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# NUTRITIVE VALUE OF SOME HOME PREPARED AND COMMERCIAL BABY FOODS

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ABSTRACT

Protein energy malnutrition is one of the major public health problems among pre-school children in developing countries. Milk is the sole natural food of infants for the first few months of life. After about six months of age, it is desirable to give supplementary foods and then to gradually wean the infant on to a mixed diet. Among the Pakistani home made baby foods, Halwa Suji and Halwa Suji + Baysen have been found to be unsuitable as weaning foods. All Pakistani home-made baby foods have also been found to be far too low in calcium, phosphorus and iron. Among the commercial baby foods, Delhya is unsatisfactory and Farex is borderline in protein quality.

## INTRODUCTION

Protein energy malnutrition is one of the major public health problems among pre-school children in developing countries. Milk is the sole natural food of infants for the first few months of life. After about 6 months of age, the quantity of breast milk is insufficient to meet the energy and nutrient requirement of children and after about 3-6 months, it is desirable to give supplementary foods containing milk or other high quality protein food and then to gradually wean the infant on to a mixed diet. However, for the first few months of life, it is important that milk should remain the largest single item of the diet.

Processing at home or industrial level may have a deleterious effect on the protein quality of food products as heat damage to proteins can result from several types of reactions. The most severe form of damage is transformation of protein nitrogen to other forms. However, less destructive reactions that render protein biologically unavailable are more common. Early work was chiefly devoted to the lysine reaction(1). This reaction can take place at relatively low temperature, therefore lysine is regarded as the most heat sensitive amino acid(2). It would thus appear

that any beneficial effect due to heat treatment might be reversed and result in damage. Thus food products such as baby foods, exposed to severe heat treatments, may have reduced protein quality. Eggum(3) showed that commercially produced baby foods can have net protein utilization values (NPU) below 50% while Abrahamsson and Hambraeus(4) observed that the NPU of these products varied between 69% and 77%. It was further shown that the low values were primarily due to duration and temperature level of heat treatment and the level of moisture and reducing substances (5). The present paper deals with the nutritional quality of home-made and commercial baby foods consumed in Pakistan.

## NUTRITIONAL QUALITY OF HOME MADE BABY FOODS

The average values for the chemical composition, including some amino acid contents and protein quality of home made baby foods as determined by Khan and Eggum(6) are shown in Table-1.

Table-1. Nutritional evaluation of home made baby foods

| | Kichri | Kheer | Halwa Suji | Halwa Suji + Baysen | Delhya |
|---|---|---|---|---|---|
| Protein (N x 6.25) | 11.4 | 9.4 | 6.1 | 7.0 | 13.0 |
| Fat% | 18.6 | 6.8 | 18.3 | 18.2 | 2.0 |
| Carbohydrate% | 60.7 | 75.6 | 73.0 | 71.7 | 81.1 |
| Crude Fibre% | 1.5 | 0.3 | 0.5 | 0.9 | 1.8 |
| Ash% | 1.7 | 4.1 | 0.4 | 0.7 | 1.7 |
| Calories(M.E.)/100 g. | 484.0 | 424.0 | 483.0 | 482.0 | 423.0 |
| Ca mg/100 g | 51.3 | 237.3 | 23.6 | 32.9 | 36.0 |
| P mg/100 g | 184.7 | 206.4 | 61.6 | 82.1 | 383.0 |
| Fe mg/100 g | 3.5 | 1.3 | 1.1 | 2.1 | 3.1 |
| Lysine (g/16 g N) | 5.4 | 6.2 | 1.5 | 3.5 | 2.5 |
| Threonine(g/16 g N) | 3.3 | 3.8 | 2.3 | 2.6 | 2.6 |
| Methionine(g/16 g N) | 1.7 | 2.6 | 1.7 | 1.7 | 1.7 |
| True protein disgestibility% (TPD) | 92.0 | 96.0 | 99.0 | 99.0 | 97.0 |
| Biological value% | 71.0 | 84.0 | 52.0 | 75.0 | 59.0 |
| Net Protein utilization% | 65.0 | 81.0 | 51.0 | 74.0 | 57.0 |
| Net dietary protein calorie% | 6.1 | 7.3 | 2.6 | 4.5 | 7.0 |

Source: Khan and Eggum (1979) J.Sci. Fd. Agri., 30, 369.

