Original article

Risk factors for severe acute malnutrition in children under the age of five: A case-control study

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Abstract

Introduction: Malnutrition is one of the leading causes of morbidity and mortality in children under the age of five in developing countries. Ethiopia being one of these countries malnutrition is an important public health problem, however little information is available on risk factors for severe acute malnutrition.

Objective: To identify and determine the risk factors for severe acute malnutrition in children under the age of five.

Methods: Matched case-control study design was applied. The cases were 102 severely malnourished children under the age of five and the controls (n=102) were recruited concurrently from children admitted with other medical problems. The controls were age matched and of good nutritional status. The study was conducted from July 2005 to April 2006 in admitted patients to Gondar University Hospital.

Results: The mean age of the cases and controls were 24.1 (± 14.8) and 21.5 (±16.2) months, respectively. The socio-economic risk factors for severe acute malnutrition were maternal illiteracy (OR=3.83, 95% CI 1.93-7.67), paternal illiteracy (OR=2.04, 95% CI 1.13–3.71), monthly family income of less than 50 USD (OR =3.44, 95% CI 1.66–7.20) and large family size with the number of children greater than 3 (OR=1.96, 95% CI 1.04 –3.73).

Inappropriate infant and young child feeding practices were commonly seen in children with severe acute malnutrition. The identified inappropriate feeding practices were supplementation with prelacteal feeds (OR=2.31, 95% CI 1.02-5.27), lack of exclusive breastfeeding in the first six months of age (OR = 3.00, 95% CI 1.58 -5.73), late initiation (at 12 months of age or beyond) of complementary diet (OR = 4.03, 95% CI 1.45 – 11.74), and bottle-feeding (OR = 3.01, 95% CI 1.24 -7.49).

Similarly there was a significant difference between the parents/caregivers of the cases and the controls in their knowledge for infant and young child feeding practices. Relatively a small proportion (40.2%) of the caregivers in the cases knew that complementary diet should be started at the age of 6 months compared to 66.7% in the controls (OR=0.34, 95% CI 0.18-0.62) and prelacteal feeds were thought to be important in 28.4% of the cases compared to 8.8% of the controls (OR=4.11, 95% CI 1.73-10.01).

Further analysis with logistic regression revealed that the risk for severe acute malnutrition was independently associated with lack of exclusive breastfeeding for the first six months of life (OR=3.22, 95% CI 1.31-7.91) and late initiation of complementary diet (OR=3.39, 95% CI 1.20–9.57) after the effects of other significant risk factors were controlled for.

Conclusion: The findings of this study confirm the association of severe acute malnutrition with inappropriate infant and young child feeding practices. To reduce childhood malnutrition due emphasis should be given in improving the knowledge and practice of parents on appropriate infant and young child feeding practices. [*Ethiop.J.Health Dev.* 2008;22 (1):21-25]

Introduction

Malnutrition remains one of the most common causes of morbidity and mortality among children throughout the world (1). Malnutrition has been responsible, directly or indirectly, for 60% of the 10.9 million deaths annually among children under five. Well over two-thirds of these deaths, which are often associated with inappropriate feeding practices, occur during the first year of life (2). Community based studies done in Ethiopia showed that malnutrition is common (3, 4). A study done in Southern Nations Nationalities and Peoples Regional state attested that 45% of the children were stunted, 42% underweight and 12% wasted (3), similarly in Jimma town the prevalence of underweight, wasting and stunting were 36%, 9% and 36% respectively (4).

The 2005 Ethiopian Demographic and Health Survey (EDHS) showed that there has been improvement in the nutritional status of children in the past five years. The percentage of stunting fell from 52% in 2000 to 47% in 2005. Similarly the percentage of underweight children declined from 47% to 38%. However, there is no change in the prevalence of wasting, as it remained 11% (5). Twenty four percent of under five children are severely stunted and 2% are severely wasted (5). Malnutrition is an important public health problem in Ethiopia; however, little information is available on risk factors for severe acute malnutrition (SAM). In this study, we tried to determine risk factors that could lead to SAM in children under the age of five.

