Nature of the Vitamin B_1-sparing Action of Fat

FROM a large number of investigations it is known that the appearance of the symptoms of polyneuritis in animals fed on an aneurin-deficient diet is accelerated by increasing the amounts of carbohydrate fed and delayed by replacing carbohydrate by fat[1]. This has led to the formulation of the so-called 'sparing action of fat on vitamin B_1'[2].

The verb 'to spare' can have a double meaning here, namely, 'to dispense with' or 'to use less of'[3]. The effects mentioned could be, and have indeed been, interpreted in both ways. According to the first meaning, an increased carbohydrate ingestion would provoke symptoms of aneurin deficiency at a level of this vitamin in the tissues at which these symptoms would not yet appear with lessened carbohydrate intake. According to the second meaning, the increased consumption would entail a bigger loss of aneurin from the tissues. Former investigations carried out in order to decide between these two possibilities gave contradictory results and did not allow of a definite conclusion because of the inaccuracy and elaborateness inherent in the rat-growth test used for the estimation of vitamin B_1[4,5,6].

The following experiment was therefore carried out. Three groups of ten male pigeons weighing 400–500 gm. were placed on the following diets which were administered directly into the stomach by forced feeding. The foods were practically free of aneurin, but contained all other vitamins in adequate amounts.

Table 1. FOOD INTAKE (IN GM.) PER PIGEON PER DAY

	Group *A*	Group *B*	Group *C*
Casein	2	2	2
Sucrose	18	6	—
Peanut oil	—	—	8
Salt mixture	0·3	0·3	0·3
Mixture of other vitamins and essential fatty acids	0·09	0·09	0·09

After 13 days, the animals were sacrificed and the aneurin pyrophosphate content—as this is the form in which the vitamin is present and active in animal tissues—of several tissues was determined by the manometric method[7]. Samples were always taken of the thoroughly minced whole organ. The results are given in Table 2.

Table 2. ANEURIN PYROPHOSPHATE CONTENT IN μGM. PER GM. OF FRESH TISSUE (ALL VALUES ARE MEANS OF 10 DETERMINATIONS)

	Group *A*	Group *B*	Group *C*	*P*-value of differences according to Fisher[8] *B*—*A*	*C*—*B*	*C*—*A*
Liver	0·69±0·10*	1·87±0·24	3·33±0·26	<0·001	<0·001	<0·001
Heart	1·45±0·16	2·02±0·21	2·53±0·05	<0·05	<0·05	<0·001
Cerebrum	1·57±0·08	2·16±0·11	2·83±0·13	<0·001	<0·01	<0·001

* Standard deviation of the mean.

The results clearly demonstrate that a larger consumption of carbohydrate causes a quicker depletion of the tissue; 'to spare' thus means 'to use less' in this case. Nitrogen determinations showed that the differences are not due to a different protein content of the tissues. Determinations of free aneurin in the excreta practically ruled out any significant contribution by the intestinal flora to the observed phenomena.

Therefore, the conclusion must be drawn that the increased metabolism of carbohydrate caused by the increased carbohydrate intake leads to a quicker disappearance of aneurin pyrophosphate—a co-enzyme in carbohydrate catabolism—from the tissues. The loss of the vitamin is highest in the liver, the central organ of carbohydrate metabolism. Further experiments suggest that the depletion of the liver is indeed directly related to the increased carbohydrate uptake and not due to a displacement of stored vitamin to other tissues.

This work forms part of investigations on the metabolism and physiological function of aneurin carried out by Prof. H. G. K. Westenbrink and collaborators. Full details and discussions will be published elsewhere.

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Vitamin B_{12} as an Anti-Anaphylactic

FOLLOWING the pure hypothesis that macrocytic anæmias could be due to an anaphylactic blockage of the bone marrow, especially as regards erythropoiesis, it was supposed that folic acid, the action of which in these anæmias has been of some help, might have an anti-anaphylactic action. Experiments were therefore performed which showed folic acid to possess a protective action on the anaphylaxis of the guinea pigs[1]. I thought it would be interesting to see whether such an anti-anaphylactic action might be shown also by vitamin B_{12}, which has turned out to be very effective, even in a very small dosage, in the treatment of pernicious and some other macrocytic anæmias[2–4].

As a source of vitamin B_{12}, 'Rubramin' (Squibb and Son) has been used. The 'Rubramin' has been tested as in the case of folic acid on anaphylactic shock of the guinea pig.

Twenty-two guinea pigs (medium weight, 450 gm.) were each sensitized with ½ c.c. of normal horse serum by intraperitoneal injection. After fifteen days, five of them, used as controls, were given intracardiacally the shocking injection of 1 c.c. of serum. Of the five, four died immediately after the injection, and one survived, but showed all the signs of severe shock.

Five other guinea pigs were given 30 μgm. of 'Rubramin' intraperitoneally and the same shocking injection of 1 c.c. of serum fifteen minutes later. All survived, although signs of shock were present. Finally, the twelve remaining guinea pigs were given 45 μgm. of 'Rubramin' intraperitoneally and the same shocking treatment fifteen minutes later. In