

RISK FACTORS FOR SEVERE ACUTE MALNUTRITION IN UNDER FIVE CHILDREN IN JIMMA ZONE, ETHIOPIA

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Abstract

Background: The effects of malnutrition on human performance, health and survival have been the subject of extensive research for several decades and studies show that malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, and physical work capacity. The objective of this study is to determine the risk factors for severe acute malnutrition among children under five years of age in Jimma Zone, Ethiopia, 2015.

Methods: Facility-based age-matched case-control study was conducted in April 2015, Jimma zone. Data were collected by face to face interview and pre-test was conducted on 5 % of the study population. Data were entered by Epi data and exported to EPI-INFO software version 3.5.1 for Univariate, bivariate, and multivariate conditional logistic analysis.

Result: A total of 204 study subjects below the age of five were analyzed. Risk factors for severe acute malnutrition were maternal illiteracy (OR=3.25, 95% CI 1.47-7.17), the monthly family income of less than 50 \$ (OR =3.14, 95%CI 1.72-5.73), birth interval less than one year (OR=4.33, 95% CI=2.09-8.94). Lack of exclusive breastfeeding for the first six months of life (AOR=3.22, 95% CI 1.31-7.91), monthly income less than 50\$ (AOR=5.98, 95% CI 2.62-13.66), discarding the colostrums (AOR=7.30, 95%CI 2.07-16.37) and bottle feeding (AOR=2.68, 95% CI 1.26-5.70) were found to be independent predictors for the occurrence of Severe Acute Malnutrition after the effects of other significant risk factors were controlled.

Conclusion and recommendation: The findings of this study confirm the association of severe acute malnutrition with an inappropriate infant and young child feeding practices and monthly income less than 50\$. To reduce childhood malnutrition due to emphasis should be given to improving the knowledge and practice of parents on appropriate infant and young child feeding practices.

Introduction

Child malnutrition may be defined as a pathological state resulting from inadequate nutrition, including undernutrition (protein-

energy malnutrition) due to insufficient intake of energy and other nutrients; over nutrition (overweight and obesity) due to excessive consumption of energy and other

nutrients; deficiency diseases due to insufficient intake of one or more specific nutrients such as vitamins or minerals(1). Children whose weight-for-height (W/H) is below minus three standard deviation (-3SD) from the median of the reference population (National Centre for Health Statistics) are considered to be thin or severely malnourished (2).

Malnourished children are much more likely to die as a result of a common childhood disease than those who are adequately nourished. Malnutrition lowers the body's ability to resist infection by undermining the functioning of the main immune-response mechanism (3).

The effects of malnutrition on human performance, health and survival have been the subject of extensive research for several decades and studies show that malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, and physical work capacity.

Approximately 2% of children living in developing countries suffer from severe acute malnutrition. This is equivalent to roughly 13 million suffering from severe acute malnutrition (SAM) at any one time (5). Almost 2.7 million deaths reported under five years of age are due to severe acute malnutrition (6).

The case fatality rates for severe malnutrition treated in health facilities in resource-poor settings have remained high at 20-30% for marasmus and up to 50-60% for kwashiorkor (7).

Severe acute malnutrition is a major public health and development concern, certainly in Sub-Saharan Africa, and has foregoing health and socioeconomic impacts. In Sub-Saharan Africa, the prevalence of malnutrition among the group of under-fives is estimated at 41% (8). It is the only region in the world where the number of child deaths is increasing and in which food insecurity and absolute poverty are expected to increase (9).

High child malnutrition rates in Ethiopia present a significant obstacle to achieving better child health outcomes (10). According to EDHS-III, in 2011, the percentage of wasting was 10% and the severe wasting was 2%. In Oromia region, the prevalence of severe wasting was 2.4% which is greater than the national figure.

Although food security is necessary, it is not the only determining factor in ensuring adequate nutritional status in Ethiopia (11). Parental illiteracy is found to be associated with a higher risk of SAM. This is observed in studies done in North Wollo, Ethiopia (12). The risk of SAM is increased when the monthly income is lower than 50 \$. Similarly, poor family income has been found as a risk factor for SAM in studies done in Nigeria (13). Infant-feeding practices constitute a major component of child caring practices apart from, economic and demographic factors (14).

Need for educating mothers for the promotion of proper infant feeding practices and other aspects of childcare has also been felt (15). Delayed initiation of breastfeeding, deprivation from colostrums, and improper complementary feeding came out to be significant risk factors of SAM. The risk of severe acute malnutrition was more in the case of late initiation of breastfeeding and deprivation from colostrums (16).

