Pathology and Laboratory Medicine
2021; 5(1): 10-18
http://www.sciencepublishinggroup.com/j/plm
doi: 10.11648/j.plm.20210501.13
ISSN: 2640-446X (Print); ISSN: 2640-4478 (Online)

Undernutrition and Associated Factors Among Seropositive Adults in ART Clinic Treatment Centre, Hiwot Fana Specialized University Hospital, Eastern Ethiopia

Aboma Motuma[1, *], Tilahun Abdeta[2]

[1]School of Nursing and Midwifery, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia

[2]Department of Psychiatry, School of Nursing and Midwifery, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia

Email address:
abomaabdi1@gmail.com (A. Motuma), tilahunabdeta@gmail.com (T. Abdeta)

[*]Corresponding author

To cite this article:
Aboma Motuma, Tilahun Abdeta. Undernutrition and Associated Factors Among Seropositive Adults in ART Clinic Treatment Centre, Hiwot Fana Specialized University Hospital, Eastern Ethiopia. *Pathology and Laboratory Medicine*. Vol. 5, No. 1, 2021, pp. 10-18.
doi: 10.11648/j.plm.20210501.13

Received: April 24, 2021; **Accepted**: June 15, 2021; **Published**: June 22, 2021

Abstract: Background: Ethiopia is found with a high HIV epidemic. HIV/AIDS and malnourishment worsen one another from different perspectives. In Sub-Saharan Africa including Ethiopia despite remarkable efforts to reduce the problems, HIV/AIDS and malnutrition has remained the main challenges of health systems. Objective: To assess malnutrition and identify factors associated with undernutrition among adult patients attending HIV follow-up service at Hiwot Fana Specialized University Hospital (HFSUH), Harar town, Eastern Ethiopia. Method: Institutional based cross-sectional study was conducted from November 1 to December 30, 2016, among five hundred two respondents. The sample was selected by a simple random sampling method from the pre-ART and ART sample frame. The data were collected using a structured questionnaire through face to face interviews. We used descriptive statistics to describe the prevalence of malnutrition and mean, frequencies, and proportion of the variables. Factors associated with undernutrition were assessed by a logistic regression model using STATA 14. Result: The prevalence of undernutrition was 26.5% (95%CI: 24.5, 28.5) among HIV/AIDS patients. Being male (AOR 2.11, 95%CI: 1.34, 3.12), age group of 18-29 years (AOR 2.85, 95%CI: 1.48, 5.62), having an unemployed partner (AOR 2.31, 95%CI: 1.36, 3.75), opportunistic infection (AOR 2.94, 95%CI: 1.44, 6.03), and not attending HIV related dietary counseling session (AOR 3.22, 95%CI: 1.64, 6.31) were significantly associated with undernutrition. Conclusion: One-fourth of HIV/AIDS patients had undernutrition. Being male, younger age groups, having an unemployed partner, having opportunistic infection, and no dietary counseling were positively associated with undernutrition. All concerned bodies should have to give attention to these identified factors.

Keywords: HIV/AIDS, Undernutrition, Ethiopia

1. Introduction

Sub-Saharan Africa is one of the regions highly infected with Human Immunodeficiency Virus (HIV). Out of the 36.7 million projected individuals living with the virus globally in 2015, Sub-Saharan Africa accounts for around 69% [1]. Ethiopia is also found with a high HIV epidemic. As stated by the 2016 national HIV, estimates reported by WHO, Ethiopia accounts for an estimated HIV occurrence of 1.1% [0.8% - 1.3%] among 15–49 years adults [2].

HIV/AIDS and malnourishment worsen one another from different perspectives. HIV patients might be malnourished due to various reasons. HIV reduces food intake resulting from appetite loss and difficulty eating, possibly as a result of infections, side effects of medication, or depression. It affects nutrients' absorption may be as the result of recurrent or chronic diarrhea and HIV-related intestinal cell damage. Moreover, HIV increases the patients' energy needs due to viral replication and opportunistic infections (OIs). Similarly, HIV changes the way the body uses the nutrients it receives

or has stored. Then again, malnutrition compromises the immune system, making the body vulnerable to frequent illness and increasing its energy and nutrient demand, thereby accelerating disease progression [3].

In Sub-Saharan Africa, malnutrition among adult HIV/AIDS patients is common and accounts for 10% to 33% [4-6]. The proportion of undernutrition among HIV adult patients was 19% in Senegal and 5.8% in Nigeria [5, 7]. Ethiopia is a poor country and carries the highest occurrences of chronic food insecurity [8]. Consistently in Ethiopia, malnutrition among HIV adult patients was high ranging from 12.3% in Dilla university hospital to 25.2% in Butajira hospital [9, 10].

Different socio-demographic and clinical related variables like wealth index, employment status, age, sex, WHO clinical Staging, CD4 count, ART interruption, and presence of opportunistic infection were some of the identified predictors of adult HIV patients' malnutrition [11-13].

