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The Effect of Food Restriction on the Net Protein Utilization (NPU) in Growing Rats

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An experiment was conducted to study the influence of food restriction on the utilization of dietary protein. Animals on restricted diet received 70 per cent of their normal food intake. NPU was measured on weanling rats fed on restricted diet for 6 days before the start of NPU assay and compared with the animals which were fed only restricted diet during the assaying period. The results indicated that rats fed restricted diet for 6 days before the start of NPU assay grew better than the groups fed restricted diet only during the period of 10 days and NPU values were 72 and 66 respectively. It was concluded that rats on restricted diet for longer period adapt to low food intake and utilized dietary protein more efficiently than the rats fed restricted diet for shorter period or fed ad-libitum.

Introduction

The energy intake is an important factor in affecting the protein value of diet. If this is reduced below a certain level, protein in the food is oxidised to meet the energy needs of the body and consequently the efficiency of utilization falls (Allison, 1958). The response to a caloric restriction was a function of the physiological state of the animal as well as the diet (Munro, 1951; Calloway and Spector, 1954). Narayana Rao and Morrison (1965) determined NPU values for different protein fed ad-libitum or at restricted levels of caloric intake. The NPU values were not markedly altered until the caloric intake was less than the maintenance energy requirement. Similarly Forbes and Yohe (1955) reported that no change in the biological value of a diet when the food intake of rats was reduced from 8 to 6 gm per day, but a fall from 99 to 69 when food intake was further reduced to 4 gm per day. Cox *et al.* (1953) demonstrated that even when energy intakes were markedly reduced, a certain amount of protein continued to be used for anabolic purposes.

The object of this experiment was to measure NPU on rats fed on restricted diet for 6 days before the start of NPU assay, and compared with the rats which were fed only restricted diet during the assaying period.

Material and Methods

Twenty weanling rats of Sprague-Dawley strain were fed on stock diet (20 per cent protein) for 6 days and divided into five groups of four rats each. Each group was housed in a wire screen mesh bottomed cage. NPU was determined according to the method of Miller and Bender (1955). The composition of experimental diets is given in Table 1. Two groups of rats were transferred into individual cages and were given ad-libitum the experimental diet (Diet A) containing 10% protein for 3 days to measure their food consumption. The

effect of food estriction of NPU value of the diet was measurred by feeding the two groups, 70 per cent of their normal food intake for 6 days.

TABLE 1.—*Composition of Experimental Diets*

Ingredients	A	B
Casein	10.0	—
Corn starch	79.0	74.0
Glucose	—	15.0
Corn oil	5.0	5.0
Vitamin mixture	2.0	2.0
Mineral mixture	4.0	4.0
Total:	100.00	100.00

For NPU assay one group was continued on the same restricted diet and the other group was changed to protein free diet (Diet B) ad-libitum for 10 days.

The other three groups received stock diet for 6 days and diet A for 3 days to measure their food intake. The NPU determined by feeding three groups of rats, ad-libitum, restricted to 70 per cent of their normal food intake and protein free diet respectively for 10 days.

After 10 days feeding the rats were killed with chloroform. Incisions were made into skull, thoracic and abdominal cavities and the carcasses were dried to a constant weight at 105°C. The nitrogen content of the carcasses of each group was determined by Kjeldahl method. The net protein utilization was calculated by applying the following equation :

$$\text{NPU} — \frac{\text{B—B}k+1k}{1}$$

Where B and Bk are the total body nitrogen of the animals on the test and protein free diets respectively and 1 and 1k are the intake of nitrogen in the two groups.

RESULTS AND DISCUSSION

Food intake and NPU values of the diet are shown in Table 2, and the changes in the body weights of all the groups are plotted in Fig. 1.

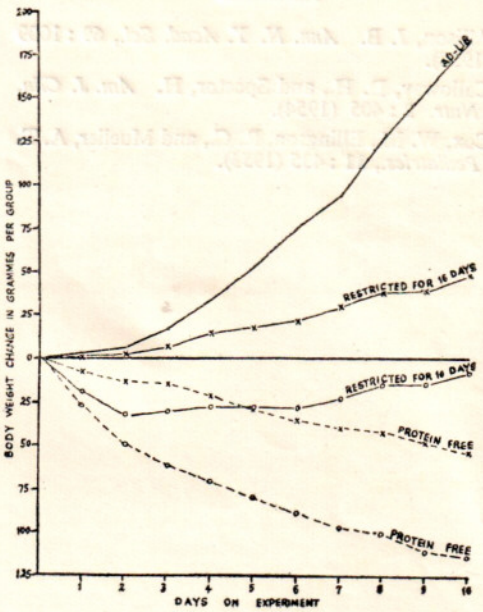

Fig. 1. Effect of food restriction on growth.

TABLE 2.—*Average Food Intake and NPU Values*

Dietary Treatment	Food intake (gm/day)	NPU (Average of Duplicate results)
Ad-libitum	11.7	66
Restricted (10 day)	7.2	66
Restricted (16 days)	6.3	72

The rats fed restricted diet (6.3 gm/day) for 6 days before the start of NPU assay grew better than the group fed restricted diet (7.2 gm/day) only during the period of 10 days and NPU values were 72 and 66 respectively. It seems that rats on restricted diet for longer period adapt to this low food intake and utilized dietary protein more efficiently than the rats restricted for shorter periods.

The food restriction did not reduce the NPU value and the animals were as efficient in utilizing the dietary protein as the rats fed ad-libitum.

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