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Development of Low-Cost Cereal Based Complementary Food from Locally Available Food Materials for Infants and Young Children

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A B S T R A C T

Providing nourishment to infants in addition to breast milk is known as complementary feeding. It is essential to introduce suitable complementary foods at the right time to ensure that infants and young children receive the necessary nutrition and meet their psychological needs. To fulfil the nutritional needs and address various forms of malnutrition, it is essential to incorporate complementary foods into the diets of infants and young children. Two types of low-cost cereal based complementary food – Wheat based and Rice based were taken into consideration for ensuring good nutrition during infancy and childhood period. The nutritive value per 100g of Rice based Food Mix was found to be Energy-366.1 kcal, Protein- 12.34 g, Fat- 3.23 g, Fiber- 0.94 g, Carbohydrates- 80.1 g, Calcium-219.7 mg and Iron-1.45 mg. Whereas Nutritive value per 100 g of Wheat based Food Mix was found to be Energy- 397.1 kcal, Protein- 15.55 g, Fat- 5.39 g, Fiber-2.12 g, Carbohydrates- 71.78 g, Calcium- 312.32 mg, Iron- 2.72 mg.

Introduction

Nutrition involves the examination of nutrients found in food, their utilization by the body, and the connection between diet, well-being, and illness. Nutrients are essential for providing nourishment, including proteins, carbohydrates, fats, vitamins, minerals, fibre, and water. Nutrition plays a crucial role in driving growth and development throughout the entire life cycle. The stages of foetal life and early childhood are critical periods for growth and development, coinciding with a time of heightened susceptibility to suboptimal conditions, which can have both immediate and long-lasting effects. Therefore, ensuring optimal nutrition for infants and young children is of utmost importance (Bhandari and Chowdhury, 2016). Inadequate complementary foods of poor quality and low nutrient density, along with inappropriate feeding practices, have been identified as significant contributors to malnutrition in young children (World Health Organization, 2018). In many developing nations, complementary foods are either introduced too early or too late, with insufficient quality and quantity, posing a high risk of nutritional deficiencies during the latter half of infancy (Pelto *et al.,* 2003). The commonly used cereal-based gruels in these regions lack essential nutrients such as iron, zinc, pyridoxine, riboflavin,

niacin, calcium, thiamine, folate, ascorbic acid, and vitamin A, further exacerbating the issue (Hotz and Gibson, 2001). Proper food choices and cooking methods can impact the safety and nutritional value of food, as well as feeding habits. Additionally, factors like a mother's education level and socio-economic status play a crucial role in providing adequate nutrition for infants and young children (Pelto *et al.,* 2003). Enhancing the availability and accessibility of affordable fortified complementary foods can significantly contribute to the required behavioural modifications for enhancing the nutritional well-being of infants and young children (Lutter, 2000). Adequate energy density, protein, and micronutrient concentration in complementary foods for infants during the second six months of life (and beyond) are frequently lacking, as well as proper preparation, storage, and feeding practices that may heighten the risk of illness. Given the intricate nature of the nutritional and behavioural challenges at hand, a thorough, interdisciplinary approach is necessary to pinpoint the nutritional deficiencies in older infants and establish suitable interventions to enhance complementary feeding, as well as infant growth and development, within specific country contexts (Brown *et al.,* 2016).

Complementary foods which are developed at home usually supply a firm basis for feeding the infants after 6 months of life. Therefore, usage of corresponding foods should be motivated. Using a combination of family meals as a basis for complementary feeding, like extensive use of the staple foods like rice, wheat, etc. as a foundation. A wide variety of household food can be used (Michaelsen & Friis, 1998). Rice, wheat, jowar, bajra, and ragi are the primary cereals and millets that are commonly consumed in India. These grains serve as the primary source of energy in Indian diets, contributing to 70-80% of the daily intake for most Indians. Due to their affordability and widespread availability, cereals and millets play a crucial role in providing energy, especially for low-income families. However, as income increases, their contribution to energy intake tends to decrease.

Millets offer significant health benefits as they are packed with phytochemicals and essential nutrients, making them particularly valuable in combating lifestyle diseases. Additionally, millet-based products are economically viable and emphasize their exceptional medical and nutritional qualities. Furthermore, cereals and millets also serve as a source of important nutrients such as calcium and iron (Sudarsan *et al.,* 2017). Utilization of milk and milk products in such cereal-based complementary foods improve the nutritional status and energy density. Taking into consideration all these facts, the current study was designed with the aim of creating an affordable supplementary diet for infants and young children using locally sourced ingredients.

