

RESEARCH ARTICLE

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Determinants of acute malnutrition among children aged 6–59 months in Public Hospitals, Oromia region, West Ethiopia: a case–control study

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Abstract

Background: Acute malnutrition is a recent and severe weight loss as a result of acute food shortage and/or illness. It is the leading causes of morbidity and mortality of children aged 6–59 months as risk of death is nine times higher than that of children without it. In Ethiopia despite recent economic progress; nutritional status of children is among the worst in the world and it remains major public health problem. According to recently published mini demographic & health survey 2014; 9 % of children are wasted (3 % severely wasted) in the country and in Oromia region 8.8 % of children are wasted (1.7 % severely wasted). However there is no information on determinants of acute malnutrition in the study area. The aim of this study was to identify determinants of acute malnutrition among children aged 6–59 months in the study area.

Methods: A facility based un-matched case control study was conducted on 339 (113 cases and 226 controls) children aged 6–59 months with their respective mothers from December 3, 2014 to March 25, 2015. The data were collected by using a pre-tested structured questionnaire and mid upper arm circumference (MUAC). Odds Ratio along with 95 % confidence interval was estimated to identify determinants of acute malnutrition (wasting) using the multivariable logistic regression. Level of statistical significance was declared at $P < 0.05$.

Results: Wasting was associated with diarrheal diseases in the previous two weeks [AOR (95 % CI) =3.94 (2.01–7.73)], mothers habit of less frequent hand washing [AOR (95 % CI) =14.39 (7.33–28.22)], did not exclusively breastfed [AOR (95 % CI) = 2.63 (1.29–4.82)], having large family sizes [AOR (95 % CI) =2.59 (1.34–5.0)], absence of latrine [AOR (95 % CI) =2.99(1.23–7.06)], illiterate mothers [AOR (95 % CI) =2.16(1.14–4.11)] and febrile illness in the previous two weeks [AOR (95 % CI) =1.89 (1.0–3.59)].

Conclusions: Wasting was significantly associated with diarrheal and febrile illness in the previous two weeks, lack of maternal education, hand washing & sub optimal breastfeeding practices, larger family size, and absence of latrine. Thus, an organized effort should be made at all levels to improve maternal and child health services, hand washing & breastfeeding practices, construction of latrines and education of mothers to restrain the problems of child acute malnutrition.

Keywords: Acute malnutrition, Children 6–59 months, Hand washing, Diarrheal disease

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Background

Acute malnutrition is a recent and severe weight loss (wasting) as a result of acute food shortage and/or illness and is measured by weight for height or mid upper arm circumference (MUAC) [1]. Acute malnutrition includes both moderate acute malnutrition (MAM) and severe acute malnutrition (SAM) where; MAM: is $MUAC \geq 115 \text{ mm} \ \& \lt \ 125 \text{ mm}$ ($\geq 11.5 \text{ cm} \ \& \lt \ 12.5 \text{ cm}$) and SAM: is defined by visible severe wasting, or by the presence of bilateral pitting edema of nutritional origin. $MUAC < 115 \text{ mm}$ ($< 11.5 \text{ cm}$) in children aged 6–59 months, is also an indicative of severe acute malnutrition [2].

The magnitude of wasting is substantial and persistent in the Sub-Saharan Africa (SSA) [3] including Ethiopia where many children are suffering from the effects of acute malnutrition [4–9]. In Ethiopia despite recent economic progress; nutritional status of children is among the worst in the world and it remains major public health problem [10]. As a result, it will be challenging to achieve better child nutritional status even though there are some improvements; for example the percentage of stunting fell from 52 % in 2000 to 47 % in 2005, 44 % in 2011 to 40 % in 2014. Similarly the percentage of underweight children declined from 47 to 38 % in 2005, 29 % in 2011 to 25 % in 2014. However, there is no significant change in the prevalence of wasting, as it remained 11 % by 2005 survey, 10 % by 2011 and 9 % by 2014 survey i.e., nearly static [5, 6, 10].

According to recently published Ethiopian mini demographic & health survey (EMDHS) 2014 report; 9 % of children are wasted (3 % severely wasted) in the country and in Oromia region 8.8 % of children are wasted (1.7 % severely wasted) [10].

Acute malnutrition remains one of the most common causes of morbidity and mortality among children throughout the world through its direct, non-synergistic effects and through its synergistic effects on mortality from infectious diseases [11, 12]. Children with SAM have a risk of death nine times higher than that of children without SAM [13].

