Undernutrition and its Associated Factors among Pediatric Age Children Attending Antiretroviral Therapy in Eastern Ethiopia

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Abstract

Background: Undernutrition results from insufficient food intake and repeated infectious diseases. Human Immunodeficiency Virus infection and malnutrition often coexist, which increases the risk of morbidity and mortality. Despite this fact, HIV-positive children are often overlooked, and their nutritional status has not been well studied in Ethiopia. Therefore**,** the aim of this study was to determine the magnitude of undernutrition and its associated factors among pediatric age children attending Antiretroviral Therapy in selected public hospitals of Eastern Ethiopia.

Methods: An institutional based cross-sectional study was conducted from February to March 2018. Three hundred seventy six HIV-positive children aged 2-15 years were selected through simple random sampling technique. A pretested questionnaire was used to collect the data through an interview method in a local language. Nutritional status was assessed using WHO growth standard values, using the WHO Anthro for children less than five and WHO Anthro plus for children over five years. The collected data were entered in to EpiData version 3.1, and transferred to SPSS version 20 for analysis. Statistical significance was declared for P-values less than 0.05 at 95% confidence interval.

Results: This study found that 24.7% (95% CI: 20.7, 29.4) of the children were stunted and 28.2% (95% CI: 23.7, 32.2) were wasted. Household food insecurity, being anemic, presence of diarrhea during the last 14 days and advanced WHO clinical stages were significantly associated with stunting. While being male, low family monthly income, medium family monthly income, low (poor and medium) dietary diversity, low food consumption score, and the presence of diarrhea during the last 14 days were significantly associated with wasting.

Conclusion: The magnitude of stunting and wasting among HIV-infected pediatric patients is relatively high in the study area. Therefore, more attention should be given in promoting nutritional education for HIV-positive children including dietary diversity and feeding practices to strengthen the immune system.

Keywords: *Pediatric, ART, Stunting, wasting, Undernutrition, Eastern Ethiopia*

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Introduction

Undernutrition is defined as a pathological state resulting from insufficient food intake and repeated infectious diseases. This includes underweight, stunting, wasting, and micronutrient deficiency (Liu *et al*., 2015). Human Immunodeficiency Virus (HIV) increases the risk of malnutrition. There are 3.4 million HIV-positive children under 15 years of age, and 340,000-450,000 new infections in the pediatric population each year (WHO, 2011). HIV/AIDS impairs nutritional status by impairing the immune system and hindering nutrient intake, absorption, and use.

Malnutrition can exacerbate the effects of HIV; hasten AIDS related illnesses, weight loss, and undernutrition among children living with HIV/AIDS; and increase the risk of morbidity and mortality (Callens *et al*., 2009).

Despite the fact that ART raises the quality of life among HIV-positive individuals, its effect on their nutritional status remains insufficient. Thus there is a need to study nutritional support for HIV-positive children (Chinkhumba *et al*., 2008: Weigel *et al*., 2010). Human Immunodeficiency Virus-positive children have greater nutritional and caloric needs due to the

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catabolic effect of the disease as compared to their counterparts. Calorie intake needs to be increased to 150% of the recommended daily allowance of calories, and the micronutrient requirement is five times that of HIV-negative child. HIV-positive children with chronic lung disease, chronic TB, or chronic diarrhea require an additional calorie intake of approximately 20-30% (WHO, 2009).

Ethiopia has prioritized nutrition as a critical component of HIV treatment, care, and support by setting guidelines and developing implementation manuals (FMOH, 2008; Pegurri *et al*., 2015). It is estimated that the population of HIV-positive children under 15 years old in Ethiopia was 160,000 in 2013 (FMOH, 2013). However, data is scarce, and studies on the magnitude of undernutrition among children with HIV/AIDS in Ethiopia are limited, especially in eastern Ethiopia. Therefore, the aim of the study was used to assess the magnitude of undernutrition and its associated factors among HIV-positive children in eastern Ethiopia.

