

Undernutrition and associated factors among HIV-positive adult patients enrolled in antiretroviral therapy (ART) clinics in the Arba Minch area, southern Ethiopia

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Background: Undernutrition constitutes an important threat to the success of HIV programs in sub-Saharan Africa, and failure to effectively address it may jeopardize the benefits gained so far in the fight against HIV. The aim of the study was to assess undernutrition and associated factors among HIV-positive adult patients enrolled in antiretroviral therapy (ART) clinics in Arba Minch area, south Ethiopia.

Methods: A facility-based cross-sectional study was conducted in 2017. There were 351 adult individual study participants who were enrolled in ART clinics in Arba Minch area public health facilities. Variables with *P*-value less than 0.25 on binary logistic regression analysis were entered into a multivariate logistic regression model to outline the independent predictors of undernutrition. CI of 95% was used to assess precision of the study.

Results: Out of all the participants, 18.23% (95% CI: 14.52–22.65) were undernourished. The prevalence of undernutrition was significantly lower among those consuming food from five or more food groups per day (AOR: 0.33; 95% CI: 0.16–0.71) and undergoing ART for more than a year (AOR: 0.24; 95% CI: 0.08–0.73). On the contrary, the prevalence was significantly higher among those who were currently smoking tobacco (AOR: 6.67; 95% CI: 1.45–30.76). In addition, those with WHO clinical stage 3 had a significantly higher prevalence of undernutrition compared to those with WHO clinical stage 1 (AOR: 311; 95% CI: 1.47–6.60).

Conclusion: The prevalence of undernutrition was high among adults with HIV/AIDS enrolled in ART clinics in the study area. The prevalence of undernutrition was lower among those who consumed diverse food groups and had been receiving ART for longer (more than a year). On the contrary, the prevalence of undernutrition was higher among those who consumed tobacco and with higher WHO clinical stage. Therefore, efforts should be made to enhance the dietary diversity of these individuals.

Keywords: ART, undernutrition, malnutrition, dietary diversity score, DSS, WHO clinical stage

Introduction

Globally more than 35.1 million adults were living with HIV in 2017.¹ In 2013, sub-Saharan African countries accounted for 74% of death from AIDS-related illnesses.² According to the Ethiopian demographic and health survey report of 2016, the prevalence of HIV among adults was nearly 1%.³

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Introduction of ART has changed the course of HIV infection through suppressing viral replication, allowing recovery of the immune system, and consequently reducing the incidence of opportunistic infection, hospitalization, and death among individuals living with HIV/AIDS.^{4,5} In Ethiopia, the number of people living with HIV/AIDS enrolled in ART programs has increased significantly, and currently the number is more than 870,000.⁶

There is a significant association between HIV infection and undernutrition.⁷ Even though there have been advancements in the treatment of patients with HIV, many deaths are related to malnutrition.⁸ Malnutrition, especially undernutrition, is the most common clinical finding among HIV patients.^{7,9,10} Even among people taking ART, weight loss and wasting is the most common problem and significantly prevalent in sub-Saharan African countries.^{9,11,12}

Undernutrition constitutes an important threat to the success of HIV programs in sub-Saharan Africa, and failure to effectively address it may jeopardize the benefits gained so far in the fight against HIV. The objective of study was to assess undernutrition and associated factors among HIV-positive adult patients enrolled in ART clinics of Arba Minch area, southern Ethiopia.

Methods

Study area

The study was conducted in Arba Minch town and Arba Minch Zuria district public health facilities. Arba Minch is located 505 km south of Addis Ababa, the capital of Ethiopia. Based on the 2007 population census of Ethiopia, the projected population of Arba Minch town and Arba Minch Zuria district for 2016 was 310,454.¹³ The study area had ten health facilities and only four of them were delivering ART during the study period. Among the health facilities, there was one hospital and three health centers. Gamo-Gofa Zone Health department's report in 2016 showed that there were 1,823 adults living with HIV who were actively participating in ART programs in these health facilities.

Study design and period

A facility-based cross-sectional study was conducted among adults who were enrolled at ART clinics in Arba Minch area public health facilities. The study was conducted from January to February 2017.

Population

The study population consisted of all adult individuals (aged 15 years and above) who were enrolled in ART clinics at public health facilities of Arba Minch town and Arba Minch Zuria district.