Globally different literatures revealed that the determinants of acute malnutrition in children aged 6–59 months include poverty, parental illiteracy, parental decision making, inadequate feeding practices, large family size, non-exclusive breastfeeding, diarrhea, low birth weight, immunization status, disturbed (broken) family, maternal hand washing habit and repeated pregnancies according to published works [14–18].

Despite the fact that there is persistently high magnitude of acute malnutrition in Ethiopia, the reasons behind it is still poorly understood and there is inconsistency across studies regarding the determinant factors behind child acute malnutrition; in addition the previous studies do not provide sufficient evidence on its

determinants at all corners of the country and most of the surveys used were cross sectional designs which are not appropriate to identify the determinants factors affecting the under five children. As a result it is important to understand its determinants at different levels in the given society as they are multitude and hierarchically interrelated.

Therefore, this study attempts to investigate the major determinants of acute malnutrition among children aged 6–59 months among public hospitals (Nekemte referral and Gida Ayana), East Wollega zone, Oromia region, West Ethiopia by using case control study.

Methods

Study area, design, and period

The study was conducted in Nekemte referral hospital and Gida Ayana hospital which are found in East Wollega zone. East Wollega zone is one of the 18 administrative zones of Oromia national regional state and is located western to Addis Ababa. It has an area of 14,255 square kilometers with estimated population of 1,531,380 (one million five hundred thirty one thousand three hundred eighty) as projected from 2007/2008 census. The economy of the people is based on subsistence farming and livestock rearing. There are two hospitals and 58 health centers owned by government in the zone currently [19–22]. A facility based un-matched case-control study was employed from December 3, 2014 –March 25, 2015.

Source and study population

All children aged 6–59 months who were visited/admitted to Nekemte referral and Gida Ayana hospitals for different health care issues during the study period were the source population. All randomly selected children aged 6–59 months were the study population. Those children who had acute malnutrition (Mid-Upper Arm Circumference (MUAC) $< 12.5 \text{ cm}$, if there is edema) for cases and who had no malnutrition (Mid-Upper Arm Circumference (MUAC) $\geq 12.5 \text{ cm}$, there is no edema) for controls with their corresponding mothers/care takers, respectively.

Inclusion criteria

Children aged 6–59 months who visited or admitted to the hospitals and who had acute malnutrition (MUAC $< 12.5 \text{ cm}$ or with bilateral pitting edema of nutritional origin), with their care takers/mothers who gave informed consent were recruited into the study as cases. Controls include children aged 6–59 months, and attending to the hospitals (MUAC ≥ 12.5 , without bilateral pitting edema of nutritional origin) with their mothers/caretakers, who gave informed consent.

Exclusion criteria

Children who had physical deformities (children born without hands due to congenital deformities, wounded, and burned hands) which make anthropometric measurements inconvenient were excluded from the study.

Selection of cases

Children aged 6–59 months who were admitted during the data collection period were allocated to both hospitals depending on previous month's acutely malnourished children flow. Cases were children with a diagnosis of moderate to severe malnutrition with MUAC of <12.5 cm or bilateral pitting edema of nutritional origin.

Selection of controls

Controls were children without malnutrition (MUAC of ≥ 12.5 cm), without bilateral pitting edema of nutritional origin and were selected from the same hospital from which cases were selected.

Sample size determination

The sample size was computed using Statcalc. application of Epi-Info version 3.5.3. Statistical software with the following assumptions: Proportion of illiteracy among fathers of controls to be 41.16 % and of the cases 58.84 % [23], 95 % confidence interval, 80 % power of the study, control to case ratio of 2:1 to detect an odds ratio of 2.04 with a 5 % of non-response rate. Thus, the sample size required for the study was 339 (113 cases and 226 controls).

Sampling technique

Both hospitals found in the zone were included and 113 children who were acutely malnourished and 226 well-nourished but visited/admitted to the hospitals for other health care issues were selected. Children aged 6–59 months with acute malnutrition were allocated to the hospitals depending on the average previous month's acutely malnourished children flow to the hospitals.

From previous months on average 27 children with cases of acute malnutrition were reported and during the four months there were 108 children with cases of acute malnutrition at Gida Ayana hospital. Depending on this; 35 cases and 70 controls were allocated to Gida Ayana hospital and systematic random sampling technique was used to select every 3rd child from 108 children.

