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Abstract

Background: Almost 1.9 billion adults worldwide are overweight or obese, while 462 million are underweight. These are primarily found in countries with low and middle-incomes, like Ethiopia. Under nutrition is the frequent health problem among peoples living with HIV/AIDS, however no large-scale research, including a number of health facilities has been conducted in Ethiopia. So this study aimed to assess the nutritional status and under nutrition related factors among HIV/AIDS patients attending ART follow-up in public hospitals of Bench Sheko zones, south west, Ethiopia.

Methods: In November/2020, a cross-sectional facility study design was carried out in all public hospitals in the Bench Sheko zone. To pick the study participants, a systematic sampling technique was used. Data were collected via face-to-face interviews and entered into Epi-data 3.1, then exported to SPSS version 24 for statistical analysis. In order to identify the candidate and independent determinants of under-nutrition, bivariate and multivariable logistic regression analyses were carried out respectively. Independent determinants of under-nutrition were measured using adjusted odds ratio with their corresponding 95% confidence level at P-value of < 0.05 cut of point.

Results: A total of four hundred two adult HIV-positive patients who were attending in ART clinics were participated with 98% response rate. The proportion of under nutrition (BMI<18.5 kg/m²), normal nutrition (BMI 18.5–24.9 kg/m²) and overweight or obese (BMI ≥25 kg/m²) patients were 29.2% [95% CI: (24.6-33.5)], 61.2% [95% CI: (56.5-66.3)], and 9.6% [95% CI: (6.6-12.9)] respectively. Out of under nutrition patients, severe malnutrition (BMI<16 kg/m²) accounted of 5.6%. Factors food insecurity [AOR: 3.26, 95% CI: (1.79-5.92)], poor ART adherence [AOR: 4.22, 95% CI: (1.47-12.14)], CD4 cell count ≤ 200 [AOR: 5.73, 95% CI: (2.45-13.13)], and substance user [AOR: 4.11, 95% CI: (2.31-7.30)] was independent factors of under nutrition.

Conclusion: This study found that the prevalence of malnutrition was high compared to other settings. The government should also pay due attention to improving the treatment of HIV/AIDS by offering nutritional support services in hospitals. Moreover policymaker and health care professionals consider the effects of these factors for nutrition while providing ART service.

Key words: HIV/AIDS, Malnutrition, ART

INTRODUCTION

Worldwide, about 38 million people were living with HIV/AIDS, over 25.5 million are in Africa. Similarly some 25.4 million people are being served while 12.6 million people are still waiting for ART treatment (1). Although 690 000 AIDS-related deaths and 1.7 million new infections have been reported in 2019, of them 0.7% were adults aged 15–49 years (1,2). The EDHS study in Ethiopia showed that the prevalence among adults in 2016 was almost 1 percent (3).

Malnutrition is physiological disorder that occurs because of lack of nutrients and energy to maintain the body's demand for growth, maintenance and basic functions of the body (4). Roughly 1.9 billion people are overweight or obese globally, while 462 million are underweight. These occur mainly in countries with low and medium incomes (4). Ethiopia is among the largest incidences of under nutrition in the world, with almost 49% of population lacking adequate nutrition (5).

Human nutrition and HIV/AIDS are closely linked to each other, both of which can independently cause progressive immune system damage. Malnutrition exacerbates the problem by speeding the progression of HIV infection to AIDS. HIV/AIDS is often correlated with biological and social factors that affect the ability of individuals to eat and use food (6).

There are multi-factorial causes of malnutrition in patients with HIV/AIDS. These includes food consumption disorder, medications that cause loss of appetite, nausea and vomiting, anorexia, opportunistic infections, diarrhea, nutrient mal absorption of nutrients and wasting syndrome (7). In addition, HIV has a particular impacts on nutritional status by increasing energy requirements through metabolic and oxidative changes (8). Adult patients with HIV/AIDS require 10% more energy consumption when asymptomatic, 20–30% more when symptomatic and increased energy intake by 30% during the recovery period compared to healthy people (8).

Studies showed that the prevalence of malnutrition among adult HIV-positive attending ART, though different degrees. For example studies conducted in Zambia and double, revealed that the prevalence of malnutrition were 36.4% and 19.34% respectively (9,10). In Ethiopia different studies have indicated different levels of malnutrition among adult HIV-positive individuals. For example a study in west Shewa public facility 23.6% (11), in east Harerge zone demonstrated that 30 % (12), in Jimma Medical center 34% (13), compared to 43% % in Jimma town Oromia region (14) of HIV positive patients had malnutrition.