Sample size determinations and sampling procedure

A single population proportion formula was used to calculate the sample size with 95% level confidence, 0.05 acceptable margin of error, and 10% expected non-response rate. In addition, from a study conducted at Hossan town, Ethiopia, the estimated prevalence of undernutrition among patients on ART (30%) was used to have the maximum sample size.¹⁴ As a result, the final sample size was 356. According to the total number of ART clients in each health facility, proportionate number of sample was assigned for each ART clinic. The list of each facility's patients was used as a sampling frame, and, by using computer-generated random number, participants were identified.

Data collection tools and procedures

Data were collected using a structured questionnaire, checklist, and measurements. The questionnaire was developed in English and translated to Amharic. The questionnaire included socio-demographics, household characteristics, diet, and behavioral issues. Variables for wealth status were adopted from EDHS 2011.¹⁵ Food security status of the household was measured using Household Food Insecurity Access Scale (HFIAS), which was developed and validated by Food and Nutrition Technical Assistance (FANTA).¹⁶ Food groups were based on Food and Agriculture Organization (FAO) guidelines for measuring household and individual dietary diversity.¹⁷ A checklist was developed to collect previous history, CD4 count, WHO clinical stage, and ART duration.

Weight and height measurements were done according to FANTA standards.¹⁸ Body weight (to the nearest 0.5 kg) was measured with the participant wearing light clothing and no shoes using a SECA digital scale. Height (to the nearest 0.5 cm) was measured using a stadiometer with participants wearing no shoes and no headwear.

Seven clinical nurses were recruited as data collectors and three health officers were supervisors of the data collection process. Two days' training was given for the data collectors and supervisors on the objectives of the study, how to collect the data, ethical issues, and on the

use of the data collection format. At the time of the actual data collection, the data collectors arrived early in the morning at ART clinics and waited until the identified person arrived for the follow-up. Data collection was carried out immediately after patients received the required service.

Quality control

The English version questionnaire was translated into Amharic and back-translated into English to check its consistency. Data collection tools were developed by reviewing literature and pre-testing. Based on the pretest findings, data collection tools were amended. Trained nurses carried out the data collection. The supervisor and principal investigator checked completeness and followed the whole data collection process.

Data processing and analysis

Data were cleaned and entered into a computer using Epi Info Version 7, then transferred to Stata version 14 for analysis. Body mass index (BMI) was generated by dividing the weight in kg by square of height in meter. Undernutrition was categorized as BMI below 18.5 Kg/m².¹⁹ Dietary Diversity Score (DDS) was calculated based on the number of individual food groups consumed over the past 24 hours. Categorization was made based on above and below the mean DDS.¹⁷ Using HFIAS, food security was dichotomized into two categories.¹⁶ Wealth index was generated by principal component analysis method using household assets and characteristics, which were adapted from EDHS 2011.¹⁵

Descriptive summaries of patients' characteristics and outcome of interest were computed. Bivariate logistic regression was used to show the relation between undernutrition and various associated factors. Finally, all explanatory variables with P-value less than 0.25 in the bivariate analyses were entered into multivariable logistic regression model to identify independent predictors of undernutrition. CI of 95% was used to assess the precision of the study.

Ethics statement

Ethical approval including verbal consent was obtained from the Institutional Research Ethics Review Committee of Arba Minch University and the study was conducted in accordance with the Declaration of Helsinki. Verbal informed consent was obtained from study participants before interviews and measurements. Privacy of the study participants was maintained by interviewing the participants alone.

Results

Three hundred and fifty-one adult HIV-positive patients who were enrolled in ART clinics participated in the study. The response rate was 98.3%. Mean (SD) age of the participants was 39.5 (9.5) years and the majority (59.5%) were within the age group of 30 to 44 years. Nearly two thirds (60.7%) of the participants were females and most (84.0%) of them were urban residents. Married respondents comprised more than half (56.4%) and those who had formal education comprised nearly two thirds (Table 1). The mean (SD) DDS and BMI were 4.4 (1.7) and 21.9 (3.7) Kg/m², respectively. Out of the total participants, 18.2% (95% CI: 14.5–22.7) were undernourished.

