

Undernutrition and Associated Factors among HIV-Infected Adults Receiving ART at Health Centers, Lega Tafo and Surrounding, Ethiopia, 2021

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Abstract

Background: Globally, 38 million people were living with HIV in 2019. In Africa, 25 million people are living with HIV/AIDS undernutrition and food insecurity is endemic. Hence, the study aimed to assess the magnitude of undernutrition and associated factors among HIV-infected adults receiving ART.

Methods: Institutional based cross-sectional study was conducted among HIV/AIDS patients who followed the ART service was selected by a simple random sampling method. The data were collected by direct interview, using a structured questionnaire. Descriptive statistics and a logistic regression model were employed.

Result: The study revealed that the magnitude of undernutrition was 18.8%. The history of opportunistic infection (AOR=4.518:95% CI: 2.304-8.857), Patients taking ART for less than one year (AOR=3.675:95% CI: 1.831-7.377) household food insecure (AOR=3.113:95% CI: 1.628-5.950) and dietary diversity score (AOR=2.340:95% CI: 1.221-4.485) were found to have a statistically significant association with undernutrition.

Conclusion: The magnitude of undernutrition among people living with HIV/AIDS was found to be high. Having an opportunistic infection, duration of taking ART treatment, household food security status, and dietary diversity status were found to statistically significant association with undernutrition.

Keywords: Undernutrition, Adult, ART, HIV

Introduction

Globally, 38 million people were living with HIV in 2019, among them 26.0 million people were accessing antiretroviral therapy as of the end of June 2020, and about 690, 000 people died from AIDS-related illnesses in 2019 [1]. In Africa where more than 25 million people are living with HIV/AIDS under nutrition and food insecurity are endemic [2].

Sub-Saharan Africa carries a disproportionate burden of HIV, accounting for more than 70% of the global burden of infection, which accounts for 74% of the 1.5 million AIDS-related deaths [3]. Undernutrition unacceptably increases the risk of mortality among adults living with the Human Immune Deficiency Virus (HIV) [6]. HIV specifically affects nutritional status by increasing energy requirements, reducing food intake, and adversely affecting

nutrient absorption and metabolism [4]. Despite major advances in the treatment and survival of patients infected with human immunodeficiency virus (HIV), weight loss and undernutrition remain common problems [8].

Undernutrition unacceptably increases the risk of mortality among adults living with the Human Immune Deficiency Virus (HIV) [6]. In sub-Saharan Africa accounted for 74% of the 1.5 million AIDS-related deaths and undernutrition has its contribution by increasing disease severity [3]. Moreover, studies indicate that lower BMI(undernutrition) was associated with a higher risk of death [9]. There is a high burden of undernutrition. HIV/AIDS and undernutrition effects are interrelated and exacerbate one another in a vicious cycle [4].

The effects of undernutrition on the immune system are well known and include decreases in CD4 Cells suppression of delayed hypersensitivity and abnormal B-cell responses[2]. The immune suppression caused by protein energy malnutrition is similar in many ways to the effects of HIV infection [2].

Another problem raised with HIV/AIDS patient undernutrition is increasing susceptibility to other opportunistic infections and diseases. This happens due to the decrement of defending cell-like B-lymphocyte and CD4 count [2-10]. Human immunodeficiency virus (HIV) compromises the nutritional status of infected individuals, and in turn, undernutrition worsens the effects of the infection itself by weakening the immune system, consequently, accelerating disease progression and death [11].

Undernutrition is also reduces the effectiveness of ART drugs and increases side effects. As studies indicate, undernutrition is reducing drug metabolism, distribution, and effectiveness due to lack of protein carrier [12]. In addition, adherence to ART drugs is low in undernourished HIV/AIDS patients [13]. HIV-infected persons are at higher risk for undernutrition, and certain conditions can magnify the risk, such as anorexia, difficulty swallowing or painful swallowing, malabsorption and diarrhea, altered metabolism of nutrients, increased utilization of nutrients, and greater loss of nutrients [4]. Not only this but also there are many factors associated with HIV/AIDS undernutrition, among them household food insecurity, lack of nutritional counseling, educational status, and economic status are evidenced by many studies [6, 10, 14,15].