Materials and Methods

Study setting

This study was conducted in selected public hospitals in Dire Dawa, Harar, and Jigjiga in the eastern part of Ethiopia around 620, 526, and 515 kilometers from Addis Ababa, respectively (CSA, 2007). Two public hospitals in Dire Dawa city (Dil Chora Hospital and Sabian Hospital), two public hospitals in Harar city (Hiwot Fana Specialized University Hospital and Jugal Hospital), and one public hospital in Jigjiga town (Karamara Hospital) were selected for this study. During the study period a total of 895 children aged 2-15 years attended the ART clinic at the selected hospitals. The study was conducted from February to March 2018.

Study design and population

An institutional based cross-sectional study was conducted among randomly selected HIV-positive children aged 2-15 years who were attending the ART follow-up clinic for treatment at the selected public hospitals in eastern Ethiopia. HIV-positive children aged 2-15 years who were critically ill were excluded.

Sample size determination and sampling procedure

The sample size was computed using single population proportion formula by considering the prevalence of undernourishment (41.8%) based on a previous study conducted in northwest Ethiopia (Berihun *et al.*, 2010), at 95% confidence interval and 5% margin of error. The final sample size including 5% non-response rate was 390. Samples were proportionally distributed to Dil Chora Hospital (174/400), Sabian Hospital (33/75), Hiwot Fana Specialized University Hospital (78/180), Jugal Hospital (22/50), and Karamara Hospital (82/190) based on the number of children attending ART clinic. Then from each hospital, a computer-generated list of HIV-positive patients was used as a sampling frame, and a simple random sampling method was used to recruit the HIV-positive children. Finally data were collected from 376 pediatric age (2-15 years) children attending the ART clinic at public hospitals in eastern Ethiopia.

Data collection instrument and procedure

Data were collected using a structured questionnaire, which was adapted from the previous literature (Berihun *et al*., 2010; Gezahign, 2017) and modified according to the title. The questionnaire was developed in English, translated into local languages, and then translated back into English by different language experts. The questionnaire consisted of socio-demographic factors, caregiver-related factors, dietary diversity, household food security, anthropometric measurements, and medical and related factors of the pediatric age group.

Data were collected using face-to-face interviews and a review of medical records. A digital scale (Seca, Germany) was used to measure weight to the nearest 0.1 kg, with study participants wearing light clothes and no shoes. Height was measured with a portable stadiometer to the nearest 0.1 cm while standing straight on a smoothly flat horizontal surface with their heels together, eyes straight forward, and touching the standing board at the heels, buttocks, and back of the head. Weight and height were converted to a height-for-age Z-score (HAZ) and a BMI-for-age Z-score (BAZ) according to WHO growth standard values using the WHO Anthro for children under five and WHO Anthro plus for children over five years. Children were categorized as stunted or wasted when their Z-score was less than negative two (<-2) (WHO, 2006 and 2009).

To assess anemia, we used the previous hemoglobin level were collected from ART record and the current hemoglobin level were measured during data collection. Anemia was categorized using the WHO criteria hemoglobin (Hgb) cutoff point for anemia and

adjusted with altitude (average of 1000 meters above sea level). Children were classified as anemic when their hemoglobin level was less than 11 g/l for children 2-5 years old, less than 11.5 g/l for children 5-11 years old, and less than 12 g/l for children 12-14 years old (WHO, 2011).

Dietary diversity was assessed by a questionnaire where study participants were asked which of 16 food groups they consumed in the past 24 hrs. A dietary diversity score was calculated based on the seven food groups (WHO, 2010).

Household food insecurity was assessed using household food insecurity access scale which measures the degree of food insecurity in the past 30 days. It consisted of questions related to occurrence (yes and no) and frequency of occurrence (rarely, sometimes, and often). The total score fell between 0-27 (Coates *et al.*, 2007). The household food consumption score was calculated by multiplying the frequency of each food group by the weight of that food group and then adding up all of these scores into one composite score. A household score can have a maximum value of 112. The average weekly consumption frequency score can range from zero for no consumption up to a maximum of seven for daily consumption. The food group weight ranged from 0.5 for sugar and oil, 1 for fruits and vegetables, 2 for Cereals and Tubers, 3 for pulses and 4 for milk, meat, and fish (WFP, 2008).

