

Determinants of Child Malnutrition among Agro Pastorals in Northeastern Ethiopia: A Cross-Sectional Study

Misgan Legesse Liben^{1*}, Taye Abuhay², Yohannes Haile²

¹Samara University, College of Medical and Health sciences, Department of Public Health, Ethiopia

²Samara University, College of Natural and Computational science, Department of Statistics, Ethiopia

*Correspondence: Misgan Legesse Liben, Samara University, College of Medical and Health sciences, Department of Public Health, Ethiopia, Tel: 251 913340321; E-mail: Imisgan@yahoo.com

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Abstract

Introduction: Under nutrition continues to be a major public health problem in developing countries, including Ethiopia. Globally it is associated with more than half of all child mortality. This study aimed to investigate the magnitude of under nutrition and associated factors among children aged 6–59 months in the Afambo district of Northeast Ethiopia.

Methods: A community-based cross sectional study was employed in Afambo district on 401 mother-child pairs. Anthropometric measurements were collected from children aged 6–59 months. Binary and multivariable logistic regression analyses were used to identify the factors associated with child under nutrition. Variables with a p-value < 0.05 were identified as statistically significant factors.

Results: In the Afambo district, 32.2%, 23.5% and 13.8% of the study children were stunted, underweight and wasted, respectively. The multivariable logistic regression model showed that being male (AOR: 1.88; 95% CI (1.01, 3.49)), not attending antenatal care visit [AOR: 3.87; 95% CI (1.87, 7.99)], severe [AOR: 6.49; 95% CI (1.62, 26.01)] and moderate household hunger scale [AOR: 2.88; 95% CI (1.27, 6.51)] were positive predictors of stunting. Colostrum avoidance [AOR: 2.34; 95% CI (1.19, 4.61)], household hunger scale [severe hunger (AOR: 3.68; 95% CI (1.13, 12.00)), moderate hunger AOR: (AOR: 3.47; 95% CI (1.65, 7.29))] and not attending ANC [AOR = 9.14 (95% CI: 4.35-19.23)] were associated with increased odds of underweight. Finally, not attending ANC [AOR: 2.87; 95% CI (1.18, 6.96)], diarrhea in the last two weeks preceding the survey [AOR: 3.48; 95% CI (1.66, 7.30)], mother-headed households [AOR: 0.37; 95% CI (0.15, 0.92)] and bottle feeding [AOR: 2.95; 95% CI (1.46, 5.97)] were predictors of wasting.

Conclusion: The prevalence of under nutrition in Afambo district is high based on WHO classification. Hence, adequate attention should be given to raise the awareness of the community regarding the value of colostrum feeding and the hazards of bottle feeding. It is also important to share and act on information about

advantages of antenatal care visit and diarrhea management in the study area.

Keywords: Stunting; Underweight; Wasting; Afambo; Afar; Northeastern Ethiopia

Introduction

Malnutrition results from an unbalanced diet that does not contain all the necessary nutrients and/or inadequate or excessive consumption of nutrients. It can also result from diseases that interfere with the body's ability to use the nutrients consumed. Malnourished children have lowered resistance to infection. Therefore, they are more likely to die from common childhood illnesses such as diarrhea and respiratory infections [1-3].

Nutritional status is primarily measured by child's growth in height and weight. However, to determine the extent of malnutrition, there are three indicators (stunting, wasting and underweight) expressed as standard deviation (SD) units from the median of the reference group. Children who fall below -2SD from the median of the reference population are regarded as moderately malnourished, while those who fall below -3SD from the median of the reference population are considered severely malnourished [4-6].

Stunting (height/length-for-age) represents the long-term effects of malnutrition in a population and is not sensitive to short-term changes in dietary intake. On the other hand, wasting (weight-for-height/length) represents the failure to receive adequate nutrition in a short period of time. However, underweight (weight-for-age) is a composite index of stunting and wasting: a child can be underweight for his/her age because he/she is stunted, wasted, or both. It is an overall indicator of the nutritional status of population [5,6].

Malnutrition is associated with more than half of all child mortality worldwide [7]. According to the 2008 lancet series, 20% of children younger than five years in low and middle income countries are underweight. Globally, 10% (55 million children) are wasted and of these 19 million are severely wasted. About 32% (178 million) of under-five children around the world are stunted. Of the estimated 178 million, 90% live in 36 countries, one of which is Ethiopia [8]. The recent Ethiopian demographic and health survey showed that 53% of

under-five mortality is attributed to malnutrition. Forty four percent of children younger than five years are stunted, 10% are wasted, and 29% are underweight [5]. In Dollo Ado district of Ethiopia wasting was 42.3%, underweight (47.7%) and stunting was 34.4% [6].

