Annals. Food Science and Technology
2013

DEVELOPMENT OF A LOW COST ENERGY DENSE COMPLEMENTARY FOOD FOR POOR SOCIETY'S YOUNG BABY IN BANGLADESH

Huq Obidul[1*] , Alom Jahangir[2] , Manir Zahidul[3] ,Moktadir Golam [2] and Haque Formuzul [4]
[1]Assistant Professor, Department of Food Technology and Nutritional Science, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh
[2]MS Research Students, Department of Food Technology and Nutritional Science, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh
[3]Nutrition Program Manager, Action Contre la Faim, Cox's Bazar
[4]Professor and Head, Department of Nutrition and Food Engineering, Daffodil International University, Dhaka-1202, Bangladesh
E-mail: obidulhuq@gmail.com

Abstract
Complementary food is the liquid or semi-solid food which started along with continued breast feeding. Usually cereals based fortified foods are introduced initially as the first complementary foods at the six months of infancy. Although, a number of convenient fortified cereal formulas are available, they are often too expensive for the poor and middle income people. To overcome this problem a study was designed to aim at the formulation of low cost complementary foods that provide sufficient protein, vitamin and minerals for the target group. Three types of complementary foods were formulated by certain proportion mixing of cereals (boiled rice, kalozira rice), legumes (Bengal gram, Black gram, Mung bean), sugar, milk powder and vegetables (Carrot and Pumpkin) in powdered form after proper processing of all ingredients. The recipe was standardized and analyzed and the nutritive values of the final complementary food contain 15.5% protein, 13.7% fat, 56.3% carbohydrate, 2.62% ash and energy 415 Kcal per 100g. On the other hand, equal amount of locally available market foods contain similar amount of nutrients although it was high prices. Comparing the various sample and market results, it was found that the standardized sample was comparatively suitable for use as complementary food at convenient prices.

Keywords: Complementary food, Breast feeding, Fortified cereal, Nutritive value, Low cost

Submitted: 24.04.2013 Reviewed: 03.06.2013 Accepted: 05.07.2013

1. INTRODUCTION

In most developed societies, fortified cereals are the first complementary foods introduced to the infant, followed by fruits, vegetable, meat and fish products. In developing countries, although a number of convenient fortified proprietary formulas are available, they are often too expensive and out of the reach of most families. The use of homemade complementary foods that can be readily prepared, available, affordable, is one feeding option that has been recommended by WHO (Eppright et al., 1970)

Complementary feeding is the feeding of foods or liquids which provided along with continued breastfeeding. The term Complementary feeding is used to describe any nutrient-containing foods or liquids, other than breast milk, that are given to young children during the period of complementary feeding (Mose et al., 1967). Complementary foods consist of special "transitional" food that are prepared especially for the infant and, increasingly as the child becomes older from the same foods that are consumed by other members of the household. Appropriate feeding practices are of primary importance for the survival, growth, development, health and nutrition of infants and children everywhere. The period from 6 months to 2 years is of critical importance in the child's growth and development. The global strategy for infants and young children aims to improve through optimal feeding, the nutritional status, growth and development, health and thus, the survival of infants and young children on worldwide. Providing safe and appropriate complementary foods from six months of age with continued breast-feeding