Adherence to antiretroviral drugs was assessed by a review of medical records. The recent adherence status of the child to the ART which is recorded as poor, fair and good based on left over pill count. Adherence is poor when the child takes less than 85% of the dose, fair when he/she takes 85-94% of the dose and good when he/she takes 95% and above of the dose (FMOH, 2008).

Data quality control

Data collectors received a training guide on how to conduct interviews, take anthropometric measurements, and test hemoglobin level. These tools were pre-tested on 20 HIV-positive children (5% of the sample) at the Jigjiga health center in order to cross-check for its objective and variable-based completeness, consistency, and acceptability. The principal investigator and supervisor conducted close follow-up and frequent checks on the interview process to ensure the completeness and consistency of the information gathered. Missing/incomplete data in outcome variables were excluded. The relative technical error of measurement (TEM) was calculated to minimize anthropometric measurement error. The functionality of digital weight scales was checked using known weights every morning before data collection began and before every weight measurement; the data collectors were assured as the scale read exactly at zero (NHNES, 2007-2008).

Data analysis

Data were cleaned, coded, and entered to a computer with EPI data version 3.1 and then transferred to the Statistical Package for Social Sciences (SPSS) version 20.0 for analysis. Anthropometric measurements were calculated using the WHO Anthro for children under five years and Anthro plus for children 5-15 years old. The descriptive statistics were summarized with frequency, percentage, mean, and standard deviation. Variables having a p-value < 0.2 in the bivariate analysis were taken into a multivariable logistic regression model to determine their association by controlling confounders. Hosmer-Lemeshow statistics were used to assess the goodness-of-fit of the models, and Multicollinearity was checked by considering the maximum standard error of < 2. Finally, variables associated with the outcome variables with P-values < 0.05 were declared as statistically significant.

Ethical consideration

The formal ethical approval letter was obtained from Haramaya University, College of Health and Medical Sciences, Institutional Health Research Ethics Review Committee (IHRERC). It was submitted to each of the selected hospitals to obtain permission. Before conducting the study, a clear description of the objective and potential risk and benefits of the study was given to parents/guardians of the child. Informed written and signed consent/assent was obtained from parents/guardians and study participants. Under nutrition children's were linked to each hospital's pediatric unit for better care and nutritional support.

Results

Socio-demographic characteristics of study panticipants

Out of 390 planned study participants, 376 pediatric age (2-15 years) children attending the ART clinic at public hospitals in eastern Ethiopia were included with

a response rate of 96.6%. Response data with missed dependent variable were excluded. The majority of children were in the age group of 120-180 months (70.7%) with the mean (±SD) of 130.37 ± 41 months.

The majority (60.1%) of the respondents were urban residents. The parenthood status of children indicated that 195 (51.9%) of the children's parents were both alive while 121 (32.2%) have one living parent. Among the study participants, 161 (42.8%) had a low monthly family income. Regarding family size, 268 (71.3%) households had over four family members **(Table 1)**

Table 1: Socio-demographic characteristics of HIV-positive pediatric aged children in public hospitals of eastern Ethiopia, 2018.

Characteristics	Category	Frequency	Percentage
Age (months)	24-59	21	5.6
	60-119	89	23.7
	120-180	266	70.7
Sex	Male	189	50.3
	Female	187	49.7
Religion	Orthodox	207	55.1
	Muslim	126	33.5
	Protestant	39	10.4
	Catholic	4	1.1
Ethnicity	Oromo	123	32.7
	Amhara	178	47.3
	Harari	9	2.4
	Somali	33	8.8
	Tigray	9	2.4
	Gurage	24	6.4
Residence	Rural	150	39.9
	Urban	226	60.1
Parental status	Two living parents	195	51.9
	One living parent	121	32.2
	No living parents	60	16
Relationship to	Parents	246	65.4
Caregiver	Family member	105	27.9
	Relatives	25	6.6
Educational status of	Cannot read and write	54	14.4
Caregivers	Can read and write	98	26.1
	Primary (1-8)	151	40.2
	Secondary (9-10)	68	18.1
	Higher education	5	1.3
Monthly family	Low (<500)	161	42.8
income (Ethiopian	Medium (500-1000)	108	28.7
Birr)	High (≥1000)	107	28.5
Family size	Less than four	268	71.3
	Four or more	108	28.7
Source of drinking	Pipe	328	87.2
water	Protected well	48	12.8
Latrine availability	Yes	349	92.8
	No	27	7.2

