Prevalence of malnutrition and associated risk factors among under-five children in Amhara Region, Ethiopia: evidence from 2016 Ethiopian Demographic and Health Survey

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Abstract

Background Childhood malnutrition is the most widely prevalent among under-five children in Amhara Region, Ethiopia. This study intended to explore the major determinants of malnutrition and its association with anemia among under-five children in Amhara Region, Ethiopia.

Methods The data from the 2016 Ethiopian Demographic and Health Survey were used. A total of 977 under-five children were included in this analysis. A multivariable binary logistic regression analysis was used at a 5% level of significance to determine the individual- and community-level factors associated with childhood malnutrition.

Results The prevalence of stunting, wasting, and underweight were 46.3%, 9.8%, and 28.4%, respectively. About 23.1% of children were both stunting and underweight, 7.3% were both underweight and wasting, and only 4.5% of children had all the three conditions. Among the factors considered in this study, Age of child in months, size of child at birth, mother highest education level, sex of household head, sources of drinking water, and type of toilet facility were significantly associated with malnutrition in Amhara Region.

Conclusion Malnutrition among under-five children was one of the public health problems in the Amhara Region. The influence of these factors should be considered to develop strategies for reducing malnutrition in Amhara Region. Finally improving the living standards of the children is important to get better health care, to enhance the child's nutritional status, and reduce child mortality.

Background

Malnutrition remains a critical public health problem among children under the age of five years in developing countries including Ethiopia. Malnutrition is triggered by multiple interweaved factors and has both short and long term negative health effects [1]. It hinders the cognitive and physical development of children, rises the risk of infections and significantly contributes to the child's morbidity and mortality [2]. Stunting, underweight and wasting are three widely recognized indicators of a child's nutritional status. Whereas stunting and wasting direct chronic and acute malnutrition respectively, underweight is a composite pointer and includes both acute and chronic malnutrition. However, different forms of malnutrition can also occur concurrently in children [3]

In Amhara region, the prevalence of stunting has increased from 52% in 2005 to 56.6% in 2011; but the prevalence of wasting was decreased from 9.9% in 2005 to 14.2% in 2011; the prevalence of underweight has sharply increased from 33.4% in 2005 to 48.9% in 2011. The prevalence of stunting has declined from 58% in 2000 to 44% in 2011 in Ethiopia. The prevalence of wasting was changed from 12% in 2000 to 10% in 2011. The underweight prevalence has steadily decreased from 41% in 2000 to 29% in 2011 [4]. In Tanzania; a high prevalence of underweight (46.0%), stunting (41.9%) and wasting (24.7%) were observed in 2017. Besides, 33% of children were both stunting and underweight, 21% of children were

underweight and wasting, and 12% of children were stunting and wasting [5] In Ethiopia, more than one-third of child deaths are associated with malnutrition [6]

Various researchers have been carried out on malnutrition among under-five children in different parts of the country. These studies were mainly focused on the prevalence and risk factors of malnutrition and exploring the relationship between malnutrition and anemia among under-five children. Hence, this study aimed to explore the major risk factors of malnutrition and its association with anemia among under-five children in Amhara Region, Ethiopia using data from the 2016 EDHS.

Methods

Data sources

Cross-sectional data was used from Ethiopian Demographic and Health Survey (EDHS). The EDHS data were collected by the Ethiopian Central Statistical Agency (ECSA) from January 18, 2016 to June 27, 2016 [4].

Study design and sampling

For this study, the 2016 Ethiopia Demographic and Health Survey data was used. Stratified sampling technique to select under-five year children such as male (503) and female (474) was used. A total of 977 under-five children were considered for this study.

Study variables

The dependent variables for this study are the malnutrition status of under-5 year children (stunting, underweight and wasting). A child whose height for age Z-score is below minus two standard deviations (-2SD) from the median of the reference population is considered as stunting. If the weight for age Z-score is below minus two standard deviations (-2SD) from the median of the reference population then the child is underweight. Children whose weight for height Z-score is below minus two standard deviations (-2SD) from the median of the reference population are considered as wasting [7].