Furthermore, more than 44% of the pastoral communities are food insecure where the three malnutrition indices are highest in Afar Regional State [9]. A cross sectional study in Aysaita district of Ethiopia revealed that the prevalence of stunting, wasting and underweight were 67.8%, 12.8% and 46.1%, respectively [10]. Hence, the prevalence of malnutrition in Afar Regional State is above the national average.

Reducing child malnutrition is central in the achievement of the health sector transformation plan (HSTP). However, the prevalence of malnutrition in Afar Regional State is far from the government's HSTP target of stunting (26%), wasting (4.9%) and underweight(13%) among under-five children by the end of 2020 [11]. Moreover, interventions on child malnutrition need evidence on factors associated with child malnutrition in different parts of Ethiopia particularly in pastoralist communities. Despite this fact, there is limited literature on factors associated with malnutrition in Afar Regional state. Therefore, this study was conducted in Afambo district of Afar Regional state to assess under nutrition and associated factors among children aged six to fifty nine months. Hence, this study may help interventions to improve child nutritional status in the study area and Afar Regional State.

Methods and Materials

Study setting and design

A community based cross sectional study was conducted in Afambo district of Afar Regional state from January 21 to February 05/2015. Afambo district is one of the eight districts in Zone one. It is located at 677 kms from Addis Ababa and 67 kms from the city of Samara. There are seven kebeles (the smallest administrative units next to district in Ethiopia). There are two health centers and eleven health posts. Based on the 2007 census population projection, the district has a total population of 29,399, of which 2,639 are estimated to be children aged 6-59 months.

Sample size and sampling procedure

The sample size was calculated based on a single population proportion formula as follows:

$$n = \left[\frac{\left(\frac{z_{\alpha}}{2} \right)^2 p(1-p)}{d^2} \right]$$

Where n = required sample size, Z = critical value for normal distribution at 95% confidence level (1.96), d = 0.05 (5% margin of error) and an estimated non-response rate of 5% were considered. Then the largest sample size was taken after

calculating the sample size based on the three indicators of under nutrition prevalence of wasting (42.3%) in Dollo Ado district of Ethiopia [6], the prevalence of stunting and underweight in Aysaita district 67.8% and 46.1%, respectively [10]. A sample size of 401, calculated based on the prevalence of underweight, was found to be the largest and was taken as a sample size for this study.

First Afambo district was selected purposively since more agro-pastoralists are living in this district. Secondly, from the seven kebeles in the district, four were randomly selected by lottery. To give equal chance in the selection of the sampling unit, proportional allocation technique was employed across each selected kebeles. Then to select the sampling units (households having children aged 6-59 months), first the total number of households with children aged 6-59 months was divided by the sample size in each selected kebeles and then systematic random sampling technique was applied.

At the time of survey, from each household unit one eligible mother-child pair was selected. If there was more than one mother-child pair in one household unit, one mother with the youngest child was selected. From mothers who had more than one child aged 6-59 months, the youngest child was selected as the reference. If mothers had twin children aged 6-59 months, one child was selected by lottery method.

Data collection process and instrument

Data were collected using a pre-tested, interviewer administered structured questionnaire. The questionnaire was prepared first in English and translated in to Qafar'af (the local language), then back to English to check for consistency. The Qafar'af version of the questionnaire was used to collect the data. Eight high school graduates who can speak the local language were recruited as data collectors. Then the questionnaire was pretested on two kebeles which were not included in the research. The pretest was done to ensure clarity, wordings, logical sequence and skip patterns of the questions. Then the pretest amendments on the questionnaire were made accordingly.

Anthropometric measurements (weight and length/height) were done for all children included in the study. Length of the infants (6-23 months) was measured in a recumbent position using a board with a wooden base and movable headpiece. Height was measured in children older than two years of age in standing position to the nearest 0.1 cm. Weight was measured in kilogram to the nearest 0.1 kg using digital weight scale which was checked against a standard weight for its accuracy in daily basis. Calibration of instrument against zero reading was made following weighting of every child. Children were weighted with light clothing and without shoes. All anthropometric measurements were taken by high school graduates with assistant.