Medical characteristics of study participants

Of the study participants, 205 (54.5%) of their caregivers received dietary counseling, and 209 (55.6%) of the children had received therapeutic food during the course of their ART treatment. Among the HIV-positive children, 164 (43.6%) had opportunistic infections and 120 (31.9%) had experienced diarrhea in the past two weeks. The proportion of previously and currently anemic HIV-positive children were 56.1% (95% CI: 50.6, 61.6) and 31.9% (95% CI: 27.2, 36.7), respectively. Most of the children (95.5%) had received Co-trimoxazole on pre-ART. Almost half of the study participants (46%) were found on WHO clinical stage two. Regarding ART duration, 194 (51.6%) of the children had been on ART for the past 7-13 years (**Table 2**).

Table 2: Medical characteristics of HIV-positive pediatric aged children in public hospitals of eastern Ethiopia, 2018.

Characteristics	Category	Frequency	Percentage
Dietary counseling	Yes	205	54.5
	No	171	45.5
Presence of therapeutic food	Yes	209	55.6
	No	167	44.4
Eating problem	Yes	177	47.1
	No	199	52.9
Type of eating problem	Loss of appetite	139	37.0
	Swallowing difficulty	13	3.5
	Vomiting	18	4.8
	Other	7	1.9
Opportunistic disease	Yes	164	43.6
	No	212	56.4
Type of opportunistic disease	Pneumonia	43	11.4
	Tuberculosis	18	4.8
	Diarrheal disease	44	11.7
	Skin infection	42	11.2
	Gastro enteritis	16	4.3
	Other	1	
Experienced diarrhea in the past two weeks	Yes	120	31.9
	No	256	68.1
Previous anemia status (at ART initiation)	Yes	211	56.1
	No	165	43.9
Current anemia status	Yes	120	31.9
	No	256	68.1
Co-trimoxazole started on Pre-ART	Yes	359	95.5
	No	17	4.5
TB treatment on Pre-ART	Yes	43	11.4
	No	333	88.6
Baseline CD4 count	<200	41	10.9
	200-349	109	29
	350-499	45	12
	>500	181	48.1
Current CD4 count	<200	3	
	200-349	22	5.9
	350-499	46	12.2
	>500	305	81.1
WHO clinical stage (On ART initiation)	WHO stage 1	148	39.4
	WHO stage 2	173	46.0
	WHO stage 3	54	14.4
	WHO stage 4	1	
WHO clinical stage (On diagnosis)	WHO stage 1	91	24.2
	WHO stage 2	172	45.7
	WHO stage 3	109	29
	WHO stage 4	4	
Adherence to the drug	Good	341	90.7
	Fair	19	5.1
	Poor	16	4.3
Duration of ART follow-up (in years)	1-3	66	17.6
	4-6	116	30.9
	7-13	194	51.6

Dietary characteristics of study participants

The dietary diversity level indicated that around one fourth (27.1%) (95% CI: 22.5, 31.9) of the study participants had a low dietary diversity score. The food consumption score of study participants showed that slightly more than half of them were categorized in the poor (18.9%) and borderline (34.8%). Among the study participants' households, 160 (42.6%); (95% CI: 38.0, 47.5) were food insecure, while the rest 216 (57.4%) (95% CI: 52.5, 62.0) were food secure (**Figure 1**).