Almost all of the participants (97%) had good adherence to the ART treatment. Around one third of participants consumed alcohol. Nearly one in five of the participants had CD4 count level less than 350 cells/mm³. Nearly 88% of the study participants were using tuberculosis prophylaxis and 92% had a follow-up period of more than a year. Ten percent developed an opportunistic infection. An amount of 18.2% (64) were using ready to use therapeutic foods. Out of the undernourished participants, 51.5% (33), and out of the normal weight participants, 10.8% (31), were using ready to use therapeutic foods, respectively (Table 2).

Those who consumed food from five or more food groups were less likely (AOR =0.33, 95% CI: 0.16–0.71) to be undernourished compared to those who consumed food from less than five food groups per day. Those who have been enrolled at ART clinics for more than a year were less likely (AOR =0.34; 95% CI: 0.08–0.73) to be undernourished. Adults with WHO clinical stage 3 were at nearly three times (AOR: 3.11; 95% CI: 1.47–6.6) higher risk of being undernourished than patients with stage 1. Among study participants, current tobacco smokers were at higher risk of being undernourished (AOR: 6.67; 95% CI: 1.45–30.67) (Table 3).

Discussion

The mean (SD) BMI of individuals on ART programs at Arba Minch area was 21.9 (3.7) Kg/m². This finding was similar to findings of studies conducted at different places in Ethiopia. For instance, studies conducted at Bahir Dar (20.5 Kg/m²), Gondar (21.5 Kg/m²), Dilla (19.5 Kg/m²), Butajira (nearly 21 Kg/m²), and Dembia (20.3 Kg/m²) health facilities showed similar findings to our report.^{20–24} In addition, studies conducted in other countries like Iran (22.12 kg/m²), Senegal (23.4 kg/m²),

Table 1 Socio-demographic characteristics and nutritional status of adults receiving ART at public health facilities of Arba Minch area, southern Ethiopia, 2017

Variable	Category	Undernourished	Normal weight	Total
		N (%)	N (%)	N (%)
Age group (years)	18–29	5 (7.8)	35 (12.2)	40 (11.4)
	30–44	44 (68.8)	165 (57.5)	209 (59.5)
	45+	15 (23.4)	87 (30.3)	102 (29.1)
Sex	Female	32 (50.0)	181 (63.1)	213 (60.7)
	Male	32 (50.0)	106 (36.9)	138 (39.3)
Residency	Urban	51 (79.7)	244 (85.0)	295 (84.0)
	Rural	13 (20.3)	43 (15.0)	56 (16.0)
Religion	Orthodox	40 (62.5)	191 (66.6)	231 (65.8)
	Protestant	23 (35.9)	84 (29.3)	107 (30.5)
	Muslim	1 (1.6)	12 (4.2)	13 (3.7)
Ethnicity	Gamo	36 (56.3)	157 (54.7)	193 (55.0)
	Goffa	7 (10.9)	20 (7.0)	27 (7.7)
	Wolyite	5 (7.8)	21 (7.3)	26 (7.4)
	Amahara	8 (12.5)	51 (17.8)	59 (16.8)
	Other	8 (12.5)	38 (13.2)	46 (13.1)
Occupation	Housewife	14 (21.9)	58 (20.2)	72 (20.5)
	Government employee	13 (20.3)	66 (23.0)	79 (22.5)
	Private/self-employed	15 (23.4)	65 (22.6)	80 (22.8)
	Merchant	11 (17.2)	50 (17.4)	61 (17.4)
	Other	11 (17.2)	48 (16.7)	59 (16.8)
Marital status	Married	43 (67.2)	155 (54)	198 (56.4)
	Unmarried	21 (32.8)	132 (46)	153 (43.6)
Education	Illiterate	13 (20.3)	51 (17.8)	64 (18.2)
	Read and write	11 (17.2)	41 (14.3)	52 (14.8)
	Formal education	40 (62.5)	195 (67.9)	235 (67.0)
Family size	≤5	47 (73.4)	218 (76.0)	265 (75.5)
	>5	17 (26.6)	69 (24.0)	86 (24.5)
DDS	<5 Food groups	51 (79.7)	162 (56.4)	213 (60.7)
	≥5 Food groups	13 (20.3)	125 (43.6)	138 (39.3)
HFIAS	Food insecure	28 (43.8)	102 (35.5)	130 (37.0)
	Food secure	36 (56.3)	185 (64.5)	221 (63.0)
Wealth index	Poor	39 (60.9)	152 (53)	191 (54.4)
	Middle	5 (7.8)	33 (11.5)	38 (10.8)
	Rich	20 (31.3)	102 (35.5)	122 (34.8)