Similarly in Nekemte referral hospital from previous months on average 59 children with cases of acute malnutrition were reported in one month and during four months there were 234 children with cases of acute malnutrition at Nekemte referral hospital and systematic random sampling technique was used to select every 3rd child. Depending on this 78 cases and 156 controls were

allocated to Nekemte referral hospital. The controls were selected as soon as cases were selected from the same hospital.

Data collection instruments and procedure

Data were collected from all eligible children mothers/care givers by data collectors using interviewer administered questionnaire under close supervision of the assigned supervisors and principal investigator. Anthropometric measurements particularly MUAC was also taken from all children after the proper training and standardizing procedures. Edema was diagnosed if a bilateral depression (pitting) remained after the pressure was released. Once a case was found and his or her care giver interviewed, two controls meeting the criteria were selected and their care givers interviewed. To identify retrospective morbidity of children, mothers were asked about any occurrence of illness during the past two weeks.

A structured interviewer administered questionnaire which was adapted after thorough review of different literatures was used to collect data related to the objectives of the study. The questionnaires were prepared in English then translated to Afan Oromo (local language) and finally back translated to English language by other person who has good command of English and Afan Oromo to check for its consistency. The questionnaire covered a range of topics including socio-economic and demographic factors, child characteristics, child caring practices, maternal characteristics and environmental health conditions. MUAC was measured using easily portable measurement device the armband/tape. For data collection four 10th grade completed students were recruited. Two nurses from the hospitals were also recruited as supervisors.

Variables of the study

Acute malnutrition (SAM or MAM) in terms of MUAC <12.5 cm, WHZ < -2 SD, and presence of bilateral pitting edema of nutritional origin in under five children were considered as dependent variables in this study. Children with weight-for-height Z-score (WHZ) < -2 SD from the median value of WHO's 2006 reference data were considered as wasted (acutely malnourished). Socio demographic variables (family size, occupation, and parental education, ethnicity, religion and place of residence); economic status (monthly income, ownership of livestock and farmland); maternal characteristics (age, hand washing, number of under five children); child characteristics and caring practices (sex, age, immunization status, feeding practices, hygiene); health related characteristics (health care seeking, and morbidity status); and community factors (distance and sanitation of water supply) were considered as independent variables.

Data quality control

The data collectors and supervisors were trained for four days and standardized particularly in the proper filling of questionnaire, and the use of the measurement device the armband/tape in order to minimize inter and intra observer errors. Data quality was controlled through conducting a pre-test on 5 % of the samples in Gimbi hospital before the actual survey and important modifications were made on the basis of the findings. Data collectors were paired during the data collection to ensure quality of the data. The data collection was supervised by the principal investigator. Every questionnaire was supervised and reviewed for completeness and logical consistency. The completeness of the questionnaire was also checked before data entry. Anthropometric measurement (MUAC) of children was done by trained data collectors using standard procedures.

Data processing and analysis

The data were checked for completeness, coded and entered in to a computer using SPSS for windows version 20 and then edited, cleaned, processed and analyzed. Descriptive analysis was used to describe the percentages and number of distributions of the respondents by socio-demographic characteristics and other relevant variables in the study. In order to investigate the association of independent variables with acute malnutrition both bivariate and multivariate analysis were used. Bivariate analysis was performed on the independent variables and their proportions and crude odds ratio were computed against the outcome variable to identify the factors that were associated with child acute malnutrition. Hosmer–Lemeshow goodness-of-fit was used to test for the model fitness. The variables that showed an association with the outcome variable at the bivariate analysis with p value < 0.05 were entered into the final multivariable logistic regression to control for potential confounders. Adjusted odds ratio (AOR) along with 95 % confidence interval was estimated to assess the strength of the association and a P value < 0.05 was considered to declare the statistical significance in the multivariable analysis in this study.

Operational definitions

Case: Child with MUAC < 12.5 or presence of bilateral pitting edema of nutritional origin.

Control: child with MUAC ≥ 12.5 , without bilateral pitting edema of nutritional origin.

Diarrhea: a child having three or more loose or watery stools per day.

Acute Respiratory Infection (ARI): A child with cough, fast breathing or difficulty in breathing and fever.

Low family income: Households earning monthly income below 50 USD.

Hand washing frequently: Those who wash hands at all activities such as after latrine, before preparing food, before serving food, after cleaning child feces etc.

