INTRODUCTION

Optimal infant and young child feeding (IYCF) practices is a set of recommendations which comprises initiation of breastfeeding within 1 hour of birth, exclusive breastfeeding for the first six months and introduction of age appropriate complementary feeding after six months along with and continued breastfeeding till 2 years or beyond (Indian Academy of Paediatrics, 2016). Complementary feeding is one of the important core indicator of Infant and Young Child Feeding Practices (IYCF) which needs to be initiated at right age (WHO, 2009). The term complementary feeding is used for giving other foods and drinks in addition to breastfeed after completion of six months of exclusive breastfeeding period (Foote and Marrot, 2003). It is the critical period of growth during which infants are at risk of nutrient deficiencies and illnesses and also marked as a period of dietary transition (Vail et al., 2015). The World Health Organization (WHO) defines complementary feeding as a “process of starting semisolid/ Solid food, when breastmilk is alone no longer to meet the nutritional requirements of infants and therefore other foods & liquid are needed along with breastmilk. World Health Organization, UNICEF and many national health agencies have recommended that the infant should be exclusively breastfed for the first six month and after that complementary food may be introduced for to achieve optimal growth, development and health. Introduction of right food at right age can prevent from serious non communicable diseases such as obesity, high blood pressure and diabetes (Motee and Jeewon, 2014).

The optimal age for introduction of complementary foods are on completion of six months when breast milk alone fails to meet the nutritional requirements of the growing infants and to meet out the increase demands of requirements of nutrients. Complementary foods are conventional or family food which meet out the gaps between the daily energy needs of children and the amount acquired from breastmilk (Abseshu et al., 2016). The target age for introducing complementary food is after completion of 6 months, which is the ideal time for...
introduction of semi solid foods, as the baby becomes biologically fit and ready to accept complementary foods. Moreover, at this stage most of the children reach neurological action stage of development which comprises chewing, swallowing, digestion, excretion etc. that enables them to be fed other foods apart from breastmilk. If introduction of semi solids and solids are delayed and the stimulus for “chewing” development is not applied at appropriate age, then the child will always be a poor chewer and will be poor in eating solids later in life.

Adequacy of Complementary Feeding for Practices

Good nutrition plays a critical role in determining our nutritional and health status. The correct eating patterns established in the first years of life influences our health during childhood and adulthood. To meet the growing nutritional needs of the baby, it is recommended to initiate complementary feeding from 6 months of age while continuing breastfeeding (WHO, 2003). The gradual introduction of semisolid/solid foods are as complementary food is very much essential for ensuring proper growth and development. (Gaping b/w words)

The complementary feeding practices must be as follows

i. **Timely:** Introduced at completion of six months when requirement of various nutrients macro and micronutrient exceeds that provided by breast milk alone.

ii. **Adequate:** It means that complementary foods must provide the sufficient nutrients to meet the growing needs of the child-energy, protein, vitamins and minerals from different food groups like cereals, pulses, fruit and vegetables, milk and milk products, animal products and fat etc.

iii. **Properly fed:** Adopt active feeding method to encourage the child to eat more without forced feeding. Children have small size of stomach and they cannot digest large meal at one time therefore should be fed more frequently on small meals. Beside of that there should be a separate cup/katori/plate for the feeding the child.

iv. **Safe:** Before preparing food and feeding the child caregiver must wash their hands with soap and water. It should be food should be properly stored. (please correct the gaping between words)

**Major Guiding Principles of Complementary Feeding (please correct initial should be in capital letter)**

In India complementary feeding has become challenge to provide good nutrition to the children. WHO has provided a set of guidelines for complementary feeding. The guidelines provide details on the amount, consistency, frequency, energy density and nutrient content of foods. The three core indicators of complementary feeding such as minimum dietary diversity, minimum meal frequency, and minimum acceptable diet are usually not incorporated/practiced by the mothers. The insufficient dietary diversity and meal frequency play a key role in nutritional deficiencies among infants and young children, leading to increased risks of childhood morbidity and mortality. (WHO, 2009)

