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Development of low-cost complementary food for infants and young children from locally available food materials

Pallavi Kumari, Jyotirmayee Sahoo, Debjani Das and Dr. Usha Singh

Abstract

Nutrition is a science of foods, nutrients and other substances, their action, interaction and balance in relation to health and disease. Young children are typically referred to an infant in the first year of age. Infants and young children require some amount of nutrition to meet out their daily physiological and metabolic functions. Up to the age of 6 months, nutrient requirement is fulfilled by mother's milk alone. After that their requirements are increasing, thus breast-milk alone is insufficient to meet their energy needs. To meet out the nutritional requirement and to get rid of different forms of malnutrition, complementary foods need to be included in the diet of infants and young children. Complementary feeding is defined as the provision of food or fluids to infants in addition to breast-milk. Timely introduction of appropriate complementary foods is important to meet the full nutritional and psychological needs of infants and young children. Infants need complementary foods with much higher nutrient density than is required for adult diets. Keeping all these points in view the present investigation had been planned with the objective to develop low-cost complementary food for the infants and young children from locally available foods. From the findings of low cost complementary food it can be concluded that ready-to-mix commercial products will be highly nutrient rich which will help for improving infant and young child feeding.

Keywords: Complementary feedings, low-cost complementary foods

Introduction

Nutrition is a science of foods, nutrients and other substances, their action, interaction and balance in relation to health and disease. Since nutrition is a major determinant of health, labor, productivity and mental development, at every stage of life, care must be given on it in order to make our society healthy and wealthy (Graeme *et al.*, 2017) ^[1].

Infancy is one of the important stages at which the proper nutrition can put a large impact. The infant is derived from the latin word, "infants", meaning "unable to speak". Thus, infancy is defined as the period from birth to approximately two years of age (Koletzko *et al.*, 2016) ^[2].

Young children are typically referred to an infant in the first year of age. Infants and young children require some amount of nutrition to meet out their daily physiological and metabolic functions. Up to the age of 6 months, nutrient requirement is fulfilled by mother's milk alone. After that their requirements are increasing, thus breast-milk alone is insufficient to meet their energy needs (Joanne Bartleman, 2019) ^[3].

Breast milk is an important food which is readily available to infants without the need of any further processing. It provides all the essential nutrients and serves the unique needs of the infants (Gartner *et al.*, 2005) ^[5]. Exclusive breast feeding should have to be employed from birth to 6 months of age. And it should be continued throughout the second year of life thus providing longer time for infants to get mother's milk, for nutrition and emotional support as well. The amount of nutrients present in 100 ml of breast-milk are 67 kcal of energy, 7 g of carbohydrate, 1.3 g of protein, 4.2 g of fat, 0.069 mg of zinc and 0.076 mg of iron (Motee and Jeewon, 2014) ^[4].

To meet out the nutritional requirement and to get rid of different forms of malnutrition, complementary foods need to be included in the diet of infants and young children. Complementary feeding is defined as the provision of food or fluids to infants in addition to breast-milk. Timely introduction of appropriate complementary foods are important to meet the full nutritional and psychological needs of infants and young children (Ahmad *et al.* 2017) ^[6]. Infants need complementary foods with much higher nutrient density than is required for adult diets.

For example, per 100 kcal of food, a breast-fed infant at 6-8 months needs 9 times as much iron and 4 times as much zinc as an adult male [who needs 0.5 mg iron and 0.26 mg zinc/100 kcal based on 2700 kcal/d and recommended intakes of iron and zinc] (WHO, 2005). Thus, infants should receive the most nutrient-rich foods available in the household, yet often the opposite is the case in low-income countries where infants are typically fed nutrient-poor, watery porridges.

Home prepared foods usually provide a good foundation for complementary feeding. Prevalence of anaemia in children under 2 years or under 5 years of age is 20% or higher, home fortification of foods with multiple micronutrient powders is recommended to improve iron status and reduce anaemia among infants and children 6-23 months of age (WHO, 2011)^[7]. Considering the poor health and nutrition of infants and young children which put an adverse effect on working capacity of the people in later stage of life, it was felt essential to develop ready to use food for infants and young children so that the mother can feed their children while working also. Such type of food may prove beneficial to bridge diversity gap of the children. Keeping all these points in view the present investigation had been planned with the

Objective: To develop low-cost complementary food for the infants and young children from locally available foods.

