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Assessment of Risk Factors Associated with Severe Acute Malnutrition Among Children Admitted to Arsi Zone Gov'tal Hospitals, Ethiopia, 2016: Cross Sectional Study

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To cite this article:
Tolessa Kebede Bedo, Birhanu Alemu Feseha. Assessment of Risk Factors Associated with Severe Acute Malnutrition Among Children Admitted to Arsi Zone Gov'tal Hospitals, Ethiopia, 2016: Cross Sectional Study. *International Journal of Clinical and Experimental Medical Sciences*. Vol. 6, No. 4, 2020, pp. 51-59. doi: 10.11648/j.ijcems.20200604.11

Abstract: *Background* Malnutrition remains one of the most common causes of morbidity and mortality among children throughout the world. It is responsible about 60% cause of death in under age of 5 years. *Objective* To assess feeding practice and factors associated with severe acute malnutrition in under age of 5 year children admitted to Arsi zone public Hospitals, Ethiopia, 2016. *Methods and Materials* A cross sectional study design was conducted from July 2014 to June 2016 on age of 5 years children admitted to Arsi Zone Governmental Hospitals. The required number of samples was selected based on the registration and diagnosis. Data was collected by review of medical records and interview of the family member nearby during data collection. The data was manipulated and analyzed by using Epi. info version 3.5.4 for windows and Statistical Package for Social Sciences (SPSS) version 16.0. *Results* Out of one hundred fifty-one study subjects, 124 (82.1%) of them breastfed; but majority of them, 65.4% did not practice exclusive breast feeding. Maternal illiteracy had 2.46 times high risk and significant association with severe acute malnutrition (AOR=2.46, 95% CI, 1.4-42.4). Being age younger than 11 months also showed 5.97 times high risk and statistically significant association with severe acute malnutrition (AOR=5.97, 95% CI, 1.8-20). Children of governmental employee mother were 2.29 times high risk to be affected by marasmus (AOR=2.29, 95% CI, 1.4–3.86). Male children were 2.28 times higher risk to be affected by the case than female children (AOR=2.28, 95% CI, 1.1–4.9).

Keywords: Malnutrition, Diarrheal Disease, Marasmus, Bottle Feeding

1. Introduction

Malnutrition is a pathological state resulting from inadequate nutrition. It is broadly classified as under nutrition, as a result of insufficient intake of energy and other nutrients, and over nutrition due to excessive consumption of energy and other nutrients [1]. Severe acute malnutrition (SAM) is defined by a very low weight for height (below -3 z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional edema [2].

Malnutrition remains one of the most common causes of morbidity and mortality among children throughout the world [3]. Particularly stunting, is still a severe public health problem in Sub Saharan Africa [4]. For example, about 35% of preschoolers are stunted; while 29% are underweight in Sub-Saharan Africa [5]. In addition, the Fifth Global Nutritional Report estimates that in East Africa 44% of children under-five were stunted while 31% were underweight in 2005 [6]. It has been responsible, directly or indirectly, for 60% of the 10.9 million deaths annually among children under five [6]. Malnutrition has both short term and long-term adverse ramifications. In the short-term for the individual, it is associated with illness, health and mortality [7].

In the long-term, it leads to impaired cognitive

development, poor educational achievement and economic productivity [8-9]. Poverty and ignorance play important roles at the background in the causation of malnutrition especially in the developing world. Poor feeding practices have been identified in the developing world to arise from ignorance about adequate breastfeeding and appropriate weaning practices. All these are closely related to the socioeconomic status and sizes of families [10]. Individuals from low socio-economic backgrounds and particularly those living in poverty are more likely to be malnourished than individuals from higher socio-economic classes. This is most often primary malnutrition as a result of food insecurity [11].

Secondary malnutrition is also more prevalent in situations of poverty due to overcrowding and poor sanitation (which for example increase the risk of infection) and contributes to the increased incidence of malnutrition amongst the poor. History of recent infectious and parasitic disease, in particular diarrhea, malaria, or intestinal worms predisposes an individual to malnutrition and these conditions reduce the proportion of nutrients which the body is able to consume [12].

2. Methods and Materials

A cross-sectional study was conducted in Arsi Zone Governmental Hospitals to assess risk factors associated with SAM among children admitted with severe acute malnutrition from July 2014 to June 2016.

