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Complementary feeding in India: A review of guidelines and recommendations for caregivers

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Abstract
The period of complementary feeding is considered a critical window for promoting optimal growth, development and good health. The impact this period has on the overall health of an individual goes far beyond that of the immediate outcomes and results. Therefore, it is of critical importance that children are fed timely, adequately, safely and properly. There are various recommendations and guidelines given by various international and national organizations on complementary feeding and related topics. The paper explores on the topics such as time of introduction, various food groups (food diversity), food texture/ consistency, amount and frequency of feeding, hygiene and commercially prepared complementary food.

Keywords: Children diet, complementary feedings, complementary foods, IYCF, infant nutrition, nutrition

Introduction
Complementary Feeding is the period that begins with the introduction of other foods to infants as the nutritional needs exceeds that which is provided by breast milk alone[1] and this period form an important and integral part of the golden 1000 days of childhood. For the optimal growth, development and good health, it is important that the children are fed adequately and appropriately as the impact this period has on the health of an individual goes far beyond the immediate outcome and results. The recommended age of introduction of complementary feeding is around the age of 6 months, and the guidelines for introduction and feeding during this period are given by various international and national organizations [1, 2]. The Infant and Young Child Feeding (IYCF) and Integrated Management of Childhood Illnesses (IMCI) are some of the guidelines and recommendations given by WHO and UNICEF to promote appropriate and adequate complementary feeding [3, 4]. They are being widely used and are adopted and adapted by various countries of the World, for development of guidelines and recommendations of their respective countries. Various Union Government Ministries and professional associations in India also have published the guidelines and recommendations based on the same; for the state governments, district authorities, national institutions, social organizations and for parents to adopt [2, 5, 6]. The paper covers the guidelines and principles important for caregivers of children during this stage of life.
To ensure meeting the nutritional needs of infants and children, complementary food should be introduced on time (timely), be able to meet the energy, protein, and micronutrient needs of the growing children (adequate), be stored, and fed hygienically (safe) and be able to meet the child's appetite and satiety, and be suitable for age (fed properly) [7]. To be able to meet all these requirements, the recommendations are as follows:

Time of Introduction
World Health Organization recommends initiation of complementary feeding at the completion of the first six months (180 days) of life, and India also has adopted the same [1, 2]. At about 6 months of age, a child is considered developmentally ready such as have better head and neck control, starts enjoying mouthing, biting, chewing, and the tendency to push solids out of mouth decreases etc. The initiation at this age supports optimal growth, prevent comorbidities, benefits cognitive growth, and prevents development of chronic diseases [8, 9, 10]. Frequent and on-demand breastfeeding should also be continued up to 2 years of age and beyond [1].

Types of Food (Food groups)

Complementary food should provide sufficient energy, protein and micronutrient needs and the foods should ideally be locally available, affordable and culturally acceptable. Children should be given a variety of nutrient-rich foods (Dietary Diversity) to ensure that all the required nutrient needs are met. There are eight food groups that are given by WHO/ UNICEF as shown in Table 1,andto ensure that daily energy and nutrient needs are met, it is recommended for a child to eat at least five or more groups daily (which is the required Minimum dietary diversity) [11]. In the revised food groups publication of 2021 by WHO/ UNICEF, Breast milk became the 8th food group, which in earlier publications was excluded [11].

Fortified food or vitamin-mineral supplements should be considered whenever regular foods may not provide adequate nutrients [11].

Table 1: Various Food Groups

Sl. No	Food Groups	Example
1	Breastmilk	Breastmilk
2	Grains, roots, and tubers	Rice, wheat, maize, ragi, jowar, sweet potato, potato, cassava etc.
3	Legumes and nuts	Pulses, nuts, oil-seeds, dry fruits etc.
4	Dairy products	Milk, curd, yogurt, butter, paneer etc.
5	Eggs	Eggs
6	Flesh foods	Meat, fish, poultry, organ meats etc.
7	Vitamin A rich fruits and Vegetables	Orange/yellow/green vegetables or fruits such as mango, carrot, papaya, pumpkin etc.
8	Other fruits and vegetables	Eggplant, tomato, cabbage watermelon, avocadoetc.