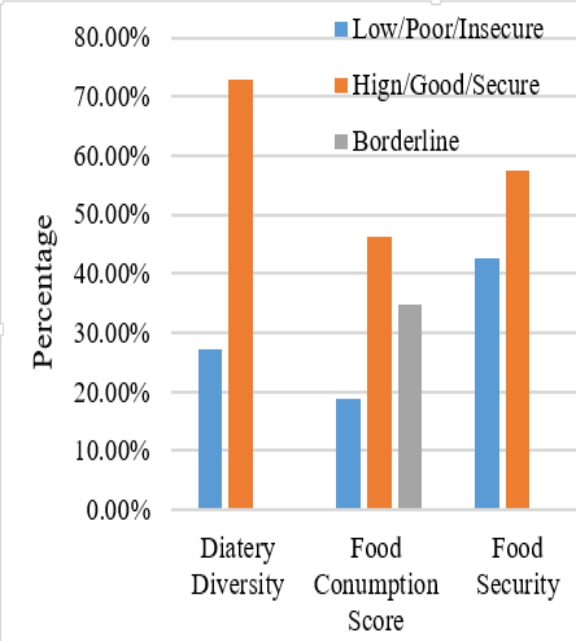

Figure 1: Dietary diversity, Food consumption score, and Household food security of HIV-positive Pediatric aged children in public hospitals of eastern Ethiopia, 2018.

Of the study participants, 83%, 67.1% and 70.2% consumed meat, fish, and eggs less than 2 days per week, respectively and 94.4% and 92.1% consumed tubers/roots and grain/cereals at least 3 days per week, respectively (**Figure 2).**

Nutritional status of HIV-positive pediatric children

Among the HIV-positive pediatric age children, 93 (24.7%) (95% CI: 20.7, 29.4) were stunted (HAZ < -2), of which 13 (3.5%) were severely stunted (HAZ < -3). Among the study participants, 106 (28.2%) (95% CI: 23.7, 32.2) were wasted (BAZ < -2), while 17 (16.9%) were overweight (2 < BAZ < 3), and only one was found to be obese (BAZ > 3).

Factors associated with stunting

In bivariate analyses; residence, family income, dietary diversity, food consumption pattern, household food security, WHO clinical stage, anemia, the presence of diarrhea in previous two weeks and duration of ART treatment follow-up were identified with p-value < 0.2 and considered as a candidate for multivariable logistic regression analysis.

In multivariable logistic regression analysis, household food insecurity, low hemoglobin (anemia), the presence of diarrhea, and advanced WHO clinical stage (stages 3 and 4) were significantly associated with stunting. Children from households with food insecurity were 5 times more likely to be stunted than those from food secured households (AOR=5.08; 95% CI: 2.29, 11.26). Children who had anemia were 1.8 times more likely to be stunted than those children who were not anemic (AOR=1.8; 95% CI: 1.02, 3.19). Children who had diarrhea in the past two weeks were 2.13 times more likely to be stunted than those who did not have diarrhea in the past two weeks (AOR=2.13; 95% CI:1.18,3.84). Children in advanced WHO clinical stages were 2.51 more likely to be stunted than those in the early stages (AOR=2.51; 95% CI: 1.18, 5.34) (**Table 3**).

Factors associated with wasting

In bivariate analyses; age group, sex, residence, parental status, family income, dietary diversity, food consumption pattern, household food security, WHO clinical stage, presence of diarrhea, presence of an eating problem and presence of therapeutic food were identified with p-value < 0.2 and considered as a candidate for multivariable logistic regression analysis.

In multivariable analysis, being male, low monthly family income, low dietary diversity, low (poor and borderline) food consumption patterns, and presence of diarrhea were significantly associated with wasting.

Male children were 2.53 times more likely to be wasted than female children (AOR=2.53; 95% CI: 1.43, 4.45). Children from a family with a low or medium monthly income were 3.12 times (AOR=3.12; 95% CI: 1.15, 8.5) and 2.25 times (AOR=2.25; 95% CI: 1.2, 5.04) more likely to be wasted than children from a family with a high monthly income. Children with low (poor and borderline) food consumption patterns were 2.49 times more likely to be wasted than

those with high food consumption patterns (AOR=2.49; 95% CI:1.31, 4.74). Children with low dietary diversity were 2.77 times more likely to be wasted than those with high dietary diversity (AOR=2.77; 95% CI: 1.44, 5.31). Children who had diarrhea in the past two weeks were 3.26 times more likely to be wasted than those who did not have diarrhea in the past two weeks (AOR=3.26; 95% CI: 1.81, 5.87) (**Table 4**).

