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CAN VITAMINS BE STANDARDIZED AS TO UNIT CONTENT?

Pharmacologists have attempted to find scientific short cuts for determining the merit of vitamins by means of their effect upon animals and to establish units of potency based on these results.

Where the chemical identity of a vitamin was thought to be established, the vitamin became subject to standardization in quantitative measurement.

Both methods were intended to remove from the user of the product (patient or physician) the necessity of depending upon their own means of appraisal (the clinical test), which, in any case, must be the final arbiter of quality. Vitamin concentrates used for therapeutic purposes are far less in need of standardization than those used for food fortification, for their continued acceptance by a physician must of necessity be accompanied by tangible results, but the user of a food product containing added vitamins has less opportunity to be able to judge its merit by the less obvious effect of the small quantities present.

In our efforts to be scientific, however, it is important that we defer the job of establishing units for measurement before a foundation of fact has been built. It appears that in this case, in our efforts to be more scientific, premature assumptions have caused most of our vitamin technologists to be a great deal less scientific.

As in all new sciences, a little knowledge is dangerous. The proponents of the scheme to test vitamins by animal experiment overlooked one vital matter that is the basic principle of animal nutrition - that each species has a biochemistry peculiar to itself, and each species has its own preferential food substances. The caloric value of hay, for example, determined by its effect upon cows and horses, is no criterion of its nutritional merit as a food for humans.

Biological standardization of vitamins (C, D and G especially), according to most recent findings, has failed to be a success because of this principle, and chemically pure "Vitamin C" (ascorbic acid) is of no benefit whatever to some species and according to its discoverer, Szent-Gyorgyi, fails to have its expected effect in treating some of the outstanding and characteristic symptoms of scurvy in the human (1).

The first forms of synthetic Vitamin D were loaded with toxic materials that were not detected in the rat experiments (2) and only recent research by German chemists have made possible a pure and non-toxic synthetic product through the use of monochromatic ultraviolet light in its synthesis by irradiation. The rat, unhappily for us, responded to the toxic product as well as to the "human" form of the vitamin without showing ill effects. Naturally the manufacturers of such abortions do not advertize their mistakes and the substitution of biologic tests for clinical experience delayed the development of true Vitamin D for a considerable time. The real truth came out only by the discovery that the "rat" vitamin was useless as a "chick" vitamin, the chicken requiring the same form of Vitamin D (in metabolizing egg shell calcium) as is effective for maintaining the health of the human race.

In the case of Vitamin G, a separate chemical form has been found for each of the three species so far studied (3).

Further work promises to greatly extend this principle of "species specificity". Since the present concept of vitamins involves whole "chemically related families," in the case of each vitamin, as we have preached for some years, this picture appears reasonable. No animal feeder in a zoo tries to maintain all the different species of animals on the same forms of fats, carbohydrates and proteins, nor on the same proportions. Some species cannot even survive unless they are supplied with certain special foods that are peculiar to their native location. There are 200 different sugars in Nature, more starches in all probability, a great diversity of fats (some fatty acids are unique in having only one source), and proteins are different for each species of animal. Why not a diversity of vitamin molecules with species preference? If there were not such a variety, we would have an exception to the general rule.

Now as to the possibility of isolating chemically a "vitamin principle", we might as well try to isolate a "carbohydrate", a "protein" or a "fat," and say it was chemically pure and supplied all the carbohydrate, protein or fat requirements of a species. Even though we realize that cellulose is a favorable nutritive medium to supply carbohydrate to the horse, that is no reason to assume that the horse will not thrive best on an assortment of carbohydrates. The group most acceptable to the horse will not fall in the same spot on the list of all possible carbohydrates as will the group best adapted to the human, but it can overlap.

The now obsolete idea that "calorie" measurement determined the nutritional values of food materials has been abandoned on identically the same grounds that we argue here - that it failed to distinguish between the "species preference" that caused a great variation in the assimilation and use of the food material in question.

The calorie has been discarded as a unit of food value since the discovery of the importance of these new food factors that the calorie did not measure.