Independent variables were selected after steering a detailed literature review [7-12] and also available with complete information in the EDHS, 2016 data set were involved in the present analysis. The explanatory variables were included socio-demographic-maternal and child-level factors. Socio-demographic-maternal factors selected were types of residence, household wealth index, mother's educational level, mother's body mass index (BMI), religion, type of toilet facility, Sex of household head and Sources of drinking water. Child-level factors were sex of child, child age, type of birth, Number of living children and child size at birth,

Statistical data analysis

The data was extracted, edited, and analyzed by using SPSS version 23 for Windows. Bivariate logistic regression was performed and a variable with a P-value of less than 0.25 was transported into a multivariable binary logistic regression analysis to identify the determinant of malnutrition of under-five children. Finally, variables with P-values < 0.05 in the multivariable logistic regression model was taken as statistically significant.

Results

Samples of 977 under-five children were considered in this research. The prevalence of stunting, underweight, and wasting in Amhara region were 46.3%, 28.4%, and 9.8%, respectively. About 23.1% of children were both stunting and underweight, 7.3% were both underweight and wasting, and only 4.5% of children had all the three conditions.

Of that 23.3 % were large and only 2.9% were multiple birth types. About 74.9% of interviewed mothers had no education and only 2.1% of them attended higher education. About 42.6% of children were found between 0 to 24 months and more than half (51.3%) were males. Only 9.1% of the respondents were from urban areas and 30.2% were in the rich wealth index. Around 19.8% of children’s mothers were underweight.

Determinants of stunting

Among the factors considered in this study, Age of child in months, size of child at birth, mother highest education level, sex of household head and sources of drinking water were associated with stunting. The log odds of stunting was higher among children in the age group of 25-47 months (AOR = 1.57, 95%CI: 1.05-2.35) and 48-59 months (AOR = 1.06, 95%CI: 0.80-1.49) respectively as compared to the age group of 0– 24months. Compared to children large size at birth, the odds of stunting among children in the medium size at birth was 0.01 times lower. The odd of stunting among children in the small size at birth was 1.60 times higher compared to children large size at birth.

The risk of being stunting among children whose mothers attended primary education was 1.07 (AOR = 1.07, 95%CI: 0.76-1.50) times more compared to children whose mothers did not attend education. The risk of being stunting among children whose mothers attended secondary education was 0.70 times less compared to children whose mothers did not attend education. The risk of being stunting among children whose father household head was 0.49 times less compared to children whose mother household headed. Children from households that used unimproved drinking water was 1.47 (AOR = 1.47, 95%CI: 1.11-1.95) times more likely to be at risk of being stunting than children from households that used improved water.

Table 1 Bivariate and multivariable logistic regression of risk factors associated with stunting on childhood less than 5 years in Amhara Region, Ethiopia, EDHS 2016.

Variables		Stunting	COR (95% CI)	AOR (95% CI)
	Yes	No		
Age of child in months				
0-24	169 (43.7%)	218 (56.3%)	1	1
25-47	149 (45.8%)	176 (54.2%)	1.09 (0.81, 1.47)	1.57 (1.05, 2.35)*
48-59	102 (51.5%)	96 (48.5%)	1.37 (0.97, 1.93)	1.06 (0.80, 1.49)
Sex of child				
Male	218 (43.6%)	282 (56.4%)	1	1
Female	232 (48.9%)	242 (51.1%)	1.24 (0.96, 1.60)	1.27 (0.97, 1.67)
Place of residence				
Urban	39 (43.8%)	50 (56.2%)	1	1
Rural	411 (46.4%)	474 (53.6%)	1.11 (0.72, 1.72)	0.53 (.26, 1.06)
Religion				
Orthodox	380 (46.3%)	441 (53.7%)	1	1
Muslin	70 (46.1%)	82 (53.9%)	0.99 (0.70, 1.40)	1.07 (0.69, 1.66)
Type of birth				
Single birth	438 (46.3%)	508 (53.7%)	1	1
Multiple birth	12 (42.9%)	16 (57.1%)	0.87 (0.41, 1.86)	1.18 (0.41, 3.39)
Mothers` BMI				
Over weight	15 (41.7%)	21 (58.3%)	1	1
Normal weight	351 (47.6%)	387 (52.4%)	1.01 (0.49, 2.06)	0.95 (0.37, 2.43)
Under weight	81 (41.8%)	113 (58.2%)	1.40 (0.30, 6.51)	0.78 (0.10, 6.21)
Size of child at birth				