The severely malnourished children are more likely to receive pre-lacteal feeds than the controls. The use of pre-lacteal feeds is not recommended as it can make the infant ill and interferes with breastfeeding. Bottle feeding is usually associated with increased risk of illness, and especially diarrheal disease, because of the difficulty in sterilizing the nipples properly. Lack of knowledge on appropriate infant and young child feeding practices predisposes young children to malnutrition (17).

Severe malnutrition has other adverse consequences which include severity of

illness, lower cognitive development, and poor pregnancy outcomes in later life.

The government of Ethiopia is trying to decrease the prevalence of severe acute malnutrition by putting nutrition policies and strategies. These are community-based severe acute malnutrition management strategy and protocol for severe acute malnutrition management which is directed to treat the cases rather than to increase community awareness to alleviate the problem.

Severe Acute Malnutrition, it is still the major public health problem in the country and the same to Jimma zone. The main objective of this study is to determine the risk factors for severe acute malnutrition in under five children in Jimma Zone, Ethiopia and to act on the problem locally.

Knowledge of the relative contribution of the major risk factors associated with SAM is, therefore, an important prerequisite for developing nutrition intervention in the study area.

Methods and materials

Study Area and period

The study was conducted in Jimma zone health facilities in April 2015. Jimma zone is one of the zones in Oromia National Regional state located at 357km away from Addis Ababa in the south-west. According to the 2007 census, a total population of the zone is 2,616,395, of this 1315720(50.3%) were male and 1300675(49.7%) female. The majority of the population in the rural area and is engaged in farming. The area is suitable for growing coffee, cereals, pulses, and root and fruit crops. The zone has 17woredas and one special zone. Five hospitals and 52 functional health centers,

44 health centers under construction, 472 health posts, 76 private clinics, and 79 drug vendors provide health services for the Jimma zone community. The zone inhabited mostly by Oromo ethnic group, who speak afan Oromo as their mother tongue.

Study Design

Facility based age-matched case-control study was employed. **Cases** were under five years

children admitted to selected health facilities and diagnosed with severe acute malnutrition with their Mothers/caregivers and Controls under five years children admitted to the same health facilities for other medical problems and good nutritional status with their mothers/caregivers. Children, whose mothers/caretakers had not been staying with them within six months prior to the study, or children those with cancer or any physical or mental condition predisposing them to malnutrition and children having TB, HIV/AIDS, diabetics were excluded from the study.

Sample size determination

The sample size was calculated using two population proportion formula. To calculate sample size, maternal illiteracy was chosen as an independent variable for it gave maximum sample size as compared to other variables from the study conducted in specialized Gonder hospital. 95% CI, 80% power of the study and case to control the ratio of 1:1 to detect an odds ratio of 3.83(28), the number of discordant pairs (20.335) and the probability of discordant pair which was assumed to be 0.2. Accordingly, 102 cases and 102 controls with a total sample size of 204 were included in the final study.

$$n = \frac{2d_p}{\pi_p}$$

$$DP = \frac{[z_{\alpha/2}(\lambda+1) + 2z_{\beta}\sqrt{\lambda}]}{(\lambda-1)^2}$$

Where:

n = Total number of pairs

DP = Number of discordant pairs

π_p = Assumed probability of discordant pairs

λ = odd ratio

Parameters

Power=80%

$Z\alpha=.05$

Odds ratio=3.83

$m=1$

Sampling technique

There is a total of 26 health facilities that provide therapeutic feeding program (OTP). Six health facilities were selected by simple random sampling technique. The six health centers included were namely TiroAfeta (Dimtu), Omo nadda (Asendabo), Manna, Gummay, Kersa (Serbo), Shebe and seka colors.

For cases: All daily admitted under five children for severe acute malnutrition and their respective mothers were recruited after the cases were confirmed by the physicians/health professionals until cases fulfilled the required sample size.

For controls: The controls for each case was chosen to be the following the admission of the case. Similarly, controls were selected, for each case, matched for age, from the health facility among under-five children who admitted within the same period, and whose date of birth matched that of the case to within ± 2 months.

Measurements and variables

Instrument

Interviewer-administered Structured questionnaire adopted from similar studies was used to collect data on important Socioeconomic and demographic Variables from the caregivers/mothers.