All children admitted to hospital with severe acute malnutrition before and during data collection were included as study participant based on their registration documented in registration book. The independent variables are socio demographic characteristics like age, sex, religion, ethnicity, education, occupation, marital status, family size and monthly income. Clinical and anthropometric information such as previous illnesses: infections, diarrhea, acute respiratory infection, HIV/AIDS and feeding practice.

The structured questionnaire was translated to Amharic languages and the questionnaire was pretested on 15 children admitted with SAM to Asella Hospital. Training was given for three supervisors (Bachelor Nurses) and six data collectors (Diploma Nurses and Bachelor Nurses) and included provision of handouts on a review of general study objectives and procedures, detailed discussion of every data item to be collected and discussion of how to resolve potential problems, practical session on measurement and observations based on standard way.

Data was entered to Epi-Info 3.5.4 for windows and analyzed using SPSS version 16.0 for windows. The data was double entered to check the consistency. The data was cleaned and edited before analysis. Data exploration was undertaken to see if there were odd codes or items that were not logical and then subsequent editing was made.

Followed the approval by Institutional Research and Publication office, Official letter of co-operation was written to the concerned bodies. As the study was conducted through review of medical records and non invasive data collection methods, the individual patients were not subjected to any harm as far as the confidentiality was kept. No personal identifiers were used on data collection form. The recorded data was not accessed by a third person except the principal investigator, and was kept confidentially.

3. Results

The total sample size included in the study was 151 subjects. All the study subjects provided their relevant information which making the response rate 100%. The mean age of the mother's is 27.99 with Standard deviation of 4.76. Concerning educational status of the mother's 57 (37.7%) were educated to grade 1-8, 29 (19.2%) can read and write, 28 (18.5%) were attended grade 9-12, 26 (17.2%) have no formal education (illiterate), and 11 (7.3%) were complete College/University. When considering occupational status of the mother's, most of them were daily labor workers 65 (43%), 46 (31.8%) were house wife, 21 (13.9%) were merchant, 9 (6%) were governmental employee and 8 (5.3%) were private workers (Table 1).

Most of the study subjects' fathers were attended grade 1-8, 53 (43.4%), 32 (25.4%) were completed grade 9-12, 21 (17.2%) were attended college/University, 10 (8.2%) can read and write and 7 (5.7%) have no formal education (illiterate). Regarding occupational status of study subject's fathers, 60 (49.2%) were daily labors, 26 (21.3%) were merchant, 20 (16.4%) were private worker and 16 (13.1%) were governmental workers (Table 1). Regarding the ethnic group of the study subjects, 46 (30.5%) were Oromo, 45 (29.8%) were Amhara, 26 (17.2%) were Tigre, 25 (16.6%) were Gurage and 9 (6%) were others. Of 151 study subjects, 96 (63.6%) were Orthodox, 28 (18.5) were Protestant and the remaining 27 (17.9%) were Muslims. (Table 1).

Monthly income of most of the study subjects' family ranges from 500-1000 Birr which accounts 59 (39.1%), < 500 Birr accounts 29 (19.2%), 1600- 2000 Birr accounts 22 (14.6%), >2000 Birr accounts 21 (13.9%) and 1100-1500 Birr accounts 20 (13.2%) (Table 1). Regarding the family size of the study subjects, 63 (41.7%) has 4 members, 34 (22.5%) has 5 members, 31 (20.5%) has 3 members, 13 (8.6%) has 2 members and 10 (6.6%) has >5 members. The number of under age of 5 years children in the family is one in most of the study subjects which is 134 (88.7%), 14 (9.3%) has 2 and 3 (2%) has >2 under age of 5 years children (Table 1). Regarding the child's socio demographic status, 73 (48.3) of them were 11 and younger than 11 months, 61 (40.4) were 12-23 months and the remaining 17 (11.3) were 24 to 59 months old. Out of 151 study subjects, 89 (58.9) were male and 62 (41.1) were female (Table 1).