Many studies were conducted on HIV/AIDS patients but since the dispute undernutrition is unanswered and still there is a lack of information in the Ethiopian context, further investigation will be needed. Again, there is a difference between malnutrition and undernutrition, but most of the studies use malnutrition and undernutrition interchangeably as the same term. Therefore, there is an interpretation error in many studies. This confusion was solved by this study, since the aim of this study was to put the magnitude of undernutrition and associated factors.

Methods and Materials

Study area and Period

The study was conducted at Lega Tefo, Edase, Yeka, Abedaw, and Hayat health centers from February 8/2021 to June 10/2021. Lega Tefo health center is found in Oromia regional states that are located at the boundary of Addis Ababa city near Yeka subcity while Edase, Yeka, Abedaw, and Hayat health centers are found in Addis Ababa, Yeka subcity. All selected health centers are ART centers and geographically located in nearly the same local area in the northeast of Addis Ababa. More than 443 patients, 268 patients, 146 patients, and 517 patients are receiving ART from Lega Tafo, Edase, Abadew, and Hayat health center, respectively (data obtained from selected health facilities).

Study Design

An Institutional based cross-sectional study was conducted.

Population

Source of Population

All HIV-infected adults received ART at Lega Tefo, Edise, Yekabadew, and Hayat health centers.

Study Population

All HIV-infected adults receive ART from selected health centers, whose fit inclusion criteria and are not excluded by exclusion criteria.

Eligibility Criteria

Inclusion Criteria

- Adult HIV/AIDS patients [R] those currently receiving ART drugs from selected health centers and come to health centers during data collection.
- Age group from 15-55 years old.

Exclusion Criteria

- Lipodystrophy patients (patients with abnormal fat accumulation).
- Patients was held in the category of lost to follow up.
- Known undernutrition patients, whose holding in the nutritional treatment program.
- Pregnant and lactated women (less than 6 months postpartum).
- Patient with Spinal deformity.
- Ascites and edematous patient due to chronic diseases like congestive heart failure.

Sample Size Determination

The sample size (n) required for the study is calculated using the formula to estimate a single population proportion by considering the following assumptions.

$Z_{\alpha/2}$ = critical value for normal distribution at 95% CI to 1.96 (Z value at $\alpha = 0.05$). According to the study conducted in 2018 in Addis Ababa, the prevalence of under-nutrition among ART attendants was 15.1% (24).

Hence, according to the study; $P = 15.1\%$

$d(w)$ = margin of error of 0.05 with 95% CI level.

$$n = \frac{(Z_{\alpha/2})^2 \rho(1 - \rho)}{d^2}$$
$$n = \frac{(1.96)^2 0.151(1 - 0.151)}{(0.05)^2}$$
$$n = 197$$

The sample size for the factors associated with undernutrition was calculated by Epi Info launcher software version 7.2.4 and aggregated in Table 1. The proportion was taken from the study conducted in Demba district, northwest of Ethiopia, and a study conducted in the Tigray region [6, 21].

Hence, 344 sample size is the largest sample size obtained and it is used as the sample size.

Therefore, the sample size is 363+10% (none response)399.

Sampling Method

Totally, 1374 patients are receiving ART at selected health centers. The desired sample was proportionally allocated based on the number of patients receiving ART. To get the proportional size, multiplying the number of ART patients in the health center with the desired sample (399) and divided by total patients of all four health centers (1374).

In Lega Tafo health center, there are 443 patients attending ART. Thus, the sample going to be taken will be128.

For all health centers calculated and represented in Figure 2. After the number of the sample was allocated and selected by considering inclusion and exclusion criteria. The sample was taken by simple random sampling from those who fit the criteria.