Study variables

The dependent variables were wasting, stunting and underweight. Children below minus two standard deviation (-2SD) from the median of the WHO reference population for

weight-for-age, length/height-for-age and weight-for-length/height were considered as underweight, stunted and wasted, respectively. All the three dependent variables were categorized into two, those children who were exposed to the event (stunted, wasted or underweight) coded as "1" and those who were not exposed to the event (not stunted, not wasted or not underweight) coded as "0" for regression analysis.

The independent variables were maternal characteristics (age, occupation, educational status, marital status, ethnicity, religion), household characteristics (family size, income, household head, household hanger scale), paternal education status, maternal health service and obstetric related variables (antenatal care (ANC), place of delivery, postnatal care (PNC), mode of delivery, child feeding counseling at ANC and PNC checkups), child characteristics (sex and age), child feeding practices (breastfeeding, bottle feeding in the 24 hours preceding the survey, dietary diversity, complementary feeding, prelacteal feeding) and diarrhea in the two weeks preceding the survey.

Data processing and analysis

Data were checked for completeness and inconsistencies. It was also cleaned, coded and entered into Epi Data version 3.02. WHO Anthro version 3.2.2 was used to convert height and weight measures into z-scores and to estimate the prevalence of under nutrition by using the WHO reference population. Then, SPSS version 20 was used to analyze the data. Descriptive statistics was calculated for continuous variables while frequency distribution was used to express the distribution of categorical variables and to show the prevalence of stunting, underweight and wasting.

Binary logistic regression analysis was performed. The crude odds ratio (COR) with 95% confidence interval was estimated to assess the association between each independent variables and the outcome variable. Variables with p-value < 0.25 in the binary logistic regression analysis were considered in the multivariable logistic regression analysis. The Hosmer-Lemeshow goodness-of-fit with enter procedure was used to test for model fitness. Adjusted odds ratio (AOR) with 95% confidence interval was estimated to assess the strength of the association. Variables with p-value < 0.05 in the multivariable logistic regression analysis were considered as significant and independent predictors of stunting, underweight and wasting.

Ethical consideration

The study was approved by the Ethical Review Committee (ERC) of Samara University. An official letter was written from Samara University to Afambo district administration office. Then permission and support letter were written to each selected kebeles. The participants enrolled in the study were informed about the study objectives, expected outcomes, benefits and the risks associated with it. A written consent was taken from the participants before the interview.

Confidentiality of responses was maintained throughout the study.

Results

Socio demographic characteristics of the study participants

A total of 370 mother-child pairs were included in the study, resulting in a response rate of 92.3%. About 84% and 85% of the mothers were Afar in ethnicity and religiously Muslim, respectively. About 35% of the mothers were household heads, and 68.4% of mothers and 79.7% of fathers did not attend formal education (**Table 1**)

Table 1 Socio-demographic characteristics of mother-child pairs in Afambo district, Northeast Ethiopia, 2015.

Variable	Frequency	Percent (%)
Age of mother (in year) (n=370)		
<20	19	5.1
20-34	265	71.6
>34	86	23.3
Mean (± SD) age of mothers	29.16(+6.20) years	
Ethnicity (n=370)		
Afar	312	84.3
Amhara	55	14.9
Tigray	3	0.8
Maternal religion (n=370)		
Muslim	314	84.9
Orthodox	56	15.1
Maternal occupation (n=370)		
Housewife	224	60.5
Agro-pastoralist	115	31.1
Government employee	20	5.4
Trader	11	3
Maternal education status (n=370)		
No formal education	253	68.4
Formal education	117	31.6
Maternal marital status (n=370)		
Currently unmarried*	21	5.7
Married	349	94.3
Husband educational status (n=349)		
No formal education	278	79.7
Formal education	71	20.3
Household head (n=370)		
Mothers of index children	133	35.9

Fathers of index children	237	64.1
Sex of the index child (n=370)		
Male	178	48.1
Female	192	51.9
Age of the index child (in month) (n=370)		
6-17	146	39.5
18-29	126	34
30-41	68	18.4
42-53	23	6.2
≥54	7	1.9
Mean (±SD) age of children	22.42(+12.69) months	
Family size (n=370)		
2	13	3.5
3-4	110	29.7
≥5	247	66.8
Average monthly income (ETB)		
<1000	135	36.5
>1000	235	63.5
*single, widowed, divorced. ETB= Ethiopian birr. SD= standard deviation.		

Maternal and child health service utilization

One hundred ninety five mothers (52.7%) had attended antenatal care (ANC). Of those who had attended ANC, about 30% had attended four and more ANC visits. Majority of mothers had delivered the index child at home (**Table 2**).