Table 1. *Socio demographic characteristics of the family and the child of the children admitted with SAM to Arsi Zone Governmental Hospitals, 2016.*

	Characteristics	Frequency	Percent
Age of mothers	20-24	31	20.5
	25-29	69	45.7
	30+	51	33.8
Ethnic Group	Amhara	45	29.8
	Oromo	46	30.5
	Tigry	26	17.2
	Gurage	25	16.6
	Others	9	6.0
Religion	Orthodox	96	63.6
	Muslim	27	17.9
	Protestant	28	18.5
Mother's educational status	Illiterate	26	17.2
	Can read and write	29	19.2
	Grade 1-8	57	37.7
	Grade 9-12	28	18.5
	College/University	11	7.3
Mother's occupation	House wife	48	31.8
	Government employee	9	6.0
	Merchant	21	13.9
	Daily worker	65	43.0
	Private worker	8	5.3
Marital status	Single	4	2.6
	Married	122	80.8
	Divorced	22	14.6
	Widowed	3	2.0
Father's education	Illiterate	7	5.7
	Can read and write	10	8.2
	Grade 1-8	53	43.4
	Grade 9-12	31	25.4
	College/University	21	17.2
	Total	122	100.0
Father's occupation	Government employee	16	13.1
	Merchant	26	21.3
	Daily labor	60	49.2
	Private work	20	16.4
Monthly income	<500 Birr	29	19.2
	500-1000 Birr	59	39.1
	1100-1500 Birr	20	13.2
	1600-2000 Birr	22	14.6
	>2000 Birr	21	13.9
Family size	2	13	8.6
	3	31	20.5
	4	63	41.7
	5	34	22.5
	>5	10	6.6
Number of children 0-59 months in the family	1	134	88.7
	2	14	9.3
	>2	3	2.0
Age in months	0-11	73	48.3
	12-23	61	40.4
	24-59	17	11.3
Sex	Male	89	58.9
	Female	62	41.1
	Total	151	100.0

Out of one hundred fifty one children diagnosed with severe acute malnutrition and admitted to hospitals 97 (64.2%) were marasmic cases, 30 (19.9%) were kwashiorkor and the remaining 24 (15.9%) were mixed type of malnutrition (marasmic-kwash) (Table 2). One of the criteria to classify an admitted child with severe acute malnutrition is bilateral edema. Out of one hundred fifty one children admitted with the case, 98 (64.9%) had no edema, 27 (17.9%) had grade II edema (++), 19 (12.6%) had grade III edema (+++) and the remaining 7 (4.6%) had grade I edema (+) when they admitted to the Hospital (Table 2). admitted to the hospitals (Table 2).

Table 2. *Degree of bilateral edema on admission and different form of SAM diagnosed among children admitted to AA governmental hospitals, 2016.*

		Frequency	Recent
Types of malnutrition	Kwashiorkor	30	19.9
	Marasmus	97	64.2
	Marasmic-kwash	24	15.9
	Total	151	100.0
Degree of bilateral edema on admission	0	98	64.9
	+	7	4.6
	++	27	17.9
	+++	19	12.6
	Total	151	100.0

Regarding weight for height condition on admission, 96 (63.6%) were <60%, 30 (19.9%) were >=80% and the rest 25 (16.6%) were between 60 – 80%. Concerning about MUAC on admission 105 (69.5%) were less than 11.5 cm and 46 (30.5%) were greater than or equal to 11.5cm (Figure 1).
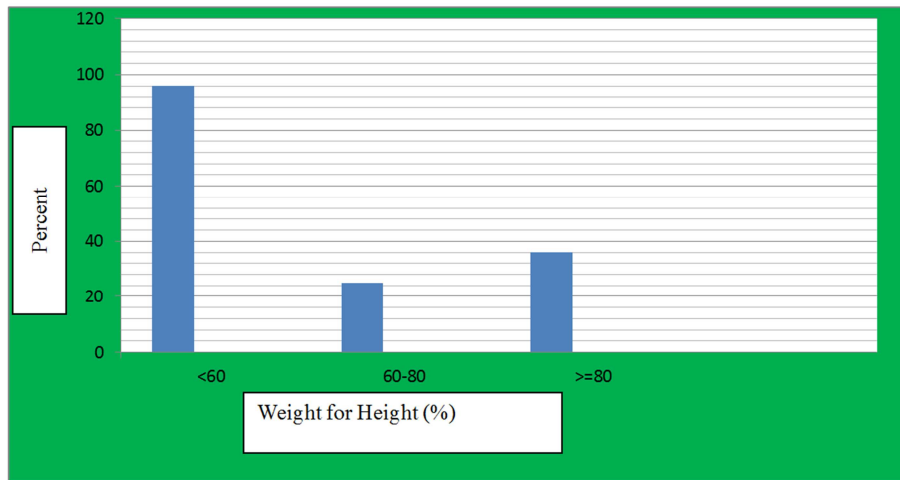

