A STUDY OF THE VITAMIN B COMPLEX OF YELLOW YAUTIA (XANTHOSOMA SAGITTAE-FOLIUM) AND OF PLANTAIN (MUSA PARADISICA L)*

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Cook, D. H. and Quinn, E. J., (1928) published a paper on the vitamin B content of white *yautía* (*Xanthosoma sagittae-folium*), and plantain (*Musa paradisica*, L.) at the time when it was shown that what was then known as vitamin B consists of at least two factors. In view of the fact that part of the work which is being done in this laboratory is concerned with the study of the vitamin B complex content of foodstuffs which are used in the dietary of the people of Porto Rico, it was deemed advisable to study the vitamin B complex of yellow *yautía* and plantain since both play an important role in the dietary of the inhabitants of this Island. Axtmayer (1930) has already published the results obtained from a similar study with red kidney beans and polished rice.

EXPERIMENTAL

The experiments were conducted according to the methods of Sherman and Spohn (1923) for the quantitative determination of vitamin B (old terminology) and of Sherman and Axtmayer (1927) for the differentiation of the vitamin B(B_1) of F factor from the vitamin B(B_2) of G factor. This latter method is based upon the fact that if better growth is obtained by the feeding of a mixture of foodstuffs as the source of vitamin B complex than is induced when double the amount of each is fed separately, then, all other conditions having been properly controlled, the conclusion is justified that the better growth is due to a supplementation of one of the factors of the vitamin B complex by the other.

Young albino rats when twenty-eight to twenty-nine days old were placed upon a vitamin B complex free diet which is not only adequate but approximately optimal (for growth of rats) in all other

* The term "vitamin B complex" is used in this paper to signify the combination of the thermo-labile factor, vitamin B(B_1) or F and the thermo-stable factor vitamin B(B_2) or G.

respects. The basal diet used, Sherman's diet No. 107, consists of purified casein, 18; Osborne and Mendel (1919) salt mixture, 4; butterfat, 8; cod-liver oil, 2; and corn-starch, 68 per cent.

The foods tested in the experiments described in this paper were yellow *yautía* (*Xanthosoma sagittae-folium*), plantain (*Musa paradisica*, L.) and autoclaved yeast. The yellow *yautía* and the plantain were bought at the local market. The former was cleaned and the skin removed with a knife taking care that as little as possible of the root itself was removed. The ripe plantain was peeled before being fed. Thin slices of each were cut and then weighed in sectors so as to feed similar portions to each of the experimental animals. These test foods were fed separately or in the combination with autoclaved yeast as sole sources of vitamin B complex to the standard test animals on the vitamin B complex-free diet. Dried bakers' yeast was placed in uncovered Petri dishes to a depth of 15 mm. and heated in an autoclave at fifteen pounds steam pressure for 150 minutes; then, after cooling and drying in the air, it was ground to a powder in a mortar. This product has been shown to be practically free from vitamin B(B_1) or F.

The experimental animals (rats) received as sole sources of vitamins B(B_1) or F and B(B_2) or G the following, daily (six days per week) portions of the test foods: 1.00 gram of yellow *yautía*; or 1.00 gram of autoclaved yeast; or 2.00 grams of plaintain; or a mixture of 0.5 grams of each of the yellow *yautía* and the autoclaved yeast; or a mixture of 1.00 gram of each of the plaintain and the autoclaved yeast; with the negative control experiments in which animals received the vitamin B complex-free basal diet.

DISCUSSION

The average weight curves of the experimental animals receiving daily portions (six days per week) of 1.00 gram of yellow *yautía;* 0.5 gram of each of the yellow *yautía* and the autoclaved yeast; 1.00 gram of the autoclaved yeast, and the negative controls are shown in Figure 1.

Table 1 gives a summary of the data obtained from these experiments. The animals receiving the 1.00- gram portions of yellow *yautía* gave a much better growth curve and showed a lower percentage of polyneuritic cases than those which received the 0.5-gram mixture of each of the yellow *yautía* and the autoclaved yeast.

TABLE I

SUMMARY OF THE DATA FROM THE EXPERIMENTS WITH YELLOW YAUTIA

Supplement	No. of Animals	Average Initial Weight (Grams)	Average Net Gains (Grams)	Average Survival (Days)	Average Basal Diet Intake (Grams)	Per cent Polyneuritic
Controls	12	39	10	30	94	91
1.00 gram yellow yautía	14	39	2.6	48	167.6	64
0.5 gram yellow yautía plus 0.5 gram autoclaved yeast	16	38.4	-1	45.8	149.8	88
1.0 gram autoclaved yeast	5	41	-3.2	30.8	106.4	60

Upon reducing the yellow *yautía* intake to 0.5 gram the vitamins F intake, already low, was further reduced and since the vitamin G addition contained in the 0.5 gram of autoclaved yeast which was added did not help to give better growth than when 1.00 gram of yellow *yautía* is fed alone, it is concluded that vitamin B(B_1) or F is the first limiting factor of the vitamin B complex content of the yellow *yautía*.

The average weight curves of the experimental animals receiving daily (six days per week) portions of 2.00 grams of the plantain; 1.00 gram each of the plantain and the autoclaved yeast; 1.00 gram of the autoclaved yeast, and the negative controls, are shown in Figure 2.

It was not deemed necessary to sacrifice experimental animals to show that 2.00 grams of the autoclaved yeast would not even give a growth curve showing maintenance.

