

## **Nutritional Evaluation of Some Commercial Baby Foods Consumed in Pakistan**

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The nutritive value of some commercial baby foods commonly consumed in Pakistan was evaluated by means of chemical and biological assays. The protein content of milk based formulas and cereal-milk blends ranged from 13.3–26.0 and 11.1–13.2%, respectively. The fat content was highest (27%) in P-7f and was lowest (3%) in Robinson Baby Food. The available carbohydrates in milk based formulas were lower (44.1–59.9%) than cereal-milk blends (71.5–77.7%). The highest content of ash (5.6%) was found in Ostermilk. The metabolisable energy (ME) values ranged from 428–473 and 349–391 kcal, respectively, in milk based formulas and cereal-milk blends. The net protein utilisation (NPU) values of milk based formulas varied between 0.68 and 0.75 and NPU values of cereal-milk blends ranged from 0.69 to 0.71. The protein quality of baby foods was compared with the standards and the low NPU values reflected the influence of the processing technique.

*Keywords:* Baby food; nutritional evaluation; net protein; nutrition.

### **1. Introduction**

Protein-calorie malnutrition is one of the major public health problems among pre-school children in developing countries. After about 6 months of age the quantity of breast milk supplied by the mother is insufficient to meet the energy and nutrient requirements of the growing infant and the introduction of semi-solid food to the diet during the first 6 months of life is imperative to prevent malnutrition. Such a food must be not only nutritious and cheap, but also safe and acceptable to local taste. Eggum<sup>1</sup> reported that commercially produced baby foods can have net protein utilisation (NPU) values below 0.5 whereas Abrahamsson and Hambræus<sup>2</sup> observed that the NPU of these products varied between 0.69 and 0.77. However, the most important factors determining the nutritive value of processed foods are the duration and temperature level of heat treatment, and the levels of moisture and reducing substances.<sup>3</sup>

In Pakistan, home-made baby foods have for long been used and their protein quality has been evaluated.<sup>4</sup> Recently, commercial baby foods have been introduced and since there is no information available on their nutritive value, the present investigation was initiated.

### **2. Experimental**

#### **2.1 Selection of baby foods**

Two different types of baby foods were selected: (i) Milk based formulas and (ii) cereal-milk blends. The commercial milk based formulas: Ostermilk (Pakistan), Meiji soft curd powdered milk (Japan) and P-7f Neo-Milk (Japan), and the cereal-milk blends: Robinson (U.K.) and Cerelac (France), commonly used in Pakistan were purchased from the market. In Table 1 the components of the baby foods are given according to the labels on the packages.

Table 1. Components of the commercial baby foods

Products		Protein source					Added sugar			Added fat	
		Milk full cream	Milk solids	Milk skimmed	Cereal	Lysine	Dextrin maltose	Sucrose	Lactose	Butter	Modified
Oster	Milk based	x								x	
Meiji P-7f			x					x			x
Robinson	Cereal-milk blends		x		x				x		x
Cerelac		x		x	x	x	x	x			

## 2.2 Chemical analysis

The chemical composition of baby foods was determined according to standard methods.<sup>5</sup> The caloric value was determined in Bomb Calorimeter and metabolisable energy (ME) was calculated according to Miller and Payne.<sup>6</sup>

## 2.3 Biological evaluation

Diets were prepared by mixing the foods samples with corn starch to calculated protein levels of 10% and supplementing with 5% corn oil, 2% vitamin mixture and 4% mineral mixture. In order to measure the metabolic faecal nitrogen, a group of rats was fed on a protein free diet consisting of corn oil 5%, glucose 15%, vitamin mixture 2%, mineral mixture 4% and corn starch 74%. A casein based diet served as control.

The experimental procedure has been described by Khan *et al.*<sup>7</sup> Fifty-six weanling rats of Wistar strain, weighing between 50 and 60g were grouped by randomised block design. Each group consisted of four rats (male and female) housed in a screen mesh-bottomed cage, a sheet of filter paper was placed under each cage for the collection of faeces. The experimental diets were randomly assigned to these groups in such a way that each diet was fed *ad libitum* to two groups of rats for a period of 10 days. Gains in body weight were recorded daily.