for up to two years of age is the global public health recommendation (Khan et al., 1992).
Most families depend on locally available formulated diets to feed infant and young children. The locally formulated foods are low in protein and high in anti-nutritional factors that reduce the bioavailability of some micronutrients in complementary foods. Poor processing and cooking methods also contribute substantially to loss of micronutrients, leading to micronutrient deficiency disorders in young baby's fed these foods. From about six months onwards there is a gap between the total energy needs and the energy provided by breast milk. The gap increases, as the child gets older. Another nutrient gap to be filled is for iron, vitamin-A at 6 months, babies need to learn to eat thick porridge and mashed foods as these foods fill the energy gap more than liquids. At 6 months of age, it becomes easier to feed thick porridge, puree and mashed food because babies can sit upright without needing support and show interest in other people eating and reach for food. In addition, at this age, babies' digestive systems are mature enough to digest a range of foods (Hossain et al.,1991). If these gaps are not filled, the child will stop growing and grow only at a slow rate. The child who is not growing well may also be more likely to become ill or to recover less quickly from an illness. It is important for young children to eat a mix of good complementary food. Usual food preparations in a household, is easier for families to feed their young children a diet with good complementary foods. It is suggested that families should try each day to give a dark green vegetable or orange colored fruit or vegetable and an animal food in addition to the staple food. Foods can be made more energy and nutrient rich in a number of ways such as replacing some (or all) of the cooking water with fresh or soured milk, coconut milk, or cream, Adding a spoonful of milk powder after cooking, Mixing legume, pulse or bean flour with the staple flour before cooking, Stiring in a paste made from nuts or seeds such as groundnut paste (peanut butter) or sesame seed paste, Adding a spoonful of margarine, ghee or oil. Germinated grain can be used to make porridge. It also helps more iron to be absorbed. Use this germinated flour to make porridge. This type of flour dose not thicker much during cooking as less water can be used. Add a pinch of the germinated flour to cooked thick porridge that has cooled a little bit. The porridge should be boiled again for a few minutes after adding will make the germinated flour. This addition will make the porridge softer and easier for the child to eat (Rashid et al., 1997).
Complementary feeding started when the children do not get sufficient nutrients from the mother's breast milk. Initially for few weeks, complementary food should be liquid and soft. Gradually shift food from liquid to semisolid and then to solid. With the increase of age, amount of food should be increase. Complementary food should be given gradually but not abruptly and breast-feeding should not be deliberately stopped at a particular point. Complementary food complements breast-feeding.

2. MATERIAL AND METHOD

Formulation of complementary food

For manufacturing of complementary foods cereals, legumes and vegetables were processed.

Processing of cereals

Two types of rice are used in this process: boiled rice and kalozira rice. At first the rice washed with cleaned water and the water is drained out well. Then the rice is grinded in a grinder to make fine powder.

Legumes Processing

Bengal gram: The grams were collected from the local market. Only the fine and healthy grams were selected from the sample and washed in distilled water and the washed water was drained out. Clean grams were steeped in equal amount of water for 12 hrs at room temperature. After 12hrs water was removed from the container where it was soaked. The wet grams were allowed to germinate for the

further 48hr. The germinated grams were dried in a drier for 45minutes at 105^0C then it was dried in a vacuum drier. After drying it was grinded in a grinder to make fine powder.
Mung bean: The mung bean (dal) legumes were collected from the local market. Only the fine and healthy grams were selected from the sample. The legumes were cleaned with water and then the legumes were roasted well. The roasted legumes were then passed through a grinder to make fine powder.
Black gram: The black gram were collected from the local market. Only the fine and healthy grams were selected from the sample. The legumes were cleaned with water and then the legumes were roasted well. The roasted legumes were then passed through a grinder to make fine powder.

Processing of Carrot and Pumpkin:
Carrot: Surface of carrot was washed with distill water and peeled the surface mechanically. Then carrot was sliced for making thin pieces. Carrot pieces were first dried in drier for 45min at 105^0C. Finally, the carrot dried in a vacuum drier at 72^0C for 1hr.The dried portion was grinded in an electric grinder to make fine powder.
Pumpkin: Surface of pumpkin was washed with distill water and peeled the surface mechanically. Then pumpkin was sliced for making thin pieces. Pumpkin pieces were first dried in drier for 45min at 105^0C.Finaly the pumpkin dried in a vacuum drier at 72^0C for 1hr.The dried portion was grinded in an electric grinder to make fine powder.

Processing of the complementary food products
All the processed cereal, legume and vegetables materials were mixed with a certain portion basis on the proportion of balanced diet. Three samples were formulated on the basis of recipe development and cost estimation.

Biochemical quality analysis
All the samples were subjected to chemical quality assessment. Moisture was determined by oven-drying method, Ash was determined by incineration method, Fat was determined by soxhlet appratus method, Protein by Kjeldahl method and Crude fiber by AOAC – 1995 method.

Recipe development 1:
For the formulation of the sample 1, 2 and 3 the following proportion of the ingredients is mixing appropriately as presented in table 1.

3. RESULTS AND DISCUSSION

The present study was designed on the formulation of a low cost complementary baby food and observation of its role to improve the nutritional status among the malnourished baby (table 2).

Table 1: Recipe for different sample.

Food Items	Sample-1(g)	Sample-2(g)	Sample-3(g)
Boiled rice	40	30	30
Kalozira rice	20	30	25
Mashkalai dal	10	10	10
Mug dal	7	5	5
Bengal gram	9	9	12
Carrot	3	3	3
Pumpkin	2	3	3
Salt	2	2	2
Sugar	2	8	10
Milk powder	5	-	-

Table 2: Cost in Tk per 100gm of complementary foods.