In Ethiopia, studies have been conducted to investigate malnutrition among adult HIV positive individuals (11–17). However, no study has been conducted on large scale, incorporating a number of health facilities covering large demographic areas and socio-cultural diversity. Moreover the previous study does not assessed the food insecurity level of the patients. So the present study aimed to assess malnutrition status and its associated factors among adult HIV positive individuals by addressing the previous studies.

Methods and materials

Study setting, design, and period

A Facility based cross-sectional study was conducted at Bench Sheko zone public hospitals, south west Ethiopia from November/2020. Mizan Aman town is, the administrative town of Bench Sheko zone located 585 km to southwest of Addis Ababa. The zone has three public hospitals, namely Chena, Tepi and Mizan Tepi university teaching hospitals, 26 health center and 128 health posts. The main food crops of Bench Sheko zone include maize, coffee, godere (taro root), and enset, while sorghum, teff, wheat and barley are cultivated to a significant extent. An average of 3540 HIV positive individuals were attending ART among the three public hospitals, of whom 1965 males and 1575 were females. The clinic provides counseling, tracing, ART treatment, nutritional and medical treatment services.

Source population

All adult people living with HIV/AIDS attending ART at public hospitals of Bench-Sheko zone.

Study Population

All adult people living with HIV/AIDS attending ART at public hospitals of Bench-Sheko zone who full fill the eligibility.

Eligibility criteria

All HIV positive aged 18 years and older, who are attending ART at public hospitals of Bench Sheko zone were included to the study. Individuals who was critical ill, having hearing impairment and severe mental illness at the time of the study were excluded.

Sample size determination and sampling technique

A single population proportion formula was used to calculate the sample size with 95% level confidence, 5% margin of error, and considering 5% non-response rate. A study conducted in Jimma University teaching Hospital, south west Ethiopia, the estimated prevalence of under nutrition among patients on ART (46.8%) was used to get the maximum sample size (16), As a result, the final sample size became 402. According to the total number of ART clients in each public hospitals, proportionate number of sample was assigned for each ART clinic. Systematic sampling technique were employed to select the study participants.

We calculated the skip interval, $k=9$. The first study subject was selected using lottery method, then the other study participants were selected every nine interval.

Study variables

The dependent variables were Malnutrition (under nutrition), while the independent variables were socio-demographic variables (age, sex, residence, educational status, occupation religion, ethnicity, and income), Clinical factors (HIV related) factors (Diarrhea, ART status, Duration of ART, CD4 count, Viral Load, WHO staging, TB treatment, ART adherence, Hemoglobin level), Behavioral factor (Alcohol use, Substance use, and extra sexual partner) and Vulnerability characteristics (Household Food consumption, Food aid) were the independent variables.

Measurements and operational definitions

Under weight (Under Nutrition): The person who has Body mass index (BMI) less than 18.49Kg/M^2 (18).

Normal weight: The person who has Body mass index (BMI) between less than 18.5Kg/M to 24.9Kg/M^2 (18).

Over weight (over nutrition): The person who has Body mass index (BMI) greater than 25Kg/M^2 (18)

Obese (over Nutrition): The person who has Body mass index (BMI) greater than 30Kg/M^2 (18).

Adherent Patients: Those who score greater than or equal to 4 based on Morisky Medication Adherence Scale-8 (MMAS-8) (19).

Non adherent Patients: are those who score less than 4 based on Morisky Medication Adherence Scale-8 (MMAS-8) (19).

Food secure household: if household head responds no to all questions items 1-9 or responds yes to question item 1 and experience rarely in the past four weeks (20).

Food insecure household: if household heads responds at least yes to question item 1 and experience sometimes in the past four weeks (20).

Current Substance use: Using at least one of a specific substance (Alcohol, Khat, Cigarette and Others) for nonmedical purpose within last 3 months according to Alcohol, smoking and substance involvement screening tool (ASSIST) (21).

Ever Substance use: using at least one of any specific substance (Alcohol, Khat, Cigarette and Others) for the nonmedical purpose at least once in a lifetime according to ASSIST (21).

Data collection procedures and tools

Data were collected using pretested and structured interviewer administered questionnaire, checklist, and measurements. Three nurses and one public health professionals were recruited as data collectors and supervisor respectively. The questionnaires included socio-demographics, clinical factors, household and behavioral characteristics.