Hand washing less frequently: Those who do not wash their hands at activities such as after latrine, before preparing food, before serving food, after cleaning child feces.

Ethical consideration

The study was cleared by the Ethical Review Committee of Wollega University (Ref. No: WU/IEC/32/07). Permission letter was obtained from zonal and woreda health offices of East Wollega zone. Informed verbal and written consents were obtained from the parents/care givers of the children before the interview. Illiterate mothers were consented by their thumb print after verbal consent. Mothers/care givers of children with acute malnutrition were advised on how to prevent and treat it and for those cases that did not begun treatment appropriate link was made to therapeutic feeding centers.

Results

Socio demographic and economic characteristics of study participants

A total of 339 child-mother pairs (113 cases and 226 controls) were included in the study. In this study 61 (53.98 %) and 133 (58.85 %) were female in gender in case and control groups, respectively. Female headed households were 9 (7.96 %) in group of cases and only 6 (2.65 %) controls were headed by females. The mean age of the children in case and controls were 24.65 (SD \pm 14.74) and 24.63 (SD \pm 14.92) months, respectively and 75 % of both cases and controls were below 36 months of age. The mean age of respondents (mothers) in cases and controls was 27.96 (SD \pm 5.89) and 28.5 (SD \pm 5.06), respectively. Average family size of the participants in cases and controls were 5.52 (SD \pm 1.84) and 4.53 (SD \pm 1.27), respectively. Similarly 50 % of participants in cases and controls had ≥ 3 and ≥ 2 under five children, respectively. Majority of the cases, 77 (68.14 %) and 106 (46.90 %) of controls had family size of \geq five. Nearly two thirds of cases 75 (66.37 %) and 66 (29.20 %) controls were children from households earning < 50 USD monthly, income. The occupation of fathers of 82 (72.57 %) cases and 114 (50.44 %) controls were farmers, respectively. Concerning maternal and paternal education half 56 (49.56 %) and 37 (16.37 %) of mothers of cases and controls and 31 (24.43 %) and 22 (9.73 %) of fathers of cases and controls were illiterate, respectively. Majority of cases; 88 (77.88 %) and 126 (55.75 %) controls were from rural residence. The predominant ethnic group of the participants were Oromo in both group where 111 (98.23 %) and 212 (93.80 %) of cases and controls were Oromo, respectively. In this study 61 (53.98 %) and 110 (48.67 %) of mothers of children in cases and

controls were protestant religion followers, respectively (Table 1).

Child characteristics and caring practices of study participants

Majority of the children 67(60.18 %) and 44(19.47 %) in group of cases and control were born at home respectively. From the total 20(17.70 %) and 7(3.10 %) of cases and controls had never been immunized respectively. More than one third of cases 44(38.90 %) and about quarter 57(25.22 %) of controls had diarrhea two weeks prior to the survey. Concerning febrile illness 32(23.32 %) of cases and 118(52.21 %) of controls had febrile illness two weeks prior to the survey. More than half 66(58.40 %) of mothers of cases and 199(88.05 %) of mothers of controls attended ANC clinic during pregnancy of the child under study. Nearly one third 36 (31.86 %) of cases and 137(60.62 %) of controls had exclusively breast fed their children for 6 months. Concerning knowledge of mothers about breast feeding 59(52.21 %) of mothers of cases and 189(83.63 %) of mothers of controls responded that they had the knowledge that the child should be exclusively breast fed for six months. More than half 64(56.63 %) of cases and 37(16.37 %) of controls were not given food from different categories during 24 h prior to hospital visit. About half 58(51.33 %) of cases and 80(35.40 %) of controls initiated breast feeding greater than one hour after delivery. From the total 58(51.33 %) and 17(7.52 %) of mothers of cases and controls reported that they had no plan to give birth of the studied child respectively (Table 2).

Environmental health conditions of study participants

For 46(40.70 %) of cases and 30(13.27 %) of controls it takes >30 min to go and come back to fetch water. The roof of houses of 50(44.25 %) cases and 49(21.68 %) controls were made of tukul/thatched. About 25 (22.12 %) of cases and 27(11.95 %) of controls don't have latrine. Majority of mothers 74(65.49 %) of cases and 27(11.95 %) of controls wash their hands rarely or even don't wash their hands during procedures like after latrine, before preparing food, before serving food, after cleaning child feces, etc. (Table 3).