Materials and Methods

The complementary foods ingredients for the study were selected from the local market of Dhenkanal district in Odisha state. Two types of Ready-To-Use cereal-based and pulses-based food mixes were prepared for the complementary feeding of infants and young children due to its high calorie content and low cost which can be helpful for poorer population.

Procurement of food materials

Cereals/Pulses

The ready to use complementary food mixes had been developed with locally available food materials such as cereals/ pulses in combination with other food materials such as peanut, milk powder, sugar and ghee to make the food energy and protein rich along with other nutrients. Since rice flakes and bengal gram dal are the most common cereals in consumption as food by the people in Odisha, the ready to use food mix for the infants and young children had been developed based on these food materials. An amount of 250g each from both the cereals and pulses (rice flakes and bengal gram dal) had been procured from the local market of Dhenkanal district (Odisha). First of all, these food materials had been cleaned.

Milk powder

300 g of milk powder had been procured from the local Dhenkanal market and kept at cool and dry place.

Sugar

An amount of 200 g of sugar has been procured from the local Dhenkanal market and kept for grinding.

Ghee

100 g of ghee had been procured from local Dhenkanal

market for the preparation of the product.

Peanut

Peanut commonly known as groundnut or mungphali had been procured from local Dhenkanal market in the amount of 100 g and left for cleaning. After cleaning portions of 50 g were made and kept in 2 lots for its use for the development of cereal-based food product.

Processing of food materials

The food materials after getting cleaned have undergone for different processing methods as described in Fig. 1.

Development of ready to eat food mixes

The Instant Food Mix was prepared with various combinations using different ingredients. For the development of food products, a standard combination of peanut, sugar, milk powder and ghee had been made in the ratio of 2:3:2.5:1. The food mixes from cereals/pulses had been developed by taking the standard combination and processed cereals- based powder in the ratio of 85:15 with water.

