

NUTRITION REVIEWS

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NUTRITION AND ARTHRITIS

Few conditions have the wealth of medical folklore and number of unconfirmed theories that are encountered in the field of rheumatic diseases. High on the list is the belief that in some way diet has something to do with the causation and cure of many forms of arthritis. Some of these ideas antedate the clearcut separation of the various forms of joint disease into clinical entities, such as the interdiction of meat or "acid" foods due to a confusion of other forms of arthritis with gout. But the failure to find a specific etiology, and the necessary empiricism of treatment for the most common forms of chronic arthritis have made it a fertile field for speculation, and some investigation, regarding metabolic and nutritional factors. As in any chronic disease subject to spontaneous exacerbations and remissions, changes in clinical course associated with changes in diet have led to erroneous conclusions due to the failure of the observers, lay and professional, to distinguish between coincidence and cause and effect.

Rheumatoid arthritis, the most serious of the common chronic joint diseases, has been the object of the most intensive search for a nutritional or metabolic aberration. Patients with this disease usually lose weight and often present an obvious nutritional problem. Yet careful studies of carbohydrate, fat, and protein metabolism have shown no abnormalities which can be considered of etiologic significance. The minor delays in carbohydrate utilization which many of these patients show in the glucose tolerance test can be eliminated in the great majority of cases by feeding a high carbohydrate diet for a few days prior to testing. These patients do not have excessive protein wastage, and positive nitrogen balance can be obtained with an adequate intake of both calories and protein. The hypothesis that

a poorly defined sulfur deficiency was important in this disease was thoroughly exploded by R. H. Freyberg, W. D. Block, and M. F. Fromer (*J. Clin. Invest.* **19**, 423 (1940)) who found no evidence of sulfur deficiency or abnormality in sulfur metabolism, and no biochemical or metabolic need for, or benefit from, sulfur medication in the treatment of arthritis. M. W. Ropes, E. C. Rossmesl, and W. Bauer (*Ibid.* **22**, 785 (1943)) found no major alteration of calcium and phosphorus metabolism, although there did appear to be an increased rate of turnover of these minerals, and a small increase in calcium excretion.

A decade ago it appeared that advances in knowledge of the vitamins might solve some of the problems of rheumatoid arthritis. Since the primary pathology of the disease is in the connective tissue, ascorbic acid was particularly implicated because of its importance in intercellular tissue. Low concentrations of ascorbic acid were found in the plasma of many patients with this disease, but the clinical course of the arthritis was unaffected by correction of the biochemical deficiency (R. H. Freyberg, *J. Am. Med. Assn.* **119**, 1165 (1942)). Since then, the gap between such biochemical evidence of lack of saturation of body stores with a particular vitamin and a clinically significant impairment of body function due to the deficiency has been more widely appreciated. In a somewhat similar fashion, the frequent subclinical and less common frank deficiencies of the vitamin B-complex seen in this disease have been accepted as accompaniments or consequences of a chronic constitutional disease, rather than a cause (T. B. Bayles, H. Richardson, and F. C. Hall, *New Engl. J. Med.* **229**, 319 (1943)).

The use of massive doses of vitamin D

and related steroids in arthritis, ranging from 100,000 to 500,000 I.U. daily, rests entirely on an empirical basis and can in no way be considered as correcting a deficiency. Those who have attempted to evaluate its use under controlled conditions emphasize its limited value, if any (Freyberg, *J. Am. Med. Assn.*, *loc. cit.*); R. H. Boots, *Ibid.* **123**, 857 (1943); C. H. Slocumb, *Ann. Int. Med.* **16**, 241 (1942). The exploitation of this form of treatment has given clinicians and pathologists their best opportunity to date of observing the effects of acute and chronic vitamin D intoxication in man (G. W. Covey and H. H. Whitlock, *Ibid.* **25**, 508 (1946); J. M. Bauer and R. H. Freyberg, *J. Am. Med. Assn.* **130**, 1208 (1946)).

More general approaches to the problem of diet and rheumatoid arthritis have also given essentially negative results. Bayles, Richardson, and Hall (*loc. cit.*) using the dietary history method, found the diets of 31 patients with rheumatoid arthritis during the year prior to onset of symptoms apparently the same as that of a cross section of families in the same area. In more than half the subjects, intake of minerals and certain vitamins was below the level recommended by the National Research Council. They concluded that a deficiency in the average diet could not contribute to the onset of rheumatoid arthritis, although the possibility of an increased total requirement in these patients could not be ruled out. W. Bauer (*J. Am. Med. Assn.* **104**, 1 (1935)) evaluated the following diets in rheumatoid arthritis: (a) low carbohydrate, (b) low caloric, (c) alteration of acid-base balance, (d) omission of "acid" fruits and vegetables, (e) restriction of servings at each meal to one type of foodstuff, (f) eliminating food to which the patient is allergic, and (g) a low protein diet. He concluded that there is no good evidence for the use of any of these in the patient with rheumatoid arthritis. The "raw food diet" probably owes whatever effect it may have to its low sodium and high potassium content (A. A. Holbrook,

Ann. Int. Med. **20**, 512 (1944)). S. D. Jacobson, B. Leichtentritt, and R. H. Lyons (*Am. J. Med. Sci.* **204**, 540 (1942)) have demonstrated temporary improvement in joint swelling and mobility associated with shifts in body water induced by altering the degree of retention of the sodium ion.

