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Original Research Article

Critical period for better nutrition among severely acute malnourished children up to two years of age: a hospital-based case-control study, Gujarat, Western India

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ABSTRACT

Background: Nutrition in the first two years of life is important for growth and development among children. To tackle undernutrition during this period, timely initiation of breastfeeding and quality of complementary feeding practices are essential. So, this study was planned to determine feeding practices associated with severe acute malnutrition children.
Methods: This was hospital-based case-control study with 1:1 ratio of cases (77) and controls (77). Cases and controls were matched for age and sex. Cases were selected from Nutritional Rehabilitation Centre and controls from Immunization clinic. Mothers were interviewed about feeding practices, immunization status and illness of their child. Weight and height of children were also measured.
Results: Children who received pre-lacteal feeding were associated with SAM. Most of cases (62.3%) and controls (70.1%) had received breastfeeding within 1 hour of birth. Among children of <7 months age, 71.4% cases breast-fed <8 times in 24 hours. Among children of 7 months to 2 years, SAM was associated with children who were not received complementary feeding (CF) at correct age, not received semi-solid/solid diet, CF not added with ghee/oil and feeding frequency ≤5 times in day. Among cases 18.2% and only 1.3% controls had ≥3 ARI episodes in last 6 months.
Conclusions: Among identified independent risk factors ($p<0.05$), type of CF, not adding ghee/oil in CF and feeding frequency (BF+CF) ≤5 times were associated with SAM among 7 months to 2 years. Hospitalization history and ≥3 ARI episodes in last 6 months were also associated with SAM.

Key words: Feeding practices, Severe acute malnutrition, Two years age

INTRODUCTION

WHO and UNICEF in 2009 coined severe acute malnutrition (SAM) terminology also called severe wasting.[1] In 2020, Globally, 45.4 million children under five were wasted of which 13.6 million were severely wasted.[2] In India, the prevalence of SAM is 7.7% according to NFHS-5.[3]

Malnutrition is the result of frequent infection, inadequate feeding and caring practices for children during first two-three years of life.[4-6] Malnutrition is multifactorial but most important and directly related factor is feeding practices during first 1000 days.

In India many child health programmes are in action still only 11.1% children age 6-23 months were receiving adequate diet along with breastfeeding (NFHS-5).[3] The diet in first two years of life for children needs to be nutritionally adequate, safe and appropriately fed to meet young child's energy and nutrient needs. So, this study was planned to determine breastfeeding and

complementary feeding practices associated with SAM children.

METHODS

This hospital-based case-control study was conducted from April 2021 to April 2022 at a nutritional rehabilitation centre (NRC) of civil hospital, Rajkot, Gujarat. By using world health organization (WHO) multicentric growth reference study (MGRS) Criteria 2006, children up to 2 years of age who had weight for height Z score (WHZ) <-3 SD with or without nutritional oedema and admitted to NRC, were included as cases. Controls were healthy children attending Immunization clinic with WHZ between -2 SD to +1 SD and mid upper arm circumference (MUAC) ≥13.5 cm. Mothers who did not give consent, children >2 years of age, children with any chronic illness and congenital anomalies were excluded from this study. To minimize the selection bias, cases and controls were matched for age and sex.[8,9] By assuming a two-sided confidence level at 95%, power of the study 80% and a case-control ratio of 1:1, sample size was calculated through STATCAL application of Epi-Info.[8] Lack of exclusive breastfeeding was taken as an exposure factor. The proportion of cases (SAM diagnosed Children) not exclusively breastfed (Exposure factor) is 44.4% with an odds ratio (OR) of 2.8 from a case–control study done at Vellore, Southern India.[9] The calculated sample size was 154 (77 cases and 77 controls) including a 10% non-response rate. After obtaining written consent, mothers were interviewed using semi-structured questionnaire. At the end of interview, weight and height (length) of children were measured by Infantometer, from these WHZ score was calculated for each child by using Anthro software (version 3.2.2, 2011).[7,10] Data entry was done in Microsoft Office Excel 2019 and analysis was done using the software package Epi Info (version 7.2.2.6) from CDC, Atlanta, USA. Chi-square test was used to analyse data. Logistic regression model was applied to the variables which were found to have a significant role ($p<0.05$) as a risk factor in univariate analysis.