Standard ingredients: Bengal gram dal 85: 15

Standard ingredients: Rice Flakes 85: 15



Plate 1: Rice flakes based ready to use infant food mix



Plate 2: Pulses based ready to use infant food mix

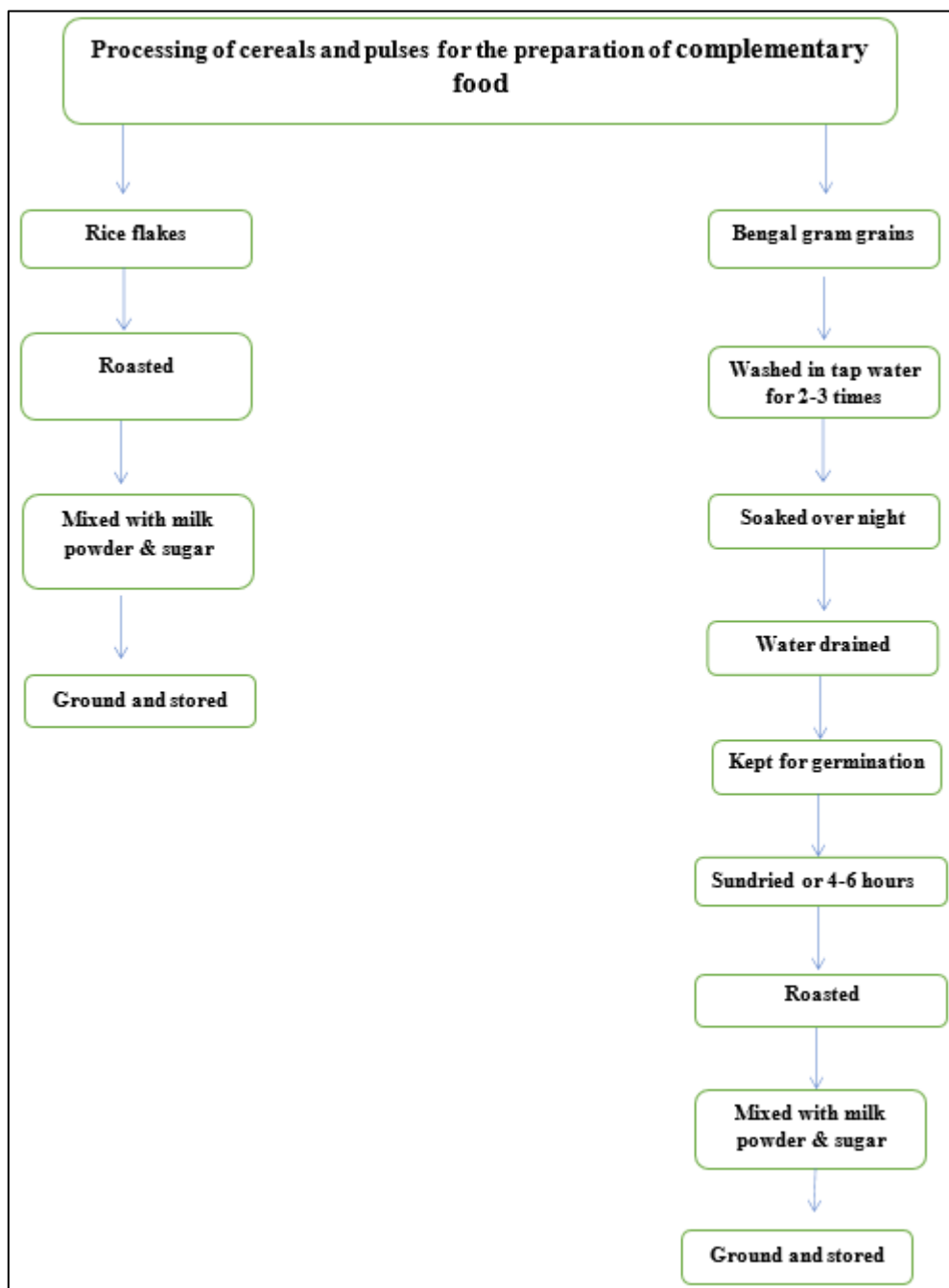


Fig 1: Processing of cereals and pulses for ready to use infant food

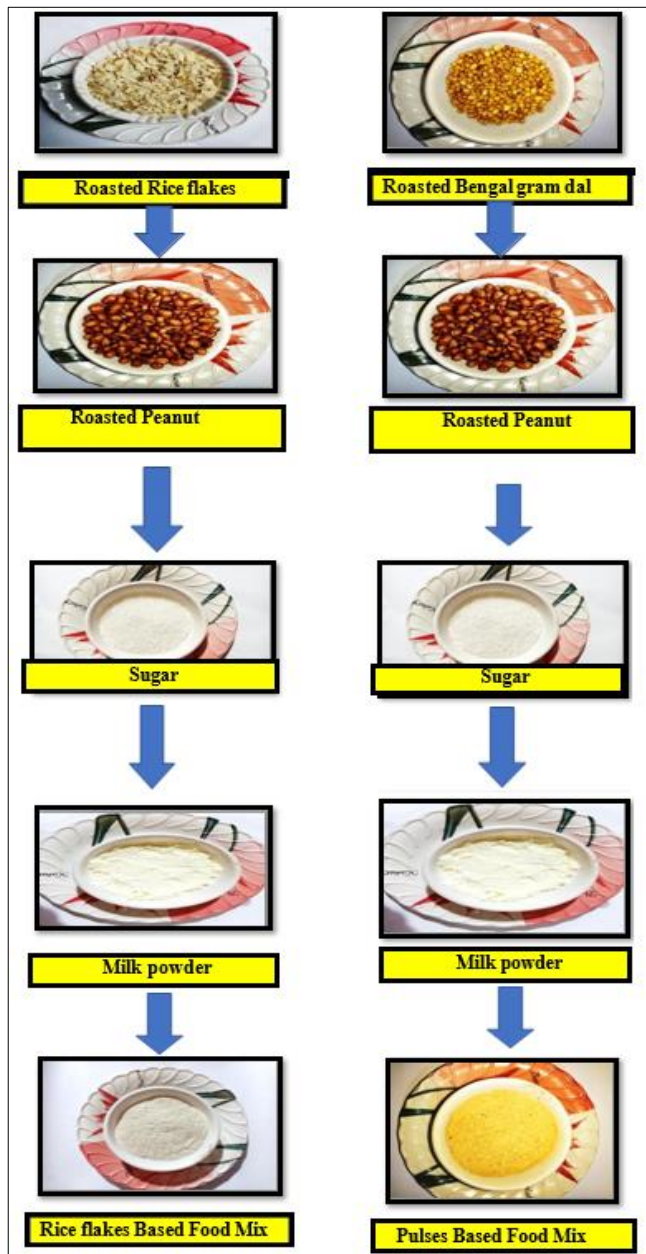


Plate 3: Processing of cereals and pulses for ready to use infant food mix

Result and Discussion

The results stated in Table 1 & 2. Nutritive value of cereal based and pulses based ready to use complementary food mix as energy, protein, fat, carbohydrates, fibre, calcium and iron are calculated according to the RDA, 2020 of infants between 6-12 months and young children 1-3 yrs.