Abbreviations: ART, antiretroviral therapy; DDS, Dietary Diversity Score; HFIAS, Household Food Insecurity Access Scale.

and Zambia (23.5 kg/m²) also showed similar findings.^{25–27} The current protocol for treatment of people living with HIV/AIDS who are malnourished indicates that those who have been identified as undernourished are eligible for RUTF.²⁸ The findings of this research showed that 18.2% of the study participants

were taking RUTF as part of their treatment; half of this study's participants were undernourished based on our assessment.

In this report, nearly one in five adult patients enrolled for ART were undernourished. The finding of this study was similar to those of other studies at different health

Table 2 Clinical and lifestyle-related characteristics and nutritional status of adults receiving ART at public health facilities of Arba Minch area, southern Ethiopia, 2017

Variable	Category	Undernourished	Normal weight	Total
		N (%)	N (%)	N (%)
Using RUTF	No	31 (48.4)	256 (89.2)	287 (81.8)
	Yes	33 (51.6)	31 (10.8)	64 (18.2)
Current tobacco smoker	No	59 (92.2)	281 (97.9)	340 (96.9)
	Yes	5 (7.8)	6 (2.1)	11 (3.1)
Khat chewing	No	59 (92.2)	261 (90.9)	320 (91.2)
	Yes	5 (7.8)	26 (9.1)	31 (8.8)
Consuming alcohol	No	46 (71.9)	194 (67.6)	240 (68.4)
	Yes	18 (28.1)	92 (32.1)	110 (31.3)
Missing doses of antiretroviral drugs	No	47 (73.4)	226 (78.7)	273 (77.8)
	Yes	17 (26.6)	61 (21.3)	78 (22.2)
WHO clinical stage	1	23 (35.9)	127 (44.3)	150 (42.7)
	2	7 (10.9)	45 (15.7)	52 (14.8)
	3	31 (48.4)	100 (34.8)	131 (37.3)
	4	3 (4.7)	15 (5.2)	18 (5.1)
CD4 count level	≤350	18 (28.1)	57 (19.9)	75 (21.4)
	>300	46 (71.9)	230 (80.1)	276 (78.6)
TB prophylaxis	No	12 (18.8)	32 (11.1)	44 (12.5)
	Yes	52 (81.3)	255 (88.9)	307 (87.5)
ART duration (months)	≤12	10 (15.6)	17 (5.9)	27 (7.7)
	>12	54 (84.4)	270 (94.1)	324 (92.3)
Presence of OI	No	56 (87.5)	260 (90.6)	316 (90.0)
	Yes	8 (12.5)	27 (9.4)	35 (10.0)

Abbreviations: ART, antiretroviral therapy; RUTF, ready to use therapeutic foods; TB, tuberculosis; OI, opportunistic infection.

facilities in Ethiopia, such as in Dembia (23.2%), West Showa Zone (23.6%), Butajira (25.2%), and Bahir Dar (25.5%).^{20–22,29} It was also similar to studies conducted at Tanzania, Nepal, and Senegal, which showed rates of malnutrition of 18.4%, 19.9%, and 22.9%, respectively.^{25,30,31} However, the finding of this report was higher compared to findings from studies from Brazil (7.3%), Zimbabwe (10%), Iran (11.1%), and Dilla Ethiopia (12.3%).^{24,26,27,32} This difference might be related to socio-economic differences and seasonal variation within the studies. However, it was lower compared to study findings at health facilities of East Hararge Zone, Oromia region; Tigray regional state; and Amhara regional state which showed rates of malnutrition of 30%, 50.5%, and 55.6%, respectively.^{14,33,34} The prevalence of undernutrition among people living with HIV may be related to the consequences of the infection which result in defective absorption, storage, and utilization of nutrients.³⁵

Undernutrition was associated with current tobacco smoking, WHO clinical stage, DDS, and duration of ART use among HIV patients enrolled in ART at Arba Minch area health facilities. Current tobacco-smoking adults enrolled in ART programs were at higher risk of being undernourished (AOR of 6.67). A comparative study between smokers and non-smokers in Canada showed that smokers consumed a less healthy diet.³⁶ But a study conducted in Nepal indicated that undernutrition was not associated with smoking.³¹ There was an inverse relationship between smoking and BMI, not only among people living with HIV but also among the general population.³⁷

