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RESEARCH ARTICLE

Underweight and associated factors among children under five years in North Shewa Zone, Oromia, Ethiopia: An observational community-based study [version 1; peer review: awaiting peer review]

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Abstract

Background: Acute and chronic child undernutrition is a continuous problem in Ethiopia. Therefore, this study was initiated to compare the prevalence of underweight and its associated factors among children aged 6-23 months in the Kuyu district, North Shewa zone, Oromia, Ethiopia.

Methods: An observational community-based study was conducted on 612 children (304 from household security and 308 from household food insecurity). A structured and standardize questionnaire was used in this study. Anthropometric measurements were generated using WHO standardize. Data was analyzed using SPSS version 20.0. Bivariate and multivariate logistic regression analysis was used to identify the independent variables associated with underweight (weight-for-age) among children in household food security and insecurity, a p value less than 0.05 with 95%CI was considered as statistically significant.

Results: The results indicated that 30.9% [95%CI; 25.7, 36.2] and 36.7% [95% CI; 31.8, 42.5] of children were underweight for their age in household food security and insecurity. Low wealth status (AOR=3.2; 95%CI: 1.099, 9.275), poor dietary diets (AOR=5.2; 95%CI: 2.046, 13.27), and lack of breastfeeding for two years (AOR= 2.1; 95%CI= 1.78, 5, 42) were associated with underweight children in household food security. Whereas lack of antenatal care visits (AOR=0.52; 95%CI: 0.12, 0.68) and poor dietary diets (AOR=3.01; 95%CI= 2.1, 17.4) were other independent variables associated with underweight children in household food insecurity.

Conclusions: This study established that there was a high prevalence of underweight in children from Oromia. Therefore, introducing household income generating activities are vital interventions in order to overcome the problem of undernutrition in this region.

Keywords

Associated Factors, Children, Food Insecurity, Undernutrition, Underweight

This article is included in the **Agriculture, Food and Nutrition** gateway.

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1. Introduction

Globally, acute and chronic child undernutrition is an important challenge affecting the mental and physical development of infants and young children.¹ Preventable undernutrition affects one in five children and contributes to nearly half of all deaths during childhood.²⁻⁴

Acute and chronic malnutrition occurs due to several factors, which are related to household food insecurity, poor quality diets, poor feeding practices, and infections.^{5,6} Ethiopian studies have shown that poor economic status, poor dietary intake, and lack of breastfeeding are major factors associated with underweight children.⁷⁻⁹ Moreover, age, sex, birth order, diarrhea, and low birth weight are also major factors associated with children being underweight.¹⁰

Household food insecurity is also a multifaceted issue associated with health and nutritional outcomes, as well as hunger and poverty.^{11,12} A study conducted in Nepal revealed that children from severely food insecure households were highly malnourished.¹³ Food insecurity and poverty can lead a child to undernutrition, which includes stunting, wasting, and being underweight, and having a mental impairment.¹

Despite significant efforts to eliminate poverty in all its forms, seasonal food insecurity and other socioeconomic factors are considered major problems in Ethiopia. The scarcity of rainfall, climate vulnerability, and reduced agricultural production are also associated with malnutrition and food insecurity.²

In Ethiopia, evidence shows that underweight prevalence among children is 23.3%.¹⁴ However, this may vary across different regions. In 2015, about 20.5% and 18.1% of children were underweight in household food insecurity and security, respectively, in the Tigray region.¹⁵ In south Ethiopia, it has been reported that approximately 26.3% of children were underweight.¹⁶

Even though there is surplus food production in the Oromia region, more children had acute and chronic malnutrition compared to less productive regions of Ethiopia.¹⁷ This supports the fact that the nutritional status of children is affected by different factors. Although efforts have been made to tackle undernutrition among children in this region, almost 25% of children were found to be underweight.¹⁸ It is currently a widespread epidemic in the different regions of Ethiopia.

Kuyu district is found in the Oromia region and suffers from food insecurity and undernutrition problems because of rainfall scarcity which affected crop production in the area. The government of the region is attempting to safeguard food security. However, many households in rural communities need food aids from different government or non-government organizations.¹² Presently, there is limited information on the comparison of children underweight and the major factors in research. Because of this, the objective of this study was to compare the prevalence of underweight and the main associated factors among children in food security and insecurity households.

