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Original Research Article

PREVALENCE OF COMPLEMENTARY FEEDING PRACTICES AND ITS ASSOCIATION WITH ACUTE MALNUTRITION AMONG CHILDREN AGED 6 TO 24 MONTHS IN NORTH-EAST INDIA: A HOSPITAL-BASED CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Complementary feeding is initiated at six months of age in children while continuing breastfeeding. Nutrition during the first two years of life is crucial for health outcome in later life. Burden of malnutrition among children aged 6-24 months is mainly caused by poor dietary intake and its quality. The study aimed to estimate the prevalence of complementary feeding practices among children aged 6-24 months with acute malnutrition and evaluate the association between appropriate complementary feeding practices and acute malnutrition at the Nutrition Rehabilitation Center in a teaching hospital, Manipur, North-East India. **Materials and Methods:** A cross-sectional study on children aged 6-24 months admitted in a dedicated Nutrition Rehabilitation Centre from November 2023 to October 2024 was conducted. A total of 107 children with acute malnutrition were assessed for socio-economic, demographic details, clinical examination and child feeding practices. Association between appropriate complementary feeding and acute malnutrition were evaluated. **Result:** The mean age was 15.6 ± 5.380 SD and boys (57%) outnumbered girls. A majority (86.9%) of children belonged to low socio-economic status. 73.8% children were of severe acute malnutrition. Less than half (44.9%) children were timely initiated with complementary feeding at 06 months. Prevalence of appropriate complementary feeding practices was found to be 18.7%. There is significant ($p < 0.05$) association between minimum dietary diversity and acute malnutrition. **Conclusion:** Appropriate complementary feeding is a preventable risk factor for reducing the burden of malnutrition. Appropriate complementary feeding practices is highly recommended among infant and young children to achieve maximum growth potential.

INTRODUCTION

Complementary feeding refers to food which complements breastmilk and ensures that, the child continuous to have enough energy, protein and other nutrients to grow normally. Breastmilk alone does not provide sufficient nutrients for the developing brain and body development in infant and young children.[1] Nutrition during the first 1,000 days of life is crucial for health outcomes in later life. The food given to children during their weaning period has very important role in their growth because an inadequate complementary diet will significantly inhibit the child's optimum growth, organ development, metabolism and cognitive development in the future.[2,3] During the first two years of life, the major causes of malnutrition are poor complementary feeding practices and breastfeeding. World Health Organization has recommended that, children start eating their first bite of solid food at six months old and continue breastfeeding until two years old.[4] The burden of malnutrition among children aged 6 to 24 months is mainly caused by inadequate complementary food and its nutrient quality. Nutrition-related factors account for 45% of deaths in children under five.[5] Insufficient food intake during complementary feeding window is one of the cardinal determinants of malnutrition apart from inadequate breastfeeding, low birth weight and infection. Globally 52 million children under five years old children are wasted, 155 million are stunted.[6] Apart from various risk factor, the major factor for causing malnutrition in children is associated with nutrient intake. According to

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NFHS-5(2019-2021), the trends in the nutritional status of Indian children under 5 years show that, 35.5% were stunted, 19.3% wasted and 32.1% of children were underweight.[7] Malnutrition increases the incidence and severity of infection in children and delays recovery. However, an intervention in the complementary feeding period is the best time to end the vicious cycle of malnutrition.[8,9]

Good complementary foods are nutrient rich, energy rich, and easily available foods. Only intake of a diverse diet can comprehensive nutrition be ensured. To be an energy-rich food, the food should also be prepared thick in consistency. Based on WHO complementary feeding guidelines 2008, the recommended frequency for complementary feeding are 2 times for 6-8 months, 3 times for 9-11 months and 3 or 4 times for 12-23 months old children respectively. Appropriate feeding practices include the timely introduction of solid food and semisolid foods from six months of age and the enhancement of the quantity and variety of foods consumed by children while maintaining breastfeeding.[10]

The emerging issues within complementary feeding are protein quality and its source, animal versus plant source food. Dairy protein has a stronger effect than meat on insulin-like growth factor, which plays an important role in child growth, compare to protein from meat.[11] Iron, vitamin A and iodine are very important micronutrients for development of the brain as well as for the child's growth. Zinc helps to prevent illness. The highest nutrient gaps in the complementary feeding period have been described for iron, vitamin A, vitamin B12, zinc, and calcium.[12] Deficiency of iron during infancy and young child results in depletion of iron stores in the body that could later result in modification of sensorimotor, cognitive/ language, social/emotional and psychological behavior in children.[13] As per NFHS 4 Report (2015-2016), one of the key findings was that especially feeding Indian children animal-sourced and vitamin-A-rich food was associated with lower malnutrition rates. Cultural acceptability, opportunity costs, nutrition and environment impacts as well as potential hygienic and toxin risks should be considered while introducing complementary feeds.[14] Despite the guidelines laid down for complementary feeding practices by WHO in 2008, many children do not meet the adequate complementary food in addition to breast feeding.