Sample	Cost (Tk.) per 100gm
Sample-1	12.43
Sample-2	11.30
Sample-3	11.17
Complementary food from market	100.00

Table 3: Nutrient content of complementary food per 100 gm (Sample-1)

Nutrients	Contents per 100 g		
	Sample-1(g)	Sample-2(g)	Sample-3(g)
Moisture	9.56	9.56	10.1
Protein	16.52	15.44	15.12
Fat	13.73	13.9	13.8
Ash	0.62	0.51	0.54
Crude fiber	2.62	2.53	2.55
Carbohydrate	56.31	56.76	58.76
Energy (Kcal)	417	414	413

As has been reported in several nutrition surveys conducted in Bangladesh, malnutrition is one of the major problems in Bangladesh, as elsewhere in developing country. Children are most vulnerable and affected by malnutrition. Inappropriate calorie intake due faulty complementary feeding after six month of age is the considerable factor for their low nutritional status. The present research was conducted to formulate such a food that can provide sufficient calorie to the children and meet other dietary essentials.

Table 3 illustrates the following nutrient contents of complementary food were estimated by using different analytical methods. Per 100 gm (Sample-1) of food product contains 9.56% moisture, 0.62% crude fiber, 416.92Kcal energy and 16.52% protein, 13.73% fat, 56.31% carbohydrate, 2.62% ash. Per 100 gm (Sample-2) of food product contain 9.56% moisture, 0.51% crude fiber, 414Kcal energy and 15.44% protein, 13.9% fat, 56.76% carbohydrate, 2.53% ash. Per 100 gm (Sample-3) of food product contain 10.1% moisture, 0.0.54% crude fiber, 413Kcal energy and 15.12% protein, 13.8% fat, 58.76% carbohydrate, 2.55% ash. Above three samples in samples-3, the amount of carbohydrate (58.76%) is more comparing to others. In sample-1 the amount of protein (16.52%) and the sample-2(13.9%) the amount of fat is more from the others. By comparing the sample 1, 2 and 3 we found that moisture content is high in sample-3 (10.1), Ash content is high in sample-1 (2.62) crude fiber content is high in sample-1 (0.62) and calorific value is high in sample-1 whereas in sample collected from market available for infants and marketed as BIOMILL -1 manufactured by Fassaka. S.A. Belgium. Contain moisture 2.5%, energy 518 Kcal, Protein 12.5%, fat 28%, carbohydrate 58%, ash 3.0%, per 100gm of dry product.

Table-2, 3 and 4 shows that the cost of different recipe development. The cost for 100gm of sample-1 was Tk.12.43, Tk.11.30 for sample-2 and TK. 11.17 for sample-3 complementary foods whereas the cost of 100gm dry complementary food in market is approximately Tk.100.00.

4. CONCLUSIONS

Importance of proper nutrition as a foundation for growth, development as well as maintaining good health is often underestimated. Poor nutrition leads to ill-health and ill-health contributes to further deterioration in nutritional status. The effects of poor nutrition and stunting continue throughout life, contributing to poor school performance, reduced productivity, and impaired intellectual and social development. Inappropriate feeding practices are a major cause of the onset of malnutrition in young children. In spite of the critical importance of appropriate complementary feeding for child growth and

development, interventions are necessary to improve feeding practices in children 6–24 months of age. In this study Complementary food was prepared using Cereals (Boiled rice and Kalozira rice), Legumes (Bengal Gram, Mung bean and Black gram), Vegetables (Carrot and Pumpkin) in powdered form. All the processed cereal, legume and vegetables materials were mixed with a certain portion on the basis of the proportion of balanced diet. The result shows that, samples-3 contain fairly higher amount of carbohydrate whereas amount of protein is relatively high in sample-1 and amount of fat is comparatively high in sample-2. Comparison of the sample 1, 2 and 3 also shows that moisture content is relatively high in sample-3, Ash content is relatively high in sample-1, crude fiber content is comparatively high in sample-1 and calorific value is comparatively high in sample-1. Comparing the result, we reach the conclusion that sample 1 is comparatively suitable for use as a complementary food. The findings of this study were expected to contribute to the production of good quality and low cost homemade complementary food which will be nutritious and preferable to the children.

5. ACKNOWLEDGEMENT

The authors are highly appreciated to the authority of Bangladesh Council of Industrial Research to support the laboratory facilities during chemical tests of the products.

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