The total protein content of home prepared baby foods varies between 6.1 and 11.4%. Lowest figures were obtained for Halwa Suji and Halwa Suji + Baysen. All the home cooked baby foods except kheer (6.8%) contained 18% fat. Less than 30% of energy intake from fat may result in a dry and unpalatable diet. In this study Khichri, Halwa Suji and Halwa Suji + Baysen each supplied 32% of the total calories from fat. The highest content of ash was found in Kheer (4.1%). The ME values were highest (482-484 K Cal) in Khichri, Halwa Suji and Halwa Suji + Baysen. The daily allowances for calcium, phosphorus and iron for 6 months old infant are 360, 240 and 10 mg respectively(7). It appears that all the samples of baby foods are far too low in these minerals.

Lysine content (g per 16 g N) was found to be highest in Kheer (6.2) and was lowest in Halwa Suji (1.5). Protein score based on the FAO scoring pattern (8) indicated that lysine and threonine are the first and second limiting amino acids in Halwa Suji and Halwa Suji + Baysen, whereas threonine and methionine are the first and second limiting amino acids in Khichri and Kheer, the rice based home prepared baby foods. Tryptophan in Khichri, Halwa Suji and Halwa Suji + Baysen and lysine in Kheer are the third limiting amino acids.

All the baby foods had a TPD above 90% and the highest TPD (99%) was observed in Halwa Suji and Halwa Suji + Baysen. The NPU of Khichri, Kheer and Halwa Suji + Baysen were 65, 81 and 74% and the lowest NPU (51%) was found in Halwa Suji. Net dietary protein calories percent (ND p cals%) of these foods were calculated according to Miller and Payne (9) and varied between 2.6 and 7.3%.

Heat processing is known to affect the nutritive value of protein in various ways. The processing damage to proteins can result from destruction of amino acids by oxidation, loss of palatability, modification of some of the linkages between the amino acids so that their release is delayed during digestion and finally formation of linkages that are not hydrolyzed during digestion.

The processing conditions employed (6) indicate that cooking temperature (100 - 110 C) does not appear to affect the total lysine content of Khichri and Kheer whereas lysine content of Halwa Suji + Baysen are damaged to a greater extent when cooked at 150 - 160 C. Maillard reaction may be responsible for this loss. Lysine and threonine are the limiting amino acids in all home prepared foods and confirm the findings of Khan and Eggum (10), who found similar losses with mixed Pakistani diets.

Although the TPD of all the baby foods was above 90% (92-99%) yet the NPU values of Halwa Suji and Khichri were only 51 and 65%, respectively. It is possible that amino acids were absorbed from the gut in non-metabolisable forms and excreted in the urine (11). Formation of toxic substances may also contribute to the reduced nutritive value of materials containing products of the Maillard reaction (12). According to Payne (13), the levels of protein required in terms of protein and energy requirement ratios for different age groups i.e. 6-9 months, 1 year and 2-3 years are 6.9, 5.4 and 5.3, respectively. Halwa Suji and Halwa Suji + Baysen are not suitable for all these age groups.

## NUTRITIVE VALUE OF COMMERCIAL BABY FOODS

Khan and Kissana (14) measured the chemical composition and biological quality of commercial baby foods and the results are presented in Table 2.

The protein content of these baby foods varied between 11.1 and 26.0%, respectively. Fat contents were highest in the milk based foods and ranged from 18.2 to 27.0% and were lowest (1.6-2.0%) in the cereal based foods. The available carbohydrates in milk based formulas were lowest (44.1-59.9%) and those in cereal based formulas were highest (81.1-84.0%). The highest ash (5.6%) was found in ostermilk. ME values were highest (428-473 Kcals) in ostermilk, Meiji and P-7f, whereas the lowest values (349-391 Kcals) were observed in Cerelac and Robinson.

