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UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF HOME ECONOMICS  
Washington, D.C.

SOME NOTES ON VITAMIN UNITS

By Hazel E. Munsell

Vitamin Units Now in General Use in the United States

- VITAMIN A The Sherman and Munsell unit for vitamin A, adopted by the present U. S. Pharmacopoeia, is that amount of the vitamin which, when fed daily, just suffices to support a rate of gain of 3 grams per week in a standard test animal (rat) during an experimental feeding period of 4 to 8 weeks.
- VITAMIN B The Sherman and Chase unit for vitamin B is that amount of the vitamin which when fed daily will induce a gain of 3 grams per week in a standard test animal during a test period of 4 to 8 weeks.
- VITAMIN C The Sherman unit for vitamin C is that amount of the vitamin which when fed daily will protect a 300-gram guinea pig during a period of 90 days.
- VITAMIN D a. The vitamin D unit of the American Drug Manufacturers Association (A.D.M.A.) is the minimum average daily amount (in mg.) of cod liver oil required to produce, in 60% of the animals in any one group, a degree of recalcification represented by a narrow continuous "line" across the metaphysis of the leg bones of the rats which have been kept and fed under the conditions as specified in the assay.
- The vitamin D content per Gm. of cod liver oil is computed by dividing 1000 mg. (1 Gm), by the determined minimum average daily amount of oil in mg., required to induce the requisite degree of recovery. The average daily dose is understood to be the total amount of cod liver oil given divided by the length of the test period, 10 days.
- A standard cod liver oil to be used as a standard of reference is one that assays 100 A.D.M.A. units per gram.

b. The Steenbock vitamin D unit is the total amount of vitamin D which will produce a narrow line of calcium deposit in the rachitic metaphyses of the distal ends of the radii and ulnae of standard rachitic rats in a period of 10 days. This is the unit accepted for "New and Non-Official Remedies" by the American Medical Association. Steenbock states that this unit is approximately equivalent to 2.7 international units.

A "potent" codliver oil assays approximately 13.3 Steenbock units per gram.

The Steenbock unit is 10 times as large as the A.D.M.A. unit or one Steenbock unit is equivalent to 10 A.D.M.A. units.

c. Oslo units (described by Poulsson, University of Oslo). In this method for vitamin D determination the same experimental animal serves both as a control and a test animal. Young rats are placed at 24 days of age on a rachitogenic diet. After 25 days a skiagram is taken of the left knee joint. The test food is then given in daily doses for 6 days. At the end of this time, a second skiagram is made. The activity of the substance tested is judged by comparing the photographs taken at the beginning and end of the test period. The efficacy of the substance tested is indicated in units per gram on a principle analogous for vitamin A in the U. S. P. From Dr. Poulsson's article, however, it is not clear whether the unit value is that amount which produces complete recovery or a certain well defined partial recovery. He simply states that it is easy to decide whether a substance tested is or is not potent and that the quantitative evaluation of a recovery involves a certain subjective element but that with practice this can be done with satisfactory regularity.

Bills states that a product assaying 4000 Steenbock units (300D) contains 12000 Oslo units.

VITAMIN G The Sherman and Bourquin unit for vitamin G is that amount of the vitamin which will give an average gain of 3 grams per week during 8 weeks in addition to any appreciable gain in a group of standard test animals maintained on the vitamin G free ration.

Provisional International Vitamin Units

An understanding of vitamin units is complicated at the present time by the fact that the Health Organization of the League of Nations, through its Permanent Commission on Biological standards, has recently proposed provisional standards and units for vitamins A, B<sub>1</sub>, C, and D. The commission includes scientists from England, the Continent and the United States. In the Report of this Permanent Commission issued in Geneva by the League of Nations in 1930 as publication C.H. 1056, the following provisional units are recommended for adoption over specified trial periods varying from 2 to 5 years.

- VITAMIN A The vitamin A activity of 0.001 milligram ( $\gamma$ ) of an international standard preparation of carotene. (A selected sample of codliver oil to be held in view as a possible secondary standard.)
- VITAMIN B The antineuritic activity of 10 milligrams of an international adsorption product of rice polishings prepared by the Seidell method.
- VITAMIN C The vitamin C activity of 0.1 cc. of fresh lemon juice
- VITAMIN D The vitamin D activity of 1 milligram of the international standard solution of irradiated ergosterol.

The report further designates the methods by which the international standards shall be prepared, and the institutions to which their preparation shall be entrusted.

Vitamin Potencies of Codliver Oils and Other Products

The U. S. Pharmacopoeia is now in process of revision and in harmony with the recommendations on vitamin units of the Permanent Commission on Biological Standardization it tentatively proposes the following methods of assaying codliver oil.

- VITAMIN A Assays of cod liver oil for vitamin A content shall be made by comparison with the Reference Codliver Oil prepared and distributed by the Food and Drug Administration of the U. S. Department of Agriculture, the vitamin A potency of which shall have been determined by a method described. This Reference Codliver oil shall contain a known number of vitamin A units, each unit to be equivalent in growth promoting and relative antixerophthalmic activity to one microgram ( $\gamma$ ) or 0.001 milligram of the International Standard Carotene.

VITAMIN D Codliver oil shall be assayed for vitamin D content by comparison with a Reference Solution of Irradiated Ergosterol or of codliver oil, prepared and distributed by the Food and Drug Administration of the U. S. Department of Agriculture, which shall contain a known number of vitamin D units, each unit corresponding to the vitamin D activity of one milligram of the Standard Solution of Irradiated Ergosterol.

At the present time the vitamin A potency of commercial products such as codliver oil and Haliver Oil (halibut liver oil) is given in U.S. Pharmacopoeial (Sherman-Munsell) units, while vitamin D potency is measured by A.D.M.A. units, Steenbock units or Oslo units.

The Council on Pharmacy and Chemistry of the American Medical Association specified that "an acceptable codliver oil is one which has a potency of 400 vitamin A units per gram when tested by the (present) U.S. Pharmacopoeial methods." However, the vitamin A values may vary widely. Several manufacturers of cod liver oil standardize their products to contain 500 vitamin A units per gram, and one claims that his products contain 1000 A units. Standardized codliver oil contains about 100 A.D.M.A. vitamin D units. One manufacturer claims that his product contains 150 A.D.M.A. units per gram.

The Council on Pharmacy and Chemistry of the American Medical Association has adopted the qualifying phrases 250D, 10D, etc. to designate the vitamin D potency of various preparations as multiples of the vitamin D potency of cod liver oil of definite potency (containing 13.3 Steenbock units per gram). Thus viosterol in oil 250D would have a vitamin D potency 250 times that of cod liver oil or would contain 3,333 units (Steenbock) per gram.