Table 2 Distribution of mothers based on maternal health service utilization in Afambo district, Northeast Ethiopia, 2015.

Maternal health services	Frequency	Percent (%)
Antenatal care (ANC) visit (n=370) *		
Yes	195	52.7
No	175	47.3
Number of ANC visit (n= 195)		
1	10	5.1
2-3	126	64.6
≥4	59	30.3
Child feeding counseling at ANC visit (n=195)		
Yes	160	82.1
No	35	17.9
Delivery place (n=370)		
Home	242	65.4

Health institution	128	34.6
Mode of delivery (n=370)		
Vaginal delivery	354	95.7
Caesarean section delivery	16	4.3
Postnatal care (PNC) visit (n=370) *		
Yes	168	45.4
No	202	54.6
Child feeding counseling at PNC visit (n=370)		
Yes	129	76.8
No	39	23.2
*at least one visit		

Child feeding practices

Nearly 91% of mothers had ever breastfed their index child. Of those who had ever breastfed, 40.4% mothers initiated breastfeeding within one hour of birth. Colostrum avoidance and prelacteal feeding were practiced by 34.9% and 49.6% of mothers, respectively (**Table 3**).

Table 3 Child feeding practices and household hunger scale in Afambo district, Northeast Ethiopia, 2015.

Variables	Frequency (n)	Percent (%)
Ever breastfeeding (n=370)		
Yes	337	91.1
No	33	8.9
Early breastfeeding practice (n=337)		
Yes	201	40.4
No	136	59.6
Prelacteal feeding (n=337)		
Yes	167	49.6
No	170	50.4
Colostrum feeding (n=370)		
Yes	241	65.1
No	129	34.9
Complementary feeding initiation at six months of age (n=370)		
Yes		
No	69	18.6
	301	81.4
MDDS in the previous 24 hour (n=370)*		
Yes	114	30.8
No	256	69.2

Bottle feeding in the previous 24 hours (n=370)		
Yes	98	26.5
No	272	73.5
Household hunger scale (n=370)		
Little to no hunger	226	61.1
Moderate hunger	120	32.4
Severe hunger	24	6.5
Diarrhea in the last two weeks (n=370)		
Yes	80	21.6
No	290	78.4
*MDDS=Minimum dietary diversity score.		

Nutritional status of children

As shown in Figures 1, 2 and 3, Z-score curves are displaced to the left of WHO growth reference curve demonstrating that under nutrition is prevalent in children aged 6 to 59 months in Afambo district.

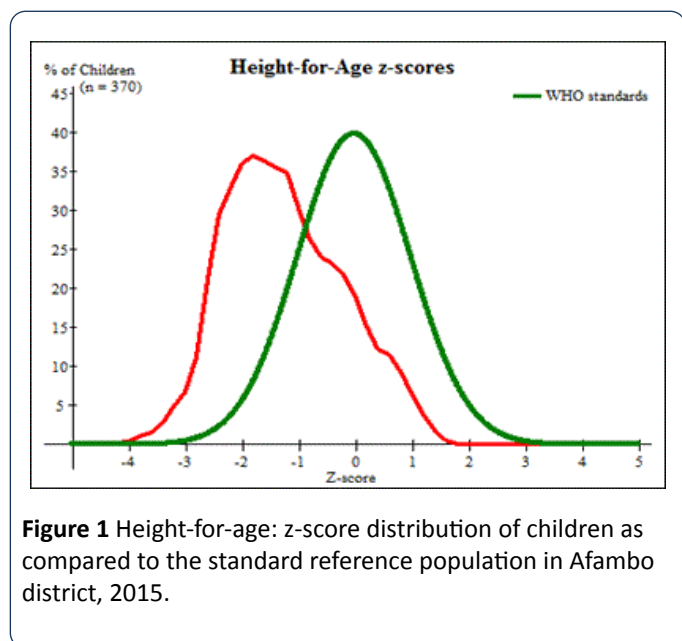


Figure 1 Height-for-age: z-score distribution of children as compared to the standard reference population in Afambo district, 2015.

Stunting (HAZ) and associated factors

The mean (\pm SD) of HAZ of the study children was $-1.24(\pm 1.02)$ (Figure 1). The prevalence of stunting for male and female children was 34.8% and 29.7%, respectively. The overall prevalence of stunting among the study children was 32.2% (95% CI: 27.4-36.9%) (Table 4).