Table 2. Nutritive value of commercial baby foods

| | Milk based formulas | | | Cereal milk blends | |
|---|---|---|---|---|---|
| | Oster | Meiji | F-7f | Robinson | Cerelac |
| Protein% (N x 6.25) | 26.0 | 13.3 | 14.9 | 13.2 | 11.1 |
| Fat% | 18.2 | 23.0 | 27.0 | 3.0 | 7.8 |
| Available carbohydrate% | 44.1 | 59.9 | 53.5 | 71.5 | 77.7 |
| Ash% | 5.6 | 2.3 | 2.5 | 3.3 | 2.0 |
| Calories(ME)/100 g | 482.0 | 460.0 | 473.0 | 349.0 | 391.0 |
| True digestibility% | 96.0 | 95.0 | 97.0 | 94.0 | 93.0 |
| Biological value% | 76.0 | 72.0 | 77.0 | 74.0 | 76.0 |
| Net protein utilization% | 73.0 | 68.0 | 75.0 | 69.0 | 71.0 |

Source: Khan and Kissana (14).

All the baby foods had a true digestibility of above 90%. The highest TPD (97%) was found in P-7f and Delhya and lowest (93%) in Cerelac. The NPU of ostermilk, Meiji and P-7f were 73, 68 and 75% for milk based formulas and 69 and 71% for the cereal milk blends of Robinson and Cerelac and 60 and 57% for Farex and Delhya, respectively. The biological value of milk based formulas, cereal milk blends and cereal based formulas varied from 72 to 77%, 74 to 76% and 59 to 63%, respectively.

Different standards for the quality of protein foods have been suggested. According to FAO/WHO Codex Alimentarius Commission (15), these standards for milk based formulas are measured against a case in reference. The lower NPU value (72%) of case in reference than of whole milk (81%) is attributed to a less well balanced essential amino acid pattern (16). If the NPU value of a milk based formula is lower than that of case in it may be due to a processing damage. The possibility of changing reference protein using lactalbumin instead of case in has been suggested (17).

In the study by Khan and Kissana (14), the protein quality of the commercial baby foods tested fulfilled the FAO/WHO requirements. However, the NPU value of the milk based formulas were lower than that of whole milk. This suggests that the protein of milk based formulas have been damaged during processing as heat processing is know to affect the nutritive value of protein. Some of the compounds produced by the Maillard reaction. i.e. the soluble premelanoids have been reported to have antinutritional and toxic properties (18). This might explain the reason for the higher TPD (95%) and lower NPU (68%) of Meiji baby foods observed in the present study. It is also possible that the amino acids absorbed from the gut were excreted in the urine, resulting in high TDN and low NPU of the product.

According to the protein calorie advisory group (PAG) guidelines (19) on protein rich mixtures for use as supplementary food, the protein quality in terms of NPU should be above 60%. In the present study, the NPU of both Cerelac and Robinson baby foods were found to be 71 and 69%, respectively and was above the level expected of products based on cereals and milk. Both the foods were satisfactory and had NPU values comparable to those of milk based formulas. The addition of lysine to cerelac resulted in higher NPU and supports the finding that lysine is the limiting amino acid in home and industrially processed baby foods. Earlier work also showed that cereal proteins were improved by supplementation with milk or legume proteins (20-23). The NPU of

Farex (63%) was satisfactory and that of Delhya (59%) was below that of desirable for baby foods.

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DISCUSSION

Raza Gill: What type of milk was fed to the rats?

Iftikhar Rana: It was powdered cow milk with 3.5% fat.

Qamar Ahmad: Difference in growth of rats could be attributed to factors other than diet i.e. genetics.

Iftikhar Rana: Efforts were made to use animals of similar genetic make-up for all the diets.

Zaka Malik: How the diets were made isocaloric and isoproteinic? Heterogeneity of food could affect the acceptance of food by the animals.

Iftikhar Rana: There was no need for making the diets isocaloric and isoproteinic in this study.

Tafazzal Shah: Growth is related primarily by protein content of the diet rather than fat.

Iftikhar Rana: Since milk was the basis of the two diets in question and one had higher fat than the second, that was probably the reason for difference in growth of rats. Fat and even quality of fat could also affect the growth.

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