Weight and height measurement of the participants were done according to FANTA guidelines (22). Household food security status was assessed using the Household Food Insecurity Access Scale (HFIAS) (20), which was established and validated by Food and Nutrition Technical Assistance (FANTA). Drug adherence of the patient was assessed using eight-item Morisky Medication Adherence Scale (MMAS-8) (19). ASSIST which is a brief screening questionnaire developed by the WHO to find out about people's use of psychoactive substances was used to assess current and ever substance use history of the participants (21). The study was conducted following the World Medical Association declaration of Helsinki ethical principles for medical research involving human subjects (23).

Data quality assurance

Data collection tool was initially prepared in English translated to local language Amharic and back-translated into English to check its consistency. A pretest was done among 5% of study sample size and training was provided to the data collectors and supervisors on the objective of the study, maintenance of ethical standards, and methods of data collection. A supervisor checked the completeness of the collected data daily and overall data collection was monitored by investigators. Also data completeness were checked before enter into Epi-data 3.1. Data coding and cleaning was performed by cross-checking to printout data for possible errors. Moreover, missing values and outliers were checked before by running descriptive analysis.

Data Processing and analysis

Data were cleaned and entered into Epi data 3.1 and then exported to SPSS version 24 for statically analysis. The descriptive statistics were presented in frequency, tables and graphs. Normality assumption was checked for continuous variables. Body mass index (BMI) was calculated by dividing the weight in kg by square of height in meter. Under-nutrition was categorized as BMI below 18.5 Kg/m² (15).

The association between under nutrition with each covariate was assessed using bivariate logistic regression to identify a candidate variable for multivariate logistic regression. Variables with P value < 0.25 were taken into multiple logistic regression analysis to identify independent predictors of under-nutrition.

A backward likelihood ratio with a 0.1 probability of removal was used to build the model. To check the goodness of fit of the final model, the Hosmer Lemshow test of goodness of fit considering good fit at P-value > 0.05 was used. Finally, independent predictors of under-nutrition were declared at P-value <0.05 cut-off point and strength of the association was assessed using AORs with their corresponding at 95% confidence level.

RESULTS

Socio-demographic Characteristics

A total of three hundred ninety four adult HIV-positive patients who were enrolled in ART clinics were participated with 100% response rate. The mean BMI (SD) and age of the participants were 19.9(2.9), 34(11) respectively. The majority of the participants 181 (45.9%) were in the age group 25 to 34 range. More than half of 216(54.8%) and about 237(60.2%) were female in sex and urban in residence. Nearly Similar proportion 157(39.8%) and 156(39.6%) were Orthodox in religion and Bench in ethnicity. Concerning to marital status about 248(62.9%) were married and about 145(36.8%) of the participants were completed their secondary education (see table 1).

Table 1: Socio-demographic characteristics of patients grouped by nutritional status (BMI) in Bench Sheko public hospital, Southwest Ethiopia, 2020.

Variables	Under nutrition No (%)	Normal weight No (%)	Overweight or above No (%)	Total No (%)
Age				
18-24	21(23.5)	30(12.4)	8(21.1)	65(16.5)
25-34	49(42.6)	116 (48.1)	16 (42.1)	181 (45.9)
35-44	19 (16.5)	50 (20.7)	6 (15.8)	75 (19)
≥ 45	20 (17.4)	45 (18.7)	8 (21.1)	73 (18.5)
Sex				
Male	49(42.6)	113(46.9)	16(42.1)	178(45.2)
Female	66(57.4)	128(53.1)	22(57.9)	216(54.8)
Residence				
Urban	64(55.7)	146(60.6)	27(71.1)	237(60.2)
Rural	51(44.3)	95(39.4)	11(28.9)	157(39.8)
Religion				
Orthodox	50(43.5)	89(36.9)	18(47.4)	157(39.8)
Muslim	21(18.3)	75(31.1)	10(26.3)	106(26.9)
Protestant	44(38.3)	77(32)	10(26.3)	131(33.2)
Ethnicity				
Bench	48(41.7)	93(38.6)	15(39.5)	156(39.6)
Kaffa	19(16.5)	79(32.8)	6(15.8)	104(26.4)
Amhara	31(27)	36(14.9)	10(26.3)	77(19.5)
Oromo	17(14.8)	33(13.7)	7(18.4)	57(14.5)