2. Methods

2.1 Study setting, design and period

An observational cross-sectional study was carried out from July 12 to 28, 2020 for approximately two weeks in the Kuyu district, North Shewa zone, Oromia region, Ethiopia. Kuyu district was purposively selected as the study site because many households in the rural areas were dependent on food aid and support for over ten years.¹⁹ The total population of the district was 121,052, with most working in agriculture. The map for the study was created using geographical information system (GIS) software (Figure 1).

All children aged 6-23 months found in the study area, Kuyu district was the target for the study, whereas the study population consisted of a sample of all households with 6-23 months old children who were residing in randomly selected kebeles. Mothers with children aged 6-23 months who had resided in the Kuyu district for at least six months, were included in this study. Children aged 6-23 months who had deformities or were chronically sick, as well as mothers who were deaf, were excluded.

2.2 Study size and sampling procedures

The study sample size was determined by applying the below formula. Where n=sample size required for each group (household food security and insecurity), $p_1=18\%$, $p_2=8\%$, $Z_{\alpha/2}=5\%$ level of significance, Z_{β} =power of 80%.¹⁹ In this sample size determination, $p_1(18\%)$ indicates the prevalence of underweight among children under five in food insecurity and $p_2(8\%)$ was expected as the 10% differences of underweight among children in food security.

$$n = (Z_{\alpha/2} + Z_{\beta})^2 * (p_1(1 - p_1) + p_2(1 - p_2)) / (p_1 - p_2)^2$$

Figure 1. Map of the study area.

Therefore, the final sample size was 612 (304 from household security and 308 from household food insecurity), considering the design effect of 1.5 and 5% non-response rate.

We used a multistage sampling method to enroll eligible children from the study area. From the 25 total kebeles of the district, four kebeles: Sombo Chika, Harelu Cheri, Dubana Agalo, and Woye Gose were selected randomly. A stratified sampling technique was used to categorize households into food security and insecurity. Next, population proportion to size allocation was done based on the data available in the zonal health office. Finally, a simple random sampling method was employed to select the eligible children from each household of each group.

2.3 Data collection and quality management

2.3.1 Socio-demographic data

Data was collected from eligible households in the Kuyu district with the use of socio-demographic questionnaires. This included mothers' occupational and educational status, age (months) and gender of the child. Moreover, household economic status, dietary diversity scores and feeding practices were also analyzed.

For this study, eight health background professional's extension workers and two public health professionals who fluently spoke Afan Oromo (survey language) participated in the data collection. To improve the quality of the data, two

days of training were given to all data collectors and supervisors. Questionnaires were also pretested on 5% of households which were not included in the actual samples of the study.

2.3.2 Anthropometric data

The anthropometric measurements such as weight, sex, and age (months) of the child were taken and calculated using child growth standards on height, weight and age.²⁰

2.3.3 Dietary diversity data

The children's minimum dietary diversity score was analysed by using the past 24-hour recall method. The seven food groups were categorized as good dietary diversity if the score out of the seven food groups was greater or equal to four, and low if it was less than four food groups.^{21,22}

2.4 Variables of the study

For this study, the weight-for-age was used as a dependent variable while socio-demographic characteristics were considered as independent variables.

Table 1. Characteristics of the study participants in Kuyu district, North Shewa zone, Oromia, Ethiopia, 2020.

Variables	Household food security	Household food insecurity
	No (%)	No (%)
Age of the mother		
≤ 24	36(11.8)	42(13.6)
25-29	56(18.4)	61(19.8)
≥ 30	212(69.6)	205(66.5)
Educational status		
Illiterate	234(77.0)	274(88.9)
Educated	70 63(23.0)	34(11.1)
Marital status		
Married	240(78.9)	281(91.0)
Divorced or other	66(21.1)	27(8.9)
Occupational status		
Housewife	112(36.8)	96(31.1)
Farmer	76(25.0)	140(45.5)
Other	116(38.2)	72(23.4)
Ethnicity		
Oromo	280(92.1)	296(96.1)
Amhara	24(7.9)	12(3.9)
Family size		
<5	84(27.6)	64(20.8)
≥5	220(72.4)	244(79.2)
Household wealth status		
Low	51(16.8)	72(23.4)
Middle	150(49.3)	176(57.1)
High	103(33.9)	60(19.5)
Sex of child		
Male	142(46.7)	187(60.7)
Female	162(53.3)	121(39.3)