Study Variables

Dependent Variable

- Undernutrition

Independent Variables

Socio-Demographic Factors

- Age
- Sex
- Employment condition
- Monthly income
- Education status
- Marital status

Dietary Patterns and Related

- Frequency of food.
- Difficult to eat
- Individual dietary diversity score.
- Appetite.
- Household food security

Opportunistic Infection and Complication Factors

- Diarrhea
- Mouth thrush.
- WHO clinical stage.
- Current clinical conditions
- Existence of co-infection

Treatment-Related Factors

- ART adherence
- Duration of ART
- CD4 count.
- Co-trimoxazole preventive therapy

Operational Definition and Measurements

Adherence to ART Drugs: It was assessed using Morisky medication adherence score to ART drugs having eight questions each with yes = 1 and no = 2, good adherence for those scores 7–8, and poor adherence for those score ≤ 6 [21].

Body Mass Index: it is a measure of body fat based on height and

weight that applies to adult men and women, and it is computed by dividing weight in kilograms by height in a meter square. BMI has been considered as Underweight (under nutrition) when $= < 18.5$, Normal weight (well-nourished) when $= 18.5\text{--}24.9$, Overweight when $= 25\text{--}29.9$ and Obesity = BMI of 30 or greater [27]. Specifically, categorized as under nutrition (severe- < 16 kg/m²; moderate 16.0 to 16.99 kg/m² and mild 17.0 to 18.49 kg/m²) [27].

High Dietary Diversity: Scoring greater than or equal to five from twelve food types [32].

Household Food Secure: If [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0] [43].

Household Mildly Food Insecure: If [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0] [43].g

Household Moderately Food Insecure: If [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0] [43].

Household Severely Food Insecure: If [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3] [43].

Low Dietary Diversity: Scoring less than five food group among nine food type [32].

Under Nutrition: When the measurement of body mass index is less than 18.5 kg/m² [24].

Data Collection Tools and Methods

Data were collected by structured questionnaires by face-to-face interviews. The questionnaires have contained questionnaires that measure the socio-demographic status of the respondents, opportunistic infections and related questionnaires, dietary pattern, and related, specifically the individual dietary diversity score measurement tool, Household Food Insecurity Access Scale (HFIAS), and Morisky medication adherence score questionnaires. In addition to that, the anthropometric measurement of the respondents was taken. Both primary and secondary data were used, patients' cards and registration books were used as secondary data.

Individual dietary diversity scores and HFIAS are adopted from FANTA(43). DDS tool has 16 types and was aggregated into 9 food types. 24 hours recall method was used to collect data for DDS. Then after it was categorized as low DDS and High DDS based on the criteria and further categorized as minimum, dietary, higher, and lower dietary diversity score.

The HFIAS was used to measure household food security levels and its data was collected through a recall period of 30 days and consists of two types of questions: nine "occurrence" and

nine “frequency-of-occurrence” questions. The respondent was first asked if a given condition was experienced (yes or no) and then asked with what frequency (rarely, sometimes, or often). Finally, based on the result, the households were categorized as food secure, mildly food insecure, moderately food insecure, or severely food insecure.

The weight and height of respondents were collected. The height was measured by using a standio-meter after the respondents were asked to remove their shoes, stand erect, and look straight in a horizontal plane. The shoulder blades, buttocks, and heel touch the standing measuring board. Height was recorded to the nearest 0.1cm. Weight was measured by using Beam balance. After the scale was set to zero, the respondents were asked to remove heavy clothes and weight measurement was recorded to the nearest 0.1kg.

Data collection was did by to be trained data collectors. Four data collectors were assigned one to each health center. The questionnaires were originally prepared in English and translated to Amharic and Afan Oromo by language expertise during data collection for more clarity. Then translated back to English after data collection for consistency. After data was collected online on Google forms, then copied to SPSS version 25 for analysis.