Methods

Study participants were children under the age of five, admitted to Gondar University Hospital from July 2005 to April 2006. All admissions with severe acute malnutrition (SAM) were analyzed during the study period until the calculated sample size was attained.

Gondar University Hospital is a referral hospital located in the Northwest of Ethiopia 750 km away from Addis

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Ababa. The hospital serves as a referral center for North Gondar administrative region and the residents around. It has a bed capacity of 350 of which 70 are used for children under the age of twelve.

The cases were children admitted with SAM and the controls were children without malnutrition admitted for other medical problems. The controls were chosen to be the first age-matched admission following the admission of the case. SAM was defined as weight for height less than 70% of the national center for health statistics (NCHS) median value, mid-upper arm circumference of less than 11 cm in children whose length is $\geq$ 75 cm or the presence of pitting bilateral leg edema in the presence of other signs of malnutrition. Controls were having weight for height above 90% of the NCHS median value and height for age above 95% of the NCHS median value.

Sample size was calculated using Epi info 6.04. The required sample size was 102 for each. The assumption used for sample size calculation were: detecting a 2.3 times higher risk of suboptimal infant feeding practices among the cases and a 40% prevalence of suboptimal infant feeding practice among the controls, based on DHS 2005, 95% CI, and 80% power, case to control ratio of 1:1.

The data were collected using structured questionnaire and information was collected on important demographic characteristics, knowledge and practice on nutrition from the immediate caregivers, which were usually the mothers. Data were entered and analyzed using Epi info version 6.04 epidemiologic software. SPSS version 11.0 epidemiologic software was used for logistic regression analysis.

Results

Socio-demographic characteristics: A total of 204 cases below the age of five (102 with severe acute malnutrition and no malnutrition for each) were analyzed. The mean age of the cases and controls were 24.1 ($\pm$ 14.8) and 21.5 ($\pm$16.2) months respectively. There were 55 (53.9%) males in the cases and 64 (62.7%) in the controls (OR=0.69, 95% CI 0.38-1.26). The illiteracy rate was higher among mothers of the cases 84 (82.4%) than the controls 56 (54.9%) (OR=3.83, 95% CI 1.93-7.67) and among the fathers of the cases 60 (58.8%) than the controls 42 (41.2%) (OR=2.04, 95% CI 1.13–3.71). Majority of the mothers, 84 (82.4%) of the cases and 89 (87.3%) of the controls, were housewives with no occupation. The main paternal occupation is farming both in the cases 59 (57.8%) and the controls 47 (46.1%). Monthly family income of less than 50 USD was higher in the cases 87 (85.3%) than the controls 64 (62.7%) (OR=3.44, 95% CI 1.66–7.20). A larger family size with the number of children greater than 3 was noticed more frequently in the household of the cases 41 (40.2%) than in the controls 26 (25.5%) (OR=1.96, 95% CI 1.04–3.73). Marital status didn't have significant influence on nutritional status (OR=2.71, 95% CI 1.00–7.63) (Table 1).

Table 1: **Socio-demographic characteristics of the cases and controls, from July 2005 - April 2006, Gondar University Hospital, Gondar**

Risk factors	Cases	Controls	Crude OR (95% CI)
Maternal illiteracy			
Yes	84	56	3.83 (1.93 - 7.67)*
No	18	46	1
Paternal illiteracy			
Yes	60	42	2.04 (1.13 – 3.71)*
No	42	60	1
Monthly income < 50 USD			
Yes	87	64	3.44 (1.66 – 7.20)*
No	15	38	1
Single, divorced, widowed or dead mothers			
Yes	17	7	2.71 (1.00 – 7.63)
No	85	95	1
Number of children greater than 3			
Yes	41	26	1.96 (1.04 – 3.73)*
No	61	76	1