Despite these failures to demonstrate any etiologic role of nutritional deficiencies or metabolic errors in this disease, attention to the nutritional state of the patient is often an important part of the management of rheumatoid arthritis. Sound dietary practices, common to the management of any chronic systemic disease, are necessary to restore caloric balance, provide favorable conditions for rebuilding of muscle, and correct any specific deficiencies which may be present. A diet liberal in calories and protein and high in vitamin and mineral content is usually indicated. Adequate justification for protective use of polyvalent vitamin preparations at supplementary levels of dosage is provided by the infrequent occurrence of clinical deficiencies and the studies suggesting a moderate increase in requirements for certain vitamins accompanying this disease. There is no evidence that the patient with rheumatoid arthritis needs a diet differing in any significant respect from the optimum or ideal diet. Yet it is often of considerable importance to see to it that he actually gets it, and eats it.

Osteoarthritis, the degenerative joint disease of older persons, has been included in some of the studies cited above with essentially the same negative conclusions. As this disease commonly affects the weight-bearing joints and is usually seen in obese individuals, reduction of weight by dietary measures is frequently indicated.

Gout, an uncommon but by no means rare disease, is the only form of arthritis in which a definite error of metabolism has been demonstrated. Modern clinical experience does not support the classic concept that this is an affliction of those addicted to over-indulgence in food and drink. Despite the

association of this disease with hyperuricemia, "a careful survey of the past and present literature reveals the astonishing fact that conclusive evidence pertaining to the effect of dietary regulation on clinical gout is entirely lacking" (W. Bauer and F. Klemperer, in G. G. Duncan's "Diseases of Metabolism, *Ed. 2, Chapt. XII, p. 638, W. B. Saunders Co., Phila., Pa. (1947)*"). There is accumulating conclusive evidence that the metabolic error involved is hereditary in nature (C. J. Smyth, R. M. Stecher, and W. Q. Wolfson (*Science* **108**, 514 (1948))). Therefore, diet cannot be a factor in the primary etiology of gout. Moreover, the influence of dietary regulation on the course of the disease is open to question. Drastic curtailment of purine intake can be obtained only by a monotonous diet of a few vegetables and cereals, eggs, and dairy products.

Caloric restriction is often indicated, and the few foods with unusually high purine content are readily eliminated.

In summary, there is no diet or essential food factor which is known to be involved in the causation of most forms of arthritis, and no diet or vitamin which so far as known can be expected to cure it. As is true of many other measures utilized in the management of disease, the diet must be adapted to the general condition of the individual patient and to the type of joint disease which he presents. A good wholesome nutritious diet is an important part of present day preventive and curative therapy.

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THE FATE OF THIAMINE IN THE HUMAN BEING

Several investigators have shown that the excretion of thiamine at adequate levels of intake by the human being is approximately of the same order whether the vitamin is administered orally, intramuscularly, or intravenously. However, at a higher level of intake, absorption, as indicated by urinary excretion, is not as complete and differs somewhat depending on the dose and method of administration. According to A. S. Schultz, R. F. Light, and C. N. Frey (*Proc. Soc. Exp. Biol. Med.* **38**, 404 (1938)) the maximal dose of thiamine which can be completely absorbed is 2 to 3 mg. Others state that the limit of absorption of a single oral dose appears to be about 5 mg. However, Schultz, Light, and Frey have found an increased quantity of thiamine in the stools after administration orally of a dose of 5 mg.; when an additional quantity of 5 mg. is given orally almost all of the additional vitamin is recovered in the stools. In the human being relatively little absorption of thiamine has been noted when the vitamin is given in

retention enemas. The most rapid excretion in the human being is noted within three to eight hours after administration of a single dose of 5 mg. with food (D. Melnick, H. Field, and W. D. Robinson, *J. Nutrition* **18**, 593 (1939); M. Jowett, *Biochem. J.* **34**, 1348 (1940)). From these reports it would seem that the absorption of thiamine in the human being is confined largely to the upper portion of the intestinal tract, whereas in aged persons the absorption apparently is extremely limited throughout the entire intestinal tract (H. A. Rafsky and B. Newman, *Gastroenterology* **1**, 737 (1943)).

T. E. Friedemann, T. C. Kmiecik, P. K. Keegan, and B. B. Sheft (*Gastroenterology* **11**, 100 (1948)) have attempted to define the limits of absorption and destruction of thiamine in the body of normal human subjects when the substance is given orally in doses within the therapeutic range.

The subjects employed were medical students and laboratory workers, varying in