Marital status				
Single	13(11.3)	31(12.9)	10(26.3)	54(13.7)
Married	74(64.3)	153(63.5)	21(55.3)	248(62.9)
Widowed	15(13)	35(14.5)	6(15.8)	56(14.2)
Divorced	13(11.3)	22(9.1)	1(2.6)	36(9.1)
Educational level				
Uneducated	25(21.7)	20(8.3)	0(0.0)	45(11.4)
Primary	45(39.1)	84(34.9)	18(47.4)	147(37.3)
Secondary	33(28.7)	101(41.9)	11(28.9)	145(36.8)
Tertiary	12(10.4)	36(14.9)	9(23.7)	57(14.5)
Occupation				
Unemployed	25(21.7)	38(15.8)	6(15.8)	69(17.5)
House wife	13(11.3)	26(10.8)	3(7.9)	42(10.7)
Daily labor	16(13.9)	23(9.5)	5(13.2)	44(11.2)
Merchant	37(32.2)	100(41.5)	14(36.8)	151(38.3)
Government employee	24(20.9)	54(22.4)	10(26.3)	88(22.3)
Average Monthly Income				
≤2500ETB	70(60.9)	104(43.2)	16(42.1)	190(48.2)
>2500ETB	45(39.1)	137(56.8)	22(57.9)	204(51.8)

Clinical and Behavioral related characteristics

This study also revealed the clinical and behavioral characteristics of the study participants. Most of the participants 231(58.6%) were diagnosed for HIV \geq 2 years and about 165(41.9%) had more than one year ART duration. Lightly above three-fourth 303(76.9%) had good ART adherence and about 261(66.2%) had hemoglobin level of \geq 12mg/dl. More over nearly half 191(48.5%) of the participants had CD4 level between 200 to 500 cells/mm³ and about 274(69.5%) of the participants had got food aid. Concerning to the behavioral characteristics nearly one-fourth 106(26.9%) were currently substance user and about 167(42.4%) had history of extramarital sex (table 2).

Table 2: Clinical and lifestyle-related characteristics and nutritional status of adults receiving ART at Bench Sheko zone public hospitals, southwest Ethiopia, 2020

Variables	Under-nutrition No (%)	Normal weight No (%)	Overweight or above No (%)	Total No (%)

HIV diagnosis				
≤2 years	47(40.9)	94(39)	22(57.9)	163(41.4)
>2 year	68(59.1)	147(61)	16(42.1)	231(58.6)
ART duration (months)				
<6 month	31(27)	54(22.4)	9(23.7)	94(23.9)
6-12 months	34(29.6)	87(36.1)	14(36.8)	135(34.3)
>12 months	50(43.5)	100(41.5)	15(39.5)	165(41.9)
CD4 Count				
≤ 200	35(30.4)	19(7.9)	4(10.5)	58(14.7)
200-500	46(40)	126(52.3)	19(50)	191(48.5)
≥ 500	34(29.6)	96(39.8)	15(39.5)	145(36.8)
WHO staging				
Stage I	11(9.6)	37(15.4)	5(13.2)	53(13.5)
Stage II	72(62.6)	175(72.6)	29(76.3)	276(70.1)
Stage III	22(19.1)	20(8.3)	2(5.3)	44(11.2)
Stage IV	10(8.7)	9(3.7)	2(5.3)	21(5.3)
ART adherence				
Poor	12(10.4)	9(3.7)	0(0)	21(5.3)
Fair	20(17.4)	42(17.4)	8(21.1)	70(17.8)
Good	83(72.2)	190(78.8)	30(78.9)	303(76.9)
Hemoglobin level				
≤12mg/dl	53(46.1)	76(31.5)	4(10.5)	133(33.8)
>12mg/dl	62(53.8)	165(68.5)	34(89.5)	261(66.2)
Diarrhea				
Yes	55(47.8)	52(21.6)	11(28.9)	118(29.9)
No	60(52.2)	189(78.4)	27(71.1)	276(70.1)
TB				
Yes	31(27)	34(14.1)	4(10.5)	69(17.5)
No	84(73)	207(85.9)	34(89.5)	325(82.5)
Hospital admission				