Objectives

The present study aimed to estimate the prevalence of appropriate complementary feeding practices which indicates timely initiation of complementary feeding at 6 months, minimum dietary diversity and minimum meal frequency among children with acute malnutrition and determine the association between appropriate complementary feeding practices and acute malnutrition.

MATERIALS AND METHODS

A cross-sectional study was conducted during November 2023 to October 2024 in a dedicated Nutrition Rehabilitation Centre, Department of Pediatrics, Jawaharlal Nehru Institute of Medical Sciences, Manipur, North-East India. Nutrition rehabilitation Centre is a unit with facility for management of malnutrition including dietary rehabilitation in children with acute malnutrition. Children with acute malnutrition aged between 6 to 24 months admitted in the Nutrition Rehabilitation Centre and their mothers/caretakers were the study participants. Children with retroviral infection and children with congenital disability and mothers/caretakers not willing to give consent were excluded.

A total of 107 children were recruited by consecutive random sampling from the Nutrition Rehabilitation Centre. Written informed consent was obtained from the parents or caregiver of child before entering in the study. After getting approval from Institutional Ethics Committee (JNIMS), data were collected using structured questionnaire from the parents or caregivers of child which included sections on socio-demographic details and complementary feeding practices. All the enrolled children were assessed for weight, length, mid upper arm circumference and clinical examination were done and checked for hemoglobin status by finger-prick method using hemoglobinometer. Electronic weighing scale was used for measuring weight. Length on lying down position for children under 24 months was measured using infantometer. The weighing scale and infantometer were calibrated before taking measures. Mid-upper arm circumference was measured using multicolor insertion tape on left arm of the child. All the children were assessed for bilateral pedal edema. By using WHO standard growth chart, nutritional status were categorized as moderately acute malnutrition who had weight for length z – score <-2 SD and severe acute malnutrition whose weight for length z –score <-3 SD.

The assessment of child-feeding practices included minimum meal frequency, minimum dietary diversity, acceptable consistency of food and age at initiation of complementary feeding in addition to breastfeeding or formula feeding. As per WHO/ UNICEF guidelines the minimum acceptable diet was estimated by 24 hours dietary recall prior to enrollment for the study.[15] Minimum meal frequency for a child was judged twice for 6 to 8 months, 3 times for 9 to 11 months and 3 or 4 times for children aged 12 to 24 months. WHO definition of minimum dietary diversity as the proportion of children aged 6 to 23 months who had received foods from at least 4 out of 7 food groups such as a) grains, roots, tubers b) legumes and nuts c) dairy products d) meat/fish e) eggs; f) vitamin A rich fruits and vegetables and g) other fruits and vegetables[16,17] was adopted. Acceptable consistency at the time of

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initiation of complementary feeding was considered to be semisolid food. The appropriate complementary feeding for a child in our study was considered when 3 criteria (minimum dietary diversity, minimum meal frequency and timely initiation of complementary feed at 6 months) for complementary feeding are met. Data collected were entered in MS Excel sheet and analyzed using Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive analysis was done to calculate frequency, percentage, mean, proportion and standard deviation for continuous and categorical variables. The indicators of complementary feeding for different age groups were determined. The percentage of anemia and pedal edema among acute malnutrition was identified. Chi-square test was used to test association between appropriate complementary feeding practices and nutritional status (weight for length) and p-value of less than 0.05 was considered to be statistically significant.

RESULTS

A total of 107 children aged between 6 to 24 months were studied. The mean age (SD) was 15.59 months ± 5.380 and the maximum number (75.70%) of children was found to be among age group 12 to 24 months. Male children comprised 57.01%. Most of the children were from rural area (65.42%) and belonged to lower socio-economic status (86.92%). Majority of children (61.68%) continued breastfeeding in addition to complementary feeding Timely initiation of complementary feeding at 6 months was found in 44.86 % of children in this study. 80.37% of children received less than 4 food groups. Only 44.86% children received 3 meals in 24 hours [Table 1].