Table 4 Distribution of under nutrition among children aged six to fifty nine months in Afambo district, Northeast Ethiopia, 2015.

Nutritional status (n=370)	Frequency	Percent
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Stunting	Normal (HAZ $\geq -2SD$)	251	67.8
	Moderate stunting (HAZ $\geq -3SD$ & $< -2SD$)	112	30.3
	Severe stunting (HAZ $< -3SD$)	7	1.9
Underweight	Normal (WAZ $\geq -2SD$)	283	76.5
	Moderate underweight (WAZ $\geq -3SD$ & $< -2SD$)	83	22.4
	Severe underweight (WAZ $< -3SD$)	4	1.1
Wasting	Normal (WHZ $\geq -2SD$)	319	86.2
	Moderate wasting (WHZ $\geq -3SD$ & $< -2SD$)	46	12.4
	Severe wasting (WHZ $< -3SD$)	5	1.4

The binary logistic regression analysis showed that sex of the index child, antenatal care visit, household hunger scale and colostrum avoidance were statistically associated with stunting. In the multivariable logistic regression analysis being male [AOR: 1.88; 95% CI (1.01, 3.49)], not attending antenatal care visits [AOR: 3.87; 95% CI (1.87, 7.99)], severe [AOR: 6.49; 95% CI (1.62, 26.01)] and moderate household hunger scale [AOR: 2.88; 95% CI (1.27, 6.51)] were independent predictors of increased odds of stunting among children aged 6 to 59 months (Table 5).

Table 5 Binary and multivariable logistic regression analysis showing factors associated with stunting in Afambo district, Northeast Ethiopia, 2015.

Variable	Stunting n (%)	COR (95% CI)	AOR (95% CI)
Household head			
Mothers of the index child	49 (36.8)	1.392 (0.89,2.18)	1.00 (0.47,2.12)
Fathers of the index child	70 (29.5)	1	1
Sex			
Male	62 (34.8)	1.27 (0.82,1.96)	1.88 (1.01,3.49)*
Female	57 (29.7)	1	1
ANC visit			
No	72 (41.1)	2.2 (1.41,3.44)*	3.87 (1.87,7.99)**
Yes	47 (24.1)	1	1
Minimum dietary diversity			
No	83 (32.4)	1.04 (0.65,1.67)	1.423 (0.69,2.89)
Yes	36 (31.6)	1	
Household hunger scale			
Little to no hunger	55 (24.3)	1	1
Moderate hunger	51 (42.5)	2.30 (1.43,3.69)*	2.88 (1.273,6.51)*

Severe hunger	13 (54.2)	3.67 (1.56,8.67)*	6.49 (1.62,26.01)*
Prelacteal feeding			
Yes	62 (37.1)	1.42 (0.89,2.24)	0.95 (0.50,1.78)
No	50 (29.4)	1	1
Colostrum feeding			
No	51 (39.5)	1.66 (1.06,2.61)*	1.10 (0.55,2.18)
Yes	68 (28.2)	1	1
Postnatal care visit			
No	70 (34.7)	1.29 (0.83,2.00)	1.26 (0.63,2.49)
Yes	49 (29.2)	1	1
Maternal Age			
<20	3(15.8)	1	1
20-34	90(34.0)	2.74 (0.78,0.97)	5.24 (0.95,28.90)
>34	26(30.2)	2.31 (0.62,8.62)	2.29 (0.39,13.16)
Monthly household income			
≤1000	55 (40.7)	1.84 (1.17,2.87)	1.35 (0.64,2.85)
>1000	64 (27.2)	1	1

Hosmer and Lemeshow Test=0.739. COR= Crude odds ratio. AOR= Adjusted odds ratio. CI= confidence interval. *significant at p<0.05. **significant at p<0.001.

male and female children was 22.5% and 24.5%, respectively. The overall prevalence of underweight among the study children was 23.5% (95% CI:19.2-27.8%) (Table 4).