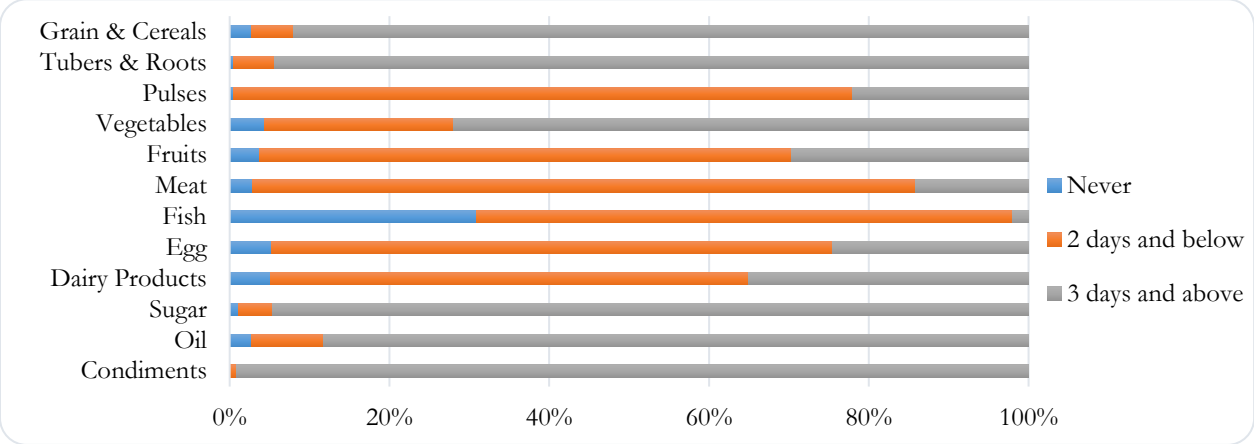

Figure 2: Food consumption patterns of HIV-positive pediatric aged children in public hospitals of eastern Ethiopia, 2018.

Table 3: Factors associated with stunting among pediatric age patients living with HIV/AIDS in public hospitals of eastern Ethiopia, 2018.

Characteristics		**Stunting**		**COR (95% CI)**	**AOR (95% CI)**
		Yes Freq. (%)	**No Freq. (%)**		
Residence	Urban	37(29.4)	89(70.6)	1	1
	Rural	56 (37.3)	94(62.7)	3.04 (1.88,4.93)*	1.61 (0.91,2.86)
Educational status of caregiver	No formal education	48(31.6)	104(68.4)	1.84 (1.14, 2.95) *	1.38 (0.75, 2.54)
	Formal education	45(20.1)	179(79.9)	1	1
Family income level (Ethiopian Birr)	Low (<500)	68(42.2)	93(57.8)	7.09 (3.45, 14.6)*	1.71 (0.76, 3.85)
	Medium (500-1000)	15(13.9)	93(86.1)	4.53 (2.42, 8.5)*	1.6 (0.56, 4.61)
	High (≥1000)	10(9.3)	97(90.7)	1	1
Dietary diversity	Low	40(39.2)	62(60.8)	2.69 (1.64, 4.43)*	1.47 (0.76, 2.85)
	High	53(19.3)	221(80.7)	1	1
HH food security	Food insecure	72(45)	88(55)	7.59 (4.39, 13.13)*	5.08 (2.29, 11.26) *
	Food secure	21(9.7)	195(90.3)	1	1
Food consumption	Poor/borderline	59(29.2)	143(70.8)	1.7 (1.05, 2.75)*	1.07 (0.57, 2)
	Good	34(19.5)	140(80.5)	1	1
Diarrhea in the past two weeks	Yes	49(7.5)	71(92.5)	3.32(2.04, 5.42)*	2.13 (1.18, 3.84) *
	No	44(17.2)	212(82.8)	1	1
Current anemic	Yes	52(20.3)	204(79.7)	2.04 (1.25, 3.31)	1.8 (1.02, 3.19) *
	No	41(34.2)	79(65.8)	1	1
WHO clinical stage	Early stages (1 and 2)	72(22.4)	249(77.6)	1	1
	Advanced stages (3 and 4)	21(38.2)	34(61.8)	2.14 (1.17, 3.91)*	2.51 (1.18, 5.34) *
Duration of ART follow-up (in years)	1-3	14(21.2)	52(78.8)	1	1
	4-6	22(19)	94(81)	1.54 (0.79, 3)	1.75 (0.92, 3.34)
	7-13	57(29.4)	137(70.6)	1.78 (1.02, 3.11)*	1.97 (0.89, 4.36)