Yes	80(69.6)	128(53.1)	24(63.2)	232(58.9)
No	35(30.4)	113(46.9)	14(36.8)	162(41.1)
HIV disclosure				
Yes	93(80.9)	186(77.2)	36(94.7)	315(79.9)
No	22(19.1)	55(22.8)	2(5.3)	79(20.10)
Nutritional counseling's				
Yes	75(65.2)	143(59.3)	23(60.5)	241(61.2)
No	40(34.8)	98(40.7)	15(39.5)	153(38.8)
Functional status				
Bed ridden	11(9.6)	16(6.6)	4(10.5)	31(7.9)
Ambulatory	10(8.7)	14(5.8)	0(0.0)	24(6.1)
Working	94(81.7)	211(87.6)	34(89.5)	339(86)
Opportunistic Infection				
Yes	37(32.2)	37(15.4)	5(13.2)	79(20.1)
No	78(67.8)	204(84.6)	33(86.8)	315(79.9)
Difficulty of swallowing				
Yes	15(13)	24(10)	1(2.6)	40(10.2)
No	100(87)	217(90)	37(97.4)	354(89.8)
Comorbidity				
Yes	37((32.2)	46(19.1)	7(18.4)	90(22.8)
No	78(67.8)	195(80.9)	31(81.6)	304(77.2)
Food aid				
Yes	35(30.4)	71(29.5)	14(36.8)	120(30.5)
No	80(69.6)	170(70.5)	24(63.2)	274(69.5)
Food insecurity				
Yes	25(21.7)	127(52.7)	19(50)	171(43.4)
No	90(78.3)	114(47.3)	19(50)	223(56.6)
Current substance use				
Yes	53(46.1)	43(17.8)	10(26.3)	106(26.9)
No	62(53.9)	198(82.2)	28(73.7)	288(73.1)

Ever substance use				
Yes	22(19.1)	64(26.6)	11(28.9)	97(24.6)
No	93(80.9)	177(73.4)	27(71.1)	297(75.4)
Extra marital sex				
Yes	44(38.3)	108(44.8)	15(39.5)	167(42.4)
No	71(61.7)	133(55.2)	23(60.5)	227(57.6)

Prevalence of Malnutrition

The proportion of under nutrition (BMI<18.5 kg/m²), normal nutrition (BMI 18.5–24.9 kg/m²) and overweight or obese (BMI≥25 kg/m²) patients were 29.2% [95% CI :(24.6-33.5)], 61.2% [95% CI: (56.5-66.3)], and 9.6% [95% CI: (6.6-12.9)] respectively. Out of under nutrition patients, severe malnutrition (BMI<16 kg/m²) accounted of 5.6% (Figure 1).

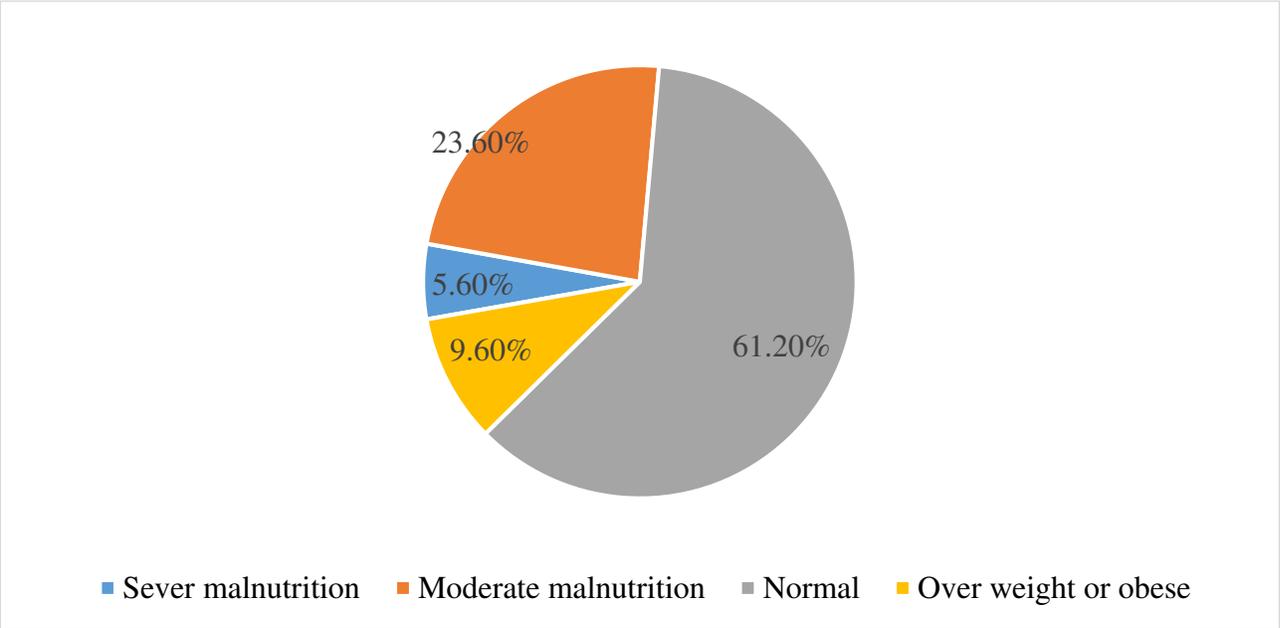


Figure 1: Nutritional status of HIV/AIDS patients on follow-up care in Bench Sheko zone public hospitals, Southwest Ethiopia, 2020

