

THE NUTRITIVE VALUE OF THE PROTEINS OF A PROCESSED PROTEIN FOOD BASED ON A BLEND OF FULL-FAT SOYA FLOUR, GROUNDNUT FLOUR AND COCONUT MEAL

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The results of studies on the preparation, chemical composition and shelf-life of a processed protein food based on a 4:3:3 blend of full-fat soya flour, groundnut flour and coconut meal have been reported in an earlier paper¹. The product contained about 42 per cent protein and adequate amounts of calcium and vitamins A and D, thiamine and riboflavin. The proteins present in the food are provided by soya, groundnut and coconut flours and may be partially deficient in one or more of the essential amino

acids. It was therefore considered desirable to study the amino acid composition and nutritive value of the proteins. The present paper describes the results of studies on the amino acid composition and protein efficiency ratio of the protein food as compared with that of skim milk powder.

Experimental

Materials: The protein food used in this experiment was the same as that described in an

earlier paper¹. An imported sample of skim milk powder of good quality was used.

Amino acid composition: The essential amino acid composition of the protein food was determined according to Krishnamurthy *et al.*², and the results are given in Table I.

Animal experiments: The protein efficiency ratio (PER) of the proteins at 10, 15 and 20 per cent levels of protein intake were determined by the rat growth method of Osborne, Mendel and Ferry³. Male weanling albino rats weighing about 45 g. from the laboratory stock colony were allotted to the required number of groups according to a randomized block design. Each group consisted of eight rats. They were fed on the experimental diets (Table II) for a period of four weeks. The procedure adopted for the preparation of the experimental diets and the feeding of animals was similar to that of Tasker *et al.*⁴. Careful records of the food intake were maintained for all the groups, and the rats were weighed weekly. The protein efficiency ratios were calculated and statistically analysed. The results are given in Table III.

Results and Discussion

Amino acid composition: The results in Table I show that the protein food contains lesser amounts of all the essential amino acids (except arginine and histidine) than skim milk powder, but judged by the FAO reference protein pattern⁵, it is deficient only in tryptophan, methionine and cystine.

TABLE I. Essential amino acid composition of the protein food as compared to that of skim milk powder

Amino acid*	Protein Food	Skim milk powder	FAO reference protein pattern†
Arginine	8.9	4.3	...
Histidine	2.3	2.4	...
Lysine	5.1	8.5	4.2
Tryptophan	1.2	1.6	1.4
Phenylalanine	4.9	5.6	2.8
Methionine	1.3	3.2	2.2
Cystine	1.7	1.1	...
Total sulphur amino acids	3.0	4.3	4.2
Threonine	3.4	4.8	2.8
Leucine	7.0	11.2	2.8
Iso-leucine	4.8	7.7	4.2
Valine	5.1	7.2	4.2

* Expressed as g./16 g.N.

† FAO Nutrition Studies No. 16, Food and Agriculture Organization, Rome, 1957.

TABLE II. Percentage composition of experimental diets

	Protein content 10%		Protein content 15%		Protein content 20%	
	I	II	III	IV	V	VI
Protein food	24.0	...	36.0	...	48.0	...
Skim milk powder	...	28.0	...	42.0	...	56.0
Salt mixture*	2.0	2.0	2.0	2.0	2.0	2.0
Vitaminised starch†	1.0	1.0	1.0	1.0	1.0	1.0
Groundnut oil	10.0	10.0	10.0	10.0	10.0	10.0
Corn starch	63.0	59.0	51.0	45.0	39.0	31.0

* Hubbel, Mendel and Wakeman salt mixture.

† Vitaminised starch of Chapman *et al.*

TABLE III. Protein efficiency ratio of the proteins of the protein food and skim milk powder (Experimental period—4 weeks: Mean values for 8 male rats in each group)

Source of protein	Level of protein %	Initial body weight (g)	Protein intake (g)	Gain in body weight (g)	Protein efficiency ratio
Protein food ...	10	45.0	20.26	47.0	2.32
" ...	15	45.5	33.06	80.4	2.44
" ...	20	45.3	49.15	104.6	2.13
Skim milk powder ...	10	45.1	22.58	69.5	3.09
" ...	15	45.1	35.64	93.4	2.62
" ...	20	45.2	47.16	96.2	2.03

Critical difference (two tailed test) at 5% level 9.50 0.195
 1% level 12.75 0.262
 0.1% level 16.81 0.345

Growth rate: The mean increase in weight of rats (47.0 g.) on diet containing 10 per cent protein from the protein food was significantly less than that (80.4 g.) of rats receiving diet containing 15 per cent protein which in turn was significantly lower than that (104.6 g.) of rats receiving diet containing 20 per cent protein. The growth of rats on diet containing 15 and 20 per cent protein from the protein food was nearly of the same order as that observed with diets containing the same levels of milk proteins.

Protein efficiency ratio: The PER of the protein food at 10 per cent level of protein intake (2.32) was significantly less than that (3.09) of skim milk powder at the same level of protein intake. On the other hand at 15 and 20 per cent levels of protein intake the PER of the protein food (2.44 and 2.13) was nearly of the same order as that of milk proteins (2.62 and 2.03), the differences being not statistically significant.

The results (Table III) reported in the present study have shown that diets containing 15 and 20 per cent protein from the protein food based on a blend of soya, groundnut and coconut flours can promote good growth in rats, comparable to that observed in rats receiving the same amounts of protein from skim milk powder. The PER of the proteins at 15 and 20 per cent levels of intake compares favourably with that of milk proteins at the same level of protein intake. At 10 per cent protein intake, however, the protein food had a lower PER than skim milk powder, but higher than that reported for the proteins of soya bean⁶ (2.0) or groundnut⁷ (1.6). It is possible to improve further the PER of the protein food by fortification with methionine and lysine and work on these lines is in progress.

Summary

1. The protein efficiency ratio of the protein food based on a 4:3:3 blend of soya flour, groundnut flour and coconut meal at 10 per cent level of protein intake (2.32) was significantly less than that (3.09) of skim milk powder at the same level of protein intake. At higher levels of protein intake (*i.e.*, 15 and 20 per cent levels), there was no significant difference in the protein efficiency ratio of the protein food (2.44 and 2.13) and skim milk powder (2.62 and 2.03).

2. The growth of rats fed on diet containing 20 per cent protein from the protein food was significantly greater than the growth rates observed with diets containing 10 and 15 per cent milk proteins but nearly equal to that with diet containing 20 per cent milk protein.

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