Figure 1. *Weight for height status on admission of children admitted with different form of SAM to Arsi Zone governmental hospitals, 2016.*

Out of one hundred fifty one study subjects, 64 (42.4%) of them reported different cases that they have experienced in a month before the study. They have reported more than one case they have experienced in the past. 35 (54.7%) of them reported history of severe vomiting, 45 (70.3%) reported history of fever, 41 (64.1%) reported history of diarrhea, 17 (26.6%) reported history of pneumonia and 27 (42.9%) reported history of chronic illnesses like heart disease, Tuberculosis, and spinal cord defect (Figure 2).
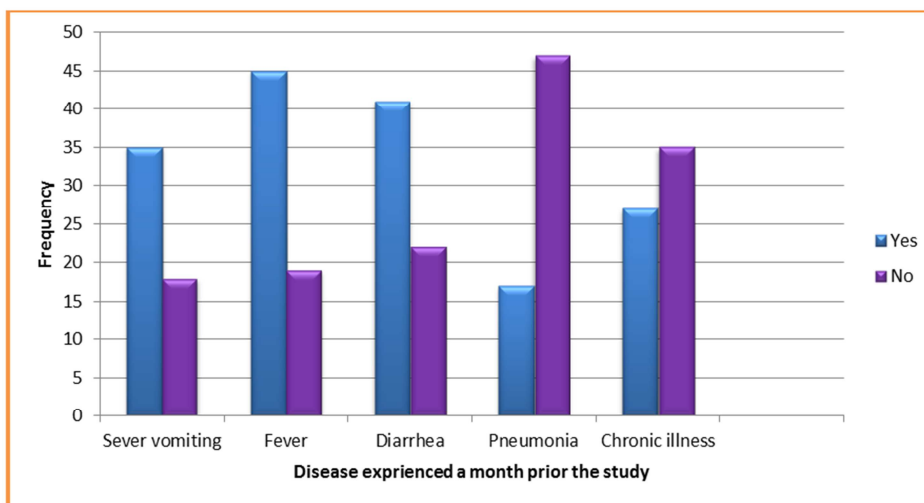

Figure 2. *History of cases experienced a month prior the study by children admitted with SAM to Arsi Zone governmental hospitals, 2016.*

Concerning HIV status of the study subjects, 105 (69.5%) of them were non reactive, 44 (29.2%) were unknown result and 2 (1.3%) were reactive (Figure 3).
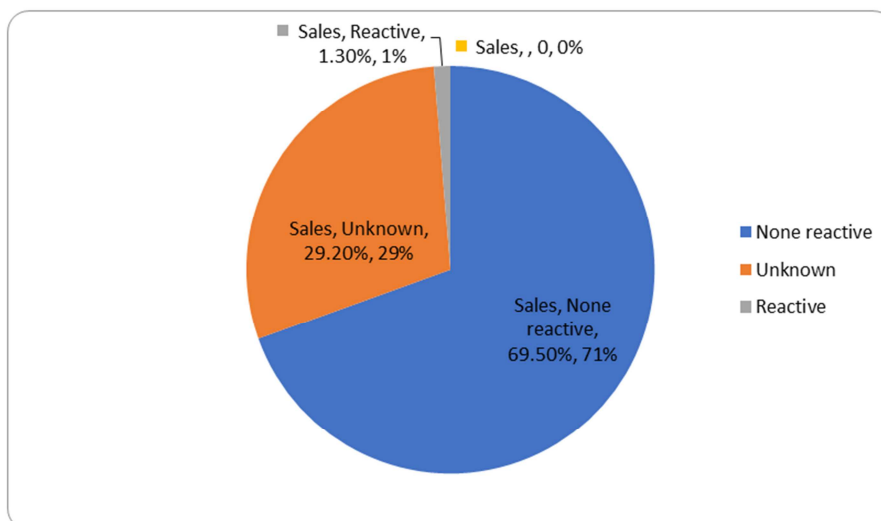
Figure 3. HIV status of children admitted with SAM to Arsi Zone governmental hospitals, 2016.

Regarding breast feeding practice, most of the study subjects have fed breast milk since their birth which accounts 124 (82.1%) and the remaining 27 (17.9%) did not feed breast milk instead they have fed formula milk. Those children who have got breast milk, fed for vary duration in time. 77 (62.1%) of them fed for 7-12 months, 21 (16.9%) fed for >12 months, 15 (12.1%) fed for 4-6 months and 11 (8.9%) fed for <4 months (Table 3).