Table 1: Baseline characteristic among study children (n=107)

Variables	Frequency (%)
Age category(months)	
• 6-8	14 (13.08)
• 9-11	12 (11.22)
• 12-24	81 (75.70)
Gender	
• Male	61 (57.01)
• Female	46 (42.99)
Residence	
• Rural	70 (65.42)
• Urban	37 (34.58)
Socio-economic status	
• Upper	0
• Upper middle	10 (9.34)
• Lower middle	4 (3.74)
• Lower	93 (86.92)
Breast feed	66 (61.68)
Formula feed	19 (17.76)
Mixed feed	22 (20.56)
Initiation of complementary feeding	
• 3-5 months	49 (45.79)
• 6 months	48 (44.86)
• >6 months	10 (9.35)
Frequency of complementary feeding	
• Less than 3 meals a day	27 (25.24)
• 3 meals a day	48 (44.86)
• More than 3 meals a day	32 (29.90)
Minimum dietary diversity	
• Minimum 4 food groups	21 (19.63)
• Less than 4 food groups	86 (80.37)
Consistency of complementary feeding at initiation	
• Semisolid	69 (64.49)
• Solid	38 (35.51)
Junk food as snacks	
• Yes	74 (69.16)
• No	33 (30.84)
Anthropometry	
• Weight for height <-2SD	28 (26.17)
• Weight for height <-3SD	79 (73.83)
Anemia	
• Yes	58 (54.21)
• No	49 (45.79)
Presence of nutritional edema	
• Yes	29 (27.10)
• No	78 (73.90)

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Anemia was detected in 54.21% children in the study. Whereas nutritional edema was found in 27.10% of the children enrolled in the study. Most of the children (64.49%) have complementary feed with semisolid food at the time of initiation of complementary feeding. 69.16% children consumed junk food in addition to complementary feeds.

All the children consumed cereal-based food (100%) whereas only 26.17% received egg protein and 30.84% of children consumed flesh foods [Figure 2]. Milk and dairy products are consumed by 20.56% of the total children and only 9.34 % children received fat rich foods. 66.36 % children consumed vegetable foods and only 11.22% children consumed fruits. 46.91 % of children age 12-24 months was timely initiated complementary feed at 6 months of age [Figure 1]. Only 12.35% children between the age group 12 to 24 months were satisfied for the appropriate complementary feeding practices.

The mean weight (SD) of the study children was 8.39 (1.6357) kg and the length (SD) was 76.07 (7.0015) cm [Table 2].

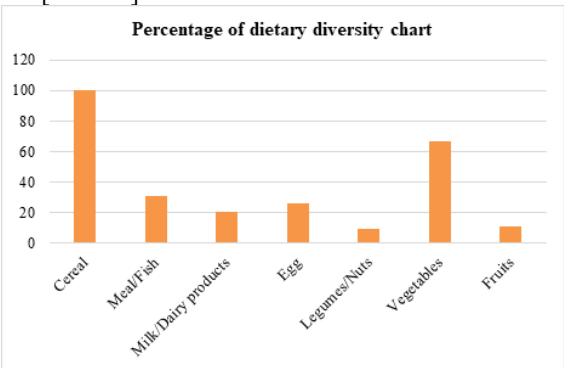

Figure 1: Distribution of food consumed by study children

Table 2: Data on continuous variable among the study children (n=107)

Continuous variable	Number	Minimum	Maximum	Mean (SD)
Age (months)	107	6	24	15.59 (5.380)
Weight (kg)	107	4.7	13.8	8.39 (1.6357)
Length (cm)	107	60.5	99.0	76.07 (7.0015)
MUAC (cm)	107	10.0	16.3	12.87 (1.5798)
Hb (gm/dl)				
• Mod acute malnutrition	28	6.1	13.3	10.75 (1.4457)
• Severely acute malnutrition	79	5.8	13.4	10.28 (1.784)

Table 3: Association between complementary feeding and nutritional status

Complementary feeding Indicators	Weight for length <-2 SD N = 28 (%)	Weight for length <-3 SD N =79 (%)	P value
Minimum dietary diversity (received 4 food groups)			
• Yes	17 (60.71)	17 (21.52)	0.00032
• No	11 (39.29)	62 (78.48)	
Minimum meal frequency			
• Yes	21 (75.00)	59 (74.68)	1.00000
• No	7 (25.00)	20 (25.32)	
Acceptable consistency at initiation of complementary feed			
• Yes	17 (60.71)	52 (65.82)	
• No	11 (39.29)	27 (34.18)	0.79828
Timely initiation of complementary feed at 6 months			
• Yes	11 (39.29)	37 (46.84)	
• No	17 (60.71)	42 ((53.16)	0.63901

Among the children with acute malnutrition, weight for length z- score below -2 SD and weight for length z- score below -3 SD were 26.17% and 73.83% respectively. In both the category of acute malnutrition, the mean hemoglobin was 10.75gm/dl for moderately acute malnutrition and 10.28gm/dl for severely acute malnutrition. Out of three appropriate complementary feeding indicators, only the minimum dietary diversity (received 4 food group) was significantly associated with acute malnutrition having p-value of 0.00032 [Table 3].