At the end of the experiment the rats were killed with chloroform. Incisions were made into skull, thoracic and abdominal cavities and the carcasses of each group were dried to a constant weight at 105°C. Dried carcasses were weighed and ground in an electric grinder. The nitrogen content of diets, faeces and carcasses of each group was determined by the Kjeldahl method. Net protein utilisation was estimated according to the method of Miller and Bender.<sup>8</sup>

$$\frac{\text{Nitrogen intake} - (\text{faecal nitrogen} - \text{metabolic nitrogen})}{\text{Nitrogen intake}} \times 100 = \text{TD} (\%)$$

$$\frac{\text{Net protein utilisation}}{\text{True digestibility}} \times 100 = \text{BV} (\%)$$

## 3. Results

### 3.1 Chemical composition of baby foods

The protein content of milk based formulas and cereal-milk blends varied between 13.3 and 26.0%, and between 11.1 and 13.2%, respectively (Table 2). Fat contents were highest in the milk based foods and ranged from 18.2 to 27.0% and were lowest (3.0–7.8%) in cereal-milk blends. The available carbohydrates in milk based formulas were comparatively lower (44.1–59.9%) than in cereal-milk blends (71.5–77.7%). The highest ash (5.6%) was found in

Table 2. Nutritive value of commercial baby foods

		Milk based formulas			Cereal-milk blends	
		Oster	Meiji	P-7f	Robinson	Cerelac
Protein (N×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 100 g <sup>-1</sup> (Metabolisable)	(%)	428	460	473	349	391
True digestibility	(%)	96	95	97	94	93
Biological value	(%)	76	72	77	74	76
Net protein utilisation		0.73	0.68	0.75	0.69	0.71

Ostermilk. ME values were highest (428–473 kcal) in Ostermilk, Meiji and P-7f, whereas the lowest values (349–391 kcal) were observed in Robinson and Cerelac.

### 3.2. Protein quality of baby foods

All the baby foods had a true protein digestibility of above 90%. The highest TD (97%) was found in P-7f and lowest (93%) in Cerelac. The NPU of Ostermilk, Meiji and P-7f were 0.73, 0.68 and 0.75 for milk based formulas and 0.69 and 0.71% for the cereal-milk blends of Robinson and Cerelac respectively. The biological value of milk based formulas and cereal-milk blends varied from 72 to 77% and 74 to 76%, respectively.

## 4. Discussion

Different standards for the comparison of protein quality of baby foods have been suggested. According to FAO/WHO Codex Alimentarius Commission,<sup>9</sup> that of milk based formulas is measured against a casein reference. The lower NPU (0.72) of casein than of whole milk protein (0.81) attributed to a less balanced essential amino acid pattern.<sup>10</sup> If the NPU value of a milk based formula is lower than that of casein it may be due to processing damage. The possibility of changing reference protein using lactalbumin instead of casein has been suggested.<sup>11</sup>

In the present study, the protein quality of all the baby foods tested fulfilled the FAO/WHO requirements. However, the NPU values of the milk based formulas were lower than that of whole milk (0.81). This suggests that the protein of the milk based formulas has been damaged during processing, as heat processing is known to affect the nutritive value of protein.<sup>3</sup> Some of the compounds produced by the Maillard reaction, i.e. the soluble premelanoids have been reported to have antinutritional and toxic properties.<sup>12</sup> This might explain the reasons for the high TD (95%) and lower NPU (0.68) of Meiji baby food, observed in the present study. It is possible that amino acids were absorbed from the gut in non-metabolisable form and excreted in the urine, resulting in high TD and low NPU of the product.