The basic ingredient of complementary food isusually the food groups belonging to grains, roots, and tubers. They are usually the local staple food such as cereals (rice, wheat, maize, ragi, jowar etc.) roots (sweet potato), and they are encouraged to be used to make first food for an infant. The largest gap in breastmilk content and requirements during this period is for iron; so it is especially important that complementary foods contain iron [12]. Animal-source foods (egg, meat, poultry, fish, and dairy) should be introduced early as they are good source of high-quality protein and have essential fatty acids and important nutrients including iron. Long-chain-polyunsaturated fatty acids - especially omega-3-fatty acids, which are found in fish (such as trout, mackerel, and sardines), seafood, nuts, seeds, soy bean and plant oils are important dietary components as they promote cognitive and motor development in children [13]. Trans fats should be avoided as they are associated with inflammation in children and chronic diseases later in adulthood [14]. Sugary drinks such as soda should be avoided or discouraged as they are low in nutrient content and have the capacity to trigger higher intake of sugary drinks in later years, increasing the risk of chances of overweight and obesity.

Food Texture/ Consistency of Food

The consistency for a child's food depends on the age and neuromuscular development of the child. It is recommended that there should be a gradual increase in food consistency and variety as the infant grows older, adapting to the infant's requirements and abilities [11]. Start with food which is well mashed/ smooth and thick or pureed, and progress to mashed or chopped food and then to family food. Complementary food should be thick enough so that it stays on the spoon and does not spill off. Intake of food which is thin in consistency will not provide the required energy density. Finger food (Food that which a child can eat) is usually introduced around 8 months of age, and by 12 months they can eat the food consumed by the rest of the family members. Although it may save time to continue feeding semi-solid foods, for optimal child development it is important to gradually increase the solidity of food with age. There is evidence of a critical window for introducing 'lumpy' foods and if these are delayed beyond 10 months of age, it may increase the risk of feeding difficulties in later years [15].

Table 2: Food Consistency/ texture

Sl. No	Age Group	Food Consistency/ Texture
1	6-8 months	Begin with pureed/ well mashed food or thick porridge/ semi-solid food
2	9-11 months	Mashed Foods, finely chopped and foods that can be picked up by hand
3	1-2 years	Family Food; chopped or mashed if necessary

Note: Food that can cause choking should be avoided

Food preparation

The energy density of food can be increased by addition of ghee, jaggery, vegetable oils, butter, etc. They also make food taste better for the infants, and help in the absorption of fat-soluble vitamins and provide essential fatty acid. Fat should comprise 30–45% of the total energy provided by breast milk and complementary foods together [3]. Fat should not provide more than this proportion, or the child will not eat enough of the foods that contain protein and other important nutrients, such as iron and zinc. The protein content of foods can also be improved by combining cereals and pulses to ensure delivery of all essential proteins which is known as supplementary action of protein. It can also be improved by using different food processing methods such as milling, germination and fermentation of different food items [6]. The viscosity of foods can be reduced by malting (leads to increased production of amylase enzyme) so that a child can eat more. Malted cereal (amylase rich flour) or pulse-mixed infant foods provides more energy.

Quantity of food and Frequency of Feeding

Young children have small stomach capacity and therefore must eat small, nutrient-rich, energy-dense food in each morsel of food, at frequent interval of time. At the age of 6 months, only small amounts of food should be started and there should be an increase in the quantity as the child gets older, while maintaining frequent breastfeeding [6].

Table 3: Recommended quantity and frequency of food

Sl. No	Age Group	Average amount of each meal	Frequency of meals per day	Energy needed per day in addition to breast milk
1	6-8 months	In the beginning, 2-3 tablespoonful and increase gradually to ½ of a 250 ml cup (125 ml)	Daily 2-3 meals along with frequent breastfeeding	200 kcal per day
2	9-11 months	½ of a 250 ml cup or bowl (125ml)	Daily 3 meals with continued breastfeeding plus offer 1–2 additional snacks	300 kcal per day
3	1-2 years	¾ - 1 Cup (250ml)	Daily 3–4 meals with continued breastfeeding plus 1–2 additional snacks	550 kcal per day
	Those who are not breastfed, give an additional 1-2 cups of milk and 1-2 extra meals daily			

* Energy density at 1kcal/gram

WHO guiding principles for feeding the breastfed child recommend that breastfed infants aged 6–8 months be provided complementary foods 2–3 times per day and breastfed children aged 9–23 months be provided complementary foods 3–4 times per day with additional nutritious snacks offered 1–2 times per day [11]. For feeding the non-breastfed child, increase in number of meals to 4–5 meals per day is recommended.