DISCUSSION

In the present study, majority of children were between the age group 12 to 24 months and boys outnumbered the girls. The reason for higher age group may indicate longer period of inadequate complementary feeding practices. More than 85% children belonged to lower socio-economic status and 65.42% children were from rural area. Lack of hygiene practices and lower consumption of minimum dietary diversity may contribute to the above findings in this study. In the present study breastfeeding were practiced in 61.68% children along with complementary feeding. Only 44.86% children introduced complementary feeding at 6 months of age in this study. The earliest age of introduction of complementary feeding was 3 months and 30.84% children initiated complementary feeding at 5 months. Previous study done by Deborah et al in urban area of Nigeria showed that 62% of

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infants were introduced to complementary feeding as early as 3-5 months of age.[18] Another study on introduction of complementary feeding in infants done by L.C. Moreira et al also showed similar findings with our study where complementary feeding were introduced as early as 3 months.[19] In the present study timely initiation of complementary feeding at 6 months was found as 46.91% among children with age group between 12 and 24 months. This finding is close to NFHS-5 Report which showed 45.9% of children received timely complementary feeding at 6-8 months.[20] WHO also recommended that children must be initiated complementary feeding at 6 months of age as breast milk is not sufficient for their growth and development.[21] NFHS 4 4 (2015-16) found that, feeding children with animal sourced foods and vitamin A rich food were associated with lower malnutrition rates. A meta-analysis done by Arimond and Ruel reported that, there is positive association between child dietary diversity and nutritional status that is independent of socioeconomic factors.[22] Children receiving minimum dietary diversity is considered when feeding the child from at least four food groups and indicate inclusion of micronutrient. In the present study only 22.2% received minimum dietary diversity food among children aged 12-24 months. Less than 27% children consumed egg protein and only 30% children received flesh (meat/fish) food. This finding could be considered for the presence of edematous acute malnutrition in our study. Presence of fats in the diet gives concentrates of energy and they provide essential fatty acids required for brain growth and visual acuity of the infant and young children. Only 9.34% children received fat-rich food in our study. Fruits are rich source of vitamins and fiber in our diet. Green, yellow and orange fruits contained beta-carotin.[23] In the present study, 11.2% children consumed fruits which is very low in proportion and may lead to micronutrient deficiency. In developed countries like Netherland, 49.6% children at age six months and above had adequate intake of fruits which help in prevention of micronutrient deficiency.[24] The energy requirement for infant and young child is based on how much energy the child needs. To meet the nutritional needs as the child grows, the minimum meal frequencies to be consumed are twice a day for infants 6-8 months and at least 3 times a day for children 9-23 months.[25] In the present study, the consumption of minimum meal frequency were very low (30.8%) among children aged 12 to 24 months. A hospital-based case-control study done in Gujarat by Harsha M Solanki et. al came to a conclusion that type of complementary feed and meal frequency contributes to malnutrition.[26] Previous studies also showed that, factors other than infant and young child feeding practices were identified to be associated with undernutrition. Protein energy malnutrition is usually associated with micronutrient deficiency. Previous studies showed that iron deficiency anemia is one of the common micronutrient deficiencies in infant and young children.[27] In the present study, nutritional anemia was detected in both moderate acute malnutrition and severe acute malnutrition groups. This finding could be related to low minimal dietary diversity and intake of low iron rich food like dark green leafy vegetables. More than 90% of children in the study do not include energy-dense oily food in their diet and this may be one of the contributing factors in developing acute malnutrition. Most of the mothers/caretakers of the children in the study used to practice hand hygiene before feeding the child. In the present study, older children aged 12 to 24 months were more prone to suffer from inappropriate complementary feeding compare to younger children aged 6 to 8 months. The prevalence of overall appropriate complementary feeding practices was 18.69%. This finding is closely similar (15.7%) with a study done by Mahama S et al in Ghana. Mahama Saaka et al in their study at Ghana, suggest that WHO IYCF indicators could be better explaining weight for length z-score than length-for-age z-score.[28] There is a strong positive association between low intake of minimum dietary diversity and severe acute malnutrition (weight for length <-3SD) in the present study. The limitation of our study includes a smaller number of populations as the study was hospital-based and blood level of micronutrients could not be done in the present study.

CONCLUSION

The prevalence of overall appropriate complementary feeding practices was 18.69%. The adequate, safe and acceptable complementary food in addition to breast feeding is essential in order to reduce acute malnutrition in children aged 6-24 months. Minimum dietary diversity was found to be positively associated with acute malnutrition. Appropriate complementary feeding practices is highly recommended among infant and young child to achieve maximum growth potential and their better future health. There is limited data on complementary feeding practices from northeastern part of India. Further study on complementary feeding practices in the community level is needed.

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