Anthropometry

The height of infants aged 6-23 months was measured in a recumbent position to the nearest 0.1 cm according to the procedure outlined on anthropometric measurement guide using a board with an upright wooden base and a movable headpiece, designed by the Department of Food Science and Nutrition at the Ethiopian Health and Nutrition Research Institute.

The height of children 24 months and older were measured in a standing-up position to the nearest 0.1cm according to the procedure described on anthropometric measurement guide using a measuring board designed by Ethiopian Health and Nutrition Research Institute.

The weight of the lightly clothed infants and children were measured to the nearest 10 g by UNICEF Electronic Scale (Item No. 0141015 Scale mother/child, electronic). The UNICEF mother/child electronic scale requires the mother and child were weighed simultaneously. The mother was weighed with the child and then weighed without the child. The difference between the two measures was the child's weight.

Eight grade 10+ completed data collectors were recruited on the basis of their ability to speak afaan Oromo and Amharic and having previous experience of data collection and three-nurse (Bsc. Holder) were recruited as supervisors. Data collectors and supervisors were trained for three days on the details of the questionnaire, measuring instrument of (weight, height), how to control the quality of data, on interviewing techniques, the purpose of the study, importance of privacy, discipline and approach to the interviewees and confidentiality. Pre-testing was undertaken on 5% of the sample in Sigimo Woreda.

Data Processing and Analysis

After the data were collected it was coded, edited, entered, into the computer by Epi-data and data were cleaned during double verification and analyzed using Epi-info version 3.5.1 for the matching analysis. McNemar chi-square test was performed to test the existence of a significant association between SAM and selected risk factors.

Odds ratio and 95% confidence intervals and p-value were estimated. Discordant pair matching analysis and conditional logistic regression were used to determine the independent effect of explanatory variables on the outcome variable. Each independent variable was entered separately with the outcome variable into matched bivariate analysis and variables whose levels were statistically significant ($P < 0.05$) were finally entered into conditional logistic regression to determine the final predictors of SAM.

Ethical consideration

Ethical clearance was obtained from the Jimma University College of public Health and Medical Sciences ethical committee. After thoroughly discussing, the ultimate purpose and method of the study, a written consent was sought from Woreda health offices and Health facilities. Additionally, an informed verbal consent was obtained from each study subjects.

Result

Socio-demographic characteristics

The response rate was 100%. A total of 204 study subjects below the age of five (102 with severe acute malnutrition and no malnutrition for each) were analyzed. There were 46 (45.1%) males in the cases and 59 (57.8%) in the controls. The illiteracy rate was higher among mothers of the cases 90 (88.2%) than the controls 72 (70.6%) and among the fathers of the cases 68 (66.6%) than the controls 56 (54.9%). The majority of the mothers 94 (92.2%) of the cases and 93 (91.2%) of the controls, were housewives with no occupation. The main paternal occupation was farming both in the cases 86 (84.3%) and the controls 73 (71.6%).

Monthly family income of less than 50 \$ was higher in the cases 68 (66.6%) than the controls 38 (37.2%). A larger family size with the number of children greater than 3 was noticed more frequently in the household of the cases 51 (50%) than in the controls 37 (36.3%). The spacing of child by

less one year 27(26.5%) among the cases and 2(1.96%) among the controls (Table 1).

The matched bivariate analysis was done to identify the socio-demographic factors associated with the severe acute malnutrition. Among the variables educational status of the mother (OR=3.25, 95%CI 1.47-7.17), birth interval less than one year (OR=4.33, 95% CI 2.09-8.94), monthly family income less than 50UD (OR=3.14 95%CI 1.72-5.73), a larger family size greater than three (OR=1.87, 95%CI 1.02-5.73) and residence (OR=5.75, 95%CI 1.98-16.62) were significantly associated with severe acute malnutrition. However, paternal education and marital status were not significantly associated with severe Acute Malnutrition (see table 2).

Parental 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 69 (67.6%) of the cases and 92 (90.2%) of the controls (OR=0.21, 95%CI 0.081-0.51), similarly 69 (67.6%) of the cases and 76 (74.5%) of the controls knew that breastfeeding should be continued up to two years of age and beyond. Sixty-two (60.8%) of the mothers in the cases knew that complementary diet should be started at the age 6 months compared to 90 (88.2%) in the controls (OR=4.57, 95% CI 2.01-10.35). Pre-lacteal feeds were thought to be important in 9 (8.8%) of the cases and 4 (3.9%) of the controls. The importance of pre-lacteal feed was said to be to strengthen and adoption with food by 8/12 (66.6%) of the mothers, the other reasons were to soften the abdominal tract and, to avoid abdominal pain (Table 3).