Energy

Around the age of 6 months, an infant’s need for energy and nutrients starts to exceed what is provided by breast milk, and complementary foods are necessary to meet those needs. An infant of this age is also developmentally ready for other foods (WHO, 2021). Thus, the energy value of the cereal-based (rice flakes) food mix and pulses-based (Bengal gram dal) food mix were 365 kcal & 413 kcal respectively which was according to the energy requirement of infants.

Carbohydrate

Starch is likely to be a major constituent of many complimentary foods for older infants and young children. To

ensure that its energy value is realized, this starch should be provided in a readily digestible form. Increasing the intake of dietary fibres increases stool bulk, causes flatulence, and decreases appetite (Rolfes *et al.*, 2008) [11]. Hence, the carbohydrate content of the products was calculated according to the RDA of infants which valued as 78.68 g for cereal-based (rice flakes) food mix and 64 g for pulses-based (Bengal gram dal) food mix product.

Protein

Protein makes important nutrient composition in complementary foods. They are major sources of essential amino acids and energy at times of energy deprivation. Adequate supply of dietary protein is vital for maintaining cellular function and integrity and for ensuring normalcy of health and growth (Rolfes, 2008) [11]. If protein and energy requirements are not met, infant suffers from Protein Energy Malnutrition (PEM). So, the protein content of the developed ready to use cereal-based (rice flakes) food mix and pulses-based (Bengal gram dal) food mixes were 15.55 g & 25 g respectively. Pulses-based (Bengal gram dal) food mix has higher protein content than the cereal-based (rice flakes) food mix.

Fat

Dietary fats constitute an important portion of nutrients obtained from foods. For infants and young children, they are source of energy, essential fatty acids, and fat soluble vitamins (A, D, E, and K). Therefore average daily fat equivalent to 30-45% of energy intake is often suggested to balance the compromise in risks from little intake (especially essential fatty acids and lowered energy density levels), and excess intake and the likelihood of childhood obesity and cardiovascular diseases (Dewey *et al.*, 2003) [13]. The fat content of the developed cereal-based (rice flakes) and pulses-based (Bengal gram dal) food mix product were 1.39 g and 5 g respectively. The fat content of the products was present mainly due to addition of ghee to increase its calorie content of infant.

Micronutrients

Micronutrients are essential for growth, development, and prevention of illness in young children (WHO, 2009) [12]. Adequate intakes of micronutrients, such as iron and calcium, are important for ensuring optimal health, growth, and development of infants and young children (Caballero *et al.*, 2005) [14].

Therefore, food developed with iron content cereal-based (rice flakes) food mix (28 mg) and wheat-based food mix (10 mg) due to the addition of peanuts which has iron content of 4.6 mg whereas calcium requirement was high for infants and calcium content in developed food product was according to its requirement i.e., 578 mg for cereal-based (rice flakes) food mix and 300.5 mg for pulses-based (Bengal gram dal) food mix due to addition milk powder.

Table 1: Nutritive value per 100 g of cereal-based (rice flakes) food mix

Energy	365 kcal
Carbohydrates	78.68g
Protein	15.55g
Fat	1.39g
Calcium	578 mg
Iron	28 mg

Table 2: Nutritive value per 100 g of pulses-based (Bengal gram dal) food mix

Energy	413 kcal
Carbohydrates	64 g
Protein	25 g
Fat	5 g
Calcium	300.5mg
Iron	10 mg

Conclusion

Complementary food can be homemade or bought as ready-to-eat or ready-to-mix commercial products. Access to adequate complementary foods is a necessary condition for improving infant and young child feeding. Such foods need to reach the intended target population, either through public programs or through purchase in the commercial sector. Identifying the highest quality, lowest cost food that is acceptable to mothers and young children will be a key factor in determining the coverage that can be reached. From the findings of low cost complementary food it can be concluded that ready-to-mix commercial products will be highly nutrient rich which will help for improving infant and young child feeding.

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