The Journal of the American Medical Association

Published Under the Auspices of the Board of Trustees

VOL. LXVIII, No. 19. CHICAGO, ILLINOIS MAY 12, 1917

THE SUPPLEMENTARY DIETARY RELATIONSHIPS AMONG OUR NATURAL FOODSTUFFS *

E. V. McCOLLUM, PH.D.

Professor of Agricultural Chemistry, University of Wisconsin

MADISON, WIS.

I am conscious of the question which will be asked concerning the cause of scurvy and of beriberi. Are not these both dietary deficiency diseases? During the past two years Mr. Pitz and I[20] have repeated all the more important work reported by others on the production by diet of experimental scurvy in the guinea-pig. We have confirmed the observations of Jackson and Moore to the effect that with a diet of oats and milk *ad libitum*, scurvy ordinarily results. Rolled oats induce the onset of the symptoms sooner than unhulled oats. Only those diets which produce feces of a character readily eliminated will relieve or prevent the disease. Milk to the extent of 10 per cent. of the solids of the diet supplies all the unidentified dietary factors necessary for growth in the rat or swine and probably for other mammals as well. We are convinced that the guinea-pig suffers from scurvy on a diet of oats and milk because of the constipating character of the diet. Oats produce pasty feces, and the guinea-pig, being unfortunate in the anatomy of its digestive tracts, is quickly debilitated by its inability to empty the large and delicate cecum. This harmonizes with our observation that orange juice, the panacea for scurvy in the human infant, gives protection to the guinea-pig, but is not so efficient as to enable this species to take an oat and milk diet and grow continuously over a long period. We have furthermore been able to effect a complete cure of guinea-pigs on a milk and oat diet after they could no longer walk, and showed badly swollen joints and the hemorrhage of the gums, by liberally dosing them with liquid petrolatum. Cavies so relieved have been as active and healthy as if on a diet of green grass, and have resumed growth and have continued to grow steadily, though at a rate slower than the normal during three months following the attack of scurvy, while confined to the same milk and oat diet which gave them the disease. The petroleum oil treatment was of course persevered in throughout this period. I question whether any one would postulate the existence in petroleum oil of a "vitamin" specific as a protection against scurvy.

I venture to suggest that the failure of Holst[21] and his co-workers to prevent or relieve scurvy in guinea-pigs by feeding dried cabbage finds its explanation in the failure of the latter to take up water in the intestine and again act as a succulent vegetable.

On the basis of anatomic lesions and for other reasons, Hess[22] has recently suggested that scurvy and beriberi show more points of similarity than have been recognized by clinicians, and was inclined to consider the two as essentially the same pathologic condition. His efforts toward curing scurvy with wheat germ and with yeast were unsuccessful, whereas orange juice was potent as a curative agent, and he was forced to conclude that the two conditions were distinct. I will offer the suggestion that the latter view is correct. Scurvy in the guinea-pig is the result of the retention of feces. I do not know whether or not the same is true of human scurvy. Neither do I know the cause of the hemorrhage of the joints and gums, whether they are the result of the absorption of a toxic substance of bacterial origin, which injures the blood vessels, or whether they are due to the invasion of the tissues by an organism, through an injured cecal wall. The recent observation by Jackson and Moore of a streptococcus in the congested joints is suggestive in this connection.

I am inclined to attribute the protective power of orange juice as an antiscorbutic to its content of certain salts of citric acid, rather than to the presence of an unidentified organic substance of the class of the so-called vitamins. Its efficiency for the guinea-pig appears to be somewhat less than for the human being. This may well find its explanation in the much more delicate and inefficient structure of the digestive tract of the cavy as compared with that of man, so that less efficient protective agents may serve for the latter than for the former. While guinea-pigs are protected against scurvy by orange juice, we have not seen them grow to any appreciable extent on a diet of oats and milk fortified with orange juice. If the results of experiments of three months' duration are to be trusted, orange juice appears no more efficient than petroleum oil in protecting guinea-pigs against scurvy when the animals are kept on a diet of oats and milk.

20. McCollum, E. V., and Pitz, W.: Unpublished data.

21. Holst and Frohlich: Ztschr. f. Hyg. u. Infektionskrankh., 1913, 72, 1.

22. Hess, A. F., and Fish, Mildred: Infantile Scurvy: the Blood, the Blood Vessels and the Diet, Am. Jour. Dis. of Child., December, 1914, p. 385. Hess, A. F.: Infantile Scurvy: THE JOURNAL A. M. A., Sept. 18, 1915, p. 1003; Proc. Soc. Exper. Biol. and Med., 1915, 13, 50; ibid., 1916, p. 145; Am. Jour. Dis. Child., August, 1916, p. 152.