Large	99 (43.6%)	128 (56.4%)	1	1
Medium	176 (42.1%)	242 (57.9%)	0.94 (0.68, 1.30)	0.99 (0.70, 1.42)
Small	175 (53.2%)	154 (46.8%)	1.47 (1.05, 2.07)	1.60 (1.11, 2.31)*
Mother highest educational level				
No education	343 (46.9%)	388 (53.1%)	1	1
Primary	87 (47.3%)	97 (52.7%)	1.02 (0.72, 1.40)	1.07 (0.76, 1.50)
Secondary	7 (18.4%)	31 (81.6%)	0.26 (0.11, 0.59)	0.30 (0.13, 0.70)*
Higher	7 (18.4%)	31 (81.6%)	1.84 (0.75, 4.49)	2.37 (0.87, 6.52)
Type of toilet facility				
Improved	236 (48.0%)	256 (52.0%)	1	1
Unimproved	215 (44.6%)	267 (55.4%)	1.15 (0.89, 1.47)	1.30 (0.96, 1.77)
Sex of household head				
Female	36 (40.4%)	53 (59.6%)	1	1
Male	414 (46.8%)	471 (53.2%)	1.29 (0.83, 2.02)	0.51 (0.28, 0.91)*
Household wealth index combined				
Poor	210 (46.7%)	240 (53.3%)	1	1
Medium	109 (47.4%)	121 (52.6%)	1.03 (0.75, 1.42)	1.04 (0.71, 1.52)
Rich	131 (44.6%)	163 (55.4%)	0.92 (0.68, 1.23)	0.77 (0.52, 1.14)
Number of living children				
1-2	160 (45.8%)	189 (54.2%)	1	1
3-4	80 (46.8%)	91 (53.2%)	0.99 (0.75, 1.31)	1.08 (0.77, 1.52)
>4	207	242	1.03 (0.72,	1.26 (0.82, 1.94)

	(46.1%)	(53.9%)	1.46)	
Sources of drinking water				
Improved	178 (50.9%)	172 (49.1%)	1	1
Unimproved	273 (43.8%)	351 (56.2%)	0.75 (0.58, 0.98)	1.47 (1.11, 1.95)*

AOR: adjusted odds ratio; COR: crude odds ratio; CI: confidence interval

Determinants of under-weight

The size of the child at birth was associated with under-weight ($P < 0.05$). The risk of being underweight was 0.22 times less likely among children that were aged 25–47 months than those aged 0–24 months. The risk of being underweight was 1.36 times more likely among children that were aged 48-59 months than those aged 0–24 months. The risk of being underweight for children whose mother attended primary and secondary education were 0.23 and 0.35 times lower than children whose mothers who did not attend formal education respectively.

Children from a household with rich economic status were 0.09 times less likely to be under-weighted compared to children living in a household with poor household economic status. Children from rural areas were 1.16 times more likely to be underweight compared to children from urban areas. Female children were 1.06 times more likely to be under-weighted as compared to male children. Children who were born with small size were 1.80 times more likely to be under-weighted than children born larger (AOR = 1.80; 95% CL 0.89-3.66) and children who had born with medium size were 1.56 times more likely to be under-weighted than children born larger (AOR = 1.56; 95% CL 1.05-2.33).

Table 2 Bivariate and multivariable logistic regression of risk factors associated with under-weight on childhood less than 5 years in Amhara Region, Ethiopia, EDHS 2016

Variables		Underweight	COR (95% CI)	AOR (95% CI)
	Yes	No		
Age of child in months				
0-24	104 (26.9%)	283 (73.1%)	1	1
25-47	86 (26.5%)	239 (73.5%)	0.98 (0.70, 1.37)	0.78 (0.53, 1.16)
48-59	63 (31.8%)	135 (68.2%)	1.27 (0.87, 1.85)	1.36 (0.89, 2.09)
Sex of child				
Male	134 (26.8%)	366 (73.2%)	1	1
Female	142 (30.0%)	332 (70.0%)	1.17 (0.88, 1.54)	1.06 (0.76, 1.49)
Place of residence				
Urban	15 (16.9%)	74 (83.1%)	1	1
Rural	261 (29.5%)	624 (70.5%)	2.06 (1.16, 3.66)	1.16 (0.50, 2.69)
Religion				
Orthodox	228 (27.8%)	593 (72.2%)	1	1
Muslin	48 (31.6%)	104 (68.4%)	1.20 (0.83, 1.75)	1.60 (1.01, 2.54)
Type of birth				
Single birth	268 (28.3%)	678 (71.7%)	1	1
Multiple birth	8 (28.6%)	20 (71.4%)	1.01 (0.44, 2.32)	1.32 (0.43, 4.03)
Mothers` BMI				
Over weight	8 (22.2%)	28 (77.8%)	1	1
Normal weight	209 (28.3%)	529 (71.7%)	1.46 (0.63, 3.39)	2.28 (0.63, 8.27)
Under weight	57 (29.4%)	137 (70.6%)	1.17 (0.20, 6.94)	0.88 (0.07, 11.51)
Size of child at birth				