In the Sub-Saharan Africa, despite significant efforts are made in HIV treatment, still HIV/AIDS and malnutrition has caused severe health problems [14]. Between 2000 and 2016, Ethiopia has reduced the new HIV infections by 90%, and AIDS-related mortality was also reduced by more than 50% [15]. Moreover, Ethiopian Ministry of Health has developed and started to implement National Guidelines for HIV/AIDS and Nutrition since 2007 [16]. However, irrespective of all the above efforts, the prevalence of HIV/AIDS still high (0.9%) in Ethiopia [15]. This could be due to low treatment effectiveness and non-adherence to the treatment and nutritional status of patients [17].

In general in Ethiopia, there is a limited national evidence, particularly in the study area related with malnutrition among HIV/AIDS patients. Therefore, this study was designed to add some value to the existing evidence by assessing malnutrition and factors associated with undernutrition among adult patients attending HIV follow up service at Hiwot Fana Specialized University Hospital in eastern Ethiopia.

2. Material and Methods

2.1. Study Setting

Hiwot Fana Specialized University Hospital is one of the oldest hospitals in Ethiopia, which was established during the occupation of Italian soldiers (1928–1933). Currently, the hospital expected to serve for more than twenty million peoples of the region and neighboring regions like Dire Dawa administrative council, Oromia, and Ethiopian Somali Regional State. The majority of the cases are referrals. We conducted this study among adult patients registered for HIV follow-up service at HFSUH located in Harari regional state, 526 kilometers far away from the capital city, Addis Ababa, and toward the eastern direction. The hospital serves as a teaching center of eastern Ethiopia and delivers different health services to the community like internal medicine, surgery, gynecology and obstetrics, TB/HIV services for community. It is the center for training undergraduate medical and other health science students and function as a research centers [18].

2.2. Study Design and Period

This hospital-based cross-sectional study was conducted in Haramaya University Hiwot Fana Specialized University Hospital in ART treatment center from November 1 to December 2016.

2.3. Study Population and Sample Size Determination

All seropositive individuals aged ≥18 years who had a regular follow up in the ART treatment center and enrolled for a minimum of six month at Hiwot Fana Specialized University Hospital in eastern Ethiopia were eligible for the study. In this study five hundred two individuals were randomly selected who age were 18 years and above and enrolled in HIV follow-up (Pre-ART and initiated ART) at Hiwot Fana Specialized University Hospital. However, patients who critically ill and HIV positive pregnant/lactating women were not included in the study. The sample size was determined using a single population proportion formula. The sample size was calculated using Open Epi 3.1 based on a single population proportion formula by considering the prevalence of undernutrtion 25.5% among HIV patients which was reported in Ethiopia [19], with assuming 4% marginal error, 95% Confidence level and 10% a non-response rate. The calculated sample size was 502.

2.4. Sampling Procedure

During our study period, there were 5,058 registered adult seropositive individuals enrolled in ART care clinic (Pre-ART and initiated ART) at HFSUH, Harar town, Eastern Ethiopia. Regarding their ART status, 3,823 patients were on ART, and 1,235 were on Pre-ART care. Then, the calculated sample size was proportional allocated to Pre-ART and ART status based on their total population. We recruited 122 patients from Pre-ART and 380 from those who initiated ART. Finally, eligible patients from respective ART status were selected using a simple random sampling method using their card number.

2.5. Data Collection Procedure

An English Version structured questionnaire was adopted from literature and translated into local languages in the study setting. Then, the local language versions were translated back English by fluent speaker to check for accuracy and consistency. Data collection was made through face-to-face interviews using interviewer-administered structured and reviewing patients' medical records. The tools was pre tested at another nearby public hospitals out of our study setting. The study subjects variables including sex, age, marital status, educational level, ethnicity, religion, patient and partner's employment status, house hold's average monthly income, functional status, food aid from community organizations, attended HIV related dietary counseling session, and eating frequency through interviewing patients. Besides, we obtained variables such as WHO clinical staging,

current CD4 cell count (cell/mm^3), ART status, and opportunistic infection from the patients' medical records. However, the height and weight of the participants were measured and recorded at the start of the interview. Then we calculated the body mass index (BMI) of each patient as weight in kilograms divided by height squared (kg/m^2). Data were collected by three trained Bachelor of Science holder clinical nurses working in the ART clinic. The overall data collection was supervised by public health professional.

2.6. Study Variables

2.6.1. Dependent Variable

Status of malnutrition among HIV/AIDS adult patients

2.6.2. Independent Variables

Socio-demographic and clinical related characteristics of HIV/AIDS patients including sex, age, marital status, educational status, ethnicity, religion, patient's employment status, house hold's average monthly income, and partner's employment status, clinical staging, CD4 cell amount, ART position, opportunistic infection, functional status, accessed HIV related food aid from community organizations, attended HIV related dietary counseling session, and eating frequency.