**P value <0.05 shows significant statistical association; COR=crude odds ratio; AOR=Adjusted odds ratio; Freq.= Frequency.*

Discussion

HIV-positive children are more vulnerable to malnutrition. In the current study, the magnitude of stunting among the pediatric age group living with HIV/AIDS was 24.7%. This is low compared to studies conducted in South Africa, Uganda, and Mozambique in which the proportion of stunting was 36.2% (Lentoor, 2018), 68% (Nalwoga, *et al*., 2010), and 57.4% (Pedrini *et al*., 2015), respectively. But, it is higher when compared to a study conducted in Nigeria where the proportion of stunting was 17.1% (Akintan *et al*., 2015). This variation could be due to the difference in study approach (population and hospital based), study population (age group), and sampling technique.

In the present study, the magnitude of wasting among the pediatric age group living with HIV/AIDS was 28.2%, This is higher than studies conducted in Addis Ababa, India, Uganda, and Tanzania, where the proportion of wasting was 15.6% (Abdulkarim, 2017), 19.5% (Swetha *et al.*, 2015), 18% (Lwanga *et al*., 2015) and 21.1% (Sunguya *et al*., 2014) respectively. This disparity could be due to the fact that the study groups in these other areas may have a different socioeconomic status.

In the current study, children with household food insecurity were 5.08 times more likely to be stunted. Reliable evidence confirms that food insecurity, undernutrition, and HIV/AIDS are overlapping and have additive effects (Ivers *et al*., 2009).

In this study, current anemic children were 1.8 times more likely to be stunted. This is in line with previous studies conducted in Harar and Dire Dawa where anemic children were 3.1 times more likely to be stunted (Gezahign, 2017). This study also found that children who experienced diarrhea in the last two weeks were 2.1 times more likely to be stunted. This was consistent with a study in Harari and Dire Dawa where children who had diarrhea in the past two weeks were 6.2 times more likely to be stunted (Gezahign, 2017). This is because children with chronic malnutrition are at an increased risk of contracting diseases due to poor immunity status.

This study determined that children in the advanced WHO clinical stages were 2.5 times more likely to be stunted. This finding is in line with other studies (Moolasart *et al*., 2017; Adedemy *et al*., 2016). This can be explained by the fact that co-infections with HIV are particularly problematic for those in the more advanced stages of the disease; as the immune system is weakened, individuals become more susceptible to other infections, making them susceptible to undernutrition (FMoH, 2008; WHO, 2009).

In the present study, children from a family with a low monthly income were 3.12 times more likely to be thin. This is in line with a study from Harar and Dire Dawa where children from families with a low monthly income were 4.73 times more likely to be thin (Gezahign, 2017). The possible reason could be that HIV infection can indirectly affect a child's nutritional status, when it has an impact on the child's social environment. In some contexts, evidence proves when the most productive members of the family are HIV-positive, agricultural production and household economic capacity are reduced, leading to a situation of food insecurity and undernutrition (Anema *et al.*, 2009).

In this study, children with a low dietary diversity were 2.77 times more likely to be thin. Similarly, a study in Harar and Dire Dawa determined that children with low dietary diversity were 8.55 times more likely to be thin (Gezahign, 2017). In this study, children with low (poor and borderline) food consumption were 2.49 times more likely to be thin. If children and adolescents' dietary diversity is limited and meal patterns are inappropriate, it will interfere with the distribution of nutrients they receive over the course of a day, resulting in low energy intake and insufficient micronutrient intake (Ochola and Masibo, 2014).

The strengths of this study were the inclusion of important clinical and dietary factors. The hemoglobin level was adjusted for altitude level of study participants to avoid underestimation. However, the cross-sectional nature of the study limits the investigation to the level of the association between determinants and outcomes of interest (malnutrition).