Large	61 (26.9%)	166 (73.1%)	1	1
Medium	101 (24.2%)	317 (75.8%)	0.87 (0.60, 1.25)	1.56 (1.05, 2.33)*
Small	114 (34.7%)	215 (65.3%)	1.44 (0.99, 2.09)	1.80 (0.89, 3.66)
Mother highest educational level				
No education	217 (29.7%)	514 (70.3%)	1	1
Primary	47 (25.5%)	137 (74.5%)	0.82 (0.56, 1.17)	0.89 (0.58, 1.38)
Secondary	5 (13.2%)	33 (86.8%)	0.36 (0.14, 0.93)	0.25 (0.05, 1.14)
Higher	7 (33.3%)	14 (66.7%)	1.18 (0.47, 2.96)	1.92 (0.50, 7.34)
Type of toilet facility				
Improved	130 (26.4%)	362 (73.6%)	1	1
Unimproved	146 (30.3%)	336 (69.7%)	0.83 (0.62, 1.09)	0.80 (0.57, 1.12)
Sex of household head				
Female	25 (28.1%)	64 (71.9%)	1	1
Male	251 (28.4%)	634 (71.6%)	0.99 (0.61, 1.60)	0.53 (0.27, 1.05)
Household wealth index combined				
Poor	133 (29.6%)	317 (70.4%)	1	1
Medium	67 (29.1%)	163 (70.9%)	0.98 (0.69, 1.39)	1.07 (0.71, 1.61)
Rich	76 (25.9%)	218 (74.1%)	0.83 (0.60, 1.16)	0.91 (0.59, 1.40)
Number of living children				
1-2	85 (24.4%)	264 (75.6%)	1	1
3-4	54 (31.6%)	117 (68.4%)	0.75 (0.55, 1.03)	0.86 (0.59, 1.26)
>4	135 (30.1%)	314 (69.9%)	0.107 (0.73, 3.90)	1.25 (0.79, 1.97)

Sources of drinking water				
Improved	113 (32.3%)	237 (67.7%)	1	1
Unimproved	163 (26.1%)	461 (73.9%)	1.35 (1.01, 1.80)	1.20 (0.85, 1.69)

AOR: adjusted odds ratio; COR: crude odds ratio; CI: confidence interval

Determinants of wasting

Results of the multivariable binary logistic regression model showed that the type of toilet facility and sex of household head were significantly associated with wasting. Children living in a household with improved toilet type were 0.48 less likely to be wasting compared to children living in a household with unimproved toilet type. Children from a male household head were 1.99 times higher compared to children from a female household head. Children of the rich household were 0.32 times less likely to be wasting compared to children living in a household with poor household economic status.

The risk of being wasting was 1.08 and 1.52 times higher among children of 25–47 and 48–59 months than those 0–24 months, respectively. The odds of being wasting of children from rural areas were 1.18 times higher compared to children from urban areas. The odds of being wasting were 0.04 times lower among female children than male children. The odds of being wasting was 1.17 times higher among children who lived in household members of >4 children who had lived in household members of 1–2 (AOR = 1.17, 95% CI 0.59-2.33).

Table 3 Bivariate and multivariable logistic regression of risk factors associated with wasting on childhood less than 5 years in Amhara Region, Ethiopia, EDHS 2016

