, meat and fish are poor. White flour contains none; but then nobody lives on white bread alone.

The vitamin is not easily destroyed except by alkalis, and it withstands ordinary cooking. There is, however, considerable destruction on cooking vegetables with soda; but, provided the diet is good and well assorted, this need not deter the housewife from using soda to keep her beans green.

Where there is any likelihood that there is a deficiency of this vitamin in the diet, it is a better and more mixed diet that is required, and not some expensive concentrate.

Vitamin B2 has very much the same distribution in foodstuffs as B1, but there are quantitative differences. Milk and meat are much richer in B2 than in B1; while the reverse is true of egg yolk and of green vegetables. Wheat embryo, very rich in B1, is poor in B2. White wheat flour on the other hand contains appreciable amounts of B2. Yeast is the richest source of both B1 and B2.

This vitamin (B2) is very resistant to destruction and, being very widespread in foodstuffs, there is little risk of any shortage of it when the diet is liberal and well varied.

In its absence a disease called pellagra appears. We are not yet certain that this is the only factor in the occurrence of pellagra, but it is an important one.

Pellagra occurs particularly among maize eating people, for example, in Italy, Egypt and among the poor whites in the southern U.S.A. Where maize forms the principal article of diet the people are generally very poor, and there is little else of value in the dietary. A relative deficiency of this vitamin is associated with poor growth.

Vitamin C is the antiscorbutic or antiscorvy vitamin; when it is absent from the food or is present in insufficient amount, scurvy develops. It had been known for a very long time that scurvy was caused by a lack of "something" in the diet; "something" associated with the freshness of the food; "something" which disappeared as the food became stale. Scurvy used to be the scourge of sailors; sometimes whole ship's crews would go down with it. It is of interest to us that the voyage of Captain Cook, when he charted the coast of Australia, was by far

the longest sea voyage ever undertaken without there being any scurvy among the crew. Captain Cook insisted on the consumption of fresh fruit and fresh vegetables at every possible opportunity, and so warded off the disease.

Scurvy is not common nowadays, but occurs even here (in a modified form) among infants fed exclusively on artificial foods made with boiled milk; and it occurs among shipwrecked sailors. It used to be common among Arctic and Antarctic explorers; but the only one on board to show signs of scurvy during the last Mawson Expedition was the ship's cat; and they forgot to give it its ration of orange juice, which was served out to the rest of the crew.

Vitamin C is very easily destroyed by prolonged cooking (or by storage of foods), but fortunately it is easily obtained. By far the richest ordinary sources are oranges, lemons, tomatoes and cabbage. Potatoes, while comparatively poor in vitamin C, easily take first place as the source of this vitamin in ordinary dietaries because of the relatively large amounts consumed. All fruit and vegetables contain some of this vitamin, while animal foods are deficient; hence the necessity for some fresh fruit or vegetables in the dietary. Where fruit and vegetables are scarce, the mode of cooking the vegetables becomes of some importance, because of the easy destruction of this vitamin by heat. Under these conditions vegetables should be cooked for as short a time as possible, *not* in stews nor in "self-cookers".

Vitamin E is a fat soluble vitamin, and is very widespread in foodstuffs and not easily destroyed. Lettuce is a very rich source. There is very little likelihood of there being a shortage of this vitamin in human dietaries.

From what I have said, it is obvious that it is particularly during infancy and early childhood that one must ensure abundance of vitamins in the food. Vitamins A, B1 and B2 are all essential for growth, vitamin D for proper formation of bones and teeth, vitamin C to maintain normal health and possibly also to aid development of the teeth. Vitamins A and D are readily supplied, where necessary, by administration of cod liver oil; but in older children butter and vegetables for vitamin A and abundant sunlight for vitamin D are better. Where it is necessary to give

vitamins B1 and B2, one or other of the yeast concentrates provides a suitable source. All children, where possible, should have orange juice to provide vitamin C; for milk is deficient, especially if it has been boiled. Preserved fruit juices are not much good; but canned tomatoes offer a very rich source, cheap and easily obtained, and keeping well.

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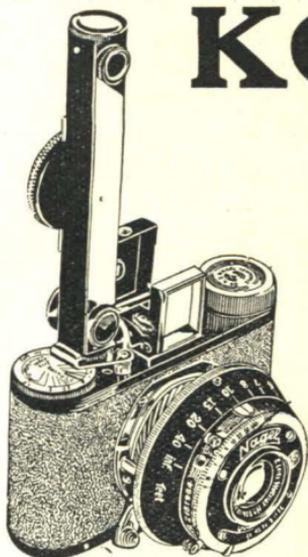
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