Predictors of under-nutrition

From the total 12 candidate variables entered into multivariable analysis, four variables were found to be independently associated with under nutrition among Adult HIV positive individuals attending ART. Under nutrition was about three times [AOR: 3.26, 95% CI: (1.79-5.92)] more likely among patients who had food insecurity than who had not.

The odds of under nutrition were four times [AOR: 4.22, 95% CI: (1.47-12.14)], higher among HIV patients who had poor ART adherence. HIV/AIDS patients with CD4 cell count \leq 200 cells/mm³ were nearly six times [AOR: 5.73, 95% CI: (2.45-13.13)], more likely under nourished than patients with CD4 cell count \geq 500 cells/mm³. Moreover individuals who were substance user is about four times [AOR: 4.11, 95% CI: (2.31-7.30)], higher risks of developing under nutrition as compared to who did not use (see table 3).

Table 3: Multivariate association of different variables with under nutrition among HIV/AIDS patients on follow-up care in Bench Sheko zone public hospitals, Southwest Ethiopia, 2020.

Variables	Under nutrition N (%)	Normal nutrition N (%)	COR (95% CI)	AOR (95% CI)	P Value
Monthly Income					
\leq 2500ETB	70(60.9)	104(43.2)	2.05(1.30-3.22)	1.73(1.00-2.98)	0.057
$>$ 2500ETB	45(39.1)	137(56.8)	1		
CD4 Count					
\leq 200	35(30.4)	19(7.9)	5.20(2.63-10.28)	5.73(2.45-13.13)	$<$ 0.0001*
200-500	46(40)	126(52.3)	1.03(0.61-1.73)	0.74(0.39-1.36)	0.331
\geq 500	34(29.6)	96(39.8)	1		
WHO staging					
Stage I	11(9.6)	37(15.4)	1		
Stage II	72(62.6)	175(72.6)	1.38(0.67-2.86)	1.58(0.60-4.14)	0.348
Stage III	22(19.1)	20(8.3)	3.70(1.50-9.15)	1.17(0.36-3.81)	0.793
Stage IV	10(8.7)	9(3.7)	3.73(1.21-11.50)	2.87(0.69-11.85)	0.144
ART adherence					

Poor	12(10.4)	9(3.7)	3.05(1.24-7.52)	4.22(1.47-12.14)	0.007*
Fair	20(17.4)	42(17.4)	1.09(0.60-1.97)	0.81(0.377-1.74)	0.588
Good	83(72.2)	190(78.8)	1		
Hemoglobin level					
≤12mg/dl	53(46.1)	76(31.5)	1.85(1.17-2.93)	1.75(0.95-3.20)	0.71
>12mg/dl	62(53.8)	165(68.5)	1		
Food insecurity					
Yes	25(21.7)	127(52.7)	4.01(2.41-6.68)	3.26(1.79-5.92)	<0.0001*
No	90(78.3)	114(47.3)	1		
Diarrhea					
Yes	55(47.8)	52(21.6)	3.33(2.07-5.37)	1.39(0.73-2.65)	0.318
No	60(52.2)	189(78.4)	1		
TB					
Yes	31(27)	34(14.1)	2.25(1.30-3.89)	1.35(0.61-2.99)	0.457
No	84(73)	207(85.9)	1		
Hospital admission					
Yes	80(69.6)	128(53.1)	2.02(1.26-3.23)	1.49(0.85-2.62)	0.160
No	35(30.4)	113(46.9)	1		
Opportunistic Infection					
Yes	37(32.2)	37(15.4)	2.61(1.55-4.42)	1.00(0.44-2.25)	0.999
No	78(67.8)	204(84.6)	1		
Comorbidity					
Yes	37(32.2)	46(19.1)	2.01(1.21-3.33)	0.70(0.29-1.70)	0.435
No	78(67.8)	195(80.9)	1		
substance use					
Yes	53(46.1)	43(17.8)	3.93(2.40-6.44)	4.11(2.31-7.30)	<0.0001*
No	62(53.9)	198(82.2)	1		

Key *= P value <0.05, 1= reference category

Discussion

This study showed that the prevalence of under nutrition and overweight or Obesity were 29.2% and 9.6%, respectively. Among under nutrition, severe malnutrition (BMI < 16kg/m²) accounted of 9%. In addition, this study also indicated that food insecurity, CD4 count, ART adherence and current substance user were the independent factors associated with under nutrition.

