

VITAMIN C, ASCORBIC ACID

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The isolation and identification of vitamin C has led to such an extensive literature since 1932 that the present review will be confined almost entirely to research papers which have appeared during the last four years. Excellent reviews of the earlier literature are readily available (1) (2) (3). Even with this limitation in scope, it has been necessary to further restrict references to the papers which have made outstanding contributions to current progress. The element of unfairness which is essentially involved in the omission of specific reference to valuable papers is greatly regretted, but the mass of papers dealing with the occurrence of the vitamin in foodstuffs, and the many suggestions of possible reactions, functions, formulas, etc., without adequate experimental support, has made many omissions necessary. The period covered by the present review has witnessed the identification of the vitamin, followed rapidly by establishment of its molecular structure, many exact measurements of its physico-chemical properties, synthesis in a number of research laboratories, commercial production of the natural and synthetic product, development of many methods of analysis, an extension hi detailed knowledge of its occurrence in plant and animal tissues, a certain degree of correlation with specific enzyme systems, and a steady but slow advance in understanding its significance in relation to human health.

Identification and isolation. Laboratory experimentation in relation to vitamin C was largely made possible by the introduction of the guinea pig as an experimental animal by Hoist and Frolich (4). Sustained investigations directed toward the isolation of the active substance were followed particularly by Zilva and associates (5), Bezssonoff and associates (6) and King and associates (7) during a period of several years. Each of these laboratories had devised varying methods of procedure, and had obtained strongly reducing, syrupy concentrates. Zilva believed that the strongly reducing substance present was a protective factor for the vitamin (8), and Bezssonoff interpreted his results as indicating that the vitamin was a dual or a tripartite factor consisting

Stocking (163), Gedda (164), and Ross (165). Repeated surveys in Scandinavia have shown that about 20 per cent of the children and an appreciable proportion of the adult population have a vitamin C intake during the winter and spring months which is low enough to cause a distinct weakening of the blood capillaries. Dry found 60 per cent of the laborers (10,000) in an African locality (Rhodesia) afflicted with mild or severe scurvy. Dalldorf reported that weakened capillaries could be demonstrated in 35 to 66 per cent of the children received from poor homes into the Grasslands Hospital, New York. The greater number of these cases responded immediately when antiscorbutic foods were given, showing that the disorder was primarily due to a specific form of malnutrition. Hanke and associates have presented an impressive record (145) of their studies in relation to tooth and gum disorders. In determining the vitamin C content of human tissues from general hospital autopsies in Pittsburgh (109) it was found that about 20 per cent of the patients had been depleted, either by dietary practice or pathological effects, to levels which were clearly subnormal.

The fact that there is a wide zone of vitamin deficiency between scurvy and optimum health is of more interest in relation to human health than the problem of clinical scurvy. Quantitative studies in this zone of malnutrition are no longer impossible. The newer methods of diagnosing mild types of vitamin deficiency, by means of measuring capillary strength or by direct titration of the vitamin in blood (51) (166), spinal fluid (167), and urine (168), provide a basis for better evaluation of vitamin C levels than has been possible in the past. The rise in indophenol titration value of urine after a standard dosage of vitamin C provides a simple, rapid and direct means of evaluating the true condition of the body tissues in terms of the vitamin reserve.

The human requirement per day appears to range from about 25 mgm. in infancy to about 40 mgm. in adults. Quantities above the required amount are eliminated rapidly by the kidneys without damage. An estimated allowance in dietary sources should be well above the minimum requirement because of individual variations and because of the risk of loss before food is eaten. There is no evidence of serious loss during the process of assimilation from the digestive tract. It is also very probable that pathological conditions, particularly infections and nephritic disorders, may be accompanied by excessive losses of vitamin C from the body tissues (128) (169).

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