

OBSERVATIONS ON THE BEHAVIOR OF B AND G AVITAMINOTIC RATS AND THE SPECIFIC GROWTH EFFECT OF VITAMIN B*

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An examination of the literature discloses significant differences in the behavior of rats during a depletion of the B vitamins. These differences may be attributed in part to the lack of uniformity in the composition of the basal vitamin B-free diets employed and to individual variations in the resistance of the animals to the effects of vitamin B depletion. The following data are presented to show the growth response of B and G avitaminotic rats in this laboratory.

The time required for cessation of growth to occur in animals deprived of the vitamin B (complex) was found to depend upon the type of carbohydrate employed in the basal diet. Albino rats weighing from 40 to 50 g were placed on vitamin B (complex)-free diets which differed only in the carbohydrate present. The composition of the basal diet was as follows: carbohydrate 58, casein (acid-washed) 18, fat 15, salt mixtures 3.5, cod liver oil 3.5, agar-agar 2.0. An examination of the growth records of 300 rats which had received the basal diets containing either ricestarch, cornstarch, or dextrin showed that cessation of growth occurred within 10 to 14 days. Rats receiving a basal diet containing cane sugar stopped growing in 8 to 12 days and in a few instances death occurred within this period.

The average period of survival for rats on the deficient diets containing either cornstarch, ricestarch, or dextrin was 35 days. Animals that were deprived of uncomplicated vitamin B showed slight growth for 5 to 14 days and a survival period of 15 to 45 days.

Although Sure^{1,2} and others^{3,4} have reported longer periods of survival for animals deprived of the vitamin B complex and undifferentiated vitamin B, in general, the growth response of young animals to vitamin B deprivation observed in this laboratory appears to be in agreement with that generally reported.

Larger rats were found to respond more quickly to a vitamin B (complex) deficiency than did small ones. Rats weighing from 75 to 150 g, ceased growing within 12 days; those weighing 150 to 225 g ceased growing within about 8 days. In some of the largest animals growth stopped immediately after the animals were placed on the deficient ration.

The decrease in food consumption subsequent to the removal of vitamin B or the vitamin B complex from the diet is marked and rapid and occurs irrespective of the initial weight of the animal. After 5 days on a vitamin B (complex)-free diet, the average daily food intake was about 1 g and by the end of 15 days the depleted animals ate less than 1 g of the basal diet daily. This amount of food is manifestly insufficient to permit growth or maintenance.

Sure, Kik, and Smith¹ have stated that vitamin B produces growth not only by increasing the plane of nutrition through a stimulation of the appetite, but that it also possesses the physiological function of stimulating growth *per se*, unrelated to food intake. This function is designated by them as the specific growth effect of vitamin B.

An experiment carried out with adult but not full grown rats weighing 78 to 184 g failed to demonstrate this particular function of vitamin B. Eleven groups of rats were used, each group consisting of four litter mates

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of the same sex. The food intake of the individual members of each series was limited to that of the first animal which received the unsupplemented vitamin B (complex)-free diet; the second, third, and fourth rats of a series received vitamin B, vitamin G, and vitamins B and G, respectively. The amount of food consumed was measured daily.

The growth response of the animals was characterized in most series by a brief period of gain of from 3 to 5 days duration, followed by a period of rapid loss of weight usually terminated by the death of the animal. Animals deprived of both vitamins B and G lost about 40 per cent of their body weight. This loss was only slightly greater than that suffered by animals that had received either one or both of the vitamins B and G. The failure of animals receiving vitamins B and G to gain or to maintain weight is explained by the low level of food intake which the depleted animals ate voluntarily.

A comparison of the survival periods shows that rats which were deprived of vitamin B alone were in all cases either the first or second animal to die in each series. Rats deprived of both vitamins B and G were never the first to succumb and in four of the series they outlived their litter mates which had received either vitamin B or vitamin G. That a deprivation of both B and G may be less detrimental than a restriction of food intake is indicated by the fact that in seven of the series, the animals deprived of both vitamins outlived their litter mates which received them.

The results of this experiment fail to give evidence of the specific effect of vitamin B upon growth.

A further paired-feeding experiment was carried out with 10 pairs of smaller animals weighing 65 to 84 g. The experimental animal of each pair ate, *ad libitum*, a basal B (complex)-free diet supplemented by vitamin G; the control received an equivalent amount of the basal diet supplemented by both vitamins B and G.

The response was characterized by a period of growth for 12 to 16 days followed by rapid loss of weight for 25 to 30 days by both experimental and control animals. In six of the ten pairs, the controls receiving vitamin B gained from 2 to 8 g more than the experimental animals; in three pairs, experimental and control animals made the same gains. In no instance was a control animal able to gain or maintain weight during the period in which its pair-mate lost weight. The differences between the ultimate gains or losses made by experimental and control animals are due not to greater gains in weight by the controls but to smaller losses. That the controls were in better nutritive condition than were the experimental animals is evidenced by the fact that although six of the latter died after 25 to 30 days, there were no deaths among the controls.

In two additional pairs of animals, both experimental and controls received vitamin B, the latter receiving 10 times as much as the former. In one of these pairs the control gained 4 g less than the experimental, in the second pair, 8 g more.

The failure of the control animals to make noticeably greater gains than did the experimental animals is in agreement with the results of Hogan and Pilcher⁵. These authors conclude from paired experiments with rats receiving different amounts of vitamin B, that rats which receive the same caloric intake will grow at approximately the same rate, regardless of the amount of vitamin B consumed.

Surel¹, however, presents data for paired-feeding experiments in which rats deprived of vitamin B were able to maintain weight over a period of 98 days, while their controls receiving vitamin B gained 40 to 50 g more than the experimentals, although receiving the same caloric intake. The ability of the rats to maintain weight during such an extended period of

vitamin B deprivation is in contrast to the response observed in the above experiments.

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