**Introduction of age appropriate complementary feeding with continued breastfeeding:** It means that after the age of six months, a child has generally at least doubled his or her birth weight, and becoming more active. Exclusive breastfeeding is no longer sufficient to meet all need of essential nutrient needs. Therefore, complementary foods should be introduced to fill the gap. After the age of six months, an infant is also developmentally ready for other foods. The digestive system is mature enough to digest the essential nutrients such as starch, protein and fat etc. Between the age of 6 to 9 months infants can receive and hold semi-solid food in their mouths more easily. Continue frequent on-demand breastfeeding until 2 years of age or beyond Breastfeeding should be continue with complementary feeding up to two years of age or beyond, and it should be on demand as often as the child wants.

**Responsive/ Active feeding:** Active style of feeding can improve food intake of child. The term “responsive feeding or active feeding” is usually applies the principles of psychosocial care. A child should have his or her own plate or bowl so that the caregiver can get the idea how much child is eating. There should be age appropriate neat clean utensils such as a plates / bowl or spoon glasses may be used for feeding the child.

**Good hygiene and safe food handling:** Safe preparation and storage of complementary foods can prevent contamination and reduce the risk of diarhhea. Microbial contamination of complementary foods is a major cause of food borne infection which is particularly common in children 6 to 12 months old. Therefore, all utensils, such as cups, bowls and spoons which is, used for an infant or young child's food should be properly washed. While feeding the child it is very important hands of caregivers and child should be properly wash

**Adequate quantity and quality of food with continued breastfeeding:** The overall quantity of calorie that child needs for the growth is measured in terms the number of kilocalories. During this stage the other micro nutrients are equally important, for prevention of micronutrient deficiencies. The energy needs of infants and young children up to 2 years of age, and how much can be provided by breast milk. It shows that breast milk covers all needs up to 6 months, but after 6 months there is an energy gap that needs to be covered by complementary foods. The energy needed in addition to breast milk is about 200 kcal per day in infants 6–8 months, 300 kcal per day in infants 9–11 months and 550 kcal per day in children 12–23 months of age. The amount of food required to cover the gap increases as the child gets older, and as the intake of breast

**Gradually change the consistency of food according to age of child:** The most suitable consistency for an infant's or young child's food depends on age and neuromuscular development. Initially at the time of introduction of complementary pureed, mashed or semi-solid foods should be included and gradually to semi solid to solid foods. At 24 months offered the same types of foods as consumed by the rest of the family. The food offered to the child should be adequate both in quantity and quality.

**Meal frequency and acceptability:** As the age of child increases, the child needs a larger total quantity of food each day. Therefore, each day of meal of child needs to be divided into smaller meals. The number of meals that an infant or young child needs in a day depends on:

- **Total requirement of calories:** To fulfill the energy gaps, he or she need enough amount of food. The meals can be

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Complementary foods should provide sufficient energy, protein and micronutrients to cover a child's energy and nutrient gaps, so that together with breast milk, they may need to be divided into more meals.

Dietary Diversity: Complementary foods should provide sufficient energy, protein and micronutrients to cover a child's energy and nutrient gaps, so that together with breast milk, they meet all his or her needs. The basic ingredient of complementary foods is usually the local staple. Staples are cereals, roots and starchy fruits that consist mainly of carbohydrate and provide energy. Cereals also contain some protein; but roots such as cassava and sweet potato, and starchy fruits such as banana and breadfruit, contain very little protein.