2.7. Data Processing and Analysis

Data were cleaned, coded, and entered by using EPiData Version 3.1 software and analyzed by using STATA version 14 (Stata Corp, USA) statistical software. We have checked the data thoroughly for consistency and completeness before entry. We computed descriptive statistics to present the outcome and independent variables using mean, frequencies, and proportion.

Using the following nutritional status classifications based on BMI calculation:

BMI (< 16 kg/m^2)=Severe malnutrition; BMI (16 kg/m^2 – 16.99 kg/m^2)=Moderate malnutrition; BMI (17 kg/m^2 - 18.49 kg/m^2)=Mild malnutrition; BMI (18.5 kg/m^2 – 24.99 kg/m^2)=Normal nutritional status; BMI (25 kg/m^2 - 29.99 kg/m^2)=Overweight; and BMI (≥30 kg/m^2)=Obesity, we merged severe, moderate, and mild malnutrition classifications as a single category (undernutrition) was created. Then, accordingly we categorized into undernutrition, normal nutritional status, and overweight and obesity. Finally, we used the category of patients with undernutrition and normal nutritional status (n=473) in logistic regression analysis to detect predictors of undernutrition. However, we reported only the magnitude of patients with overweight/obesity (n=29) in the result of this study. We further used variables with a P-value < 0.05 in bivariate analysis into the final multivariable model. Then the statistical level of significance was reported at P < 0.05. We used a p-value and odds ratio with a 95% confidence interval to ascertain the report. We checked the fitness of the model by using Hosmer and Lomshow goodness-of-fit.

2.8. Data Quality Control

In assuring quality of the data, we emphasis highly on designing and data collection instrument. We pretested the questionnaire on 5% of the sample and accordingly the questions were refined based on the feedback obtained during pretest to reach the final version. One day training was given to data collectors and supervisors regarding data collection procedures, study objectives, and other related issues. Then we checked the questionnaires for consistency and completeness before data entry. The principal investigator and supervisor have closely supervised data collector on daily bases.

2.9. Operational Definitions

Based on the body mass index (BMI) calculation, nutritional status was classified as follows [20].

BMI (< 16 kg/m^2)=Severe malnutrition
BMI (16 kg/m^2 – 16.99 kg/m^2)=Moderate malnutrition
BMI (17 kg/m^2 - 18.49 kg/m^2)=Mild malnutrition
BMI (18.5 kg/m^2 – 24.99 kg/m^2)=Normal nutritional status
BMI (25 kg/m^2 - 29.99 kg/m^2)=Overweight
BMI (≥30 kg/m^2)=Obesity

2.10. Ethics Approval and Informed Consent

This study has been performed following the principles stated in the Declaration of Helsinki. We obtained ethical approval from the College of Health and Medical Science of Haramaya University Institutional Health Research Ethics Review Committee. We also obtained permission from the hospital managers and ART clinic unit coordinator before starting data collection as well as written informed consent was obtained from participants. We informed and respected the participants' right either to refuse or withdraw from the study if needed. We have highly assured the respondents' confidentiality and privacy by using a nameless questionnaire and performing the interview in a private room.

3. Results

3.1. Socio-demographic and Clinical Characteristics of the Study Participants

We recruited a total of 502 respondents in this study. Their mean age was 36.73±(9.65) years with a minimum and maximum of 19 and 76 years. The majority of the participants (60.8%) were females. More than one-third of respondents (42.4%) found in the age group of 30-39 years. The majority (57.6%) were currently married. Regarding their educational status majority (38.8%) of respondents had attended secondary school & above. Most of the respondents were Oromo by their ethnicity (69.9%), and Orthodox Christian followers (63.7%) by their religion. Regarding their employment status, 55.4% of the participants and 52.9% of their partners were employed. Concerning on household's average monthly income, the majority (37.1%) of households have an average monthly income of > 1000 Ethiopian Birr, while (7.0%) of respondents' households have no constant

monthly income. More than half of patients (63.9%) found in stage-I WHO clinical staging. One hundred ninety-nine (39.6%) patients have a current CD4 cell count of ≥ 500 (cell/mm^3). The majority of the total patients (75.7%) have started ART drug. From the total study participants, one hundred sixty-two (32.3%) of participants have developed an opportunistic infection. The (4.6%) out of the total participants were ambulatory regarding their functional status. Twenty-two (4.4%) respondents had got HIV related food aid from community organizations, while (49.2%) have attended HIV related dietary counseling session. Additionally, majority (61.2%) of respondents eat ≥ 3 meals/day (Table 1).