2.5 Statistical analysis

The data obtained was analyzed by using SPSS version 20.0. Anthropometric measurements were calculated using WHO Anthro 3.2.1 Software. The child was considered underweight for his/her age if the z-score was below -2. Logistic regression analysis was performed to identify the factors associated with underweight. A p-value < 0.05 was statistically significant. Finally, adjusted odds ratio (AOR) with a 95% CI were reported.

3. Results and discussion

3.1 Socio-economic and demographic characteristics of the study participants

Table 1 shows that approximately 77.0% vs. 88.9% of mothers were illiterate in household food security and insecurity, respectively. About 76 (25%) of mothers in household food security and 140(45.5%) of insecurity were farmers. Moreover, the family size greater than or equal to five per household food security and insecurity was 220 (72.4%) and 244 (79.2%), respectively.

3.2 Child feeding practices

As presented in the Table 2, children who did get a meal frequency/day ≤ 3 were 111 (36.5%) and 167 (54.2%) in household food security and insecurity, respectively. In addition, the results indicated that almost 85(28%) vs. 121

Table 2. Child feeding practices in Kuyu district, North Shewa Zone, Oromia, Ethiopia, 2020.

Variables	Household food security	Household food insecurity
	No (%)	No (%)
Child meal frequency per a day		
Greater than or equal to four	193(63.5)	141(45.8)
Less than or equal to three	111(36.5)	167(54.2)
Child has breakfast		
Yes	219(72.0)	187(60.7)
No	85(28.0)	121(39.7)
Child has a mid-morning snack		
Yes	119(39.1)	67(21.8)
No	185(60.9)	241(78.2)
Child has afternoon snacks		
Yes	171(56.3)	146(47.4)
No	133(43.8)	162(52.6)
Child has a bedtime snack		
Yes	69(22.7)	37(12)
No	235(77.3)	271(88)
How did the child eat his food?		
Upon the child demands	149(49)	228(74)
When convenient for the mother	155(51)	80(26)
Restrict the child from his/her meal		
No	179(58.9)	119(38.6)
Yes	125(41.1)	189(61.4)
Leftover food available at home		
No	146(48)	129(41.9)
Yes	158(52)	179(58.1)
What do you do when food is leftover at home?		
Give to an animal	51(16.8)	62(20.1)
Give to the child	106(34.9)	117(38)

(39.7%) of children did not eat breakfast in food secure and insecure households, respectively. Moreover, about 158 (52%) and 179(58.1%) of children were fed on leftover food in food secure and insecure households, respectively.

3.3 Child dietary diversity scores

Table 3 shows that cereals, roots, and tubers were the most common food group consumed by children in food-secure (96%) and insecure (99.4%) households. The next most consumed food groups were pulses, legumes and nuts, which was 82.1% vs. 81.2% in food secure and insecure households, respectively. In this study, about 54.9% [95%CI;49.4, 60.5] and 68.5% [95%CI; 63.3, 73.7] of children had poor dietary diets in household food security and insecurity, respectively.

3.4 Nutritional status of children

This study shows that 36.7% [95% CI; 31.8, 42.5] and 30.9% [95%CI; 25.7, 36.2] of children were underweight in household food insecurity and security, respectively (Table 4). The differences between the two groups were statistically significant when p value was less than 0.003.

Table 3. Child dietary diversity scores in Kuyu district, North Shewa zone, Oromia, Ethiopia, 2020.