Table 3. Duration of breast feeding among children admitted with SAM to Arsi Zone governmental hospitals, 2016.

Age	Frequency	Percent
<4 months	11	8.9
4-6 months	15	12.1
7-12 months	77	62.1
>12 months	21	16.9
Total	124	100.0

Out of children who have got breast milk, 107 (86.3%) of them have started additional food other than breast milk. Most of them started before the age of 6 months which accounts 70 (65.4), 30 (28.1%) started at the age of 6 months, 6 (5.6%) started between the age of 7-12 months and 1 (0.9%) started after 12 months old (Figure 4).
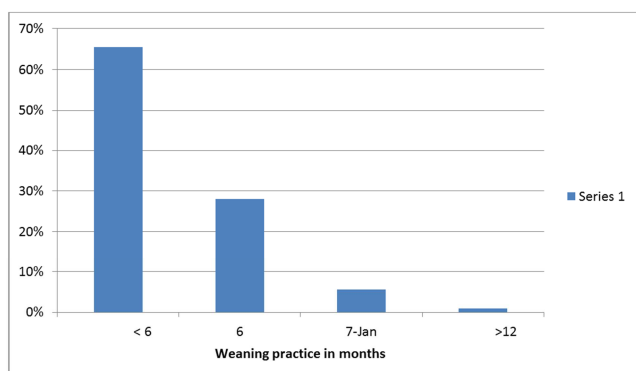

Figure 4. Weaning practice among children admitted with SAM to Arsi Zone governmental hospitals, 2016.

Out of one hundred thirty four children who are currently on feeding other than breast milk and/or breast milk, 98 (73.1%) are fed by mothers or fathers, 20 (14.9%) are fed by siblings and 16 (12.0%) are fed by others like grandmother. Regarding the means of feeding foods other than breast milk, 115 (85.8%) are used bottle feeding, 14 (10.5%) are used cup and 5 (3.7%) are used spoon to feed the child (Figure 5).
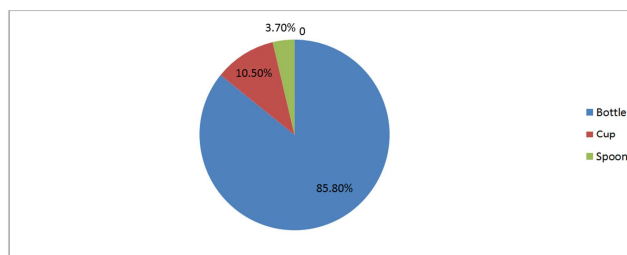

Figure 5. Means of feeding foods other than breast milk among children admitted with SAM to Arsi Zone governmental hospitals, 2016.

From the table of association below, 55 of children 11 months and younger were marasmic. These age group is 4.37 times high risk to be affected by marasmus and has statistically significant association at (COR=4.37, 95% CI, 1.45-13.15). Further adjustment for other variables by multinomial logistic regression again shows that these age group is 5.97 times high risk to be affected by the case which indicate stronger association between these variables and statistically significant association at (AOR=5.97, 95% CI, 1.8 - 20) (Table 4). Regarding the sex, the risks of male children being marasmic relative to female children were high: 1.99 times of female children and has statistically significant association at (COR=1.99, 95% CI, 1.01-3.93); and adjustment with other variables by multinomial logistic regression indicates 2.28 times high risk male children affected than female children and has statistically significant association at (AOR=2.28, 95% CI, 1.1 – 4.9) (Table 4). When concerning maternal education, children from illiterate mothers were 5.04 times affected by marasmus and has statistically significant association at (COR=5.04, 95% CI,

1.09-234). Further adjustment also shows greater association and significance (AOR=2.46, 95% CI, 1.4 – 42.4) (Table 4). Children of governmental employee mother were 1.15 times affected by marasmus form of SAM and has statistically significant association at (COR=1.15 95% CI, 1.12-9.89); then further adjustment also shows more strength and significant association at (AOR=2.29, 95% CI, 1.4 – 3.86) (Table 4).