Data Quality Control

Pre-data collection, the questionnaires were organized in an orderly manner and translated to the local language Afan, Oromo and Amharic language by linguistics. Experienced data collectors were selected and training was given on how to collect data, taking appropriate anthropometric measurements, recording data, ethical approach, and how to submit data. Anthropometrics measurement materials were checked whether they well function or not. Beam balance was set to zero before measurement. All materials in all four health centers were compared and accepted with only minimal variation. The pretest was done on 5% of respondents to assure its fitness for the newly prepared questionnaire. The data collectors give a brief orientation for the candidate before data collection.

During data collection, based on the instruction of the questionnaires, the data was collected online on Google forms. The code was given for each candidate during data collection. The anthropometric of the respondents was taken carefully. The investigator was controlled, supervised, and supported the overall work of data collectors. After data collection, data were checked for completeness and consistency and then copied from Google from spreadsheet to the Statistical Package for Social Science (SPSS) software version 25 for further processing.

Data Processing and Analysis

Data were checked for completeness and consistency and then exported to the Statistical Package for Social Science (SPSS) software version 25 for analysis. Descriptive statistics were used to describe the study population about relevant variables. Logistic regression was fitted to identify the association between dependent (undernutrition) and independent variables.

The analysis was conducted to select candidate variables for the initial multivariable model. Those variables that show an association with undernutrition at a p-value less than 0.2 were included in an initial multivariable logistic regression model. Both crude and adjusted odds ratios with their corresponding 95% confidence intervals were used to determine the strength of association. Assumptions of logistic regression were checked before the final multivariable analysis using probability bivariable graph and collinearity diagnostic (Variance inflation factor and correlation matrix).

The final multivariable model goodness of fit was checked using classification table, percentage, Hosmer-and Lemeshow chi-square test, and log-likelihood chi-square test. A p-value of less than 0.5 was used to declare the statistical significance of the findings in this study. The result was presented using text, tables, and graphs based on the types of data.

Ethical Considerations

An ethical clearance letter was taken from Addis Ababa Public Health Research and Publication Directorate after the requested letter was obtained from Abichus Campus of Rift Valley University. In addition, the Permission letter was taken from Lega Tefo, Edase, Yekabadew, and Hayat Health center. Informed consent was done with study participants. Confidentiality of the data was kept and used only for this study.

Results

Three hundred eighty-three (96%) of HIV-infected ART attendants at lega Tafo and surrounding health centers participated in this study.

Characteristics of Sociodemographic and Socioeconomic Respondents

The majority, 274(71.5%) respondents were females and 228(59.5%) of the respondents were married. The Median Age of the respondents was 38 years old with 10 years interquartile range. Two hundred one (52.6%) of the respondents earn monthly income less than 2000ETB with a median of monthly income was 2000 Birr. Three hundred fifteen (82.2%) of the respondents were working in the private work area and 209(54.6%) attended grade 1-12 education (Table 2).

Opportunistic Infection and other Related Characteristics of Respondents

Most of the respondents had no diarrhea, mouth thrush, abdominal disturbance, and vomiting as well. Similarly, 366 (95.6%) of the respondents were clinically improved and most of the respondents were in CLINICAL stage I while only 94 (24.5%) of them were in stage I- IV. One hundred four (27.2%) of the respondents had an opportunistic infection within the past six months. Tuberculosis was the most codisease reported among HIV/infected patients while almost half tuberculosis thirty-six (48.6%) infected individuals were undernutrition. The report indicated that few of the respondents were clinically not improved thirteen (3.4%) and almost all (twelve) (92.3%) of them were undernutrition (Table 3).

Treatment and follow-up of Respondents

The majority, 305(79.6%) of the respondents were following ART drugs at least for one year and 305(79.6%) of them adhered to take ART drugs. Eight-two (21.4%) of the respondents were receiving co-trimoxazole therapy and 74(19.3%) of the respondents were on Tuberculosis treatment (Table 4).

Dietary Related Variables

One hundred forty-seven (38.4 %) of HIV infected were household food insecure while nineteen (5%) of them were severely household insecure. Only 6.8% of individuals with household food security were undernutrition. Similarly, sixty (15.7%) of the respondents scored low on dietary diversity while one hundred twenty-seven (33.2%) of them were higher. About more than 93% of respondents scoring higher dietary diversity were not undernutrition. Only 7 respondents were receiving food support within the past three months (Table 5).