Table 1. *Socio-demographic and clinical characteristics of adult patients enrolled in HIV follow-up service at HFSUH, Harar town, Eastern Ethiopia, 2016.*

Variables	Frequency	Percentage (%)
Sex		
Male	197	39.2
Female	305	60.8
Age		
18-29	117	23.3
30-39	213	42.4
40-49	121	24.1
>=50	51	10.2
Marital status		
Single	73	14.5
Married	289	57.6
Separated/Divorced/Widowed	140	27.9
Educational status		
Cannot read and write	109	21.7
Read & write only	12	2.4
Primary school	186	37.1
Secondary school and above	195	38.8
Ethnicity		
Oromo	351	69.9
Amhara	122	24.3
Others (Harari, Tigre, Gurage)	29	5.8
Religion		
Orthodox	320	63.7
Protestant	164	32.7
Muslim	18	3.6
Patient's employment status		
Employed	278	55.4
Unemployed	224	44.6
Household's average monthly income		
≤ 500 ETB	160	31.9
501-1000 ETB	121	24.1
> 1000 ETB	186	37.1
No constant monthly income	35	7.0
Partner's employment status (n=289)		
Employed	153	52.9
Unemployed	136	47.1
WHO clinical staging		
Stage-I	321	63.9
Stage-II	111	22.1
Stage-III/Stage-IV	70	13.9
Current CD4 cell count (cell/mm^3)		
< 200	59	11.8
200- 349	100	19.9
350- 499	144	28.7
≥ 500	199	39.6
ART status		
Pre-ART	122	24.3
ART Initiated	380	75.7
Opportunistic infection		
No	340	67.7
Yes	162	32.3
Functional status		
Working	479	95.4
Ambulatory	23	4.6
Get HIV related food aid from community organizations		
No	480	95.6
Yes	22	4.4
Attended HIV related dietary counseling session		

Variables	Frequency	Percentage (%)
No	255	50.8
Yes	247	49.2
Eating frequency		
≤ 2 meals/day	195	38.8
≥ 3 meals/day	307	61.2

3.2. Nutritional Status of the Respondents According to BMI Calculation

In this study the mean body mass index was 20.3 with SD + 2.7 kg/m^2. The prevalence of undernutrition (BMI<18.5 kg/m^2) was (26.5%; 95%CI: 24.5, 28.5) (n=133), out of this a severe undernutrition was 4.6% (n=23), moderate 5.6% (n=28), and mild was 16.3% (n=82). The majority 67.7% (n=340) have normal nutritional status (BMI 18.5–24.9 kg/m^2) and only 5.8% (n=29) have overweight or obesity (BMI ≥ 25 kg/m^2). We found that patients with undernutrition was (n=133) and normal nutritional status (n=340), while we reported only the prevalence of overweight or obesity was 29 participants.

3.3. Bivariate Logistic Regression Analysis of Factors Associated with Undernutrition

As presented in (Table 2), variables including sex, age group, partner's employment conditions, clinical staging, CD4 cell count, opportunistic infection, status of functions, dietary counseling session, eating frequency have a significant association with undernutrition. Then we entered all these variables into multivariate analysis.

Table 2. *Bivariate analysis of different variables associated with undernutrition among adult patients enrolled in HIV follow-up service at HFSUH, Harar town, Eastern Ethiopia, 2016.*

Variables	Undernutrition	Normal nutrition	p-value	COR (95%CI)
Sex				
Male	31	146	0.001	2.48 (1.57, 3.91)
Female	102	194	Ref	Ref
Age group in years				
18-29	24	88	0.01	2.62 (1.26, 5.44)
30-39	51	149	0.03	2.18 (1.18, 4.02)
40-49	38	75	0.33	1.41 (0.70, 2.82)
>=50	20	28	Ref	Ref
Marital conditions				
Not married	19	48	Ref	Ref
Married	83	190	0.74	0.91 (0.50, 1.64)
Separated/Divorced/Widowed	31	102	0.44	1.30 (0.67, 2.54)
Educational status				
Cannot read and write	27	77	0.93	1.16 (0.26, 4.33)
Read & write only	3	8	Ref	Ref
Primary school	60	120	0.68	0.75 (0.19, 2.93)
Secondary school and above	43	135	0.82	1.18 (0.29, 4.64)
Ethnicity				
Oromo	94	240	0.66	0.81 (0.31, 2.18)
Amhara	33	81	0.62	0.78 (0.28, 2.11)
Others (Harari, Tigre, Gurage)	6	19	Ref	Ref
Religion				
Orthodox	88	213	0.37	0.56 (0.16, 2.01)
Protestant	42	114	0.48	0.63 (0.17, 2.31)
Muslim	3	13	Ref	Ref
Patient's employment status				
Employed	78	180	Ref	Ref
Unemployed	55	160	0.26	1.26 (0.84, 1.89)
Household's average monthly income				
≤ 500 ETB	50	104	0.08	0.65 (0.39, 1.16)
501-1000 ETB	36	80	0.18	0.69 (0.41, 1.18)
> 1000 ETB	40	128	Ref	Ref
No constant monthly income	7	28	0.63	1.25 (0.51, 3.17)
Partner's employment status (n=273)				
Employed	33	115	Ref	Ref
Unemployed	50	75	0.002	2.32 (1.37, 3.94)
WHO clinical staging				
Stage-I	72	227	Ref	Ref
Stage-II	31	73	0.08	1.77 (0.94, 3.33)
Stage-III/Stage-IV	30	40	0.002	2.37 (1.37, 4.16)
Current CD4 cell count (cell/mm^3)				
< 200	31	26	0.001	4.06 (2.17, 7.58)

