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# SUPPLEMENTARY VALUE OF A SPRAY DRIED INFANT FOOD FORMULATION BASED ON GROUNDNUT PROTEIN ISOLATE AND FULL-FAT SOYA FLOUR TO A POOR RICE DIET

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Rice forms the staple food of nearly half the world's population.[1] Diet and nutrition surveys carried out in several rice-eating regions have shown that the diets consumed by weaned infants and young children of the low income groups of the population are deficient in proteins and certain vitamins and minerals and do not promote optimum growth in children.[1-3] In view of the acute shortage and high cost of milk and other protective foods, weaned infants and young children in rice eating countries are fed on ill-balanced diets consisting mostly of cooked rice, rice gruel and containing small quantities of pulses and vegetables.[3,4] Consequently, protein malnutrition and other deficiency diseases are widely prevalent among weaned infants and young children in these countries.[2-4] A considerable amount of work has been carried out during recent years by several groups of workers on the development of supplementary foods based on locally available protein-rich foods of vegetable origin, suitable for supplementing the diets of children.[5-8] In the earlier papers from this laboratory, studies on the preparation and nutritive value of a spray dried infant food formulation based on groundnut protein isolate and full-fat soya flour have been reported.[9,10] The present paper describes the results of studies on supplementary value of the infant food formulation to a poor Indian rice diet.

## Experimental

*Materials :* Spray dried infant food formulation, based on groundnut protein isolate, full-fat soya flour, dextrimaltose and hydrogenated groundnut oil and fortified with dl-methionine and certain vitamins and minerals and the milk food used in this study were the same as those described by Shurpalekar *et al.*[9].

*Animal experiments :* The supplementary value of the infant food to poor rice diet was determined by growth experiments on albino rats. Groups of freshly weaned rats weighing 46-47g. (12 in each group, distributed according to sex and body weight) were alloted to different groups according to randomized block design ignoring litters. The animals were housed individually in raised wire screen bottom cages and were fed *ad lib* on the different diets, the composition of which is given in Table I. The composition of the basal rice diet was the same as that recommended by the Vanaspati Research Advisory Committee.[11] The infant food (with and without added methionine) and milk food were incorporated at 10% level in the diet by replacing an equal amount of rice so as to provide about 2.5% extra protein. The diets were cooked in three times the amount of water in feeding cups by steaming for 10 minutes and fed to the rats. Careful records of food intake and weekly gain in body weight of animals were maintained. Another group of weanling rats of similar weight was used to determine the initial carcass composition.

At the end of 8 week feeding period, the haemoglobin and red blood cell count of the blood, moisture, fat and protein contents of the livers and carcasses of rats as also the retention of protein in the different groups of animals were deter-

Table I. Percentage composition of experimental diets

| Constituents | Diet | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Rice | 78.5 | 68.5 | 68.5 | 68.5 |
| Infant food formulation (I.F.F.) | — | 10.0 | — | — |
| I.F.F. +Methionine | — | — | 10.0 | — |
| Milk food | — | — | — | 10.0 |
| Red gram dhal (*Cajanus cajan*) | 5.0 | 5.0 | 5.0 | 5.0 |
| Groundnut oil | 5.0 | 5.0 | 5.0 | 5.0 |
| Skim milk powder | 0.9 | 0.9 | 0.9 | 0.9 |
| Common salt | 0.3 | 0.3 | 0.3 | 0.3 |
| Non-leafy vegetables : Potatoes Brinjal (*Solanum melongena*) | 8.2 | 8.2 | 8.2 | 8.2 |
| Leafy vegetables (*Amaranthus gangeticus*) | 2.1 | 2.1 | 2.1 | 2.1 |

Table II. *Effect of supplementing poor rice diet with infant food formulation† and milk food on the growth and composition of blood of rats*
(Mean values for 6 males and 6 females per group; duration of experiment : 8 weeks)

| Group | Diet | Initial body weight (g) | Protein content of diet* (%) | Daily food intake* (g) | Weekly gain in body wt (g) | Red blood cells ($10^6$/cu.mm) | Haemoglobin (g/100ml blood) |
|---|---|---|---|---|---|---|---|
| A | Poor rice diet | 46.6 | 7.9 | 7.0 | 5.3 | 6.2 | 13.5 |
| B | do +Infant food formulation (I.F.F.) | 46.6 | 10.3 | 10.6 | 14.6 | 7.7 | 15.3 |
| C | do +I.F.F.+ methionine | 46.5 | 10.4 | 11.1 | 15.0 | 7.4 | 15.0 |
| D | do+Milk food | 46.3 | 10.5 | 10.9 | 15.0 | 7.4 | 14.8 |
| | Standard error of the mean based on 30 degrees of freedom | | | | ±0.51 | ±0.14 | ±0.2 |
| | Critical difference at (one tailed test) 5% level | | | | 1.22 | 0.33 | 0.6 |
| | 1% level | | | | 1.77 | 0.50 | 0.8 |
| | 0.1% level | | | | 2.44 | 0.69 | 1.2 |

† Based on full-fat soya flour and groundnut protein isolate
* On moisture-free basis.

mined according to Shurpalekar *et al.*[12] The results are given in Tables II-IV.