Variables	Household food security	Household food insecurity
	No (%)	No (%)
Cereals, Root and Tubers		
Yes	289(96.0)	306(99.4.)
No	12(4.)	2(0.6)
Pulses, Legumes and Nuts		
Yes	247(82.1)	250(81.2)
No	54(17.9)	58(18.8)
Milk and dairy products		
Yes	127(42.2)	85(27.6)
No	174(57.8)	223(72.4)
Meat, Fish and Poultry		
Yes	60(19.9)	52(16.9)
No	241(80.1)	256(83.1)
Eggs		
Yes	58(19.3)	46(14.9)
No	243(80.7)	262(85.1)
Vitamin A rich fruits and vegetables		
Yes	146(48.5)	130(42.2)
No	155(51.5)	178(57.8)
Other vitamin A fruits and vegetables		
Yes	63(20.9)	38(12.3)
No	238(79.1)	270(87.7)
Child dietary diversity scores		
Good dietary diversity	137(45.1)	97(31.5)
Poor dietary diversity	167(54.9)	211(68.5)

Table 4. Weight for age (Underweight) among children in Kuyu district, North Shewa zone, Oromia, Ethiopia, 2020.

Weight for age (Underweight)	Household food security status	
	Food Security (304)	Food insecurity (308)
Normal No (%)	210(69.1)	195(63.3)
Underweight No (%)	94(30.9)	113(36.7)

Table 5. Selected associated factors of children underweight in household food security and insecurity of Kuyu district, North Shewa zone Oromia, Ethiopia, 2020.

Variables	Weight for age (Underweight)			
	Household food security		Household food insecurity	
	Crude odds ratio	Adjusted odds ratio	Crude odds ratio	Adjusted odds ratio
Household wealth Status				
High	1	1	1	1
Medium	1.67 (0.895, 2.937)*	0.918 (.368, 2.289)	2.36 (1.15, 4.87)*	1.73 (0.656, 4.57)
Low	5.15 (2.47, 10.7)*	3.2 (1.099, 9.275)**	5.89 (2.639, 13.2)*	1.13 (0.74, 6.97)
Child meal frequency per day				
Greater than or equal to four	1	1	1	1
Less than or equal to three	3.51 (2.12, 5.84)*	3.34(0.82, 13.6)	2.03 (1.25, 3.3)*	2.83 (0.73, 5.88)
Child has breakfast				
Yes	1	1	1	1
No	2.92 (1.73, 4.94)*	1.34 (0.51, 3.579)	2.34 (1.455, 3.78)*	1.054 (0.47, 2.35)
Child has a mid-morning snack				
Yes	1	1	1	1
No	1.466 (0.88, 2.44)*	0.645 (0.22, 1.9)	1.477 (1.82, 2.648)	0.74 (0.25, 2.2)
Child has afternoon snacks				
Yes	1	1	1	1
No	2.24 (1.36, 3.67)*	0.687 (0.25, 1.88)	2.1 (1.27, 3.29)*	1.35(0.78, 2.33)
The child has a bedtime snack				
Yes	1	1	1	1
No	1.65 (0.884, 3.1)	0.856 (0.27, 2.71)	1.94 (0.879, 4.27)	0.645 (0.16, 2.54)
How did the child eat his food?				
When convenient for the mother	1	1	1	1
Upon the child demands	1.976 (1.2, 3.24)*	1.0 (0.37, 2.7)	1.9 (1.1, 3.34)*	2.52 (0.72, 8.75)
Child restrict during his/her meal				
No	1	1	1	1
Yes	2.14 (1.298, 3.52)*	0.47 (0.18, 1.26)	1.35 (0.847, 2.15)	1.12 (0.5, 2.45)

Table 5. *Continued*

Variables	Weight for age (Underweight)			
	Household food security		Household food insecurity	
	Crude odds ratio	Adjusted odds ratio	Crude odds ratio	Adjusted odds ratio
Leftover food available in the home				
No	1	1	1	1
Yes	2.3 (1.388, 3.82)*	1.66 (0.914, 3.02)	1.14 (0.71, 1.83)*	0.9 (0.53, 1.538)
What did you do when food is leftover in your home?				
Give to an animal	1	1	1	1
Give to the child	1.677 (0.83, 3.39)	1.62 (0.68, 3.87)	0.775 (0.41, 1.456)*	0.77 (0.37, 1.89)
Dietary diversity scores				
High dietary diversity score	1	1	1	1
Low dietary diversity score	7.59 (4.1, 14.02)*	5.2 (2.046, 13.27)**	5.82 (3.1, 11.1)*	3.01 (2.1, 17.4)**
Breastfed the bay for 2 years				
Yes	1	1	1	1
No	2.45 (2.12, 7.43)*	2.1 (1.78, 5.42)**	2.61 (1.56, 4.34)*	1.0 (0.43, 2.34)
Antenatal care follow up				
No	1	1	1	1
Yes	2.32 (1.42, 3.82)*	1.03 (0.41, 2.63)	0.64 (0.23, 0.97)*	0.52 (0.12, 0.68)**