Magnitude of Undernutrition

This study indicated that 72(18.8%) (95% CI (15.1%-23%)), of respondents were undernourished, of which 34(8.9%) (95%, CI (6.4%-12.8%)) of them had mildly undernourished, 13(3.4%) (95%, CI (1.97%-5.77%)) of them had moderately undernourished and 25(6.5%) (95%, CI (4.44%-9.49%)) had severe undernourished (Figure 3).

Factors Associated with Undernutrition

The bivariate analysis was carried out to examine the associations between each of the independent variables and the dependent variable separately, and the unadjusted odds ratios of the associations and the 95% confidence intervals of each independent variable with the dependent variable were obtained. Those variables showed association with outcome variables at $p < 0.25$ in the bivariate analysis such as abdominal disturbance, difficulty of digestion, appetite change On TB treatment, opportunistic infections, CLINICAL stage, duration on ART, co-trimoxazole therapy adherence status, and household food security Dietary diversity status.

The multivariable logistic regression analysis was used by taking all these factors into account simultaneously and only four of them remained to be significantly and independently associated with the dependent variable. Having an opportunistic infection, duration of taking ART treatment, household food security status, and dietary diversity status had statistically significant associations with undernutrition. Hence, the patients who had one or more opportunistic infections were four times more likely to develop undernutrition as compared to those who do not have opportunistic infections [AOR=4.518(2.304-8.857)]. Patients taking ART for less than one year are 3.6 times more likely to develop undernutrition as compared to those who are taking more than one year [AOR=3.675(1.831-7.377)]. Patients were from household food insecurity three times more likely to develop undernutrition as compared to those from food secure households [AOR=3.113(1.628-5.950)]. Patients with low dietary diversity scores were two times more likely to develop undernutrition as compared

to those with high dietary diversity scores [AOR=2.340(1.221-4.485)] (Table 6).

Discussion

The study was intended to assess the magnitude of under nutrition and associated factors. The study indicated the magnitude of under nutrition was 18.8% (95% CI (15.1%-23%)), it is in line with study conducted in Arba minchi(18.2%), Study conducted in south Africa(18.2%), study conducted in Asella (18.3%) and in Addis Ababa (15.1%) [24, 38]. The finding is in line with the study conducted in Addis Ababa might be due to the similarity in socio-economic level and health service accessibility. Likewise, it is in line with the prevalence range of study conducted in Goba town (12.3%-55.6%) [22]. Similarly, it is in line with the study conducted in Awassa town which is 20% [45]. The finding was lower when compared with study conducted in Brazil (46%), study conducted in Kenya (29%), Tanzania (27%), study reported from Tigray region (42%), study reported from Jimma(34%), Southern Ethiopia (23.72%) and Silte Zone(24.1%) [15, 17-18, 20-21, 23, 46].

The discrepancy might be related to socio-economic variation, cultural changes in health service quality, and feeding pattern related characteristics among the study areas. It could be an increment of awareness through an increase in information accessibility. Again, it might be due to most of our respondents were in CLINICAL stage I (75.5%) and most of our respondents were well adhering to ART (79%). Since clearly, ART adherence and WHO clinical stage I are negatively associated with under nutrition as evidenced by many studies [19, 23, 38].

However, the finding of the study indicated the magnitude of under nutrition obtained from our study was greater than the study conducted south Africa, which is (13%) [19]. The discrepancy could be due to socio-economic and methodological approach. Likewise, our study were greater than study conducted in Dilla university(12.3% [25]. This variation might be as a result of sample size.

The magnitude of under nutrition is high in males when compared to females. In this study, the magnitude of under nutrition among males were. 22% while 17.5% among women, the study conducted in South Africa proved that the prevalence of under nutrition was high, according that study prevalence of under nutrition was higher in males (18%) than females (9%) [19].