In our slight present knowledge of vitamin chemistry, we have so far found four forms of Vitamin A, six forms of Vitamin B, three forms of Vitamin C, twelve forms of Vitamin D, etc.

The naive assumption that Vitamin A can be measured as milligrams of carotene now is obviously a premature jump at a conclusion. A patient can be shown to have a deficiency of Vitamin A even though his skin is yellow with unassimilated carotene. It has been shown that carotene may not be converted into Vitamin A in certain diseases in the human, and the liver normally has this function (4). It is apparent here that the chemical identification of a "vitamin" after too limited experimentation, followed by a pharmacopeial standard of "so and so" many milligrams of the compound so identified can be a grievous error. The well-known tendency of political bodies and quasi-politicians to refuse to admit their mistakes is well exemplified in these cases of the promotion and acceptance of both carotene and toxisterol as Vitamins A and D respectively.

Ascorbic acid has proven quite useless in controlling a condition of bleeding gums, loose teeth and "black and blue spots" (pseudo bruises) that indicate a definite scurvy condition.

Crystalline Vitamin B has no such reputation for treating heart conditions as has the concentrate of Vitamin B complex.

And so on down the line of Vitamin D, Vitamin E, Vitamin F and Vitamin G.

"Seals of Acceptance" are merely an endorsement of the exploded "biological unit" and "chemically purified" theories. The granters of "Seals of Acceptance" refuse to accept clinical evidence of merit, and even go so far as to condemn products that they have admittedly failed to test or investigate in any way. How can such unreliable purveyors of swivel-chair opinions' command any respect among thinking people?

We can say then that it is not practical to rate a vitamin in quantitative units depending upon its assumed identity as a certain chemically known molecule. Such an assumption has resulted in errors that probably have cost us years of progress in the vitamin field and has caused embarrassment for those who accepted the principle as fact and attempted to put it into practice.

We can say that animal tests are of value only to the extent of offering evidence as to the kind of deficiency symptoms to associate with a particular vitamin, but the chemical nature of the factor that has the same effect in the human may be quite different but closely related and probably associated in foods. The term "vitamin complex" recognized this association of "closely related families" that the recent experiments with the "molecular still", as developed at the Eastman Kodak Laboratories, has shown. To chemically separate or crystallize out the special factor that is best for some test animal may mean (and usually does) the elimination of the special factor that is best for the human.

Concentrates made by determining the physical properties and solubilities with consequent extraction with proper solvents obtains the whole group of related factors. To use them as a group is just as sensible as to use a variety of sugars and starches as Nature provided them in a diet, instead of preferring refined cane sugar or glucose as a sole source of carbohydrate.

It is evident, when we see the true picture as it is unfolding, that vitamin units as heretofore established are just as wide of the mark in measuring vitamin merit. This is not an argument against real measuring units, but against false and misleading ones.

Men mined and sold coal for warming their habitations long before scientists discovered how to measure its worth for the purpose in heat units. Vitamin concentrates will be sold and will produce results without being tested for unit content for years before the real and correct means will be developed for measuring its effect other than "the rule of thumb."

Until better ways of determining facts are available, the only safe guide in ascertaining the merit of any commodity is to inquire into the reputation of the product among those qualified to know - its experienced users.

(1) Los Angeles Times, New Lemon Vitamin Cure for Bleeding, March 14, 1937 (Abstract of Nature, Volume 138, pages 27 and 798, July 4 and November 7, 1936 repectively).

(2) Sherman, H. C., Chemistry of Food and Nutrition, Fifth Edition, pages 455-456, The Macmillan Company, N. Y., 1937.

(3) Lepkovsky, S. and Krause, M. E., Tripartite Nature of Vitamin G. (Abstract from Journal of Nutrition, 13, 6, Supplement page 12, June 10, 1937).

(4) Schneider, E. and Widmann, E., The Hepato-hormonal Direction of Vitamin A Metabolism and the Etiology of Paget's Disease, Klin. Wchnschr., 14 : 1786, 1935 (Abstract by Endocrinology, 20, 3:451, May 1936).

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