## Results

*Growth and composition of blood :* The results presented in Table II show that the infant food and milk food when incorporated in poor rice diet to provide 2.5% extra protein brought about a highly significant ($P<0.001$) increase in the growth of rats. The mean haemoglobin level and red blood cell count of rats receiving the supplements were significantly higher ($P<0.001$) than those of rats receiving the control rice diet. No significant differences were observed in the mean growth rate, haemoglobin level and the red blood cell count of rats receiving the supplements of infant food with and without added methionine and milk food.

*Composition of liver and carcass :* The mean protein contents of the livers and carcasses of rats receiving the supplements of methionine fortified infant food and milk food were significantly higher ($P<0.001$) than those of rats receiving the control rice diet. There were no significant differences in the mean fat contents of the livers of rats fed on the different diets.

*Intake and retention of protein*: Table IV shows that the mean protein retentions per 100g gain in body weight of rats receiving the different supplements were significantly higher than those receiving

Table III. *Effect of supplementing poor rice diet with infant food formulation and milk food on the composition of livers and carcasses of rats*
(Mean values for 6 males in each group; duration of experiment : 8 weeks)

| | Diet | Body weight (g) | | Weight of fresh liver (g) | Composition of liver | | | Composition of carcass | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial | Final | | Moisture (%) | Fat (%) | Protein* (%) | Moisture (%) | Fat (%) | Protein* (%) |
| A | Poor rice diet | 48.5 | 95.0 | 4.3 | 72.2 | 3.8 | 16.4 | 60.7 | 15.1 | 17.7 |
| B | do + Infant food formulation (IFF) | 48.2 | 188.2 | 7.4 | 71.3 | 3.7 | 18.4 | 56.0 | 16.4 | 19.8 |
| C | do + I.F.F. + methionine | 48.2 | 194.3 | 7.6 | 70.8 | 3.6 | 18.3 | 56.9 | 15.7 | 20.2 |
| D | do + Milk food | 48.2 | 195.8 | 7.8 | 70.4 | 3.5 | 18.4 | 57.4 | 15 2 | 20.6 |
| | Standard error of the mean based on 15 degrees of freedom | | | | ±0.3 | ±0.14 | ±0.2 | ±0.4 | ±0.3 | ±0.4 |
| | Critical difference (one tailed test) at 5% level | | | | 0.7 | 0.35 | 0.6 | 0.9 | 0.8 | 1.1 |
| | 1% ,, | | | | 1.0 | 0.52 | 0.9 | 1.3 | 1.1 | 1.6 |
| | 0.1% ,, | | | | 1.5 | 0.75 | 1.3 | 1.9 | 1.6 | 2.3 |

* Nx 6.25

Table IV. *Effect of supplementing poor rice diet with infant food formulation and milk food on the retention of protein in rats* (Mean values for 6 males per group; duration of experiment : 8 weeks)

| Group | Diet | Total protein+ intake (g) | Total gain in body weight (g) | Body protein (g) | | Protein retained (g) | Protein (g) retained per 100g gain in body wt. | |
|---|---|---|---|---|---|---|---|---|
| | | | | Initial | Final | | | |
| A | Poor rice diet | 30.9 | 46.5 | 8.6 | 16.8 | 8.2 | 17.7 | |
| B | do + Infant food formulation (I.F.F.) | 62.3 | 140.5 | 8.6 | 37.3 | 28.7 | 20.5 | ±0.6 |
| C | do + I.F.F. + methionine | 64.7 | 146.3 | 8.5 | 39.1 | 30.6 | 20.9 | (15 df) |
| D | do + Milk food | 64.1 | 147.7 | 8.6 | 40.4 | 31 8 | 21.5 | |
| | Critical difference (one tailed test at 5% level) | | | | | | 1.4 | |
| | ,, 1% ,, | | | | | | 2.1 | |
| | ,, 0.1% ,, | | | | | | 3.0 | |

\+ On moisture-free basis.

the control rice diet. There was no significant difference, however, in the mean protein retention per 100g. gain in the body weight of rats receiving the infant food or the milk food.

## Discussion

The results obtained in the present investigation have shown that a spray dried infant food formulation based on groundnut protein isolate and full-fat soya flour possessed a highly significant supplementary value to poor rice diet comparing well with that of milk food of similar composition. It is of interest to note that the infant food when providing only 2.5% extra protein and extra amounts of calcium and certain vitamins was as effective as milk food in making up the deficiencies in the poor rice diet and in promoting growth in rats. This finding is of considerable practical importance when viewed in the light of acute shortage of milk and other animal proteins and the high incidence of protein malnutrition amongst children of the poorer classes in several developing countries in the tropical and sub-tropical regions. There is considerable scope for

the large scale production and use of the infant food formulation based on groundnut and soyabean as supplements to the poor dietaries of weaned infants and children in these regions.

**Summary**

The supplementary value of a spray dried infant food formulation based on groundnut protein isolate, full-fat soya flour, dextrimaltose and hydrogenated groundnut oil and fortified with dl-methionine and certain vitamins and minerals to poor rice diet was determined by growth experiments on albino rats.

Infant food formulation fortified with methionine or milk food, when incorporated at 10% level providing about 2.5% extra protein in the poor rice diet brought about highly significant increases in the growth rates, haemoglobin levels, red blood cell counts and protein contents of the livers and carcasses as also the retentions of protein per 100g. gain in body weight of rats. No significant differences were, however, observed between the values obtained for rats receiving supplements of infant and milk foods.

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