Materials and Methods

The ingredients for the study's complementary foods were carefully chosen from the local market in Cuttack district, located in the state of Odisha. Two variants of Ready-To-Use cereal-based food mixes were created specifically for the purpose of providing infants and young children with a cost-effective and calorie-rich complementary feeding option (Kumari *et al.,* 2022). This approach aims to benefit the economically disadvantaged population.

Procurement of food materials

Cereals

The locally available food materials, such as cereals, have been used to develop ready-to-use complementary food mixes. These mixes are made by combining cereals with other food materials like peanut, milk powder, sugar, and ghee to ensure they are rich in food energy, protein, and other essential nutrients (Kumari *et al.,* 2022). Considering that wheat and parboiled rice are the most commonly consumed cereals in Odisha, the ready-to-use food mix for infants and young children has been specifically developed using these cereals. A total of 250 g of each cereal (wheat and parboiled rice) has been procured from the local market in Cuttack district, Odisha. The procured food items have been thoroughly cleaned and sun-dried.

Peanut

Peanuts, also known as groundnuts or mungphali, were purchased from the local Cuttack market in a quantity of 100g and set aside for cleaning. Once cleaned, two separate portions of 50g each were prepared and stored for the purpose of developing a cereal-based food product.

Milk Powder

300 grams of powdered milk was obtained from the nearby Cuttack market and stored in a cool and dry location.

Sugar

A quantity of 200 grams of sugar was acquired from the local Cuttack market and prepared for grinding.

Ghee

100 grams of clarified butter was purchased from the nearby Cuttack market in order to make the product.

Processing of food materials

The food materials after getting cleaned have undergone for different processing methods as described in Fig. 2.

Peanut

Peanut seeds were roasted at 180˚C for 15-20 minutes. After cooling, the roasted peanuts were hand rubbed for the removal of peanut husk. Then the seeds were ground in a mixer grinder and kept in an airtight container for the development of food.

Rice

Parboiled rice grains were washed thoroughly in tap water for 2-3 times. Then the water was drained and sundried for 4 hours. After drying the grains were roasted, ground and stored in an airtight container till mixing.

Wheat

Wheat grains were washed thoroughly in tap water for 2-3 times. The grains were soaked in water and kept for overnight. Next morning water was drained and kept for germination. Once small sprouts appear, the grains were kept in the sun for drying. The properly dried grains were roasted at 180˚C for 15 minutes. Once the normal room temperature was obtained, the grains were ground in fine powder and stored in an airtight container for prevention of absorption of moisture.

Development of ready to eat food mixes

Various combinations of ingredients were used to prepare the Instant Food Mix. A standard combination consisting of peanut, sugar, milk powder, and ghee was prepared in a ratio of 2:3:2.5:1 for the development of food products (Kumari *et al.,* 2022).

The food mixes from cereals were produced by combining the standard mixture with processed cereals-based powder in a ratio of 85:15 with water, as shown in Fig 1.

Standard ingredients: Wheat	85: 15
Standard ingredients: Rice	85: 15

Results and Discussion

Nutritive Value of Cereals-based Complementary Food

The above results depicted in Table 1 and 2 states that the nutritional content of rice-based and wheat-based ready-to-use complementary food mixtures, including energy, protein, fat, carbohydrates, fibre, calcium, and iron, has been determined based on the Recommended Dietary Allowances (RDA) for infants aged 6-12 months and young children aged 1-3 years.

Energy

Basal and total energy requirement for infants is higher than adults per unit body weight. Older infant needs high energy requirements due to 50% energy intake is used for basal energy, 25% energy for activity, 40% energy for activity (for extremely active child) and 25% energy for growth. Thus, the energy value of the rice-based and wheat-based food mix are 366.1 kcal & 397.1 kcal respectively which is according to the energy requirement of infants. The wheat-based food mix has higher calorie content than the rice-based food fix.

Protein

Protein needs are elevated in infants compared to adults, similar to energy requirements, because of the increased need for skeletal muscle development. Failure to meet protein and energy needs can lead to Protein Energy Malnutrition (PEM) in infants. Therefore, the protein content in ready-to-use food mixes is 12.34g for rice and 15.55g for wheat. Additionally, the calorie and protein content in wheat-based food mixes is higher and more desirable than in rice-based food mixes.