Variables	Undernutrition	Normal nutrition	p-value	COR (95%CI)
200- 349	28	66	0.001	3.91 (2.03, 7.53)
350- 499	32	105	0.003	2.81 (1.42, 5.57)
≥ 500	42	143	Ref	Ref
ART status				
Pre-ART	36	76	Ref	Ref
ART Initiated	97	264	0.28	1.29 (0.81, 2.04)
Opportunistic infection				
No	74	246	Ref	Ref
Yes	59	94	0.001	2.18 (1.38, 3.17)
Functional status				
Working	118	332	Ref	ref
Ambulatory	15	8	0.001	5.28 (2.18, 12.76)
Get HIV related food aid from community organizations				
No	129	324	Ref	Ref
Yes	4	16	0.41	1.59 (0.52, 4.85)
Attended HIV related dietary counseling session				
No	81	159	Ref	Ref
Yes	52	181	0.006	1.77 (1.18, 2.67)
Eating frequency				
≤ 2 meals/day	64	124	Ref	Ref
≥ 3 meals/day	69	216	0.02	1.62 (1.17, 2.42)

3.4. Multivariate Logistic Regression Analysis of Factors Associated with Undernutrition

As displayed in (Table 3), in multivariate analysis after adjusting for all independent variables, sex, age group, partner's employment status, opportunistic infection, and attended HIV dietary counseling session were significantly associated with undernutrition. Male patients have higher odds of undernutrition compared to those female patients (AOR 2.11, 95%CI: 1.34, 3.12). Young age groups (18-29 yers) were nearly three times more likely undernutrition was nearly about three as compared to elder patients in the age group of ≥50 years (AOR 2.85, 95%CI: 1.48, 5.62). Patients who have unemployed partners were more than two times more likely undernourished than patients who have employed partners (AOR 2.31, 95%CI: 1.36, 3.75). Patients who have opportunistic infection were about three times more likely to have undernutrition compared to patients who did not develop opportunistic infection (AOR 2.94, 95%CI: 1.44, 6.03). Moreover, patients who did not attend HIV related dietary counseling session have higher odds of undernutrition as compared to patients who attended HIV related dietary counseling session (AOR 3.22, 95%CI: 1.64, 6.31). However, WHO clinical staging, current CD4 cell count, functional status, and eating frequency have a significant association with undernutrition in bivariate logistic regression but they have no association in the final multivariate analysis.

Table 3. *Multivariate analysis of different variables associated with undernutrition among adult patients enrolled in HIV follow-up service at HFSUH, Harar town, Eastern Ethiopia, 2016.*

Variables	Undernutrition	Normal nutrition	p-value	AOR (95%CI)
Sex				
Male	31	146	0.001	2.11 (1.34, 3.12)
Female	102	194	Ref	Ref
Age group in years				
18-29	24	88	0.01	2.85 (1.48, 5.62)
30-39	51	149	0.06	2.67 (0.96, 7.42)
40-49	38	75	0.61	1.31 (0.47, 3.68)
≥50	20	28	Ref	Ref
Partner's employment status (n=273)				
Employed	33	115	Ref	Ref
Unemployed	50	75	0.001	2.31 (1.36, 3.75)
WHO clinical staging				
Stage-I	72	227	Ref	Ref
Stage-II	31	73	0.286	1.47 (0.51, 4.26)
Stage-III/Stage-IV	30	40	0.477	1.64 (0.66, 4.05)
Current CD4 cell count (cell/mm^3)				
< 200	31	26	0.30	2.58 (0.96, 6.95)
200- 349	28	66	0.59	1.76 (0.60, 5.17)
350- 499	32	105	0.06	1.35 (0.46, 3.96)
≥ 500	42	143	Ref	Ref
Opportunistic infection				
No	74	246	Ref	Ref
Yes	59	94	0.003	2.94 (1.44, 6.03)
Functional status				

Variables	Undernutrition	Normal nutrition	p-value	AOR (95%CI)
Working	118	332	Ref	ref
Ambulatory	15	8	0.16	2.74 (0.67, 11.13)
Attended HIV related dietary counseling session				
No	81	159	0.001	3.22 (1.64, 6.31)
Yes	52	181	Ref	Ref
Eating frequency				
≤ 2 meals/day	64	124	0.86	1.06 (0.53, 2.14)
≥ 3 meals/day	69	216	Ref	Ref

4. Discussion

The primary aim of our study was to determine the prevalence of undernutrition and its predictors among adult Sero-positive individuals enrolled in HIV follow-up service at HFSUH, Harar town, Eastern Ethiopia. Moreover, this study presented the magnitude of overweight or obesity among the study participants.