A variety of other foods should be added to the staple every day to provide other nutrients. These include:

- Animal food products: are good sources of protein, iron and zinc. Liver also provides vitamin A and folate. Egg yolk is a good source of protein and vitamin A, but not of iron. A child needs the solid part of these foods, not just the watery sauce.
- Milk and Milk products: such as milk, curd, ghee paneer and butter are good sources of calcium, protein, energy and B vitamins.
- Pulses and lentils: peas, beans, lentils, peanuts, and soybeans are good sources of protein, and some iron.
- Fats and oils: are concentrated sources of energy, and of certain essential fats that children need to grow.
- Fruits and vegetables: enough amount of fruits and vegetables should be offered to the child to fulfill the requirement of micronutrients. Orange-coloured fruits and vegetables such as carrot, pumpkin, mango and papaya, and dark-green leaves such as spinach, are rich in carotene from which vitamin A is made. Vitamin C sources such as tomatoes, citrus and other fruits and green leafy vegetables etc. at the same time helps iron absorption.
- Sugar products: is a concentrated source of energy, but it has no other nutrients. It can damage children's teeth, and lead to overweight and obesity.
- Carbonated drinks: sugar and sugary drinks, such as soda, should be avoided because they decrease the child's appetite for more nutritious foods. Tea and coffee contain compounds that can interfere with iron absorption and are not recommended for young children.

Use fortified complementary foods: Unfortified complementary foods that are predominantly plant-based generally provide insufficient amounts of certain key nutrients (particularly iron, zinc and vitamin B6) to meet recommended nutrient intakes during complementary feeding. Inclusion of animal-source foods can meet the gap in some cases, but this increases cost and may not be practical for the lowest-income groups. Furthermore, the amounts of animal-source foods that can feasibly be consumed by infants (e.g. at 6–12 months) are generally insufficient to meet the gap in iron. The difficulty in meeting the needs for these nutrients is not unique to developing countries. Average iron intakes in infants in industrialized countries would fall well short of recommended intake if iron-fortified products were not widely available.

Active feeding during illness: During an illness, the need for fluid often increases, so a child should be offered and encouraged to take more, and breastfeeding on demand should continue. A child's appetite for food often decreases, while the desire to breastfeed increases, and breast milk may become the main source of both fluid and nutrients. A child should also be encouraged to eat some complementary food to maintain nutrient intake and enhance recovery. Offering of his or her favourite foods, and if the foods are soft and appetizing. The amount eaten at any one time is likely to be less than usual, so the caregiver may need to give more frequent, smaller meals.

Scenario of Complementary Feeding Practices In India

India is a kaleidoscope of various cultures and traditions—a lot of the customs and practice have effect over health including infant feeding practices. An infant’s first bite of solid food is ceremonial and holds religious importance in many cultures. For instance an ‘annaprashan’, a Hindu ritual where the infant is fed sweetened rice porridge, usually blessed, by an elder family member. Socio cultural factors and traditional practices influence the practice of introducing early complementary feeding (Aggarwal et al., 2008). Caregivers lack the knowledge about appropriate complementary feeding and foods (quality and quantity). Low income and poor household food security are important factors in nutritional outcomes of infants and young children (Chaturvedi et al., 2016).

National Family Health Survey (2015-16) reported that the rates of early initiation of breastfeeding was increased from 23.4% to 41.6% as reported by NFHS-3 and NFHS-4 reports, though 21% of newborns were still receiving prelacteal feeds as stated by NFHS-4 in comparison to NFHS-3. On the other hand, the initiation of complementary feeding did not reported to be satisfactory as less than half of children were initiated for complementary feeding at age of 6-23 months and only 9.6% children were reported to have minimum acceptable diet.