The minimum meal frequency (MMF) [16] for breastfed and non-breastfed children are as follows:

- 2 feedings of solid, semi-solid or soft foods for breastfed infants aged 6–8 months
- 3 feedings of solid, semi-solid or soft foods for breastfed children aged 9–23 months; and
- 4 feedings of solid, semi-solid or soft foods or milk feeds for non-breastfed children aged 6–23 months whereby at least one of the four feeds must be a solid, semi-solid or soft feed.

The minimum acceptable diet includes meeting both Minimum Diet Diversity and Minimum Diet Frequency requirements.

- For breastfed children: receiving at least the minimum dietary diversity and minimum meal frequency for their age during the previous day.
- For non-breastfed children: receiving at least the minimum dietary diversity and minimum meal frequency for their age during the previous day as well as at least two milk feeds.

Good Hygiene and proper food handling

Food and water should be kept safe and hygienic and be free from contamination. Microbial contamination of complementary foods isa major cause of diarrhoeal disease and is particularly common in children between 6 to 12 months of age [17]. All utensils, such as cups, bowls, and spoons used for an infant or young child's food should be washed thoroughly, and use of bottles for feeding should be discouraged. Eating by hand is common in many cultures, and it is important that both the caregiver's, and the child's hands be washed thoroughly before eating, or before preparation of food by the caregivers.

Responsive Feeding

The practise of responsive feeding is an approach to feeding where caregivers encourage children to eat, provide food inresponse to the child's appetite and satiety signals, and feed their children with care [1]. It applies the principles of Psycho-social care. Responsive feeding helps children develop healthy eating habits. A child should have his or her own plate or bowl so that the caregiver knows if the child is getting enough food. A utensil such as a spoon, or just a clean hand, may be used to feed a child, depending on the culture. The utensil needs to be appropriate for the child's age.

Commercially prepared complementary food (CPCF)

Commercially prepared complementary food (CPCF) are either fortified or unfortified complementary foods that are commercially processed (either locally or internationally) and available in the market [18]. There has been a substantial growth in the processed food markets in the last decade in South-East Asia including CPCF. The drive has been attributed to convenience (ready-to-use food) and aggressive promotion. CPCF are heterogeneous in the nutritional quality where some may be of optimal nutrient composition, whereas some others maybe of concern due to high levels of added salt, sugar or other potentially harmful additives and are not suitable for feeding children[18].The World Health Organization regional office for European region has developed Nutrient Profile Models to guide decisions on which products for children aged 6–36 months in the European region are suitable for promotion based on their composition and labelling standards for different food categories. The recommendations have prohibited the use of added sugars, limit total sugar content (for dry savoury snacks ≤ 15% of energy), set minimum energy density threshold (minimum energy threshold of 60 kcal/ 100 g for some wet spoonable foods) and maximum permitted sodium content (maximum permitted sodium content for most products is 50mg/ 100g) and fats (total fat should not exceed 4.5g/100 kcal) [18]. Studies conducted in the South-East Asia region have shown that most CPCF products analysed were not found to be suitable for promotion to older infants and young children based on nutrient profiles. So it critical that, parents and caregivers should themselves get adequately equipped with the guidelines and recommendations regarding complementary food and feeding, so that they can provide nutritious, appropriate and adequate home-cooked food to their children.

Feeding during and after Illness

The need for liquid often increases during times of illnesses and therefore, children should be encouraged to take more. Breastfeeding on demand should be continued as breastmilk may become the main source of fluid and nutrients as appetite for other food decreases. During the episode of illness, children should be offered soft, varied, and appetizing food to maintain nutrient intake and help in recovery. They should also be fed at frequent interval as the amount of intake at one time is likely to be reduced than usual. As the child recovers and appetite improves, extra portions of meals and snacks should be given [3, 11].

Conclusion

The complementary feeding period, from 6 to 23 months of age, is one of the most challenging times to meet children's nutrient demands. While children's stomach can only hold a small amount of food, their nutrient needs reach a lifetime peak, leaving them vulnerable to development of infections, malnutrition and growth faltering. While first foods should be nutrient-rich, young children are often fed meals based mainly on staple cereals and grains, which are low in energy, protein, iron, zinc and other essential nutrients. Improving children's diets through home-cooked, appropriate and adequate feeding is the foundation for a healthy individual and for a sustainable and prosperous society.

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