DDS measures the quality of food intake in Africa.³⁸ This study showed that increased dietary diversity was associated with decreased probability of undernutrition among ART-enrolled adults. A study conducted at referral hospitals of Amhara regional state, Ethiopia showed that

Table 3 Factors associated with undernutrition among adults receiving ART in public health facilities of Arba Minch area, southern Ethiopia 2017

Variable	Category	COR	AOR	(95% CI)
Age group (years)	18–29			
	30–44	1.87	1.92	(0.66–5.6)
	45+	1.21	1.29	(0.39–4.22)
Sex	Female			
	Male	1.71	1.26	(0.67–2.37)
Marital status	Married			
	Unmarried	0.57	0.61	(0.32–1.13)
DDS	<5 Food groups			
	≥5 Food groups	0.33**	0.31	(0.15–0.63)**
HFIAS	Insecure			
	Secure	0.71	0.88	(0.47–1.63)
Current tobacco smoker	No			
	Yes	3.97*	4.27	(1.1–16.52)*
WHO clinical stage	1			
	2	0.86	1.05	(0.4–2.79)
	3	1.71	2.22	(1.15–4.29)*
	4	1.1	1.56	(0.39–6.28)
CD4 count level	≤350			
	>300	0.63	0.86	(0.43–1.71)
ART duration (months)	≤12			
	>12	0.34**	0.34	(0.13–0.86)*

Notes: *P-value <0.05; **P-value <0.01.

Abbreviations: ART, antiretroviral therapy; DDS, Dietary Diversity Score; HFIAS, Household Food Insecurity Access Scale.

those HIV patients with lower dietary diversity were at higher risk of undernutrition.³⁴ But studies conducted in Senegal and Butajira, Ethiopia indicated that undernutrition was not associated with dietary diversity.^{21,25}

Patients on ART for more than a year were less likely to be undernourished compared to those using ART for less than a year. This finding was consistent with the finding at Felege Hiwot Referral Hospital, Bahir Dar, Northern Ethiopia and West Shewa Zone, Central Ethiopia.^{20,29} In addition, at the start of ART, there is a risk that opportunistic infections, immune reconstitution inflammatory syndrome, and early adverse drug reactions may develop, which contribute to undernutrition.³⁹

In this study, WHO clinical stage was associated with undernutrition. ART patients with WHO clinical stage 1 were less likely to be undernourished than those with WHO clinical stage 3. A cohort study in Singapore showed that there was a significant association between clinical disease stage and nutritional status.⁴⁰ Similarly, the studies at Gonder and West Shewa Zone Ethiopia and Kathmandu Valley, Nepal indicated that the risk of undernutrition increased from WHO clinical stage 1 to 4.^{23,29,31} There was a relationship between weight change and HIV clinical stage, which showed that there were distinct patterns of weight loss that occurred in stage 4 HIV infection.⁴¹

In this study, we tried to identify factors associated with undernutrition among adults receiving ART at Arba Minch area public health facilities. To avoid recall bias, medical charts were checked with primary data by using a structured interview questionnaire and checklist. However, the cross-sectional nature of the study limited the investigation to the level of the association between determinants and undernutrition. In this assessment, both undernourished and well-nourished adults had been using RUTF. Another limitation is that we did not assess the reason for its use. In addition, we did not take into consideration the seasonal variation related to intake of food (DDS).

Conclusion

In this study, the prevalence of undernutrition was high among adult HIV/AIDS clients enrolled in ART programs. The prevalence of undernutrition was lower among those who consumed diversified food groups and had been receiving ART for a longer period of time. On the contrary, the prevalence of undernutrition was higher among those who consumed tobacco and when the WHO clinical stage was higher. Therefore, efforts should be made to enhance the dietary diversity and to strengthen systems for cessation of tobacco smoking among those enrolled in ART programs. Nutrition-related attention should be given based on individuals' WHO clinical stage (especially 3 and 4), and to those who have recently enrolled in ART programs. Further investigations need to be done to assess the impact of RUTF on the nutritional status of adults receiving ART.

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Author contributions

All authors contributed toward data analysis, drafting and revising the paper, gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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