***Table 4.** Risk factors associated with marasmus among children admitted with SAM to AA public hospitals, 2014.*

Variables	Marasmus					
	Yes %	No %	p-value	COR (95% CI)	p-value	AOR (95% CI)
Age of child (months)						
0-11	55 (75.3)	18 (24.7)	0.009	4.37 (1.45- 13.15)*		
12-23	35 (57.4)	6 (42.6)	0.24	1.92 (0.65-5.72)	0.004	5.97 (1.8-20)**
24-59	7 (41.2)	10 (58.8)				
Sex						
Male	63 (70.8)	26 (29.2)	0.046	1.99 (1.01-3.93)*	0.035	2.28 (1.1-4.9)**
Female	34 (54.8)	28 (45.2)				
Age of mother (yrs)						
20-24	22 (71.0)	9 (29.0)	0.447	1.45 (0.56-3.79)		
25-29	43 (62.3)	26 (37.7)		0.98 (0.46-2.07)		
30+	32 (62.7)	19 (37.3)				
Mother Education						
Illiterate	21 (80.8)	5 (19.2)	0.039	5.04 (1.09-23.4)*		
Can read & write	19 (65.5)	10 (34.5)	0.253	2.28 (0.56-9.36)		
Grade 1-8	33 (57.9)	24 (42.1)	0.450	1.65 (0.45-6.04)	0.028	2.46 (1.4-42.4)**
Grade 9-12	19 (67.9)	9 (32.1)	0.202	2.53 (0.61-10.56)		
College/University	5 (45.5)	6 (54.5)				
Father Education						
Illiterate	4 (57.1)	3 (42.9)	0.650	0.67 (0.12-3.84)		
Can read & write	9 (90.0)	1 (10.0)	0.191	4.5 (0.47-42.97)		
Grade 1-8	33 (62.3)	20 (37.7)	0.723	0.83 (0.29-2.39)		
Grade 9-12	15 (48.4)	16 (51.6)	0.196	0.47 (0.15-1.48)		
College/University	14 (66.7)	7 (33.3)				
Mother occupation						
Housewife	27 (56.2)	21 (43.8)	0.119	3.86 (0.71-21.09)		
Gov't employee	7 (77.8)	2 (22.2)	0.040	1.15 (1.12-9.89)*		
Merchant	16 (76.2)	5 (23.8)	0.019	9.6 (1.45-63.5)*	0.030	2.29 (1.4-38.6)**
Daily labor	45 (69.2)	20 (30.2)	0.026	6.75 (1.25-36.4)*		
Private worker	2 (25.0)	6 (75.0)				
Father occupation						
Gov't employee	9 (56.2)	7 (43.8)	0.821	0.86 (0.23-3.25)		
Merchant	20 (76.9)	6 (23.1)	0.221	2.22 (0.62-7.97)		
Daily labor	34 (56.7)	26 (43.3)	0.794	0.87 (0.31-2.44)		
Private worker	12 (60.0)	8 (40.0)				
Marital status						
Single	3 (75.0)	1 (25.0)	0.287	6 (0.22-162.53)		
Married	75 (61.5)	47 (38.5)	0.349	3.2 (0.28-36.18)		
Divorced	18 (81.8)	4 (18.2)	0.102	9 (0.65-125.32)		
Widowed	1 (33.3)	2 (66.7)				
Monthly income						
<500 birr	18 (62.1)	11 (37.9)	0.726	1.23 (0.91-3.85)		
500-1000 birr	38 (64.4)	21 (35.6)	0.556	1.36 (0.49-3.75)		
1100-1500 birr	13 (65.0)	7 (35.0)	0.607	1.39 (0.39-4.92)		
1600-2000 birr	16 (72.7)	6 (27.3)	0.287	2 (0.56-7.16)		
>2000 birr	12 (57.1)	9 (42.9)				
Family size						
<4	28 (63.6)	16 (36.4)	0.921	0.96 (0.46-2.0)		
>=4	69 (64.5)	38 (35.5)				
Previous illness						
Yes	34 (54.0)	29 (46.0)	0.027	0.47 (0.24-0.92)*		
No	63 (71.6)	25 (28.4)				
Severe vomiting						
Yes	17 (48.6)	18 (51.4)	0.282	0.58 (0.21-1.57)		
No	18 (62.1)	11 (37.9)				
Fever						
Yes	27 (60.0)	18 (40.0)	0.192	2.1 (0.69-6.13)		
No	8 (42.1)	11 (57.9)				
Diarrhoea						
Yes	22 (53.7)	19 (46.3)	0.825	0.89 (0.32-2.49)		