Fat

Linoleic acid is the most crucial essential fatty acid for infants. Insufficient fat intake in infants can lead to the

development of skin lesions and diarrhoea, which can result in growth retardation (Kent, 2015). The fat content in the rice-based food product is 3.23g, while in the wheat-based food product, it is 5.29g. The primary reason for the fat content in these products is the addition of ghee to increase the calorie content for malnourished infants.

Carbohydrates

The carbohydrate content in these products is responsible for 70 percent of the infants' energy requirement. To determine the carbohydrate content, the RDA of infants was considered, which is 80.1g for rice-based food and 71.7g for wheat-based food products.

Calcium

Infants require a significant amount of calcium and phosphorus due to their rapid growth. At birth, their bones are poorly calcified, so it is essential to ensure proper bone calcification by the time they start walking to support their body weight (Cowbrough, 2010). Therefore, the calcium content in the developed food products meets the infants' requirements, with 219.7mg for rice-based food and 312.32mg for wheat-based food mix, thanks to the addition of milk powder.

Table.1 Nutritive value per 100g of Rice based Food Mix

Energy	**366.1kcal**
Protein	12.34g
Fat	3.23g
Fiber	0.94g
Carbohydrates	80.1g
Calcium	219.7mg
Iron	1.45mg

Table.2 Nutritive value per 100g of Wheat based Food Mix

Energy	**397.1kcal**
Protein	15.55g
Fat	5.39g
Fiber	2.12g
Carbohydrates	71.78g
Calcium	312.32mg
Iron	2.72mg

Figure.1 Developed Ready to use Complementary food after made in to appropriate consistency with hot water