RESULTS

In this study, among cases 53.3% were male and 46.7% were female. More number of cases had illiterate parents (40.3% mothers and 31.2% fathers) as compared to parents of controls (7.8% mothers and 3.9% fathers). Mothers of 31.2% cases were working while 3.9% mothers of controls were working so, they cannot pay more attention to their children. Fathers of 71.4% cases were labourer while among controls 62.3% were doing service. Antenatal Care: number of total living children (>3), <2 years of birth interval, mother's <4 antenatal care visits were risk factors for SAM. Immunization with Td vaccine and Iron folic acid (IFA)+calcium tablets consumption by mother during pregnancy was proved protective factor against SAM occurrence.

In this study, those children received pre-lacteal feeding was associated with SAM [0.27 (0.08-0.87)]. Majority of study participants (62.3% cases and 70.1% controls) had received breastfeeding within 1 hour of birth. In the study, 87% cases and 92.2% controls had received colostrum feeding. In this study, mothers of majority of study participants (96.8%) had immunization records of their child in the form of Mamta card or private hospital's file. Among cases 54.1% were partially-immunized and 5.2% were unimmunized, while among controls majority of them (73.1%) were completely immunized as per their age (Table 1).

Table 1: Feeding practices and immunization status of study participants.

Variables	Cases (n=77), Frequency (%)	Controls (n=77), Frequency (%)	OR (CI)	P value	AOR (CI)
Pre-lacteal feeding					
Not received	64 (83.1)	73 (94.8)	0.27 (0.08-0.87)	0.02	0.3 (0.1-1.4)
Received	13 (16.9)	4 (5.2)			
Time of initiation of BF					
Within 1 hour	48 (62.3)	54 (70.1)	0.71 (0.36-1.38)	0.31	-
>1 hour	29 (37.7)	23 (29.9)			
Colostrum feeding					
Received	67 (87.0)	71 (92.2)	0.57 (0.19-1.64)	0.29	-
Not received	10 (13.0)	6 (7.8)			
Immunization					
Immunized	29 (37.7)	73 (94.8)	0.03 (0.01-0.1)	0.00	0.03 (0.01-0.11)
Partial or unimmunized	48 (62.3)	4 (5.2)			

OR: Odd's ratio, CI: Confidence interval, AOR: Adjusted Odd's Ratio.

Among study participant of <7 months of age (N=16)

Majority of them (87.5% cases and 93.6% controls) were fed with breast milk only. Among cases, 71.4% were fed ≤8 times within 24 hours while among controls all of them were fed ≥9 times. The frequency of feeding ≤8 times was significantly associated with SAM ($p<0.01$).

Table 2: Complementary feeding practices of 7 months to 2 years of study participant.

Complementary feeding (CF) practices	*Cases (n=61), Frequency (%)	*Controls (n=61), Frequency (%)	OR (CI)	P value	AOR (CI)
Age of starting CF					
At 6 months	16 (26.2)	21 (34.4)	0.67 (0.31-1.47)	0.32	-
After 6 months	45 (73.8)	40 (65.6)			
Type of food given as CF					
Semisolid and solid	29 (47.6)	40 (65.6)	0.48 (0.23-0.99)	0.04	1.3 (0.6-2.9)
Liquid	32 (52.4)	21 (34.4)			
Adding small amount of ghee or oil in CF					
Yes	4 (6.6)	20 (32.8)	6.95 (2.20-21.86)	0	6.8 (1.9-24.4)
No	57 (93.4)	41 (67.2)			
Frequency of feeding before admission (BF+CF)					
≥6 times	32 (52.5)	53 (86.9)	0.17 (0.067-0.41)	0	6.2 (2.4-16.4)
≤5 times	29 (47.5)	8 (13.1)			

*Numbers of study participants <7 months of age excluded, OR: Odd's ratio, CI: Confidence interval, AOR: Adjusted Odd's Ratio.

Table 3: History of illness and history of hospitalization of study participants.