Variables		Wasting	COR (95% CI)	AOR (95% CI)
	Yes	No		
Age of child in months				
0-24	33 (8.5%)	354 (91.5%)	1	1
25-47	30 (9.2%)	295 (90.8%)	1.09 (0.65, 1.83)	1.08 (0.64, 1.82)
48-59	25 (12.6%)	173 (87.4%)	1.55 (0.89, 2.69)	1.52 (0.87, 2.64)
Sex of child				
Male	50 (10.0%)	450 (90.0%)	1	1
Female	46 (9.7%)	428 (90.3%)	0.97 (0.63, 1.48)	0.96 (0.58, 1.58)
Place of residence				
Urban	7 (7.9%)	82 (92.1%)	1	1
Rural	89 (10.1%)	796 (89.9%)	1.31 (0.59, 2.92)	1.18 (0.36, 3.88)
Religion				
Orthodox	79 (9.6%)	742 (90.4%)	1	1
Muslin	17 (11.2%)	135 (88.8%)	1.18 (0.68, 2.06)	1.22 (0.62, 2.37)
Type of birth				
Single birth	94 (9.9%)	852 (90.1%)	1	1
Multiple birth	2 (7.1%)	26 (92.9%)	0.68 (0.16, 2.98)	0.53 (0.06, 4.32)
Mothers` BMI				
Over weight	5 (13.9%)	31 (86.1%)	1	1
Normal weight	71 (9.6%)	667 (90.4%)	0.67 (0.23, 1.94)	2.50 (0.32, 19.44)
Under weight	19 (9.8%)	175 (90.2%)	0.89 (0.09, 8.82)	2.73 (0.34, 22.08)
Size of child at birth				

Large	22 (9.7%)	205 (90.3%)	1	1
Medium	46 (11.0%)	372 (89.0%)	1.15 (0.67, 1.97)	1.36 (0.71, 2.61)
Small	28 (8.5%)	301 (91.5%)	0.87 (0.48, 1.56)	0.87 (0.42, 1.77)
Mother highest educational level				
No education	72 (9.8%)	659 (90.2%)	1	1
Primary	18 (9.8%)	166 (90.2%)	0.99 (0.58, 1.71)	1.32 (0.71, 2.46)
Secondary	4 (10.5%)	34 (89.5%)	1.08 (0.37, 3.12)	1.63 (0.39, 6.73)
Higher	2 (9.5%)	19 (90.5%)	0.96 (0.22, 4.22)	2.96 (0.46, 19.07)
Type of toilet facility				
Improved	39 (7.9%)	453 (92.1%)	1	1
Unimproved	57 (11.8%)	425 (88.2%)	0.64 (0.42, 0.99)	0.52 (0.31, 0.87)*
Sex of household head				
Female	14 (15.7%)	75 (84.3%)	1	1
Male	82 (9.3%)	803 (90.7%)	1.83 (0.99, 3.39)	1.99 (1.06, 3.73)*
Household wealth index combined				
Poor	46 (10.2%)	404 (89.8%)	1	1
Medium	29 (12.6%)	201 (87.4%)	1.27 (0.77, 2.08)	1.12 (0.66, 1.90)
Rich	21 (7.1%)	273 (92.9%)	0.68 (0.39, 1.16)	0.68 (0.38, 1.19)
Number of living children				
1-2	30 (8.6%)	319 (91.4%)	1	1
3-4	17 (9.9%)	154 (90.1%)	0.77 (0.48, 1.24)	1.04 (0.59, 1.82)

>4	49 (10.9%)	400 (89.1%)	0.90 (0.53, 1.61)	1.17 (0.59, 2.33)
Sources of drinking water				
Improved	36 (10.3%)	314 (89.7%)	1	1
Unimproved	59 (9.5%)	565 (90.5%)	1.10 (0.71, 1.70)	0.96 (0.57, 1.61)

AOR: adjusted odds ratio; COR: crude odds ratio; CI: confidence interval

Associations between children's anemia and malnutrition

This study showed that among stunting, underweight, and wasting children, 41.5%, 45.8%, and 35.0% were anemic respectively. Moreover, the percentages of stunting, underweighting and wasting were lower among anemic children as compared to no-anemic children. Stunting children were 1.31 times more likely to be anemic compared to those of not stunting (AOR= 1.31; 95% CI 0.94, 1.82). Underweight children were 0.36 times less likely to be anemic compared to those of not underweight (AOR= 0.64; 95% CI 0.44, 0.93). Wasting children were 1.80 times more likely to be anemic compared to those of not wasting (AOR= 1.80, 95% CI 1.07, 3.04).