Factors associated with acute malnutrition

In bivariate analysis, the nutritional status as measured by wasting was significantly associated with paternal education, maternal education, paternal occupation, place of residence, HH monthly income, family size, presence of diarrhea in the last two weeks, febrile illness, ANC attendance, place of delivery, time the child initiated breast feeding, duration the child exclusively

breast fed, round trip distance to fetch water, what type of roof of house was made from was associated at ($P < 0.001$, 95 % CI) and presence of latrine ($P < 0.05$, 95 % CI).

The variables that showed an association with the outcome variable at the bivariate analysis with p value < 0.05 were entered into the final multivariable logistic regression to control for potential confounders and the variables in Table 4 are those variables that showed association at $P < 0.05$ on multivariable logistic regression analysis.

Multivariable logistic regression analyses showed that the odds of acute malnutrition was significantly higher among children who had diarrhea in the previous two weeks [(AOR = 3.94, 95 % CI: (2.01–7.73)], ($P = 0.000$), mothers habit of less frequent hand washing [(AOR = 14.39, 95 % CI: (7.33–28.22)], ($P = 0.000$), did not exclusively breastfed [(AOR = 2.63 95 % CI: (1.39–5.0)], ($P = 0.003$), having large family sizes [(AOR = 2.59, 95 % CI: (1.34–5.0)], ($P = 0.005$), absence of latrine [(AOR = 2.99, 95 % CI: (1.23–7.06)], ($P = 0.015$), illiterate mothers [(AOR = 2.16, 95 % CI: (1.14–4.11)], ($P = 0.018$) and febrile illness in the previous two weeks [(AOR = 1.89, 95 % CI: (1.0–3.59)], ($P = 0.04$) were associated with acute malnutrition at ($P < 0.05$) (Table 4).

Discussion

In the present study, statistically significant association was found between acute malnutrition(wasting) and diarrheal disease in the previous two weeks, hand washing and exclusive breast feeding practices, larger family sizes, absence of latrine, maternal illiteracy and febrile illness in the previous two weeks after multiple logistic regression ($P < 0.05$).

The present study found a significant association between acute malnutrition and diarrheal disease with OR 3.94 indicating fourfold risk of acute malnutrition among children who had diarrhea as compared to those without it. This finding was in agreement with the study conducted in North Gondar and Machakal woreda Northwest Ethiopia [18, 23]. This could be due to decrease in appetite and absorption of nutrients from intestine which can lead to weight loss during diarrhea. It could also be due to a reciprocal relationship with diarrhea leading to malnutrition and malnutrition predispose to diarrhea.

The study also found that the odds of acute malnutrition were fourteen fold higher among children whose mothers had practices of hand washing only at the time of after visiting latrine or before serving/preparing food or after cleaning child feces or not wash their hands at all as compared to those whose mothers had practices of hand washing at each activity. This was also in agreement with the study findings of Machakal woreda of

Table 1 Socio-demographic characteristics of the study participants by nutritional status in Public Hospitals, Oromia region, West Ethiopia from December 2014- March 2015

Characteristics	Nutritional status		COR(95 % CI)	P-value
	Cases(%)	Controls(%)		
Gender of the child				
Male	52(46.02)	93(41.15)	0.82(0.52–1.29)	0.39
Female	61(53.98)	133(58.85)	1.00	
Sex of head of household				
Female	9(7.96)	6(2.65)	3.17(1.10–9.15)	0.033
Male	104(92.04)	220(97.35)	1.00	
Age of the child in month				
6–12	32(28.31)	60(26.55)	1.07(0.43–2.64)	0.89
13–24	40(35.40)	86(38.05)	0.93(0.38–2.25)	0.87
25–36	16(14.16)	30(13.27)	1.07(0.39–2.29)	0.90
37–48	16(14.16)	32(14.16)	1.00(0.37–2.72)	0.99
49–60	9(7.96)	18(7.96)	1.00	
Age of mother in years				
≤ 34	95(84.07)	191(84.51)	0.98(0.52–1.80)	0.92
≥ 35	18(15.93)	35(15.49)	1.00	
Family size				
≥ 5	77(68.14)	106(46.90)	2.42(1.51–3.89)	0.0001
< 5	36(31.86)	120(53.10)	1.00	
Household's monthly income				
< 50 USD	75(66.37)	66(29.20)	4.79(2.95–7.77)	0.0001
> 50 USD	38(33.33)	160(70.80)	1.00	
Paternal occupation				
Farmer	82(72.57)	114(50.44)	2.60(1.59–4.24)	0.0001
Others	31(27.43)	112(49.56)	1.00	
Maternal education				
Illiterate	56(49.56)	37(16.37)	5.02(3.01–8.36)	0.0001
Literate	57(50.44)	189(83.63)	1.00	
Paternal education				
Illiterate	31(24.43)	22(9.73)	3.51(1.92–6.41)	0.0001
Literate	82(72.57)	204(90.27)	1.00	
Place of residence				
Rural	88(77.88)	126(55.75)	2.79(1.67–4.68)	0.0001
Urban	25(22.12)	100(44.25)	1.00	
Ethnicity				
Oromo	111(98.23)	212(93.80)	3.67(0.82–16.41)	0.090
Amhara	2(1.77)	14(6.19)	1.00	
Religion				
Ethiopian orthodox	28(24.78)	93(41.15)	0.54(0.32–0.92)	0.002
Muslim	24(21.24)	23(10.18)	1.88(0.98–3.61)	0.057
Protestant	61(53.98)	110(48.67)	1.00	