Food insecurities has long-term and short-term effects on nutritional status as evidenced by different studies. In this study, about 38.4% of the household children were recorded under household food insecure. This finding is almost similar to the study conducted in Awassa Town (38.5%). About 33.3% of patients from household food insecure were under nutrition.

The findings of the study showed that household food insecurity was significantly associated with under nutrition. This finding was consistent with a study conducted in Humera hospital, West shewa

zone (five times) and Goma [14]. Similarly, nearly the same report from Study conducted in Bale Goba and study conducted in Asella Town [44]. However, also house food security agreed with a study reported from Siltie zone that stated household food security as a protective effect on under nutrition HIV/AIDS patients [15, 22]. This is might be why food accessibility is directly related to daily consumption of food. In our study, more than half of respondents from household food insecure were consuming less than four types of food per 24 hours.

Duration on ART less than one year was strong and positively associated with under nutrition. This report was consistent with study conducted in Arba Minch and study conducted in West Shewa Zone [46,47]. This association may be due to the action of ART drugs reducing viral load by increasing CD4 number and giving recovery for the patient through time to time. This study indicated opportunistic infection was four times more risk for under nutrition. It is consistent when compared with the study conducted in Debre markos and the study conducted in Asella. Likewise, our study indicated opportunistic infection was double odds of risk when compared with study conducted in Awassa [28, 44, 45]. This strong association might be due to opportunistic reducing eating pattern (anorexia), difficulty swallowing or painful swallowing, malabsorption and diarrhea, altered metabolism of nutrients, increased utilization of nutrients, and greater loss of nutrients [4].

Dietary diversity score is measurement of daily consumption of food that is another factor associated with under nutrition. According to this study, patients with low dietary diversity scores were two times more likely to be being under nutrition. This finding was in line with a study recently conducted in Awassa [45]. Similarly, our study showed the magnitude of under nutrition was significantly lower among those consuming food from five or more food groups per day. It is agreed with the study conducted in Arba minchi [38].

Conclusion and Recommendation

Conclusion

The magnitude of undernutrition among people living with HIV/AIDS was found to be high. Having an opportunistic infection, duration of ART treatment, household food security status, and dietary diversity status were found to statistically significant association with undernutrition.

Recommendation

Based on the finding, the following recommendations were forwarded. Health care providers should early monitor, evaluation, and treat patients with the opportunistic infection before threatening and complication. Health workers provide health education daily for improve the food intake of patients. The government should prepare and implement an appropriate stratagems to improve economic status for alleviating the problem of household food insecurity. The non-government organization should support patients with severe household food insecurity by food aid. It is better if investigators conducted a study by using a different method of body composition measurement not only by BMI.

Acronym and Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ART	Anti-retro Viral Therapy
DDS	Dietary Diversity Score
ETB	Ethiopia Birr
FANTA	Food and Nutrition Technical Assistance
HFIAS	Household food Insecurity Access Scale
H/C	Health Center
HIV	Human Immune Virus
OIS	Opportunistic Infection Symptom
PLWH	People Living With HIV
WHO	World Health Organization

Ethics Approval and Consent to Participate

An ethical clearance letter was taken from Addis Ababa public health research and publication directorate after the requested letter was obtained from Abichus Campus of Rift Valley University. Moreover, the Permission letter was taken from Lega Tefo, Edase, Yekabadew, and Hayat Health center. Informed consent was done with study participants. Confidentiality of the data was kept and used only for the purpose of this study.

Consent for Publication

Not applicable

Availability of Data and Materials

All data relating the study are available, we can obtain from the corresponding author through email for tangible reasons.

Competing Interests

The authors declare that they have no competing interests

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Authors' Contributions

Lelisa Worku (LW), participated in the design of the study, statistical analysis, and served as cross ponding.

Gadise Ragessa(GR), Eyerusalem Degife (ED), and Sisay Hailu(SH) performed the data collection and helped cross ponding authors with analysis.

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