According to the Protein Calorie Advisory Group (PAG) Guidelines<sup>13</sup> on protein rich mixtures for use as a supplementary food, the protein quality in terms of NPU should be above 0.6. In the present study, the NPU of both Robinson and Cerelac baby foods were found to be 0.69 and 0.71, respectively, and above the level expected of products based on cereal and milk. Both the foods were satisfactory and were comparable to that of the NPU of milk based formulas. Similar results have been reported by Khan and Eggum.<sup>4</sup> 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 produced baby foods. Similarly, NPU of roasted products was improved by the addition of lysine,<sup>3</sup> and confirms earlier work in which cereal proteins were improved by supplementation with milk or legume proteins.<sup>14-17</sup>

### References

1. Eggum, B. O. *Aminosyrekoncentration og proteinkvalitet stougaards Forlage*, Copenhagen, 1968.
2. Abrahamsson, L.; Hambræus, L. The protein quality of instant blends for infants and children based on milk or cereals and milk. *Am. J. Clin. Nutr.* 1977, **30**, 441-448.
3. Bender, A. E. Processing damage to protein food. A review. *J. Food Technol.* 1972, **7**, 239-250.
4. Khan, M. A.; Eggum, B. O. Effect of home and industrial processing on protein quality of baby foods and breakfast cereals. *J. Sci. Food Agric.* 1979, **30**, 369-376.
5. Association of Official Analytical Chemists. *Official Methods of Analysis*. AOAC, Washington, D.C. 1970, 10th edn.
6. Miller, D. S.; Payne, P. R. A ballistic bomb calorimeter. *Br. J. Nutr.* 1959, **13**, 501-508.
7. Khan, M. A.; Alams, K.; Abid, A. R.; Yaqoob, M. The effect of gram flour on the quality of wheat protein. Pakistan. *J. Agric. Sci.* 1976, **13**, 167-172.
8. Miller, D. S.; Bender, A. E. The determination of the net utilisation of proteins by a shortened method. *Br. J. Nutr.* 1955, **9**, 382-388.
9. Codex Alimentarius Commission. Eleventh Session 1976. *Report on the Ninth Session of the Codex Committee on foods for special dietary uses. APP. IV. Proposed draft standard for processed cereal-based foods for infants and children (Advanced to step. 8)*. Bonn, 22-26 Sept. 1975, Rome: FAO/WHO, 1976.
10. FAO. Amino acid content of foods and biological data on proteins. *Nutritional studies No. 24*. Food and Agriculture Organisation, Rome, 1970.
11. Hambræus, L.; Forsum, E.; Lonnerdal, B.; Hakansson, E.; Astrand, M. Synpunkter Panytt referensprotein stallet for kasein. *Stockholm: Hygiea, Svenska Lakarsallskapets riksstamma, Sammanfattningar* 1975, p. 335.
12. Adrian, J. La reaction de Maillard vue sous l'angle nutritionnel. III. Substances prejudiciable engendées par la reaction de Maillard. *Ind. Alim. Agric.* 1973, **90**, 449-454.
13. *PAG Guideline on protein-rich mixtures for use as weaning foods studies No. 8*. FAO/WHO/UNICEF Protein Advisory Group, United Nations. New York Feb. 1971.
14. Khan, M. A.; Eggum, B. O. The nutritive value of some Pakistani diets. *J. Sci. Food Agric.* 1978, **29**, 1023-1029.
15. Khan, M. A.; Ahmad, J.; Abid, A. R. Nutritive value of wheat flour as supplemented by lentils and fish meal. *J. Anim. Sci. (Pakistan)* 1979, **1**, 51-56.
16. Khan, M. A.; Haq, R.; Abid, A. R.; Yaqoob M. The nutritive value of wheat flour (Mexi-Pak) as affected by supplementation with defatted soy flour. *Pakistan. J. Agric. Sci.* 1977, **14**, 69-75.
17. Khan, M. A.; Yasmin, S. F.; Abid, A. R. Nutritional evaluation of lentil as protein supplement for wheat protein. *Acta Agric. Scand.* 1979, **29**, 109-111.