Case = under five children with MUAC < 12.5 cm and/or bilateral pitting edema

Control = under five children with MUAC ≥ 12.5 cm, without bilateral pitting edema

Ethiopian currency: 1USD = 20.5 ETB

Table 2 Maternal and child characteristics, and caring practices of the study participants by nutritional status in Public Hospitals, Oromia region, West Ethiopia from December 2014 - March 2015

Characteristics	Nutritional status		COR(95 % CI)	P-value
	Cases(%)	Controls(%)		
Place of delivery				
Home	67(60.18)	44(19.47)	6.03(3.66–9.93)	0.0001
Health Institution	46(40.7)	182(80.53)	1.00	
Immunization status				
Never been immunized	20(17.70)	7(3.10)	6.73(2.75–16.45)	0.0001
Immunized	93(82.30)	219(96.90)	1.00	
Presence of diarrhea in the last two weeks				
Yes	44(38.93)	57(25.22)	1.89(1.17–3.06)	0.01
No	69(61.06)	169(74.78)	1.00	
Illness with fever				
Yes	32(23.32)	118(52.21)	0.36(0.22–0.59)	0.0001
No	81(71.68)	108(47.79)	1.00	
ANC attendance				
Not attended	47(41.59)	27(11.95)	5.25(3.03–9.09)	0.0001
Attended	66(58.4)	199(88.05)	1.00	
Time the child initiated BF after birth				
> One hour	58(51.33)	80(35.40)	1.93(1.22–3.05)	0.005
≤ one hour	55(48.67)	146(64.60)	1.00	
Duration the child exclusively breast fed				
Less or greater than 6 months	77(68.14)	89(39.38)	3.29(2.04–5.31)	0.0001
= 6 months	36(31.86)	137(60.62)	1.00	
Mother knowledge concerning BF				
Less or greater than 6 months/don't know	54(47.79)	37(16.37)	4.68(2.81–7.79)	0.0001
= 6 months	59(52.21)	189(83.63)	1.00	
Did the child been given d/t food categories during the last 24 h before hospital visit				
No	64(56.63)	37(16.37)	6.67(4.0–11.14)	0.0001
Yes	49(43.36)	189(83.63)	1.00	
Plan to give birth of the child				
No	58(51.33)	17(7.52)	12.97(6.98–24.02)	0.0001
Yes	55(48.67)	209(92.48)	1.00	

Case = under five children with MUAC < 12.5 cm and/or bilateral pitting edema

Control = under five children with MUAC ≥ 12.5 cm, without bilateral pitting edema

Northwest Ethiopia [18]. This probably due to hand washing prevents from several infections.

Non-exclusively breastfed children were about 2.5 times more likely to be acutely malnourished than their exclusively breastfed counter parts. This finding was in agreement with the study conducted in some parts of Ethiopia, China and Pakistan [23–27]. This probably due to introduction of other diets before the age of six months leads to increase chances of infection like diarrheal illness and pneumonia leading to malnutrition in

these children. However in a case control study in Malaysia there was no significant association between duration of exclusive breast feeding and nutritional status [28].