Nutritional practice of the mothers/caretakers

One hundred one (99.0%) of the cases and 102 (100%) of the controls were breastfed. Breastfeeding was initiated within the first hour of birth in 44 (43.1%) of the cases and 77(75.5%) of the controls (OR=4.06, 95% CI 2.234- 7.38), however, pre-lacteal feeds

were given more frequently in the cases 12 (11.7%) than in the controls 4 (3.9%) (OR=3.26, 95% CI 1.1-10.5). Butter is the most commonly used pre-lacteal feed 8/9(88.8%), and fenugreek 1/9(11.2%). Sixty-three (61.7%) of the cases and 24 (23.5%) of the controls (OR=5.00, 95% CI 2.53-9.85) discarded the first milk (colostrums). Discontinuation of breastfeeding before 24 months of age was seen in 15/29 (51.7%) of the cases and in 8/25 (32.0%) of the controls (OR=1.83, 95% CI 0.95-2.67). Lack of exclusive breastfeeding for the first 6 months of age was more common in the cases 37 (36.3%) than in the controls 10 (9.8%) (OR=4.10, 95% CI 2.05-8.18). Bottle-feeding was more frequently used in the cases 78 (76.5%) than in the controls 45 (44.1%) (OR=4.00, 95% CI 2.11-7.74) (Table 4).

Morbidity status of the cases and controls in the last two weeks before the study

The majority of the cases 67 (65.7%) had at least one episode of diarrhea infection and while only 26 (25.5%) the controls group had at least one episode of diarrhea in the last two weeks (OR=0.88, 95% CI 0.43-1.74). Twenty-two (21.5%) of the cases and 9 (8.8%) of the controls (OR=1.20, 95% CI 0.36-3.93) had malaria. Four (3.9%) of the cases and 4 (3.9%) of the controls (OR=1.00, 95% CI 0.20-4.95) and 21 (20.6%) of the cases and 5 (4.9%) of the controls (OR=1.75, 95% CI 0.51-5.71) had measles and pneumonia in the last two weeks respectively (see table 5).

The overall Predictors of Severe Acute Malnutrition by multivariate analysis

The final model was constructed using conditional logistic regression method. All variables which had shown statistically significant association during the bivariate matched analysis such as mother's educational status, birth interval less than one year, monthly income lower than 50UD, Number of children greater than 3, Breastfeeding not initiated within an hour of birth, Colostrums discarded, Lack of

exclusive breastfeeding in the first six months, bottle feeding, Pre-lacteal feed given and nutritional factors were included.

The multivariate analysis with conditional logistic regression model revealed that the risk for SAM was independently associated with lack of exclusive breastfeeding for the first six months of life (OR=2.63, 95% CI 1.02-6.76), monthly income less than 50UD (OR=3.62, 95% CI 1.20-10.95), discarding the colostrums (OR=7.30, 95% CI 2.07-16.37) and bottle feeding (OR=2.68, 95% CI 1.26-5.70) after the effects of other significant risk factors were controlled (Table 6).

Discussion

The study has provided pertinent information about risk factors associated with severe acute malnutrition in under five children for decision makers and planners as well.

In this study, illiterate women were 3.25 times more likely to have SAM children compared to literate women. This would probably be due to the fact that literate mothers adopt many improved behaviors related to maternal and child health care, feeding and eating practices which ultimately affect the nutritional status of children. Education is one of the most important resources that enable women to provide appropriate care for their children, which is an important determinant of children's growth and development (24).

A study done in Gonder University hospital indicated that the maternal illiteracy was associated with 3.83 fold increase the risk of severe acute malnutrition in their children (28) which is higher than the result of this study. Similarly, a study done in Bangladesh showed that the maternal illiteracy was associated with a fourfold increase in the risk of severe acute malnutrition in their children (26) which is greater than this study.

In this study, the children those who lack exclusive breastfeeding in the first six months of age were 2.63 times more likely

to have SAM children than those exclusively breastfed. As a global public health recommendation, infants should be exclusively breastfed for the first 6 months of life to achieve optimal growth, development, and health. A study was done in China also showed that the introduction of another diet before the age of six months increased the prevalence of pneumonia and diarrheal disease (27). Similarly, a Study conducted in Bangladesh showed that appropriate breastfeeding is rarely practiced (26) which supports this study. Infants are introduced to other foods either too early or too late. Colostrums feeding to the child right after birth is quite important to boost up the immune system and their nutritional status. However, in many mothers of the cases throw away the colostrums milk considering that it is dirty. Children who are not fed colostrums were 7.3 times more likely to be severely wasted.