* = Significant associations

Nutritional practice: One hundred one (99.0%) of the cases and 100 (98.0%) of the controls were breastfeed. In both groups breastfeeding was initiated within the first hour of birth in 73 (71.6%) of the cases, however, prelacteal feeds were given more frequently in the cases 24 (23.5%) than in the controls 12 (13.3%) (OR=2.31, 95% CI 1.02-5.27). Butter is the most commonly used pre-lacteal feed 19/36(52.8%), followed by sugar water solution, cow's milk and fenugreek (abish). Discontinuation of breastfeeding before 24 months of age was seen in 12/39 (30.8%) of the cases and in 6/32 (18.8%) of the controls (OR=1.93, 95% CI 0.56-6.85). Lack of exclusive breastfeeding for the first 6 months of age was more common in the cases 49 (48.0%) than in

the controls 24 (23.5%) (OR=3.00, 95% CI 1.58-5.73). Late initiation of complementary diet (at 12 months of age or beyond) was also more common in the cases 23/100 (23.0%) than in the controls 6/87 (6.9%) (OR=4.03, 95% CI 1.45–11.74). Bottle-feeding was more frequently used in the cases 23 (22.5%) than in the controls 9 (8.8%) (OR=3.01, 95 % CI 1.24-7.49) (Table2).

Table 2: **Nutritional practice of the cases and controls, from July 2005 - April 2006, Gondar University Hospital, Gondar**

Risk factors	Cases	Controls	Crude OR (95% CI)
Not breastfed			
Yes	1	2	0.50 (0.02-7.10)
No	101	100	1
Stopped breast-feeding before 24 months of age			
Yes	12	6	1.93 (0.56-6.85)
No	27	26	1
Lack of exclusive breast-feeding in the first 6 months			
Yes	49	24	3.00 (1.58-5.73)*
No	53	78	1
Initiation of complementary diet at 12 months of age or beyond			
Yes	23	6	4.03 (1.45-11.74)*
No	77	81	1
Prelacteal feed given			
Yes	24	12	2.31 (1.02-5.27)*
No	78	90	
Bottle-fed			
Yes	23	9	3.01 (1.24-7.49)*
No	79	93	

* = Significant associations

Further analysis with logistic regression model revealed that the risk for SAM was independently associated with lack of exclusive breast-feeding for the first six months of life (OR=3.22, 95% CI 1.31-7.91) and late initiation of complementary diet (OR=3.39, 95% CI 1.20–9.57) after the effects of other significant risk factors were controlled for (Table 3).

Table 3: **Adjusted Odds Ratios for risk factors significantly associated with severe malnutrition, from July 2005 - April 2006, Gondar University Hospital, Gondar**

Risk factors	Adjusted OR	95% CI
Prelacteal feeds given		
Yes	1.39	0.44 - 4.38
No	1	
Lack of exclusive breast- feeding		
Yes	3.22	1.31 - 7.91*
No	1	
Bottle feeding		
Yes	2.43	0.87 - 6.82
No	1	
Number of children greater than 3		
Yes	1.70	0.83 - 3.49
No	1	
Maternal illiteracy		
Yes	2.62	0.98 - 7.00
No	1	
Paternal illiteracy		
Yes	1.27	0.52 - 3.06
No	1	
Monthly income less than 50 USD		
Yes	1.79	0.75 - 4.27
No	1	
Complementary diet started at 12 months of age or beyond		
Yes	3.39	1.20 - 9.57*
No	1	

* = Significant associations

Parental (caregivers') knowledge on infant and young child nutrition: Most of the caregivers had a knowledge that breastfeeding should be initiated within the first hour of birth, 82 (80.4%) of the cases and 84 (82.4%) of the controls; similarly 94 (92.2%) of the cases and 97 (95.1%) of the controls knew that breastfeeding should be continued up to two years of age and beyond. Forty one (40.2%) of the caregivers in the cases knew that complementary diet should be started at the age 6 months compared to 68 (66.7%) in the controls (OR=0.34, 95% CI 0.18-0.62). Prelacteal feeds were thought to be important in 29 (28.4%) of the cases and 9 (8.8%) of the controls (OR=4.11, 95% CI 1.73-10.01) (Table 4). The importance of prelacteal feed was said to be to soften the gastrointestinal tract by 12/38 (30.8%) of the caregivers, the other reasons were to keep the infant healthy and strong, to avoid abdominal pain and just as a tradition.