Another important factor, which was anticipated to influence child nutritional status, was presence of latrine as children from households with no latrine were three times more likely to be acutely malnourished as compared to their counterparts from households who had latrine. The possible explanation is that the use of latrines

Table 3 Environmental health conditions of study participants by nutritional status in Public Hospitals, Oromia region, West Ethiopia from December 2014 - March 2015

Characteristics	Nutritional status		COR(95 % CI)	P-value
	Cases(%)	Controls(%)		
Round trip distance to fetch water				
> 30 min	46(40.70)	30(13.27)	4.49(2.62–7.68)	0.0001
< 30 min	67(59.29)	196(86.73)	1.00	
Type of roof of house made from				
Tukul/thatched	50(44.25)	49(21.68)	2.87(1.76–4.67)	0.0001
Corrugated iron sheet	63(55.75)	177(78.32)	1.00	
Presence of latrine				
No	25(22.12)	27(11.95)	2.09(1.15–3.81)	0.016
Yes	88(77.88)	199(88.05)	1.00	
Hand washing practices of mothers				
Wash less frequently/not wash	74(65.49)	27(11.95)	13.99(8.0–24.45)	0.0001
Wash frequently	39(34.51)	199(88.05)	1.00	

Case = under five children with MUAC < 12.5 cm and/or bilateral pitting edema

Control = under five children with MUAC ≥ 12.5 cm, without bilateral pitting edema

may confirm the numerous health benefits associated with hygiene. This finding was also consistent with study conducted in East Amhara, Eastern Hararghe zone of Ethiopia and Iran [15, 25, 29].

Result of the present study also indicated statistically significant differences between children in the cases and the control groups regarding their family size; as very large family size was significantly higher among the cases in comparison to the controls, with similar results shown in studies conducted in North Gondar Ethiopia, Egypt, Pakistan and Malaysia [23, 26, 28, 30–32]. This may be due to the higher the family size the lower care given to the children hence transmission of diarrhea and other infections which can lead to malnutrition.

The study also indicated that children from illiterate mothers were about two times more likely to be acutely malnourished as compared to their counterparts from literate mothers. This finding was in agreement with studies conducted in North Gondar, Ethiopia [23] and Machakal woreda Northwest Ethiopia and Bangladesh [17, 18, 33]. This could be due to the higher education level of the mothers, the better perception and estimation of malnutrition in their children. In contrast to this finding the study conducted in other part of the country and Uganda didn't show significant association among maternal education and child acute malnutrition [13, 24, 34].

The odds of acute malnutrition were also higher among children with febrile illness with OR 1.89 indicating about two times more risk of acute malnutrition for children who had febrile illness as compared to those without it. This finding was consistent with

the study conducted in some parts of the country and case control study in Chad [35, 36]. This probably due to repeated infection causes decreased food intake and increased losses of fluid which impair childhood nutritional status.

The strength of this survey was that we were capable of evaluating the association of wasting to other exposure variables since it was case control study. The limitation of the study was that the study relied on participants' self-reported data, which was prone to recall bias and social desirability bias and interviewer bias due to the retrospective tracking of information beyond the advantages of case control study. The other limitation was that since it was a case-control study, it cannot establish the correct temporal relationship between exposure and disease. Maintaining inter-observer reliability of anthropometric measurements was also another limitation even though we tried to limit it as much as possible. The other limitation was technical error of anthropometric measurement, which could result in misclassification of children's nutritional status. However, due attention was given to the study procedures, including the process of training the research team, standardization of anthropometric measurements, and a close supervision throughout the field activities to minimize the expected biases.

Conclusions

From the present study it can be concluded that several risk factors were found to be associated with acute malnutrition (wasting). The factors with which wasting was

Table 4 Both bivariate and multivariate results of determinants factors of acute malnutrition among children aged 6–59 months by nutritional status in Public Hospitals, Oromia region, West Ethiopia from December 2014- March 2015