Comprehensive National Nutrition Survey (2016-18) conducted by Ministry of Health and Family Welfare (MOHFW) reported that over half (53%) of the infants aged 6 to 8 months received timely initiation of complementary feeding. A higher proportion (59%) of children residing in urban areas was given complementary foods from six months...
of age, compared to their rural counterparts (51%). The proportion of infants receiving timely complementary feeding increased with household wealth, from 42% in the lowest wealth quintile to 68% in the highest wealth quintile. There were state level differences in dietary diversity and meal frequency. The proportion of children aged 6 to 23 months who received a minimum diverse diet or more was highest in Meghalaya (62%) and lowest in Jharkhand (12%) and Rajasthan (12%). The percentage of children receiving minimum meal frequency ranged from 22% in Andhra Pradesh to 67% in Sikkim. Overall, only 9% of children aged 6 to 23 months received iron-rich foods. The mother’s diet influenced the consumption of iron-rich foods by their children, as 4% of children of mothers who were vegetarians consumed these foods. Consumption of iron rich foods was substantially higher among Christian children (30%), followed by Muslim children (16%). There was a high state variability, with the lowest consumption of iron rich foods in Haryana (1%) and the highest consumption in Meghalaya (54%). In 7 out of 30 states, less than 5% of children aged 6 to 23 months consumed iron-rich foods. Only six percent of all children aged 6 to 23 months were fed a minimum acceptable diet. The percentage increased slightly with higher levels of maternal schooling and household wealth. Only 4% of children of mothers who had no schooling received a minimum acceptable diet, as compared to 10% of children of mothers with 12 or more years of schooling. Similarly, only 3% of children from households in the lowest wealth quintile received a minimum acceptable diet, as compared to 9% of children in the highest wealth quintile households. The prevalence of minimum acceptable diet varied widely across states, ranging from 1% in Andhra Pradesh to 36% in Sikkim. In 10 out of 30 states, < 5% of children aged 6 to 23 months received a minimum acceptable diet.

**Figure 1** Children aged 6-8 months receiving solid or semi solid foods and breast milk

**Minimum Dietary Diversity, Minimum Meal Frequency and Minimum Acceptable Diet**

A nutritionally adequate diet during the first two years of life is necessary for optimal growth, health and development of children. Dietary diversity is a proxy for nutrient adequacy of the diet. It refers to the consumption of higher number of food items and food groups such as grain, roots and tubers, legumes and nuts, dairy products, flesh foods (meat, fish, poultry, eggs) and vitamin A rich fruits and vegetables, other vegetables, which is associated with improved adequacy of the diet. The average healthy breastfed infant, meals of complementary food should be provided two to three times per day at six to eight months of age and three to four times per day nine to 11 and 12-24 months of age, with additional nutritious snacks offered one to two times per day as desired to maintain the minimum meal frequency. The minimum acceptable diet measures both the minimum feeding frequency and minimum dietary diversity.

Dietary diversity differed between breastfed and non-breastfed children, with a higher proportion of non-breastfed children aged 6 to 23 months receiving an adequately diverse diet (36%), compared to breastfed children (18%). A reverse pattern was observed for minimum meal frequency, with a higher proportion of breastfed children being fed the minimum number of times for their age) compared to children who were not breastfed (50% vs 42%). There were clear trends of increasing dietary diversity and increasing meal frequency with age among non-breastfed children. However, among breastfed children, dietary diversity increased with age, while meal frequency declined. Dietary diversity was lower among children of mothers who were vegetarians, compared to children of mothers who consumed non-vegetarian foods. Among both breastfed and non-breastfed children, a higher proportion of children residing in urban areas (26.9%) were fed an adequately diverse diet compared to children in rural areas (19%). This was in contrast to minimum meal frequency, with 44% and 37% of rural and urban children receiving the required number of meals, respectively.

The prevalence of minimum dietary diversity increased with the level of the mother’s schooling, with the reverse observed for minimum meal frequency. A similar pattern was observed for household wealth, with a steady increase in the percentage of children receiving an adequately diverse diet in higher wealth households and a decreasing trend for meal frequency. While a larger proportion of Sikh children (39%) and Christian children (35%) were fed a minimum diverse diet, compared to children of other religions, larger proportions of Hindu (43%) and Muslim (42%) children were fed the minimum number of times for their age, compared to other religious groups.