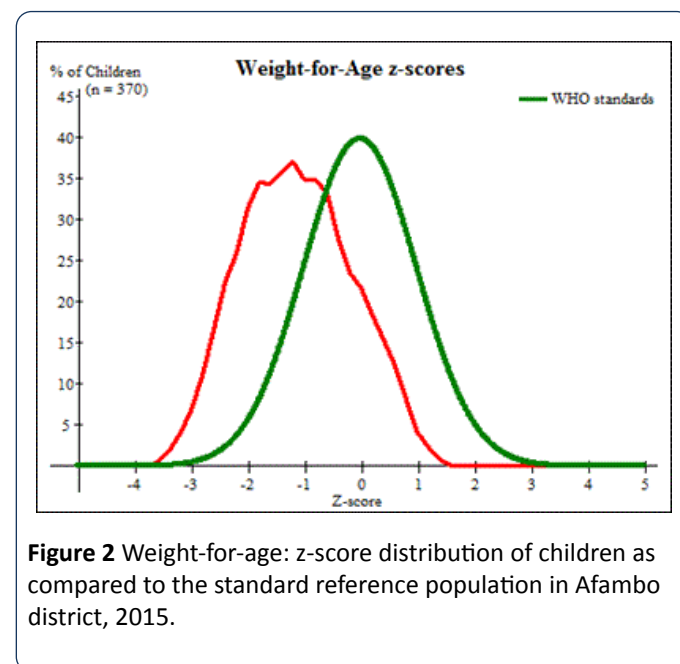


Figure 2 Weight-for-age: z-score distribution of children as compared to the standard reference population in Afambo district, 2015.

Binary logistic regression analysis showed that antenatal care visit, household hunger scale, prelacteal feeding, colostrum avoidance and postnatal care visit were significantly associated (at p<0.05) with underweight. As shown in Table 6 in the multivariable model the factors associated with increased odds of underweight were colostrum avoidance [AOR: 2.34; 95% CI(1.19,4.61)], household hunger scale [severe hunger (AOR:3.68; 95% CI (1.13,12.00)), moderate hunger AOR: (AOR: 3.47; 95% CI (1.65,7.29))] and not attending antenatal care visit [AOR = 9.14 (95% CI: 4.35-19.23)] (Table 6).

Underweight (WAZ) and associated factors

The mean (±SD) of WAZ of the study children was -1.14(±0.95) (Figure 2). The prevalence of underweight for

Table 6 Binary and multivariable logistic regression analysis showing factors associated with underweight in Afambo district, Northeast Ethiopia, 2015.

Variable	Underweight n (%)	COR (95% CI)	AOR (95% CI)
ANC visit			
No	66 (37.7)	5.02 (2.91,8.66)**	9.14 (4.35,19.23)**
Yes	21 (10.8)	1	1
Household hunger scale			
Little to no hunger	34 (15.0)	1	1
Moderate hunger	41 (34.2)	2.93 (1.73,4.95)**	3.47 (1.65,7.29)*
Severe hunger	12 (50.0)	5.65 (2.34,13.61)**	3.68 (1.13,12.00)*
Prelacteal feeding			
Yes	50 (29.9)	1.92 (1.15,3.19)*	1.15 (0.63,2.11)
No	31 (18.2)	1	1

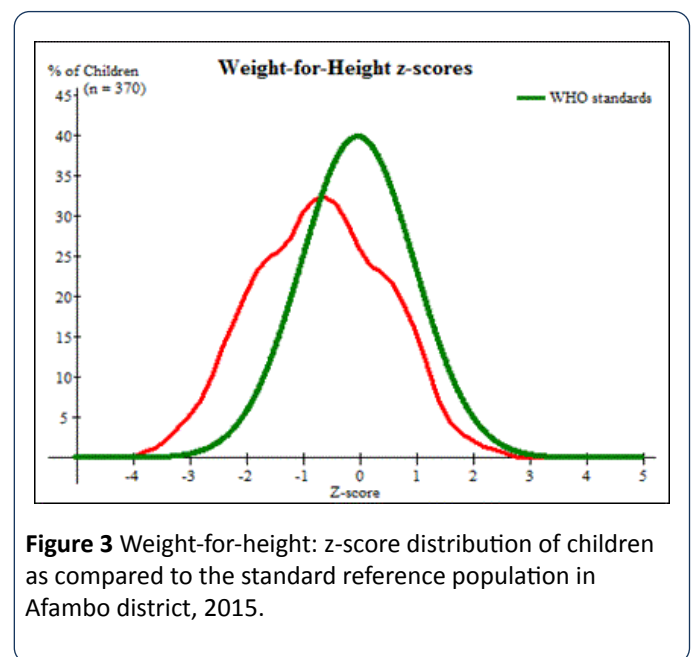
Colostrum feeding			
No	44 (34.1)	2.38 (1.46,3.89)*	2.34 (1.19,4.61)*
Yes	43 (17.8)	1	1
Postnatal care visit			
No	57 (28.2)	1.81 (1.09,2.98)*	0.78 (0.37,1.66)
Yes	30 (17.9)	1	1
Maternal educational status			
Non formal education	85 (24.6)	3.76 (0.87,16.28)	2.54 (0.52,12.49)
Formal education	2 (8.0)	1	1
Complementary feeding initiation at six months of age			
Yes	11 (15.9)	1	1
No	76 (25.2)	1.78 (0.89,3.57)	1.40 (0.60,3.26)