Table 4 Malnutrition associated with anemia among under-five children in Amhara Region, Ethiopia, EDHS 2016

Variables	Categories	Anemic	Non-anemic	P-value	AOR (95% CI)
Stunting	Stunting	146 (41.5%)	206 (58.5%)	0.10	1.31 (0.94, 1.82)
	Non stunting	186 (43.5%)	242 (56.5%)		1
Underweight	Underweight	104 (45.8%)	123 (54.2%)	0.02	0.64 (0.44, 0.93)
	Non underweight	228 (41.2%)	325 (58.8%)		1
Wasting	Wasting	28 (35.0%)	52 (65.0%)	0.03	1.80 (1.07, 3.04)
	Non wasting	304 (43.4%)	396 (56.6%)		1

AOR: adjusted odds ratio; CI: confidence interval

Discussion

In this study, the prevalence of malnutrition and associated factors in Amhara region was assessed. The prevalence of stunting, underweight and wasting in Amhara region were 46.3%, 28.4% and 9.8%, respectively. In this study, stunting and underweight are higher than that of the studies conducted in Ethiopia which were 38.3% and 23.3% [7], in Haramaya district 45.8% and 21% [13], in Dale district 25.6%

and 19% [14], Takusa district 36.5% and 19.5% [15], respectively. The prevalence of stunting and underweight in this study are higher than the finding reported in Nairobi Peri-Urban Slum 30.2% and 14.9% [16], respectively. This could be due to there is a difference in obstacles to under-nutrition such as cultural differences and other socio-demographic characteristics. The prevalence of wasting in this study is lower compared to the study conducted in Ethiopia 10.1% [7], in Haramaya district 10.7% [13], in Dale Woreda 14% [14], in Pakistan 10.7% [17] and in Kilimanjaro Region, Tanzania 24.7% [5]. The prevalence reported in this study is higher compared to the one reported by Nairobi Peri-Urban slum 4.5% [16]. This divergence might be due to the difference in socioeconomic background, variation in sample size, dietary habit and type of meals among the study population.

About 23.1% of children were both stunting and underweight, 7.3% were both underweight and wasting, and only 4.5% of children had all the three conditions. The prevalence of both stunting and underweight at this study is higher than compared to the study conducted in Ethiopia 19.47% [7], but lower than the study conducted in Kilimanjaro Region, Tanzania 33% [5]. The prevalence of all the three conditions at this finding is lower than the study conducted in Kilimanjaro Region, Tanzania 12% [5], but higher than in Ethiopia 3.87% [7]. The variation might be due to socioeconomic background, geographical characteristics of the study area, access to health care, cultural difference in dietary habits and care practices.

Among the factors considered in this study, Age of child in months, size of child at birth, mother highest education level, sex of household head and sources of drinking water were associated with stunting. The log odds of stunting were higher among children in the age group of 25–47 months and 48–59 months respectively as compared to the age group of 0–24 months. This finding is in line with the studies conducted in Ethiopia [7], in Haramaya district [13], in Pakistan [17] and in Kilimanjaro Region, Tanzania [5]. Compared to children large size at birth, the odds of stunting among children in the medium size at birth was 0.01 times lower. The odds of stunting among children in the small size at birth were 1.60 times higher compared to children's large size at birth. This finding is supported by a study conducted previously in SNNPR, Ethiopia. [18].

The risk of being stunting among children whose mothers attended secondary education was 0.70 times less compared to children whose mothers did not attend education. This finding is consistent with the study conducted in Bangladesh [19] and in Pakistan [17]. This is because if the level of education of the mother is low, her decision making and her contribution to the total family income will be low. This leads to the children being stunting. The risk of being stunting among children whose father household head was 0.49 times less compared to children whose mother household headed. Children from households that used unimproved drinking water were 1.47 times more likely to be at risk of being stunting than children from households that used improved water. This finding is supported by the result of similar studies conducted in Haramaya district, Eastern Ethiopia [13].

The size of the child at birth was associated with under-weight ($P < 0.05$). The risk of being underweight was 1.36 times more likely among children that were aged 48–59 months than those aged 0–24 months.

This finding is supported by the study conducted in Ethiopia [7]. The risk of being underweight for children whose mother attended primary and secondary education were 0.23 and 0.35 times lower than children whose mothers who did not attend formal education respectively. This finding is supported by the study conducted in Ethiopia [7] and in Pakistan [17]. The sources of discrepancy might be due to maternal education contributes for proper infant feeding practices. Educated mothers might also have better income.