According to this study the prevalence of under-nutrition was close to that of a study conducted in various parts of Ethiopia; 30% in hospitals in the east Harerge zone (12), 25.2% in Butajira hospital (24), and 27% in Nekemte referral hospital (25), However the prevalence of this study was lower than 60.2%, west Gojam zone public hospitals (17), 46.8% in Jimma University specialized hospital (16) 43% in south west Oromia region (14), and higher than study conducted in 12.3% in Dilla university hospital (26) 18.2% in Arba Minch area public health facilities (15). Similarly, the prevalence is also much higher compared to studies done in different parts of the world; 19.5% in Tanzania (27), 10% in Zimbabwe (9), and 19.2% in Senegal (28). The potential difference in the prevalence of malnutrition could be attributable to socio-economic, food and cultural factors.

This study revealed that food insecurity has been found to be significantly associated with under-nutrition. HIV patients who had food insecurity were 3.3 times more likely under-nourished when compared to counterparts. Similarly, the research done in East Hararge Zone hospitals of Ethiopia and Senegal found that patients with household food deficiency had higher risks undernourishment (12,28). This is because there is insufficient food to satisfy nutritional requirements for productive and healthy living, contributing to macro and micronutrient deficiencies.

There was a strong correlation between CD4 numbers and under-nutrition with respect to CD4 counts. Patients with a CD4 count of < 200 cells/mm³ were approximately six times more likely than those with a CD4 count of > 500 cells/mm³ to grow under-nutrition. Similarly, the Jimma Ethiopia, Senegal, Tanzania, study found that CD4 was significantly associated with lower CD4 counts (13,27,28). On the other hand, the results of research conducted in the southern part of Ethiopia at Dilla University Hospital indicate that CD4 has no major impact on nutrition (26). Contrary to our research results, the disparity could be due to differences in the cultural variation of the study population and the study duration (12).

This study also revealed that drug adherence had significant association with under nutrition. HIV patients who had poor ART adherence were nearly four times higher risks of developing under nutrition when compared to counterparts. Study done in Senegal and Ethiopia revealed patients who had good drug adherence had less likely to develop under nutrition (25,28,29). This may be due to reducing the dietary intake and nutrient absorption.

Current substance use has significant effect on under nutrition. Patients who use any substance in the last three months were four times more likely develop under nutrition as compared to those who had not use. Study done in Arbamnch and Canada showed that Current tobacco-smoking adults enrolled in ART programs were at higher risk of being undernourished (15,30). However, study in Nepal showed behavioral factors like alcohol and smoking were found to have no association with under nutrition (31). The possible difference may be due to difference in study population, study design and period.

Conclusion and Recommendation

This study revealed that the prevalence of malnutrition was high compared to other settings in Ethiopia. It was also shown that food insecurity, poor ART adherence, CD4 cell count ≤ 200 cells/mm³, substance use were independently associated with under nutrition among adult HIV/AIDS patients attending ART.

This demands the government to give due attention to strengthening the HIV/AIDS treatment, nutritional assessment, supplementation, counseling, care and support to patients and support services at hospitals. In addition, the implications of food insecurity, poor ART adherence, CD4 cell count less than 200 cells/mm³ and substance use should be considered by policy makers and health professionals working at the ART clinic on the nutritional status among adult HIV patients.

Limitation of the study

The cross-sectional nature of the data, which makes it difficult to draw conclusions about the direction of relations among study variables.