The prevalence of undernutrition and overweight or obesity was 26.5% and 5.8%, respectively. Out of all undernutrition, 4.6% have severe malnutrition (body mass index < 16 kg/m^2), 5.6% have moderate undernutrition (body mass index: 16 kg/m^2 – 16.99 kg/m^2), and 16.3% have mild undernutrition (BMI: 17 kg/m^2 - 18.49 kg/m^2). In the final model analysis, we identified sex, age group, partner's employment status, opportunistic infection, and attended dietary counseling session were independently associated with undernutrition.

The prevalence of undernutrition found in our study was comparable with the previous study findings from different areas of Ethiopia like in Wolayita Sodo Hospital 26.6% [21], Nekemte referral hospital 27% [13], Butajira hospital 25.2% [22], and Bahir Dar Hospital 25.5% [23]. However, our findings was lower than previous studies like 46.8% in Jimma Hospital southwest Ethiopia [12], 42.3% in Tigray, northern Ethiopia [24], 30% in East Hararghe Zone Hospitals, eastern Ethiopia [25], 73% in India [26], and 57% in Malawi [27]. However, the findings of this study was higher than the study conducted in Senegal 19.2% [28], in Tanzania 19.4% [29], in Zimbabwe 10% [30], in Nigeria 5.8% [31], in southern Ethiopia 12.3% and 23.72% [32, 33], and in northwest Ethiopia 23.2% [34].

The discrepancy in the magnitude of undernutrition might be due to difference in the study design, socio-economic status, residence, culture and feeding styles of different ethnic groups, clinical stages of HIV, current CD4 cell count, health care awareness of the respondents, and the difference in ART care services like routine nutritional screening and variations in measurements of nutritional status. For instance, in our study, the majority of participants (63.9%) were found at the clinical stage one. However, undernutrition is high among patients with advanced clinical stage of HIV as compared to stage one [24, 35]. Similarly, in our study, 39.6% of respondents have a current CD4 cell count of ≥ 500 cell/mm^3, and only 11.8% have < 200 cell/mm^3. This could also create a variation as having CD4 < 200 cell/mm^3 was significantly associated with undernutrition [24]. Moreover, a study in Nigeria evaluated the nutritional status using objective method such as body mass index, and subjective methods with malnutrition universal screening tool (MUST) and subjective global assessment (SGA) tool. But in our study, we used only the objective body mass index method [31].

The multivariate analysis result of our study revealed that male patients have higher odds of having undernutrition as compared to those female patients (AOR 2.11, 95%CI: 1.34, 3.12) and the finding was consistent with the previous study findings in Ethiopia and other African countries [21, 23, 30]. This result could be due to different possible justifications. Firstly, in Ethiopia, females are more concerned about their family particularly to care for their children, and possibly for the sake of their children female patients could seek help early and will be more adhere to HIV-related treatments like ART, and food counseling given to them. Secondly, in Ethiopia, some of the previously reported predictors of undernutrition among HIV patients such as substance abuse including khat, alcohol, and cigarettes are more common among males than females [25, 33].

Patients who were found in the age category of 18-29 years have higher odds of undernutrition compared to elder patients of ≥50 years old (AOR 2.85, 95%CI: 1.48, 5.62) and this finding was similar with studies in Zimbabwe and Ethiopia [30, 34]. This can be attributed to 1. Young adults are more vulnerable to substance misuse which could affect their nutritional habits. 2. Younger adults have a poor coping mechanism to stressful life events like acquiring HIV/AIDS and its consequences and also, having emotional instability like persistent anxiety, and depression could negatively affect their dietary intake and treatment outcome [36].

In this study partners' employment status was one of the important associated factors of undernutrition. Patients who have unemployed partners were more likely undernourished than patients who have employed partners (AOR 2.31, 95%CI: 1.36, 3.75). This result was consistent with a previous study in Ethiopia [32]. This result might be due to the reality that unemployment indorses poverty which in turn could be the base for household's food insecurity. This finding implies that generating employment chances for adult individuals living with HIV/AIDS might have a contribution to reducing undernutrition.

Also, patients who have developed opportunistic infection have higher odds of undernutrition compared to those who did not develop opportunistic infection (AOR 2.94, 95%CI: 1.44, 6.03). This finding matched the results of previous

studies in Ethiopia [25, 32]. This result could be due to the complications of opportunistic infections like diarrhea could worsen patients' nutritional status. This finding indicates that appropriately managing opportunistic infections is vital. Our study also revealed that patients who hadn't attend HIV related dietary counseling session have higher odds of undernutrition compared to those who attended HIV related dietary counseling session (AOR 3.22, 95%CI: 1.64, 6.31). This result was consistent with a previous study conducted in Ghana [37].