Table 4: Factors associated with wasting among pediatric age patients living with HIV/AIDS in public hospitals of eastern Ethiopia, 2018.

Characteristics		Wasting		COR (95% CI)	AOR (95% CI)
		Yes Freq. (%)	No Freq. (%)		
Age (in years)	Less than 7	21(41.2)	30(58.8)	1.976 (1.074, 3.64) *	1.77 (0.85, 3.69)
	7-15	85(26.2)	240(73.8)	1	1
Sex	Male	67(85.4)	122(14.6)	2.1 (1.31, 3.31) *	2.53 (1.43, 4.45) *
	Female	39(20.9)	148(79.1)	1	1
Residence	Urban	49(17.1)	177(82.9)	1	1
	Rural	57(38)	93(62)	2.21 (1.4, 3.5)*	1.04 (0.58, 1.86)
Parental status	Both alive	48(24.6)	147(75.4)	1	1
	Single died	35(28.9)	86(71.1)	1.53 (0.79, 2.93)	1.32 (0.57, 3.07)
	Both died	23(38.3)	37(61.7)	1.9 (1.03, 3.52)*	1.43 (0.65, 3.17)
Family income level	Low	77(47.8)	84(52.2)	8 (3.99, 16)*	3.12 (1.15, 8.5)*
	Medium	18(16.7)	90(83.3)	4.6 (2.53, 8.3)*	2.25 (1.2, 5.04)*
	High	11(10.3)	96(89.7)	1	
Dietary diversity	Low	56(56)	46(46)	5.45 (3.32, 8.96)*	2.77 (1.44, 5.31) *
	High	50(18.2)	224(81.8)	1	
HH food security	Food insecure	76(47.5)	84(52.5)	5.61 (3.42, 9.2)*	1.89 (0.91, 3.95)
	Food secure	30(13.9)	186(86.1)	1	
Food consumption	Poor/borderline	59(29.2)	143(70.8)	1.12 (0.71, 1.75)	2.49 (1.31, 4.74)*
	Good	47(27)	127(73)	1	1
Presence of	Yes	70(33.5)	139(66.5)	1	1
therapeutic food	No	36(21.6)	131(78.4)	1.83 (1.15, 2.92)*	1.15 (0.58, 2.29)
Eating problem	Yes	63(35.6)	114(64.4)	2.0 (1.27, 3.16)*	1.08 (0.55, 2.12)
	No	43(27)	156(73)	1	1
Presence or diarrhea	Yes	60(50)	60(50)	4.56 (2.83, 7.37)*	3.26 (1.81, 5.87)*
in the past two weeks	No	46(18)	210(82)	1	1
WHO clinical stage	Early stages (1 and 2)	87(27.1)	234(72.8)	1	1
	Advanced stages (3 and 4)	19(34.5)	36(65.5)	1.42 (0.77, 2.61)	1.51 (0.69, 3.27)

**P value <0.05 shows significant statistical association; COR=crude odds ratio; AOR=Adjusted odds ratio; Freq.= Frequency*

Conclusion

This study indicated that there is a higher magnitude of stunting and wasting among HIV-positive pediatric patients in selected public hospitals in eastern Ethiopia. Factors associated with stunting were household food insecurity, low hemoglobin levels (anemia), the presence of diarrhea, and the WHO clinical stage. While, factors associated with wasting were being male, low monthly family income, low dietary diversity, low (poor and borderline) food consumption patterns, and presence of diarrhea.

Malnutrition and its effects on HIV-positive pediatric patients are complex and interwoven, and no simple solution exists. Therefore, more attention should be given in promoting nutritional education for HIV-positive children including dietary diversity and feeding practices to strengthen the immune system and prevent opportunistic infections. In addition to this, children who are in the advanced stages should be given more attention regarding their nutritional status and feeding practices. Finally, longitudinal based studies should be done in future to address the causal association between determinants and outcomes of interest (malnutrition).

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Author contributions

All authors participated in designed the study, data collection, analysis, interpretation, and write-up, drafted the manuscript and critically revised the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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