The following Table gives a summary of the data from the experiments with plantain.

TABLE II

Supplement	No. of Animals	Average Initial Weight (Grams)	Average Net Gains (Grams)	Average Survival (Days)	Average Basal Diet Intake (Grams)	Per cent Polyneuritic
Controls	12	39	10	30	94	91
2.0 grams plantain	7	39.7	9.1	54.5	204.4	14.2
1.0 gram plantain plus 1.0 gram autoclaved yeast	7	37.9	16.1	50.1	190.1	57.1
1.0 gram autoclaved yeast	5	41	3.2	30.8	106.4	60

The experimental animals receiving the daily portions of the 1.00 gram mixture of each of the plantain and the autoclaved yeast gave a much better growth curve than those animals which received the 2.00- gram daily portions of the plantain alone. This justifies the conclusion that vitamin B(B_2) or G is the first limiting factor of the vitamin B complex content of the plantain which was used.

It has been said that the yellow *yautía* and plantain are two

food stuffs which are used by the people of Porto Rico. These are taken together in many dishes, as for example in the *"pasteles"*. Hence, it can be said that this dish is an adequate source of the vitamin B complex, since the deficiency of the yellow *yautía* is made good by the plantain.

SUMMARY AND CONCLUSION

Experiments are described by means of which the vitamin B complex of yellow *yautía* (*Xanthosoma sagittae-folium*) and plantain (*Musa padisica L*) is determined.

Vitamin B(B_1) or F is found to be the first limiting factor of the vitamin B complex of the yellow *yautía*.

Vitamin B(B_2) or G is found to be the first limiting factor of the vitamin B complex of the plantain.

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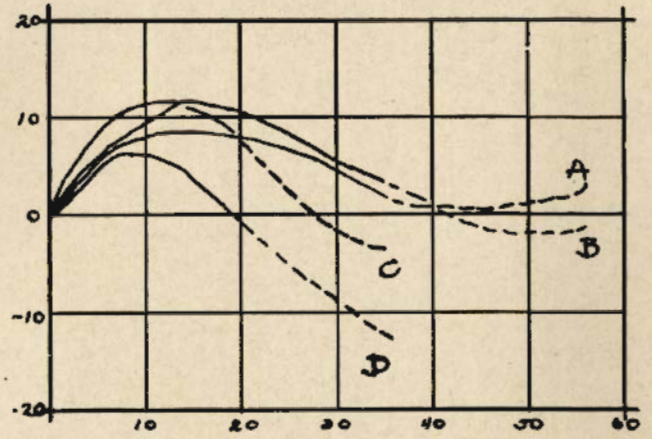

FIGURE I, LEGEND

Average weight curves of directly comparable groups of experimental animals (rats of initial age 28 to 29 days) receiving a basal diet devoid of vitamin B complex but good in all other respects, and in addition: Curve A, 1.0 gram of yellow *yautía* (Xanthosoma Sagittae-folium) (daiiy except Sundays); Curve B, 0.5 gram of yellow *yautía* plus 0.5 gram of autoclaved yeast (daily except Sundays); Curve C, 1.0 grams of autoclaved yeast (daily except Sundays); Curve D, no other food,—these are the negative controls. The average weight curve for each group is represented by a solid line to the point at which the first death occurred among the experimental animals, and from that point onward by a broken line representing the average weight of the surviving experimental animals of the group until the end of the eight-week experimental period.

Curve B. shows no supplementation between the vitamin B (B_2) or G content of the autoclaved yeast and the vitamin B complex content of the yellow *yautía*, proving, therefore, that vitamin B(B_1) or F is the limiting factor of the vitamin B complex of yellow *yautía*.

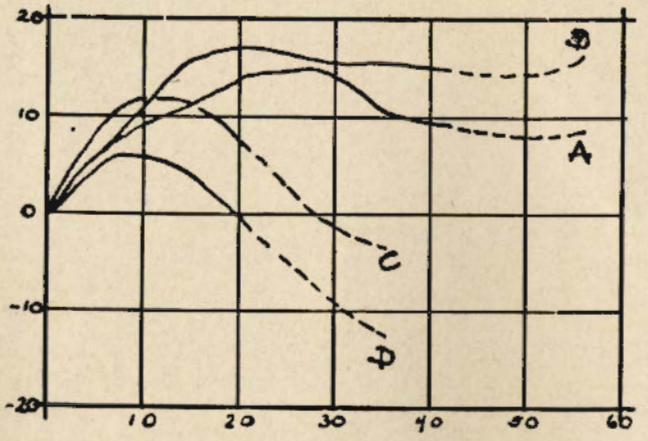

FIGURE II, LEGEND

Average weight curves of directly comparable groups of experimental animals (rats of initial age 28 to 29 days) receiving a basal diet devoid of vitamin B complex but good in all other respects, and in addition: Curve A, 2.0 grams of plantain (Musa Paradisica L) (daily except Sundays); Curve B, 1.0 gram of plantain plus 1.0 gram of autoclaved yeast (daily except Sundays); Curve C, 1.0 gram of autoclaved yeast (daily except Sundays); Curve D, no other food, these are the negative controls. The average weight curve for each group is represented by a solid line to the point at which the first death occurred among the experimental animals, and from that point onward by a broken line representing the average weight of the surviving experimental animals of the group until the end of the eight-week experimental period.

Curve B shows marked supplementation, proving that vitamin B(B_2) or G is the limiting factor of the vitamin B complex of plantain.