Limitations of the Study

First, we assessed the participants' nutritional status objectively with anthropometric measurement like body mass index. However, we did not use subjective methods such as subjective global assessment (SGA) tools and laboratory methods to measure some micronutrient deficiencies. So, using only anthropometric measurement (BMI) might not reflect the exact respondents' nutritional status measurement. Second, due to its cross-sectional nature, our study cannot reveal the cause-effect relationships between the outcome variable (undernutrition) and independent variables.

5. Conclusions

Our study indicated that one-fourth of the study participants had undernutrition, which was very high. Being male, young age group, partner's employment status, having opportunistic infections, and attended HIV related dietary counseling session were significantly associated with undernutrition. Therefore, all concerned bodies, hospitals, other governmental and non-governmental stakeholders have to give attention to the identified associated factors to improve the nutritional status of HIV patients. Patients who have developed opportunistic infections need getting attention. Moreover, the emphasis on generating employment chances and strengthening HIV related dietary counseling for individuals living with HIV/AIDS is crucial.

Data Availability

The datasets used in this study are obtainable from the corresponding author on rational request.

Funding

The College of Health and Medical Science of Haramaya University has provided financial support to collect data. However, the college did not contribute to designing the study, data collection process, analysis, the decision to publish, and manuscript preparation and for publication.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

Both authors highly contributed to the conception, design, acquisition, analysis, interpretation of the data, drafting, and critically reviewing the manuscript. The authors have agreed to submit on HIV/AIDS - Research and Palliative Care journal of Dove Medical Press. Moreover, the authors have agreed on the final version of this manuscript before submitting it to this journal and also, they have approved to be accountable for all aspects of this article.

Acknowledgements

We are grateful to the College of Health and Medical Science of Haramaya University for providing ethical approval and financially supporting the data collection of this study. Likewise, we thank the study participants, data collectors, and supervisors.

References

[1] Joint, U., Programme on HIV/AIDS. Global AIDS Update 2016. Joint United Nations Programme on HIV. AIDS, 2016.

[2] Charua, M. N., M. Prince, and A. Mann, Common Mental Disorders Among Those Attending Primary Health Clinics and Traditional Healers in Urban Tanzania. 2003.

[3] Gromova, H., V. Gafarov, and I. Gagulin, Depression and risk of cardiovascular diseases among males aged 25-64 (WHO MONICA--psychosocial). Alaska medicine, 2006. 49 (2 Suppl): p. 255-258.

[4] Weiser, S. D., et al., The association between food insecurity and mortality among HIV-infected individuals on HAART. Journal of acquired immune deficiency syndromes (1999), 2009. 52 (3): p. 342.

[5] Benzekri, N. A., et al., High prevalence of severe food insecurity and malnutrition among HIV-infected adults in Senegal, West Africa. PloS one, 2015. 10 (11): p. e0141819.

[6] Xavier, A., et al., Impactof malnutrition and social determinants on survival of HIV-infected adults starting antirretroviral therapy in resourse-limited settings. AIDS, 2012. 26 (9): p. 1161-6.

[7] Folasire, O., A. Folasire, and R. Sanusi, Measures of nutritional status and quality of life in adult people living with HIV/AIDS at a Tertiary Hospital in Nigeria. Food and Nutrition Sciences, 2015. 6 (04): p. 412.

[8] Skoet, J. and K. G. Stamoulis, The state of food insecurity in the world 2006: Eradicating world hunger-taking stock ten years after the world food summit. 2006: Food & Agriculture Org.

[9] Hailemariam, S., G. T. Bune, and H. T. Ayele, Malnutrition: Prevalence and its associated factors in People living with HIV/AIDS, in Dilla University Referral Hospital. Archives of Public Health, 2013. 71 (1): p. 13.

[10] Uthman, O. A., Prevalence and pattern of HIV-related malnutrition among women in sub-Saharan Africa: a meta-analysis of demographic health surveys. BMC Public Health, 2008. 8: p. 226.

[11] Mulu, H., L. Hamza, and F. Alemseged, Prevalence of Malnutrition and Associated Factors among Hospitalized Patients with Acquired Immunodeficiency Syndrome in Jimma University Specialized Hospital, Ethiopia. Ethiop J Health Sci, 2016. 26 (3): p. 217-26.

[12] Alemayehu kenea, M., Assessment of Adult Nutritional Status and Associated Factors Among ART Users in Nekemte Referral Hospital and Health Center, East Wollega Zone, Ethiopia. Journal of Food and Nutrition Sciences, 2015. 3 (2): p. 55.

[13] Bhatti, A. B., M. Usman, and V. Kandi, Current scenario of HIV/AIDS, treatment options, and major challenges with compliance to antiretroviral therapy. Cureus, 2016. 8 (3).

[14] Agency, C. S. and ICF, Ethiopia Demographic and Health Survey 2016: Key Indicators Report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA. CSA and ICF. 2016.

[15] Organization, W. H., The world health report 2002: reducing risks, promoting healthy life. 2002: World Health Organization.