Rice based Ready to use Complementary Food

Wheat based Ready to use Complementary Food

Figure.2

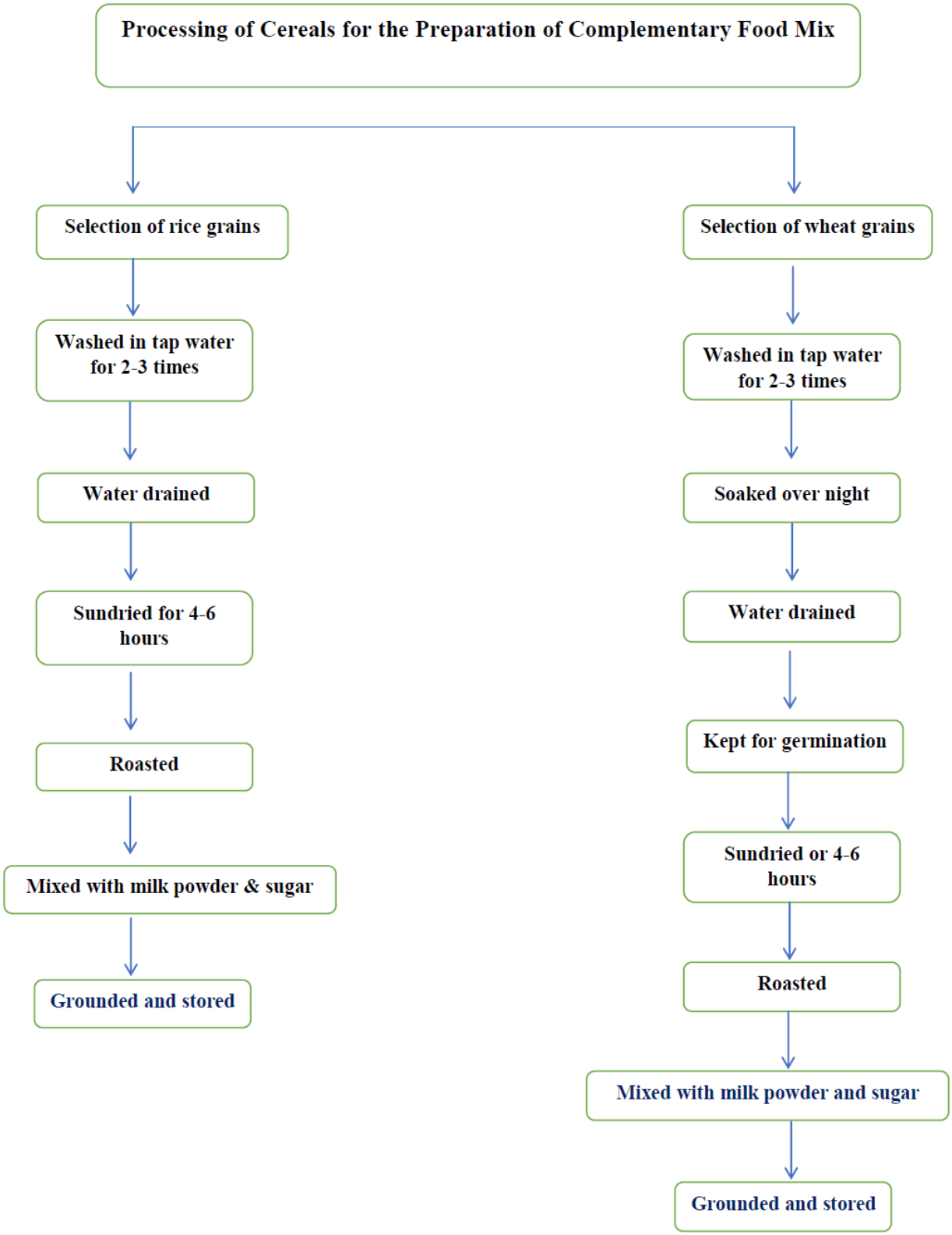
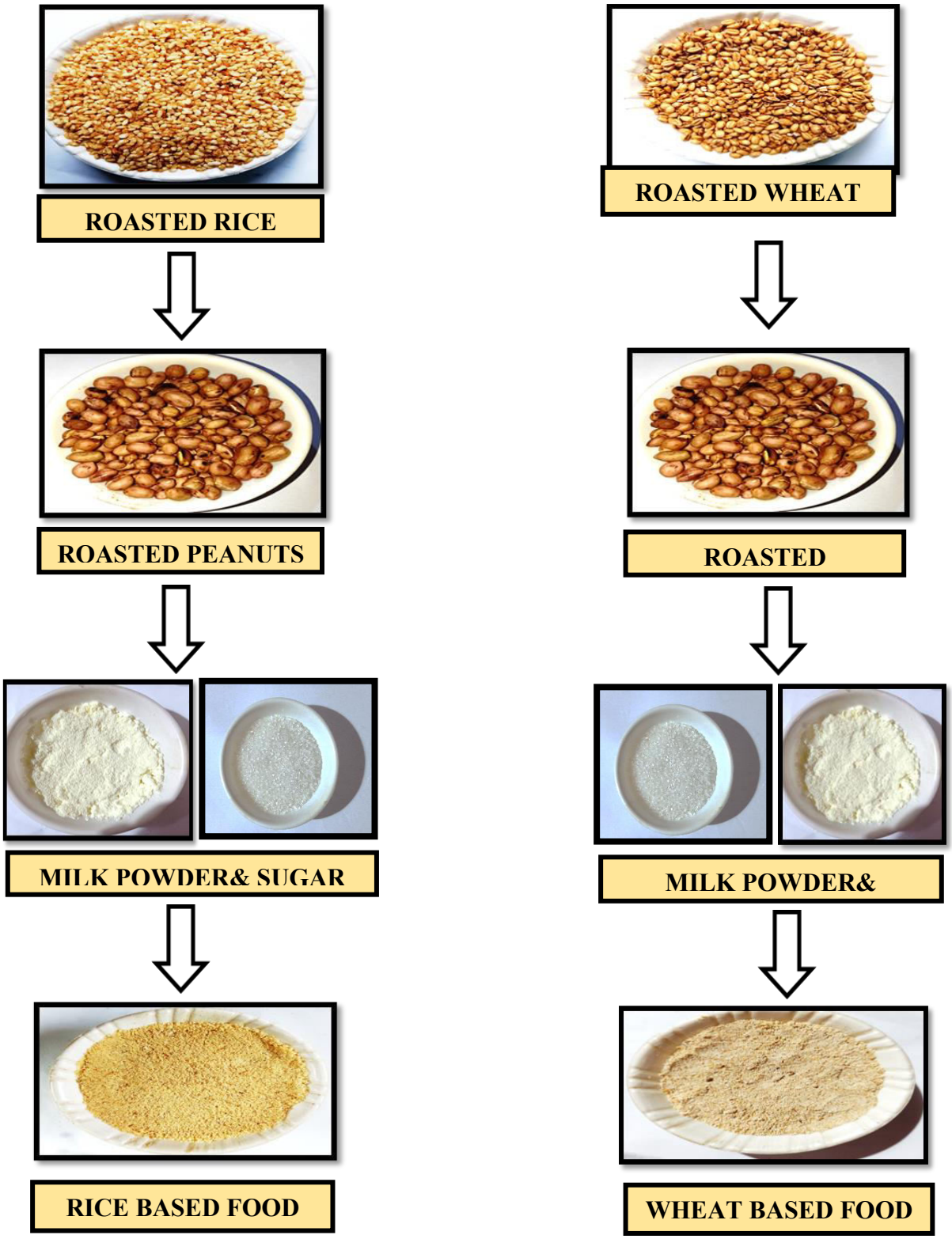