Hosmer and Lemeshow Test=0.331. COR= Crude odds ratio. AOR= Adjusted odds ratio. CI= confidence interval. *significant at p<0.05. **significant at p<0.001.

Wasting (WHZ) and associated factors

The mean (\pm SD) of WHZ of children aged 6 to 59 months was $-0.68(\pm 1.14)$ (**Figure 3**). The overall prevalence of wasting in the study area was 13.8% (95% CI:10.3-17.3%) of which 12.9% male and 14.6% female children were wasted, respectively (**Table 4**).

The binary logistic model showed that mother-headed households, not attending antenatal care visit, diarrhea in last two weeks preceding the survey, bottle feeding, colostrum avoidance, appropriate age (at 6 completed months) of complementary feeding initiation and postnatal care visit were significantly associated (at $p<0.05$) with wasting. In multivariable logistic model not attending antenatal care visit [AOR: 2.87; 95% CI (1.18, 6.96)], diarrhea in last two weeks preceding the survey [AOR: 3.48; 95% CI (1.66, 7.30)] and bottle feeding [AOR: 2.95; 95% CI (1.46, 5.97)] were associated with increased odds of wasting. The factor associated with decreased odds of wasting was mother-headed households [AOR: 0.37; 95% CI (0.15, 0.92)] (**Table 7**).



Discussion

The prevalence of stunting, underweight, and wasting in this study were 32.2%, 23.5% and 13.8%, respectively. The multivariable logistic regression model showed that sex of the index child, antenatal care visits and household hanger scale were independent predictors of stunting. In addition, colostrum avoidance, household hanger scale and antenatal care visit were significantly associated with underweight. Finally, antenatal care visits, diarrhea in last two weeks preceding the survey, bottle feeding and household headship were significantly associated with wasting.

The levels of underweight, stunting and wasting identified in this study were lower as compared with other studies in Ethiopia [5,6,10,12-14]. Stunting was higher compared with

the studies done in Gumbrit of Amhara region [15] and Kersa Demographic Surveillance and Health Research Centre [16]. This discrepancy might be due to socio-cultural, child feeding and life style variations across the communities. However,

according to the world health organization classification in assessing severity of malnutrition by prevalence ranges among children aged less than five years, the prevalence of under nutrition in Afambo district was high.

Table 7 Binary and multivariable logistic regression analysis showing factors associated with wasting in Afambo district, Northeast Ethiopia, 2015.

Variable	Wasting n (%)	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Household head			
Mothers of the index child	10(7.5)	0.39(0.19,0.80)*	0.37(0.15,0.92)*
Fathers of the index child	41(17.3)	1	1
Maternal occupation			
Housewife	37(56.5)	1.87(0.97,3.59)	1.57(0.73,3.39)
Other†	14(9.6)	1	
ANC visit			
No	37(21.1)	3.47(1.80,6.66)**	2.87(1.18,6.96)*
yes	14(7.2)	1	
Site of delivery			
Home	38(15.7)	1.65(0.84,3.22)	0.77(0.32,1.83)
Health institution	13(10.2)	1	
Household hunger scale			
Little to no hunger	26(11.5)	1	1
Moderate hunger	19(15.8)	1.45(0.76,2.74)	1.88(0.77,4.56)
Severe hunger	6(25.0)	2.56(0.93,7.04)	2.05(0.63,6.74)
Diarrhea in the last 2 weeks			
No	31(10.7)	1	1
Yes	20(25.0)	2.79(1.49,5.22)*	3.48(1.66, 7.30)*
Bottle feeding in the last 24 hour			
No	24(8.8)	1	1
Yes	27(27.6)	3.93(2.14,7.23)**	2.95(1.46, 5.97)*
Colostrum feeding			
No	27(20.9)	2.39(1.32,4.35)*	2.07(0.99,4.31)
Yes	24(10.0)	1	1
Complementary feeding initiation at six months of age			
Yes			
No	4(5.8)	1	1
	47(15.6)	3.00(1.05,8.65)*	2.82(0.82,9.67)
Postnatal care visit			
No	35(17.3)	1.99(1.06,3.72)*	0.917(0.37,2.29)
Yes	16(9.5)	1	
Maternal Age			
<20	5(26.3)	1	1