History of illness and hospitalization in last 6 months	Cases (n=77), Frequency (%)	Controls (n=77), Frequency (%)	OR (CI)	P value	AOR (CI)
Hospitalization			0.13 (0.04-0.39)	0	11.02 (2.9-41.01)
No	55 (71.4)	72 (93.5)			
Yes	22 (28.6)	5 (6.5)			
No. of episodes of diarrhoea			-	0.8	0.2 (0.01-1.9)
None or one	74 (96.1)	77 (100)			
≥2	3 (3.9)	0 (0)			
No. of episodes of ARI			0.059 (0.01-0.46)	0	0.1 (0.007-0.8)
≤2	63 (81.8)	76 (98.7)			
≥3	14 (18.2)	1 (1.3)			

Among study participant of 7 months to 2 years of age (n=61)

Majority of them (98.3% cases and all controls) were exclusively breastfed up to 6 months of life. Less than half cases (47.6%) were given semi-solid or solid diet as CF, as compared to controls (65.6%). Only 6.6% cases received CF with added ghee or oil while among controls 32.8% received CF with added ghee or oil. Regarding frequency of feeding (BF+CF), only half (52.5%) were fed ≥6 times among cases while more than three forth (86.9 %) controls were fed ≥6 times. Semi-solid and solid type of food as complementary feeding (CF), adding of ghee or oil in CF and frequency of feeding (BF+CF) ≥6 times were proved protective factors against SAM for study participants of 7 months to 2 years of age. The study found not adding ghee or oil in CF and frequency of feeding (BF+CF) ≤5 times were independent risk factors for 7 months to 2 years aged children (Table 2).

Among cases 28.6% cases while among controls only 6.5% had history of hospitalization in last 6 months. Only 3.9% cases had ≥2 episodes of diarrhoea in past 6 months. Among cases 18.2% and only 1.3% controls had ≥3 episodes of ARI in last 6 months was associated with SAM ($p<0.05$). History of hospitalization in last 6 months and numbers of ARI episodes (≥3) in last 6 months ($p<0.05$) were found as independent risk factors for all study participants (Table 3).

DISCUSSION

In this study, only 16.9% cases and 5.2 % controls received pre-lacteal feed. Similar results were also reported by the study done at Karnataka and at Gedeo Zone, Ethiopia.[11,12] The use of pre-lacteal feeds is not recommended because it affects stimulation of breast milk production, suckling and mother-baby bonding. It may also increase the risk of infections. Majority of study participants of this study had history of breastfeeding initiation within 1 hour of birth. In contrast of this, a study done by Pravana et al and by Wie et al majority of study participants were initiated breastfeeding after one hour of birth (6-59 months of age group).[13,14] Delayed initiation of breastfeeding after birth (after 1 hour) was significantly associated with acute malnutrition as initial colostrum milk has more fat, high nutritive value and immunity providing substance. Children who were not initiated breastfeeding within an hour after birth were more likely to develop acute malnutrition when compared

to those who were initiated breastfeeding within an hour of birth.[14] In the present study, only 13% cases had not received colostrum feeding. The reason for the same found was familial cultural practices. Findings of study done at Kavre and at Afar (6-59 months of age group) were also consistent with these findings.[15,16] This might be due to low awareness regarding the importance of colostrum feeding or due to some social norms like most of the community people think that colostrum may cause diarrhoea and they prefer to discard it out before feeding.[15] In this study, among cases only 37.7%, while 94.8% of controls were immunized with all vaccines as per their age. Findings of the study conducted at Vellore and at Ethiopia were corroborative to this study as incomplete and nil immunization was high among cases as compared to controls.[9,14] Immunization against childhood diseases reduces childhood mortality and morbidity. Children who develop these diseases suffer from malnutrition as well as impaired cognitive, emotional and social skills.[16]