Where: * = P value < 0.25 in the bivariate analysis.
 ** = P value < 0.05 in the multivariate analysis and 1 = Reference.

In this study, although the prevalence of underweight children was high in both household food security and insecurity, the nutritional status of children in household food security was better. This could be explained by the fact that food secure households can ensure the nutritional status of children compared to their counterparts. Other studies conducted in Pakistan,⁹ Nigeria,²³ and Ethiopia^{15,24} also reported similar results. This might be explained by the fact that household food security can ensure the nutritional status of children than household food insecurity.

3.5 Independent variables associated with underweight

In the multivariate logistic regression analysis, low wealth status (AOR=3.2; 95%CI: 1.099, 9.275), poor dietary diets (AOR=5.2; 95%CI: 2.046, 13.27), and lack of breastfeeding for two years (AOR=2.1; 95%CI=1.78, 5.42) were associated factors with underweight children in household food security (see Table 5). However, poor dietary diets (AOR=3.01; 95%CI= 2.1, 17.4) and lack of antenatal care visits (AOR=0.52; 95%CI: 0.12, 0.68) were associated factors for children with household food insecurity (Table 5).

Children in the low-income households were more likely to be underweight than those in high-income households in both comparison groups. This finding is in line with a study conducted in the region of Africa.²⁵

Children who had poor dietary intake from the seven food groups were more likely to be underweight in both household food security and insecurity (Table 5). This finding is similar to the results of a few studies conducted in Ethiopia.^{8,26,27}

In the multivariate logistic regression of this study, the variable found as an associated factor with underweight children in household food security was breastfeeding for less than two years ($p<0.001$) (Table 5). The finding of this study is supported by a study conducted in northwest Ethiopia.⁸

Moreover, mothers who did follow antenatal care visits had children who were less likely to be underweight in household food insecurity. This finding is consistent with studies conducted in different regions of Ethiopia.^{7,25,28} This might be because the health and nutrition information has a great contribution to improving the nutritional status of the baby.

Limitation of the study

This survey was conducted in a single period and this may not reflect the true children's dietary diversity scores and their nutritional status. The households being grouped as food secure and insecure based on productivity safety net program criteria may not also indicate the current food security status of the surveyed households; as many households classified as food secure were out of the program for more than ten years. So, this may increase bias in the research.

Conclusions

The child underweight in this study was significantly associated with low-income households, poor dietary diets, and a lack of breastfeeding children in food-secure households. An underweight child was also associated with low dietary diets and a lack of mother's antenatal care visits. Therefore, establishing and strengthening income generation activities such as home gardening and breeding of small livestock may reduce child underweight through both improved household wealth status and dietary diversity.

Author contribution

The author involved in conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, software, validation, visualization, writing-original draft preparation, writing- review & editing.

Data availability

Underlying data

OSF Register: Underlying data for "Underweight and associated factors among children under five years in North Shewa Zone, Oromia, Ethiopia: An observational community-based study; <https://doi.org/10.17605/OSF.IO/3VKZA>

The project contains the following underlying data:

blank questionnaire.docx

Raw anthropometric data.sav

raw dietary diversity data.sav

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

Ethical considerations

Ethical approval was obtained from the Department of Food and Nutritional Sciences, Wollega University (FNSWU487/2020). After the purpose of the study was explained to the study participants, a written informed consent was taken from each study participant. The responses were kept confidential by coding. At the end of the survey, the nutrition and health information about malnutrition was given to mothers who had severely malnourished children for further treatment in the study area.

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