20-34	30(11.3)	0.36(0.12,1.06)	0.31(0.09,1.09)
>34	16(18.6)	0.64(0.20,2.04)	0.39 (0.09,1.62)
Hosmer and Lemeshow Test=0.375. COR= Crude odds ratio. AOR= Adjusted odds ratio. CI= confidence interval. *significant at p<0.05. **significant at p<0.001. †Government employee, trader, agro-pastoralist.			

Moderate and severe household hunger scales were associated with increased odds of stunting and underweight. The recent Ethiopian demographic and health survey showed that a higher proportion of children in the lowest household wealth quintile are stunted than children in the highest wealth quintile [5]. In Gumbrit of North West Ethiopia, children belonging to the low-income households were at a higher risk of being stunted and underweight than children of better income families [15]. Similar findings were also reported at India [17] and Kenya [18]. Moreover, it was found that children of households having poor socioeconomic status were more likely to be stunted and underweight compared with the children of households having rich socioeconomic status [19].

In Afambo district, not attending antenatal care visit was associated with increased odds of stunting, underweight and wasting among children aged 6-59 months. Similar result was reported at Medebay Zana District of Ethiopia [13] and Nigeria [20]. This could be lack of antenatal visit might create favorable environment for traditional child feeding malpractices that might affect child nutritional status. In addition, mothers who had attended antenatal visit might be advised by health professionals on proper child feeding practices.

This study revealed that boys were more likely to be stunted compared with girls. Similarly male children were more likely to be stunted compared with female children in Bule Hora district [21]. This result is similar to the results of previously conducted studies [5,13,22,23]. This sex related difference requires further study, but it is believed that boys are more influenced by environmental stress than girls [24,25].

Colostrum avoidance had significant association with increased odds of underweight among the study children. This might be probably colostrum provides protective effect to the newborns, and infants who did not receive colostrum might have high incidence, duration and severity of illnesses such as diarrhea and pneumonia which contribute to malnutrition. Similar finding was reported at west Gojjam [14] and Nigeria [26].

Diarrhea in the two weeks and bottle feeding during the 24 hours preceding the survey were predictors of wasting. A high prevalence of wasting was observed among children who had diarrhea in the two weeks before the survey and who fed on bottle in Afambo district. Similar findings were reported at Bule Hora district [21], Nigeria [26], Somali Region [27] and Durbete town [28]. This could be bottle fed children are more likely to get infections including diarrhea which then contributes to wasting. There is also a reciprocal relationship; malnourished children will have diarrhea.

Children of mother-headed households were less likely to be wasted in Afambo district. In rural Amhara communities, children from male-headed households were more likely to be wasted than children from female-headed households [29]. This could be explained in such a way that mothers who were household head might decide on proper child feeding practices compared to mothers who were not household head. Moreover, mothers might have more time to be with their children throughout the whole day. Therefore, they can prepare and serve foods in the safe way.

This study could have the following limitations. Firstly, it was difficult to establish a cause-effect relationship. Secondly, the findings could be affected by recall, interviewer and social desirability bias. It might also be liable to anthropometric measurement bias which could result in misclassification of children's nutritional status. However, due attention was given to the study procedures, including the process of training, standardization of anthropometric measurements, and close supervision throughout the field activities.

Conclusion

The prevalence of under nutrition among the study children is high based on WHO classification in assessing severity of malnutrition by prevalence ranges. In the multivariable analysis not attending antenatal care and increasing level of household hunger scale were independent positive predictors of stunting and underweight. Moreover, colostrum avoidance and sex of the index child (being male) were associated with increased level of underweight and stunting, respectively. Finally, not attending antenatal care visits, diarrhea in last two weeks preceding the survey, bottle feeding during the 24 hours preceding the survey and mother-headed households were predictors of wasting. Therefore, adequate attention should be given by the district health office to raise awareness of mothers regarding the value of colostrum feeding and the hazards of bottle feeding. It is also important to provide health education and information to the mothers on the advantages of antenatal care and diarrhea management in the study area.

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Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors conceived, designed the study and supervised the data collection. MLL performed the data analysis, interpretation of data and drafted the manuscript. All authors read and approved the final manuscript.

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