List of abbreviations

AOR: Adjusted Odds Ratio; **ART:** Anti-Retroviral Therapy; **BMI:** Body Mass Index; **CI:** Confidence Interval; **COR:** Crude Odds Ratio; **EDHS:** Ethiopian Demographic and Health Survey; **FANTA:** Food and Nutrition Technical Assistance; **HFIAS:** Household Food Insecurity Access Scale; **HIV:** Human Immune Deficiency Virus; **MMAS-8:** Morisky Medication Adherence Scale-8; **MTU:** Mizan Tepi University; **SD:** Standard Deviation; **SPSS:** Statistical Package for the Social Sciences; **WHO:** World Health Organization

Declarations

Ethics approval and consent to participate

The research was approved and ethical clearance was obtained from institutional review board (IRB) of Mizan Tepi University. Approval letters was taken from each hospital medical director. The objective and purpose of the study was verified briefly to the study participant, confidentiality was assured, and informed written consent was obtained from each participants. For uneducated participants, informed consent was obtained from legally authorized representatives.

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Availability of data and materials

The datasets created and analyzed during the study will be made available to organizations and individuals by the first author based on fair request.

Authors' Contribution

NS, AM, GM, SG, RM, and TW wrote the protocol, participated in data collection, analyzed the data and wrote the manuscript. All authors read and approved the final manuscript.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Figures

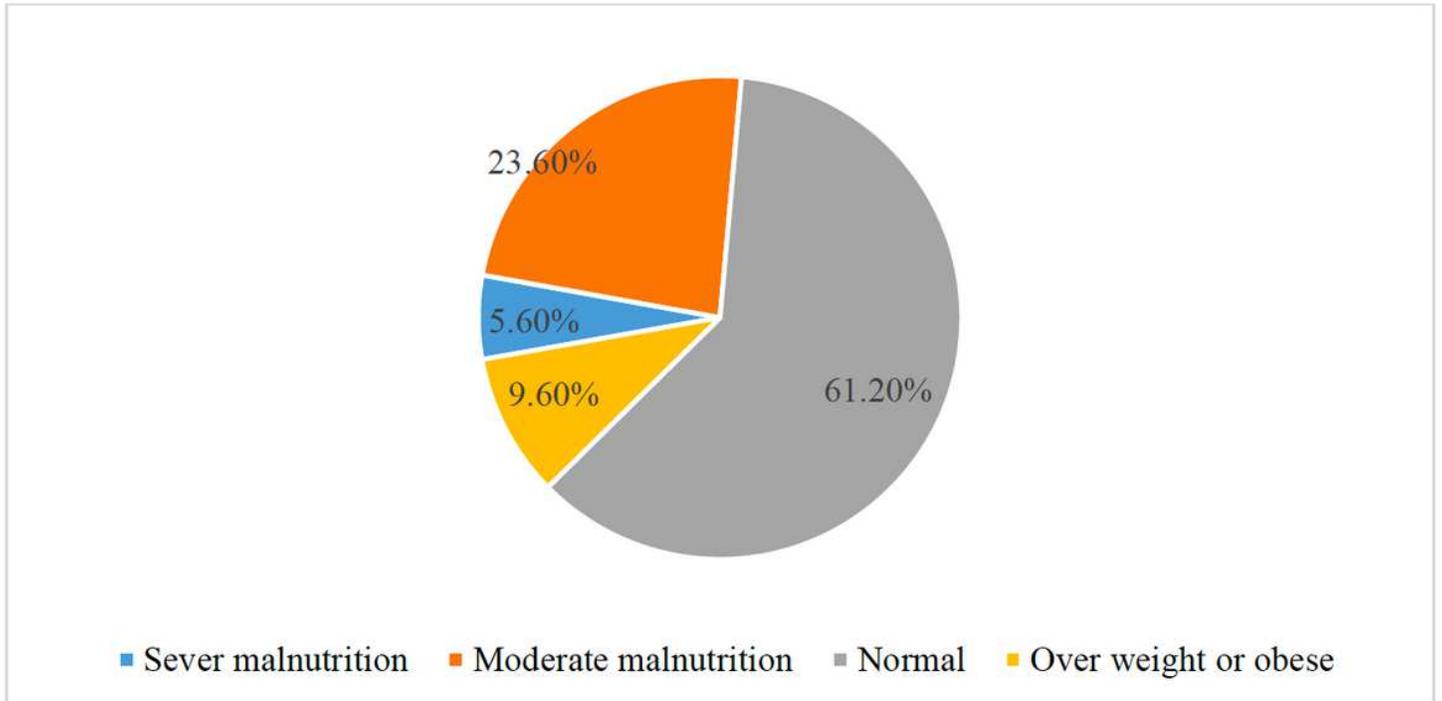


Figure 1

Nutritional status of HIV/AIDS patients on follow-up care in Bench Sheko zone public hospitals, Southwest Ethiopia, 2020