83. Feeding Experiments with Decomposition Products of Proteins II.

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In the preceding paper,¹⁾ the author has shown, from the results of feeding experiments with white rats, that the whole of the protein in diets can be replaced by the mixture of its complete, biuret-free decomposition products by sulphuric acid and those by baryta. It must be considered that, by boiling protein with sulphuric acid, tryptophane in it is completely decomposed, while by treating with baryta, tryptophane is only racemized, and not destroyed. Moreover, it has been confirmed by several authors that tryptophane is one of the indispensable amino acids for building up the body protein, and it can not be substituted with any other amino acids. So, intending to decide whether the indispensable substance in the baryta hydrolytic products, which is lacking in the acid hydrolytic products, is tryptophane only, the present author fractionated the baryta hydrolytic product by mercuric sulphate into two parts, the one, consisting solely of crystalline tryptophane, the other, the filtrate from HgSO_4 -precipitate, therefore free from tryptophane. Mercury and sulphuric acid in the filtrate were removed by hydrogen sulphide and baryta respectively, the resulting filtrate was neutralized, and then evaporated to dryness at lower temperature.

The results of feeding experiments are described in the following :

I. Experiments with the acid or the baryta hydrolytic products separately.

Fish meat protein and horse meat protein were freed from biuret reaction by boiling with sulphuric acid and with baryta, just like the previous experiments. Feeding experiments were carried out with each hydrolytic product separately. Young albino rats were fed first on a diet consisting of 15% fish meat protein, 65% starch, 15% butter (ether soluble part), 5% McCollum's salt mixture, besides 5% alcohol extract of yeast, and let grow for 8 days, then the whole of the protein was replaced by each hydrolysate, so the body weights soon

1) S. Mayeda : Proc. 8 (1932), 98.

began to decline, and finally succumbed. (Fig. I, VII).

II. Experiments with the acid hydrolytic product supplemented with tryptophane.

Rats were fed first on fish meat protein and let grow for 8 days, then the protein was replaced by its acid hydrolysate, so the rats began to lose their body weights, owing to the lack of tryptophane. Then two rats were supplied with racemic tryptophane¹⁾ to the extent of 3% of the acid hydrolysate, and to the other two rats was given the filtrate part of the baryta hydrolysate, replacing half the quantity of the acid hydrolysate. Hereupon, a sudden increase of body weight was resulted in the former case, namely on the ration containing tryptophane. Rats grew normally from 64 gr. and 65 gr. up to 187 gr. and 190 gr. respectively in 70 days, while the rats receiving the latter ration lost their body weights remarkably. To the remaining one, supplied with tryptophane, and grown vigorously for 38 days was given the baryta hydrolysate, replacing half the quantity of the acid hydrolysate. In this case also, the rat soon began to decline the body weight. (Fig. II, IV, V & VI). From these results, it may be seen that the filtrate part of the baryta hydrolysate have no supplementing effect on the acid hydrolysate, but, what should give us concern is that some toxic substance might contaminate the filtrate during the process of the fractionation, so the experiments were repeated with the following scheme.

Rats were fed on a diet consisting of 7.5% the acid hydrolytic product, 7.5% the baryta hydrolytic product, 65% starch, 15% butter, 5% McCollum's salt mixture, besides 5% alcohol extract of yeast. After 20 days, the baryta hydrolytic product was replaced by its tryptophane-free filtrate part, so the growing rats began to lose their weights remarkably. 3% of tryptophane was then added, hereupon, the rats revived suddenly and began to grow vigorously. After 20 days, the filtrate part was omitted, and no effect on growth was observed, rats grew as normally as ever. (Fig. III).

From the above results, the author wishes to conclude that the acid hydrolytic product of protein, supplemented with tryptophane, can replace the protein in diets completely.

1) Some tryptophane for this experiment was prepared from casein by boiling with baryta.

Fig. I.

Experiments with the acid or the baryta hydrolytic products.

..... fish meat protein.

— hydrolytic product of protein.

Fig. II.

Experiments with the acid hydrolytic product supplemented with tryptophane.

A: fish meat protein.

B: the acid hydrol. prod.

C: B. suppl. with 3% of tryptophane.

D: B. suppl. with the filtrate part in the baryta hydrol. prod.

Fig. III.

Similar experiments as shown in Fig. II.

A: the mixture of the acid and the baryta hydrol. prod.

B: the acid hydrol. prod. and the filtrate part in the baryta hydrol. prod.

C: B. suppl. with 3% of tryptophane.

D: the acid hydrol. prod. suppl. with 3% of tryptophane.

Fig. IV. 64 gr. 20 mm. 65 gr.

Fig. IV.

Before the experiment.

Fig. V. 187 gr. 20 mm.

Fig. V & VI.

Fed on the acid hydrol. prod. suppl. with 3% of tryptophane.

Fig. VI. 190 gr. 20 mm.

Fig. VII. 40 gr. 20 mm.

Fig. VII.

Fed on the acid hydrol. prod. of fish meat prot., lacking tryptophane.