Variables	Marasmus		p-value	COR (95% CI)	p-value	AOR (95% CI)
	Yes %	No %				
No	13 (56.5)	10 (43.5)				
Pneumonia						
Yes	12 (70.6)	5 (29.4)	0.130	2.5 (0.76-8.23)		
No	23 (48.9)	24 (51.1)				
Chronic illnesses						
Yes	12 (44.4)	15 (55.6)	0.191	0.51 (0.19-1.40)		
No	22 (61.1)	14 (38.9)				
Breast feed						
Yes	78 (63.4)	45 (36.6)	0.658	0.82 (0.34-1.97)		
No	19 (67.9)	9 (32.1)				
Weaning practice						
<6 months	53 (69.7)	23 (30.3)	0.157	1.62 (0.83 -3.18)		
6 months	24 (52.2)	22 (47.8)	0.042	0.48 (0.24-0.98)*		
7-12 months	5 (50.0)	5 (50.0)				
>12 months	1 (100.0)					
Means of feeding						
Bottle	74 (64.3)	41 (35.5)	0.247	1.8 (0.66- 4.9)		
Cup	7 (50.0)	7 (50.0)				
Spoon	3 (50.0)	2 (50.0)				

Note: *Significant association by binary logistic regression.
**Significant association by multinomial logistic regression.

4. Discussion

According to nutrition baseline survey report for the national nutrition program of Ethiopia, 12 percent of children aged 6 to 59 months were wasted and three percent of them were severely wasted [32]. Many studies conducted in different countries justified that maternal literacy, family income; family size, previous illness and feeding practice are the factors either directly or indirectly affecting child nutritional status. Therefore, conducting this study is mandatory to dig out which one of this factor contributes to the occurrence of severe acute malnutrition among the study subjects. Educational level of mother is important because educated mothers are more knowledgeable about their children's health and nutrition. They can make better use of health services, provide better care, have better hygienic practices and also have higher status in the family [32]. Being age 11 months or younger increased the risk of severe acute malnutrition as shown strong association in this study.

But reason why being male child predispose to the case is unclear which needs further investigation. In this study, many of the study subjects were reported more than one past illness they have been experienced a month prior to the study. But there is no significant association shown with severe acute malnutrition in case of this study. The reason behind is the difference of study subjects, severity of the case and duration of the diseases they have been experienced. The study conducted in Nigeria indicated that the risk of severe acute malnutrition among children who have experienced malaria, diarrhea and respiratory diseases was higher [34]. Though, most of the children (82.1%) were breastfed, 65.4% of them have been started complementary feeding before the age of six months. According to WHO recommendation the child should be exclusively feed breast milk for the first six months of life. Regarding means of feeding foods other than breast milk, however, there is no significant association between severe acute malnutrition and means of feeding in this study; most of the study subjects' family, (85.8%) used bottle feeding which increases the risk of malnutrition and other diseases. Many studies showed that bottle-feeding should be discouraged at any age because it is usually associated with increased risk of illness, and especially diarrheal disease, because of the hygienic problem which is difficulty in sterilizing the nipples properly. It also shortens the period of postpartum amenorrhea and increases the risk of pregnancy [18, 27].

5. Conclusion and Recommendation

Although, most of the variables analyzed in this study did not show statistically significant association with the outcome variable, maternal education, maternal occupation, sex of the child being male and age of the child younger than 11 months have strong and statistically significant association with child sever acute malnutrition with child severe acute malnutrition.

The Ministry of Health in collaboration with Ministry of Education should be encouraged maternal education because it plays a vital role in child care, and feeding. Ministry of Health should be provided education concerning appropriate means of feeding and exclusive breast feeding practice at each level in the community. The respective hospitals where the data was collected should be provided health education for mothers visiting hospitals about exclusive breast feeding and appropriate feeding of complementary food. Oromia Health Bureau should arrange training program for mothers on the way of child feeding to improve child nutritional status.

List of Abbreviations

AIDS – acquired immunodeficiency syndrome

EDHS – Ethiopian Demographic Health Survey
ETB – Ethiopian Birr
GAM – Global Acute Malnutrition
Gov't - government
HIV – Human immune virus
IGME - Interagency Group for Child Mortality Estimation
SAM – Severe acute malnutrition
LMIC – Low and Middle income countries
MDG – Millennium development goal
NGO – Nongovernmental Organization
SNNPR – Southern Nation, Nationalities and People Region
SPSS – Statistical package for social science
TFC - Therapeutic feeding center
UN – United Nation
USD – United State Dollar
WHO – World Health Organization

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgements

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