Variables	Nutritional status		COR(95%CI)	AOR(95%CI)
	Cases (%)	Controls (%)		
Presence of diarrhea in the last two weeks				
Yes	44(38.93)	57(25.22)	1.89(1.17–3.06)**	3.94(2.01–7.73)***
No	69(61.06)	169(74.78)	1.00	1.00
Hand washing habit of mothers				
Wash less frequently	74(65.49)	27(11.95)	13.99(8.0–24.45)***	14.39(7.33–28.22)***
Wash frequently	39(34.51)	199(88.05)	1.00	1.00
Duration the child exclusively breast fed				
Less or greater than 6 months	77(68.14)	89(39.38)	3.29(2.04–5.31)***	2.63(1.39–5.01)**
= 6 months	36(31.86)	137(60.62)	1.00	1.00
Family size				
≥ 5	77(68.14)	106(46.90)	2.42(1.51–3.89)***	2.59(1.34–5.00)**
< 5	36(31.86)	120(53.10)	1.00	1.00
Presence of latrine				
No	25(22.12)	27(11.95)	2.09(1.15–3.81)*	2.99(1.23–7.06)*
Yes	88(77.88)	199(88.05)	1.00	1.00
Maternal Education				
Illiterate	56(49.56)	37(16.37)	5.02(3.01–8.36)***	2.16(1.14–4.11)*
Literate	57(50.44)	189(83.63)	1.00	1.00
Illness with fever				
Yes	32(23.32)	118(52.21)	0.36(0.22–0.59)***	1.89(1.0–3.59)*
No	81(71.68)	108(47.79)	1.00	1.00

Statistically significant at * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, CI confidence interval, COR crude odds ratio, AOR adjusted odds ratio. Case = under five children with MUAC < 12.5 cm and/or bilateral pitting edema
Control = under five children with MUAC ≥ 12.5 cm, without bilateral pitting edema

significantly associated were diarrhea in the previous two weeks, mothers' hand washing and non-exclusive breastfeeding practices, larger family size, absence of latrine, illiterate mothers, and febrile illness in the previous two weeks. Based on these findings we recommend that Regional health bureau should strengthen intervention like prevention of diarrheal disease which may include activities such as the community-targeted promotion of hygiene, hand-washing (mothers/care givers need to wash their hands before preparing food, before feeding baby and after visiting of toilet or disposing of child feces), construction and use of latrines and the promotion of exclusive breastfeeding practices. District health offices should give serious attention for households to manage their family size which may include creating sufficient awareness on family planning, its methods and accessibility of its methods to effect family planning in the rural households through health extension workers. District health offices should also strengthen the capacity of health

extension workers to communicate appropriate and targeted messages to promote optimal caring practices to prevent and treat malnutrition among children. District health offices should also design intervention which increases mother's awareness related to risk factors of acute malnutrition and how to manage the different infections among their children to make nutritional interventions more effective. The national nutritional program should also monitor the growth of the under-five children in terms of wasting so that community based nutrition program should be strengthened and implemented at all community levels to tackle the problem of acute malnutrition and its consequences. Zonal health offices should strengthen and expand therapeutic nutrition program. Government intervened investments into improvements of environmental health should also be considered as soon as possible.

Therefore, an organized effort should be made at all levels to improve maternal and child health services, hand washing and breastfeeding practices, construction

of latrines and education of mothers to restrain the problems of child acute malnutrition.

Abbreviations

AIDS: Acquired Immune Deficiency Syndrome; ANC: Ante Natal Care; AOR: Adjusted Odds Ratio; ARI: Acute Respiratory Infection; CI: Confidence Interval; COR: Crude Odds Ratio; EDHS: Ethiopian Demographic and Health Survey; EMDHS: Ethiopian Mini Demographic and Health Survey; ETB: Ethiopian Birr; HIV: Human Immune Deficiency Virus; MAM: Moderate Acute Malnutrition; MCH: Mother and Child Health; MUAC: Mid Upper Arm Circumference; OR: Odds Ratio; PNC: Post Natal Care; SAM: Severe Acute Malnutrition; SD: Standard Deviation; SSA: Sub Saharan Africa; UNICEF: United Nations Children's Fund; WHO: World Health Organization.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

The authors' responsibilities were as follows: AB participated in the design of the study, performed the data collection and the statistical analysis and served as the lead author of the manuscript. TW & AS designed and supervised the study, and ensured quality of the data and made a substantial contribution to the local implementation of the study assisted in the analysis and interpretation of the data. TW highly participated in revising this final manuscript. All authors read and approved the final manuscript.

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Acknowledgments

The authors would like to express their sincere gratitude to Wollega University for their support for the accomplishment of this study. The authors are also thankful for officials of East Wollega Zonal and Woreda Administrative Health offices for delivering necessary information for this study. We would also like to thank supervisors and data collectors for taking their precious time to collect the data. We are glad to thank the mothers of children who participated in this study and took their time to provide information.

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Received: 5 August 2015 Accepted: 13 November 2015

Published online: 19 November 2015

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