Feeding practices

For < 7 months of age group: Among cases, majority of them (71.4%) were fed ≤8 times within 24 hours while among controls all of them were fed ≥9 times within 24 hours. Children require fewer amounts but more frequent diet during developing age for growth. Therefore, less frequent diet may be linked with malnutrition and growth retardation. For 7 months-2 years of age group: In the present study, majority of them (62.3% cases and 70.1% controls) were exclusively breastfed. Findings of the study conducted at Vellore, India and at Nepal were contradictory to these findings.[9,15] In Rajkot as per data of DLHS-5, prevalence of children under 3 years of age who were breastfed within one hour of birth is 45.2% only.[17] Breast feeding has all the nutrients which are required up to 6 months of infant's life. So, less nourishment to the infant, during initial months of life put them to the higher risk of infections and malnutrition. In this study, only one fourth (26.2%) cases and 34.4% controls were started complementary feeding at correct age (completion of 6 months). Studies conducted at Gedeo Zone of Ethiopia, Jhapa district of Nepal and Bara district of Nepal also observed that majority of cases had delayed in initiation of complementary feeding.[12,18,19] Late initiation of CF leads to nutritional deprivation to the child. Almost half of cases (47.6%) were given semi-solid or solid diet as complementary feeding. Among these study participants, very few cases (6.6%) as compared to controls (32.8%) were fed with diet of added ghee or oil. If liquid diet is more diluted it will not provide enough nutrition to the child this may lead to growth faltering. To prevent growth faltering and to provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs, semisolid diet with adding of ghee or oil is recommended.[20]

In the study, frequency of feeding (BF+CF) ≥6 times in 24 hours was protective factor for SAM. In Rajkot, only 13.6% children of 6-23 months of age had received adequate diet as per DLHS-5 data.[17] The caregiver's lack of awareness and financial problems could be linked to sub-optimal frequency of complementary feeding which affects the nutrition status of the children.[21] Along with complementary feeding, breastfeeding should be continued till 2 years of age as breast-milk is nutritious, safe and easily available to the children so, protective against communicable diseases and malnutrition.[20] History of hospitalization and illness: In the study, history of hospitalization was proven as risk factor for SAM. Malnourished children were more prone to develop common communicable diseases therefore increased hospitalization. Inadequate nutritional supplementation during illness would further worsen the pre-existing malnourishment and weight loss.[9] This study did not find any association with diarrhoea episodes and SAM. The study conducted at Nepal found recurrent diarrhoea as risk factor for SAM.[15] The diarrhoea has been reported to have a two-way impact on different forms of undernutrition as it can affect and cause poor nutrient absorption.[22] Morbidity status of the child with diarrhoea preceding 2 weeks before the onset of SAM is significantly associated with severe wasting of the children.[23] The present study found, >3 episodes of ARI in last 6 months as risk factor for SAM. The study done at Nepal also reported similar findings.[15] Malnutrition decreases the immunity make child more prone to infections. Infections further lead to malnutrition. Child may get stuck in the vicious cycle of malnutrition and infection.

Logistic regression analysis

Nil or partial immunization was found to be independent risk factor for SAM. A study done at Gambella Town, Ethiopia also stated that children who did not complete vaccination according to their age, was independently associated with SAM (Table 1).[14]

The study found not adding ghee or oil in CF and frequency of feeding (BF+CF) <5 times were independent risk factors for 7 months to 2 years aged children. Study done at Bangladesh indicated that SAM was independently associated with lack of taking balanced diet >3 times/day.[22,23] Study conducted at Rural part of India also stated that <3 feeds per day and not giving semi-solid food in the weaning period predisposes the child for SAM (Table 2).[24] This study found history of hospitalization in last 6 months and numbers of ARI episodes in last 6 months ($p<0.05$) were independent risk factors for SAM. A study conducted at Kurigram, Bangladesh also revealed that any kind of illness in the last 2 weeks was independent risk factors for SAM (Table 3).[21]

Limitations

Limitations were; majority of the mothers (among both cases and controls) had difficulty in recollecting the

information regarding feeding practices of children which could have raised a recall bias in the study. It was minimized to some extent by careful probing and providing adequate time to recall. In this study chances of occurrence of confounding factors (parent's education and occupation, place of residence, Antenatal care of mother, institutional birth etc) may occur as matching was done only for two factors (age and sex of study participants). Due to COVID-19 pandemic during study period, community-based control selection was difficult.

CONCLUSION

This study found pre-lacteal feeding, not adding ghee or oil in complementary feeding during first 2 years of life along with nil or partial immunization, more frequency of hospitalization and ARI episodes (≥3) in last 6 months were associated with SAM. While not giving semi-solid and solid diet as complementary feeding, frequency of feeding ≤5 times associated with SAM. Among identified independent risk factors ($p<0.05$), type of CF, not adding ghee/oil in CF and feeding frequency (BF+CF) ≤5 times were associated with SAM among 7 months to 2 years. Hospitalization history and ≥3 ARI episodes in last 6 months were also associated with SAM.

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