**Importance of Introduction Complementary Feeding At Right Age**

Adequate nutrition care during early stage of life is a fundamental pillar of human life, health and development across the entire life span. Since from the earliest stages of fetal development, at birth, through infancy, childhood, adolescence, and on into adulthood and old age, proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health and well-being. It is well recognized that the period from birth to two years of age is a critical window for the promotion of optimal growth, health and behavioral development (WHO, 2000). Many research studies have shown that this is the peak age for growth faltering, deficiencies of certain micronutrients and common childhood illness such as diarrhea. After child reaches 2 years of age, it is very difficult to reverse stunting that occurred earlier (Dewey, 2003). An appropriate diet is critical in the growth and development of children especially in the first two years of life (Aggarwal et al., 2008). Complementary feeding is one of the important core indicators of Infant and Young Child Feeding Practices (IYCF) which needs to be initiated at right age. Delayed and inappropriate complementary feeding such as timely introduction (too late or too early) of complementary foods and unhygienic practices can have severe detrimental threats to health and nutritional status of children. Inadequate introduction of complementary food leads frequent bouts of sickness and impaired development. The health outcomes of a child are directly proportional to their feeding practices, which are, in turn,
dependent on the knowledge and practices of the mother. The first two years of a child’s life are crucial to ensure appropriate growth and development. Malnutrition during this period results in a series of problems, beginning with reduced weight for age and stunting, progressing to the inability to achieve potential height in adulthood, and reduced capacity for physical work, which ultimately has implications for national development (WHO, 2009). Improper feeding practices have also been linked to reduced reproductive capacity, complicated deliveries, and increased incidence of low birth weight infants in women who were malnourished as children (Bhagwat B et al., 2019). However, breastfeeding rates continue to be low worldwide, especially in high-income countries, where just one in five infants is breastfed (Victoria et al., 2016).

Infants and young children are at an increased risk of malnutrition from six months of age onwards, when breast milk alone is no longer sufficient to meet all their nutritional requirements and complementary feeding should be started. Initiating complementary feeds too early or too late can lead to malnutrition (Aggarwal et al., 2008). The early introduction of complementary foods before the age of six months can lead to displacement of breast milk and increased risk of infections such as diarrhea, which further contributes to weight loss and malnutrition (BPNI, 2013). Besides this, it is thought that babies are also not physiologically ready to receive complementary feeds under six months due to immaturity of the gastrointestinal and neuro developmental systems and the kidneys.

In a study conducted by Sreedhara and Banapurmath (2013) affirmed that Infant and Young Child Feeding (IYCF) practices are the most important determinants of nutritional status of children and the objective of his study was to find out the prevailing complementary feeding practices and analyze their impact on infant growth in an urban slum community. The study was conducted in an urban slum community of central Karnataka. It was found that prevalence of Exclusive breastfeeding for 6 months was 68%. Complementary foods were introduced at appropriate age in 55% of infants. 72% of infants were receiving thick (energy dense) complementary foods. 61% were fed adequate amount of complementary foods. The prevalence of wasting at one year was 34% and stunting was 32%. Higher prevalence of malnutrition was noticed in infants in whom complementary feeding was initiated before six months and in whom complementary feeding was inadequate, or inappropriate.

Another study by Vartika Saxena and Praveer Kumar (2014) to assess the complementary feeding practices in rural community of Doiwalla block of Dehradun district. The study showed that 87.3% children of above six months of the age were on complementary feeding at the time of study, although timely CF was initiated only in 70.1% of them. 36.4% of children were given complementary food in liquid consistency only 17.2% children were given green leafy vegetables. Study highlighted that currently 25.1% children, below six month of the age were put on early complementary feeding as mother perceived "not having enough milk", or have to "resume their jobs" etc.

In a study carried out by Venugopal and Chandrashekar (2016) found that there is significant correlation between knowledge of complementary feed and its effect on the child nutrition. A total of 500 mothers with children 6-24 months of age attending OPD in Mc Gann were interviewed. Only few had correct information from health personnel. 23% of mothers started complementary feeding at 6 months of age. 21.6% of mothers used commercial foods. Male child, illiterate mothers, low socio-economic group and rural mothers tend to wean late (p<0.001). Parity, had no influence on complementary feeding age (p>0.05). 34.1%, 34.5% and 23.8% of children were under weight, stunted and wasted respectively. There was significant association between delayed complementary feeding and malnutrition of the child. Mean age of complementary feeding was delayed due to improper information, false beliefs and attitudes, illiteracy, low socio-economic status and rural mothers, thus leading to malnutrition of the child. Hence, mothers should be educated properly regarding complementary feeding, foods, preparation and practice to prevent malnutrition and improve the health status of the children.