Children from a household with rich economic status were 0.09 times less likely to be under-weight compared to children living in a household with poor household economic status. This finding is supported by the study conducted in Ethiopia [7] and in Pakistan [17]. Children from rural areas were 1.16 times more likely to be underweight compared to children from urban areas. This finding is in agreement with the study conducted in Takusa district, Northwest Ethiopia [15]. The remarkable difference in the rate of underweight among rural and urban children might be differences in living circumstances, deviations in early screening of mothers at child conception in urban areas compared with rural areas, exposure to poor dietary diversity and greater risks of infections among rural children. Female children were 1.06 times more likely to be under-weighted as compared to male children. This study is against the studies conducted in Ethiopia [7], in Pakistan [17], in Bule Hora district, South Ethiopia [20] and in Dale Woreda, southern Ethiopia [14]. Children who were born with a small size were 1.80 times more likely to be under-weighted than children born larger and children who had born with medium size were 1.56 times more likely to be underweight than children born larger. This finding is in agreement with the study conducted in Ethiopia [7] and in Dale Woreda, southern Ethiopia [14].

Results of the multivariable binary logistic regression model showed that the type of toilet facility and sex of household head were significantly associated with wasting. Children living in a household with improved toilet type were 0.48 less likely to be wasting compared to children living in a household with unimproved toilet type. This finding is in agreement with finding in Bule Hora district, South Ethiopia [20]. Children from a male household head were 1.99 times higher compared to children from a female household head. Children of the rich household were 0.32 times less likely to be wasting compared to children living in a household with poor household economic status. This finding is supported by the study conducted in Ethiopia [7] and in Pakistan [17].

The risk of being wasting was 1.08 and 1.52 times higher among children of 25–47 and 48–59 months than those 0–24 months, respectively. This finding is supported by the studies conducted in Dale Woreda, southern Ethiopia [14] and in Kilimanjaro Region, Tanzania [5]. The odds of being wasting of children from rural areas were 1.18 times higher compared to children from urban areas. The variation might be due to food preference, food consumption patterns and inequalities in dietary diversity between urban and rural areas. This finding is consistent with the study conducted in Haramaya district, Eastern Ethiopia [13]. The odds of being wasting were 0.04 times lower among female children than male children. This study is in line with the studies conducted in Bule Hora district, South Ethiopia [20], in Dale Woreda, southern Ethiopia [14], in Kilimanjaro Region, Tanzania [5] and in Pakistan [17]. The difference might be because boys are more influenced by environmental stress than girls. The odds of being wasting was

1.17 times higher among children who lived in household members of > 4 children who had lived in household members of 1–2. This finding is in line with the study conducted in Dale Woreda, southern Ethiopia [14]. The probable reason is that when there are too many children who are living together in the family, there may be a tendency for under-nutrition to occur.

This study showed that among stunting, underweight, and wasting children, 41.5%, 45.8%, and 35.0% were anemic respectively. These findings are lower than compared with the study conducted in Ethiopia 61%, 64.3% and 68.2% respectively [7]. Moreover, the percentages of stunting, underweighting and wasting were lower among anemic children as compared to non-anemic children. Stunting children were 1.31 times more likely to be anemic compared to those of not stunting. Underweight children were 0.36 times less likely to be anemic compared to those of not underweight. Wasting children were 1.80 times more likely to be anemic compared to those of not wasting. These findings are supported by the study conducted in Ethiopia [7]. In the current study, anemia and malnutrition of children were highly associated with that anemic children were more likely to be malnutrition as compared to non-anemic [21].

Conclusion

This study showed individual- and community-level factors determined childhood malnutrition in Amhara region children. Among the factors considered in this study, Age of child in months, size of child at birth, mother highest education level, sex of household head, sources of drinking water and type of toilet facility were significantly associated with malnutrition in Amhara region. The authors concluded that malnutrition among under-five children was one of the public health problems in Amhara region. Therefore, the effect of these issues should be considered to develop strategies to reduce malnutrition in Amhara region.

Limitations Of The Study

This study was done based on a cross-sectional study design. There were some missing values for some variables in the EDHS dataset. Therefore, the authors fail to consider some important factors which could affect the interpretation of the results.

Abbreviations

AOR

adjusted odds ratio; BMI:body mass index; COR:crude odds ratio; CSA:Central Statistical Agency; SNNPR:South Nations, Nationalities, and People Region; SPSS:Statistical Package for Social Science; DHS:Demographic and Health Surveys; EDHS:Ethiopian Demographic and Health Survey.

Declarations

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Availability of data and materials

The data set used and analyzed during the current study is available from the corresponding author on reasonable request (in SPSS code).

Authors' contributions

DK conceived the idea, drafts the manuscript and interpreted the results. DK and YM performed statistical analysis and help in results interpretation and writing. DK and YM critically reviewed the manuscript.