[16] HIV/AIDS, J. U. N. P. o., Prevention gap report. Geneva: UNAIDS, 2016.

[17] Bodena, D., Z. Ataro, and T. Tesfa, Trend Analysis And Seasonality Of Tuberculosis Among Patients At The Hiwot Fana Specialized University Hospital, Eastern Ethiopia: A Retrospective Study. Risk management and healthcare policy, 2019. 12: p. 297.

[18] Daniel, M., F. Mazengia, and D. Birhanu, Nutritional status and associated factors among adult HIV/AIDS clients in Felege Hiwot Referral Hospital, Bahir Dar, Ethiopia. Science, 2013. 1 (1): p. 24-31.

[19] Atalay, A., Prevalence of mental distress in the outpatient clinic of a specialized leprosy hospital. Addis Ababa, Ethiopia, 2002. Lepr Rev, 2004. 75: p. 367-75.

[20] Lula, A., D. Tsegaye, and H. Yoseph, Under nutrition and associated factors among adult on highly active antiretroviral therapy in Wolaita Sodo teaching and referral hospital, southern nations nationalities peoples region, Ethiopia. International Journal of Nutrition and Metabolism, 2017. 9 (2): p. 10-19.

[21] Gedle, D., et al., Prevalence of malnutrition and its associated factors among adult people living with HIV/AIDS receiving anti-retroviral therapy at Butajira Hospital, southern Ethiopia. BMC Nutrition, 2015. 1 (1).

[22] Daniel, M., Nutritional Status and Associated Factors Among Adult HIV/AIDS Clients in Felege Hiwot Referral Hospital, Bahir Dar, Ethiopia. Science Journal of Public Health, 2013. 1 (1): p. 24.

[23] Gebru, T. H., H. H. Mekonen, and K. G. Kiros, Undernutrition and associated factors among adult HIV/AIDS patients receiving antiretroviral therapy in eastern zone of Tigray, Northern Ethiopia: a cross-sectional study. Arch Public Health, 2020. 78: p. 100.

[24] Mulugeta Dedha, M. D., Gudina Egata and Lemma Negesa, Undernutrition and associated factors among adults human immunodeficiency virus positive on antiretroviral therapy in hospitals, East Hararge Zone, Oromia, Ethiopia: A cross-sectional study. International Journal of Health Sciences, 2017. Vol. 11 (Issue 5).

[25] Sati, B., et al., Prevalence of malnutrition among HIV infected individuals in Rajasthan, India. Jul: 2004 abstract no. MoPeB3267.

[26] R. Zachariah', M. P. S., A. D. Harries' and F. M. L. Salaniponi, Moderate to severe malnutrition associated with early death. TRANSACTIONS OF THE ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE, 2002. 96 (1): p. 291-294.

[27] TITUS K. KABALIMU, E. S. a. W. C. L., Malnutrition and associated factors among adults starting on antiretroviral therapy at PASADA Hospital in Temeke District, Tanzania. Tanzania Journal of Health Research, 2018. Volume 20 (Number 2).

[28] Takarinda, K. C., et al., Malnutrition status and associated factors among HIV-positive patients enrolled in ART clinics in Zimbabwe. BMC Nutrition, 2017. 3 (1).

[29] Folasire, O. F., A. M. Folasire, and R. A. Sanusi, Measures of Nutritional Status and Quality of Life in Adult People Living with HIV/AIDS at a Tertiary Hospital in Nigeria. Food and Nutrition Sciences, 2015. 06 (04): p. 412-420.

[30] Solomon Hailemariam, G. T. B. a. H. T. A., Malnutrition: Prevalence and its associated factors in People living with HIV/AIDS, in Dilla University Referral Hospital. ARCHIVES OF PUBLIC HEALTH, 2013. 71 (13).

[31] Oumer, B., et al., Prevalence Of Undernutrition And Associated Factors Among Adults Receiving First-Line Antiretroviral Treatment In Public Health Facilities Of Arba Minch Town, Southern Ethiopia. HIV AIDS (Auckl), 2019. 11: p. 313-320.

[32] Mitiku, A., et al., Undernutrition and associated factors among adults living with Human Immune Deficiency Virus in Dembia District, northwest Ethiopia: an institution based cross-sectional study. Arch Public Health, 2016. 74: p. 33.

[33] Ab, G., G. Ae, and K. Db, Malnutrition and Associated Factors among Adult People Living with HIV/AIDS Receiving Antiretroviral Therapy at Organization for Social Service Health Development in Jimma Town Oromia Region South West Ethiopia. General Medicine: Open Access, 2018. 06 (02).

[34] Rabkin, J. G., HIV and depression: 2008 review and update. Current Hiv/aids Reports, 2008. 5 (4): p. 163-171.

[35] Tabi, M. and R. L. Vogel, Nutritional counselling: an intervention for HIV-positive patients. J Adv Nurs, 2006. 54 (6): p. 676-82.