Complementary feeding is a process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk. Sandhya and Radha (2018) studied complementary feeding practices among mothers in urban and rural areas Mangalore Taluk. It was assessed that 69.3% mothers in the rural area and 30.6% mothers in urban area started complementary feeds at the age of 6 months. The most common food preferred as complementary food was combination of rice and dal together. The number of meals per day given to the child varied from 2-4/day. The number of snacks given per day to the child varied from 1-4 /day; commonly preferred snacks were Biscuits both in urban and rural areas Bottle feeding was practiced by 44.4% the mothers, that included 62.4% from rural area and 37.5% from urban area.

Breast Promotion Network of India (2015) conducted a hospital based cross sectional study to assess the knowledge, attitude and practices of mothers regarding infant feeding. In the present study it was found that 68.6% mothers were having knowledge of initiation of complementary feeding at the age of 6 months and 4.1% started complementary feeding at the age of 8 months Common complementary food items given to infants were home made solid / semisolid food (73.7%), followed by milk other than breast milk (26.2%), commercial infant foods (14.4%) and non‐milk‐liquid like Dal pani, Rice water (19%) etc. Homemade food, in turn, was dominated by grain made food (73.7%) followed by fruits, dry fruits, vegetables (17.7%) etc and flesh food and egg (10.1%). On the other hand dairy foods avitamin A rich fruits & vegetables constitute to just 4.2% and 2.5% of the home food respectively. (gapping b/w words, please justify the paragraph)

Chaudhary et al., 2015 conducted an interventional study among 60 mothers of Ram Nagar Urban Health Centre, Belagavi. It was found that food diversity, food consistency, food quantity, meal frequency and modes of feeding complementary food were improved in the post-test after following health education intervention. The complementary feeding practices and its constituent variables significantly increased after health education intervention. There is need of proper health education intervention through health workers to mothers, for improvement regarding complementary feeding practices throughout the nation.
DISCUSSION

Good nutrition forms the basic foundation of health, particular for good growth and development, survival and maintenance of health throughout life. Food that we eat is the single most important factor to the growth, development and well being of all living being. Growth and development is continuous process which begins at conception and ends at maturity. Adequate nutrition during infancy and early childhood is fundamental to the development of each child’s full human potential. Early nutritional deficits are linked to long-term impairment in growth and health. Under nutrition during the first 2 years of life causes stunting and their intellectual performance get impaired. It is well recognized that the period from birth to two years of age is a “critical window” for the promotion of optimal growth, health and behavioral development (Kumar, 2006). Children under two years of age have high nutrient needs to support growth and development. Inadequate nutrition during this period can slow a child's physical and mental development for the rest of his or her life. In order to grow and stay healthy, young children need a variety of nutritious foods such as meat, fish, pulses, grains, eggs, fruits and vegetables, as well as breastmilk. Early life nutrition, particularly during the first 1,000 days, has an important influence on immediate growth and development, but also an important role in forming early food preferences and food behavior that set the trajectory to susceptibility to development of non-communicable disease later in life.

CONCLUSION AND RECOMMENDATIONS

The status of complementary feeding practices in India is remain suboptimal after formulation of many policies and programme. Mothers are not introducing the “first food” at right age, it is either too early or too late. Simultaneously, major determinants of complementary feeding i.e minimum meal frequency, minimum dietary diversity and minimum acceptable diet is not being achieved in majority of the infants aged six months to two years. Many reasons are associated with inadequate complementary feeding practices such as mothers education, father’s occupation, poor socio economic status, postnatal counseling, lack of appropriate knowledge and awareness etc. Therefore, there is urgent needs to be taken to improve the perinicious situation.

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