This supports the notion that non-nutritional factors should be essential components in the effort to reduce severe acute malnutrition in Jimma zone. 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 (4) which is consistency with this observation. Breastfeeding was initiated within the first hour in 44 (43.1%) of the cases and 77(75.5%) of the controls and even to delay the onset of breastfeeding by more than 10 hours. This indicates that the mothers of the children have no knowledge about the importance of breastfeeding initiation in the first hour of birth which is not concordant with the national figure 69%. The severely malnourished children are more likely to receive pre-lacteal feeds than the controls. Pre-lacteal feeds were also considered to be of importance in 8.8% of the mothers of the cases when compared to 3.9% of the controls. The use of pre-lacteal feeds is not recommended as it can make the infant ill and interferes with breastfeeding (28).

Bottle-feeding is more commonly observed in the severely malnourished group 78 (76.4%) than the controls 45(44.1%). Those children who bottle fed were 2.68 times more likely to have SAM than those children who did not bottle fed. Bottle-feeding is discouraged at any age. It is usually associated with increased risk of illness, and especially diarrheal 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 (26).

A statistically significant difference in knowledge on the recommended duration of breastfeeding and on the appropriate time of initiating complementary diet between the mothers of the severely malnourished children and the controls was observed. This indicates that it is not only lack or shortage of food that predisposes young children to malnutrition but also a lack of knowledge on appropriate infant and young child feeding practices. Unfavorable health environment caused by inadequate water and sanitation can increase the probability of infectious diseases and indirectly cause certain types of malnutrition (18).

Mothers who earn a monthly income less than 50\$ were 3.62 times more likely to have SAM children compared to mothers who earn more than 50\$. A study from Brazil also showed that of the social variables studied, family income was the risk factor that had the strongest association with the nutritional status (21) which is consistency with this study. Similarly, poor family income has been found as a risk factor for severe acute malnutrition in studies done in Nigeria (13), Gonder university hospital (28), Sudan (22), Zimbabwe (23) and India (25). A community-based study was done in Jimma, Ethiopia also showed that children with malnutrition lived in a household with low monthly income (4), which is also observed in this study. In this study a larger family

size with greater 3 children were 1.87 times more likely to have SAM children compared to a family size with less than 3. 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 (12, 26).

A waste disposal system was significantly associated with Severe Acute Malnutrition in this study. A similarly comparative study was done in some developing countries (19) and in Jimma, Ethiopia (24) also showed that unprotected water source and non-availability of waste disposal pit was associated with malnutrition, which supports this study.

Children who suffer from repeated episodes of diarrhea or Acute Respiratory Infections (ARI) are more likely to suffer from SAM. This is partly because of reduced appetite, less quantity of fluids and foods offered during diarrhea and another sickness. A comparative study conducted on children's nutritional status (20) indicated that SAM was highest among children with recent diarrhea which is similar to this study

Conclusion

In conclusion, factors associated with Severe Acute Malnutrition in under five children are almost similar as many developing countries. The findings of this study confirm the association of severe acute malnutrition with an inappropriate infant and young child feeding practices. This indicates that it is not only lack or shortage of food that predisposes young children to malnutrition but also a lack of knowledge on appropriate infant and young child feeding practices. The major risk factors for Severe Acute Malnutrition among under-five children are a lack of exclusive breastfeeding in the first six months of life, bottle feeding, and discarding the colostrums.

Recommendation

1. Jimma zone health department, Woreda health offices, and the respective health facilities should work on increasing

knowledge and practice of the parents on early initiation of breastfeeding, exclusive breastfeeding in the first six months of life for the child during anti-natal care to decrease SAM.

- a. Health education should be given on:
 - The side effects of bottle feeding for the mothers during anti-natal care.
 - The importance of colostrums for the pregnant women
- b. factors increasing the occurrence of diarrhea diseases such as inappropriate waste disposal system and unsafe water supply

Competing interests

I declare that I have no competing interests

Authors' contributions

I Habtamu Oljira Desta is the Principal Investigator, participated in Conceptualized the study, designed the study instrument and conducted the data analysis and wrote the first draft and final draft of the manuscript and involve in a critical review of the manuscript.

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