Ethics approval and consent to participate

Ethics approval and consent to participate The EDHS 2016 has taken into account the standard ethical guidelines of the measure DHS program. The authors have obtained the data from measure DHS website (https://www.dhsprogram.com/data/dataset_admin/index.cfm) following their data obtaining procedure. The formal ethical clearance was obtained from the Demographic and Health Surveys (DHS) program.

Consent for publication

Not applicable.

Conflict of interests

The authors declare that they have no conflict of interests.

References

1. Guideline W, Updates on the management of severe acute malnutrition in infants and children. Geneva: World Health Organization, 2013. 2013: p. 6–54.
2. Pelletier DL, Frongillo EA. Changes in child survival are strongly associated with changes in malnutrition in developing countries. *J Nutr*. 2003;133(1):107–19.
3. De Onis M, Blössner M. The World Health Organization global database on child growth and malnutrition: methodology and applications. *Int J Epidemiol*. 2003;32(4):518–26.
4. Icf C. Ethiopian demographic health survey 2011. Addis Ababa and Calverton: Central Statistical Agency (Ethiopia) and ICF International, 2012: p. 17–27.

5. Mgongo M, et al. Underweight, stunting and wasting among children in Kilimanjaro Region, Tanzania; a population-based cross-sectional study. *Int J Environ Res Public Health*. 2017;14(5):509.
6. Debela BL, Shively G, Holden ST. Does Ethiopia's productive safety net program improve child nutrition? *Food Security*. 2015;7(6):1273–89.
7. Tekile AK, Woya AA, Basha GW. Prevalence of malnutrition and associated factors among under-five children in Ethiopia: evidence from the 2016 Ethiopia Demographic and Health Survey. *BMC Res Notes*. 2019;12(1):391.
8. Tariq J, et al. Factors associated with undernutrition in children under the age of two years: secondary data analysis based on the Pakistan demographic and health survey 2012–2013. *Nutrients*. 2018;10(6):676.
9. Talukder A. Factors associated with malnutrition among under-five children: illustration using Bangladesh demographic and health survey, 2014 data. *Children*. 2017;4(10):88.
10. Asim M, Nawaz Y. Child malnutrition in Pakistan: evidence from literature. *Children*. 2018;5(5):60.
11. Das S, Gulshan J. Different forms of malnutrition among under five children in Bangladesh: a cross sectional study on prevalence and determinants. *BMC Nutrition*. 2017;3(1):1.
12. Akombi BJ, et al. Multilevel analysis of factors associated with wasting and underweight among children under-five years in Nigeria. *Nutrients*. 2017;9(1):44.
13. Yisak H, Gobena T, Mesfin F. Prevalence and risk factors for under nutrition among children under five at Haramaya district, Eastern Ethiopia. *BMC Pediatr*. 2015;15(1):212.
14. Wolde M, Berhan Y, Chala A. Determinants of underweight, stunting and wasting among schoolchildren. *BMC Public Health*. 2015;15(1):8.
15. Nigatu G, et al. Prevalence and associated factors of underweight among children 6–59 months of age in Takusa district, Northwest Ethiopia. *Int J Equity Health*. 2018;17(1):106.
16. Chesire E, et al. Determinants of under nutrition among school age children in a Nairobi peri-urban slum. *East Afr Med J*. 2008;85(10):471–9.
17. Khan S, Zaheer S, Safdar NF. Determinants of stunting, underweight and wasting among children < 5 years of age: evidence from 2012–2013 Pakistan demographic and health survey. *BMC Public Health*. 2019;19(1):358.
18. Ayalew E. The Prevalence of Stunting and Associated Factors Among Children Age 6–59 Months At Mizan-Aman Town, Bench Maji Zone, Snnpr Region, Ethiopia, 2015, 2015, Addis Ababa University.
19. Siddiqi MNA, Haque MN, Goni MA. Malnutrition of under-five children: evidence from Bangladesh. *Asian Journal of medical sciences*. 2011;2(2):113–9.
20. Asfaw M, et al. Prevalence of undernutrition and associated factors among children aged between six to fifty nine months in Bule Hora district, South Ethiopia. *BMC Public health*. 2015;15(1):41.
21. Roba KT, et al. Anemia and undernutrition among children aged 6–23 months in two agroecological zones of rural Ethiopia. *Pediatric health medicine therapeutics*. 2016;7:131.