Table 4: **Knowledge on nutrition of the cases and controls from July 2005 - April 2006, Gondar University Hospital, Gondar**

Variables	Cases (n=102)	Controls (n=102)	Crude OR (95% CI)
Breastfeeding should be initiated within an hour of birth	82 (80.4%)	84 (82.4%)	0.88 (0.41-1.88)
Prelacteal feeds are important	29 (28.4%)	9 (8.8%)	4.11(1.73-10.01)*
Time of initiation of complementary diet			
Before 6 months	24 (23.5%)	11(10.8%)	2.55 (1.11-5.95)*
At 6 months	41 (40.2%)	68 (66.7%)	0.34 (0.18-0.62)*
7 -12 months	37 (36.3%)	23 (22.5%)	1.96 (1.01 – 3.79)*
After 12 months	22 (21.6%)	9 (8.8%)	2.84 (1.16-7.10)*
Breastfeeding should be continued for up to two years of age and beyond	94 (92.2%)	97(95.1%)	0.61(0.17-2.14)

* =Significant associations

Discussion

Parental illiteracy is found to be associated with a higher risk of SAM. This is observed in studies done in North Wollo, Ethiopia (6), and in other African (7-10), Southeast Asian (11-13) and Latin American countries (14). In a case-control study in Bangladesh, the maternal illiteracy was associated with a fourfold increase in the risk of severe acute malnutrition in their children (12); which is higher than our observation.

The risk of SAM is increased when the monthly income is lower than 50 USD. Similarly poor family income has been found as a risk factor for severe acute malnutrition in studies done in Nigeria (15), Sudan (16), Zimbabwe (17), India (11) and Bangladesh (12). A community based study done in Jimma, Ethiopia showed that children with malnutrition lived in a household with low monthly income (4).

A larger family size is associated with an increased risk of SAM. The effect of a large family size with overcrowding and inadequate spacing has been implicated as a risk factor for severe malnutrition in different studies as well (6, 7, 13 and 15). This supports the notion that non-nutritional factors should be essential components in the effort to reduce severe acute malnutrition in Ethiopia.

The effect of the above socio-economic risk factors, however, has been less significant in this study when compared to the effect of infant and young child feeding practices.

Breastfeeding is a norm in Ethiopia; nearly all the children in both groups were breastfed. The national survey indicated that 96% of children under the age of 5 are breastfed (5). Breastfeeding was initiated within the first hour in 72% of the cases and controls. This is in concordance with the national value of 69%. The severely malnourished children are more likely to receive prelacteal feeds than the controls. The use of prelacteal feeds is not recommended as it can make the infant ill and interferes with breastfeeding (18). Introduction of other diet before six months of age is 3.2 times more common with cases than in the controls; and initiation of complementary diet after one year of age was 3.4 times more common in the malnourished group, indicating that children with severe acute malnutrition are started with complementary diet either too early or too late. A study done in China showed that the introduction of other diet before the age of six months increased the prevalence of pneumonia and diarrhoeal disease (19). Similarly a study in Kenya showed an increased risk of being underweight when complementary food was started early (20). As a global public health recommendation, infants should be exclusively breastfeed for the first 6 months of life to achieve optimal growth, development and health. Thereafter to meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for up to two years of age or beyond (21). Bottle-feeding is more commonly observed in the severely malnourished group than the controls. Bottle-feeding is discouraged at any age. It is usually associated with increased risk of illness, and especially diarrhoeal disease, because of the difficulty in sterilizing

the nipples properly. Bottle-feeding also shortens the period of postpartum amenorrhea and increases the risk of pregnancy (5).

A statistically significant difference in knowledge on the recommended duration of breastfeeding and on the appropriate time of initiating complementary diet between the caregivers of the severely malnourished children and the controls was observed. Prelacteal feeds were also considered to be of importance in 28% of the mothers of the cases when compared to 9% of the controls. This indicates that it is not only lack or shortage of food that predisposes young children to malnutrition but also lack of knowledge on appropriate infant and young child feeding practices.

In conclusion, the findings of this study confirmed that the association of severe acute malnutrition to inappropriate infant and young child feeding practices. To reduce childhood malnutrition due emphasis should be given in improving the knowledge and practice of parents on appropriate infant and young child feeding practices. However, as this is a hospital-based study further community based studies are recommended to identify risk factors for severe acute malnutrition.

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