Processing of Cereals for the Preparation of Complementary Food Mix
Selection of rice grains
Washed in tap water for 2-3 times
Water drained
Sundried for 4-6 hours
Roasted
Mixed with milk powder & sugar
Grounded and stored
Selection of wheat grains
Washed in tap water for 2-3 times
Soaked over night
Water drained
Kept for germination
Sundried or 4-6 hours
Roasted
Mixed with milk powder and sugar
Grounded and stored

Figure.3 Processing of cereals



Iron

There is no stockpile of iron left after the first 6 months of life. Consequently, the need for iron significantly rises, particularly in proportion to body size and energy intake in the last 6 months of infancy. Infants should be provided with iron-fortified complementary food from 7 to 12 months. As a result, food products have been created with iron-rich rice-based food (1.45 mg) and wheat-based food blend (2.72 mg) by incorporating peanuts, which contain 4.6 mg of iron.

The formulation of an advised nutrient composition for a processed complementary food is merely a single aspect among numerous factors that may contribute to enhanced nutrition for infants and young children. These types of foods must be made available to the target population, either through public programs or by being sold in the commercial sector. The identification of the most superior quality, cost-effective food that is acceptable to both mothers and young children will play a crucial role in determining the extent of coverage that can be achieved. Additionally, feeding practices such as breastfeeding, responsive feeding, safe preparation and storage of complementary foods, food texture, and meal frequency are also vital in ensuring optimal nutrition during this critical stage of development.

Author Contributions

B. R. Abha Ayushree: Investigation, formal analysis, writing—original draft. Monalisha Munda: Validation, methodology, writing—reviewing. Jyotirmayee Udgata:—Formal analysis, writing—review and editing. Subhasmita Udabar: Investigation, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Bhandari, N. & Chowdhury, R. (2016). Infant and Young Child Feeding. *Proceedings of the Indian Academy of Sciences* - Section B. 82. 1507-1517. https://www.who.int/news-room/fact-sheets/detail/infant-and-young-child-feeding

Brown, K. H, Dewey, K. G, Allen, L. H. Complementary feeding of young children in developing countries: a review of current scientific knowledge. New York: UNICEF, 2016.

Cowbrough, K. (2010). Complementary Feeding for Infants 6 to 12 months. The journal of family health care. 20: 20-30.

Hotz, C., and Gibson, R. S. (2001). Complementary feeding practices and dietary intakes from complementary foods amongst weanlings in rural Malawi. *Eur J Clin/ Nutr*,55: 841-9. https://doi.org/10.1038/sj.ejcn.1601239

Kent J. C. Breastfeeding expectations. Infant 2015; 11(3): 78-82.

Kumari, P., Sahoo, J., Das, D., & Singh, U. (2022). Development of low-cost complementary food for infants and young children from locally available food materials. *The Pharma Innovation Journal*. 11(9): 1692-1696

Lutter, C. K. (2000) Processed complementary foods: summary of nutritional characteristics, methods of production and distribution, and costs. *Food Nutr. Bull*. 21(1): 95–100. http://dx.doi.org/10.1177/156482650002100118

Michaelsen, K. F., & Friis, H. (1998). Complementary feeding: a global perspective. *Nutrition*, 14(10), 763-766 https://doi.org/10.1016/s0899-9007(98)00079-3

Pelto, G. H., Levitt, E. and L, Hairu. (2003). Improving feeding practices: current patterns, common constraints, and the design of interventions. *Food Nutrition Bulletin*. 24: 45-82. https://doi.org/10.1177/156482650302400104

Sudarsan, S. M., Santhanam, S. G., & Visalachi, V. (2017). Development and formulation of instant soup mix from sprouted horse gram and radish leaves. *International Journal of Home Science*, 3(1), 346-349.

World Health Organization. 2018. Forward. *Food Nutr. Bull*. 24: 3-4.

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