


RESEARCH ARTICLE

Dietary diversity and associated factors among HIV-positive adults attending the anti-retroviral therapy clinic at Felege Hiwot Comprehensive Specialized Hospital, Northwest Ethiopia: a cross-sectional study

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(Received 5 September 2020 – Final revision received 20 January 2021 – Accepted 26 January 2021)

Journal of Nutritional Science (2021), vol. 10, e18, page 1 of 10

doi:10.1017/jns.2021.5

Abstract

The aim of the study was to assess dietary diversity (DD) and associated factors among human immune deficiency virus (HIV)-positive adults attending the anti-retroviral therapy (ART) clinic at Felege Hiwot Comprehensive Specialized Hospital (FHCSH) in Northwest Ethiopia. An institution-based cross-sectional study was conducted at FHCSH in 2019. A systematic random sampling technique was employed to select 352 study subjects. Data were collected using an interviewer-administered questionnaire and chart review. Statistical Package for the Social Science version 26 was used for analysis. A simple and multivariable binary logistic regression was used to determine associated factors. Two hundred and nine (59.4 %) adults had consumed a diversified diet. The mean individual DD score was 3.86 ± 1.18 . Self-employment status (adjusted odd ratio (AOR): 4.60; 95 % confidence interval (CI): 1.72, 12.27), quintiles of wealth index (the second (AOR: 4.33; 95 % CI: 1.72, 10.89), middle (AOR: 4.40; 95 % CI: 1.71, 11.31), fourth (AOR: 6.60; 95 % CI: 2.36, 18.48) and the highest quintiles (AOR: 9.45; 95 % CI: 3.34, 26.77), the last CD4 count 200–349 cells/mm³ (AOR: 8.08; 95 % CI: 2.93, 22.23), those who took first-line ART regimen drugs (AOR: 4.49; 95 % CI: 2.19, 9.21), subjects who did not take co-trimoxazole prophylaxis (AOR: 6.36; 95 % CI: 2.54, 15.88), those who had nutritional counselling at a health institution (AOR: 2.36; 95 % CI: 1.08, 5.16), had no food preference (AOR: 2.42; 95 % CI: 1.14, 5.13) and a food-secure household (AOR: 3.51; 95 % CI: 1.85, 6.67) were associated factors of DD among adults on ART. This study exhibited that the DD status among adults attending the ART clinic was below two-thirds. Health institutions and health professionals working at ART clinics shall strengthen their efforts to sustain the nutritional counselling service and ART adherence at health institutions and encourage the patients to avoid food preference for their meal. It is vital to ensure the household food security of adults on ART.

Key words: 24-h food recall: Anti-retroviral therapy: Dietary diversity: HIV-positive adults

Dietary diversity (DD) is the number of individual food items or food groups consumed over a given reference period⁽¹⁾. It is eating different food types across and within food groups, such as vegetables, fruits, grains and animal source foods⁽²⁾. To guarantee the adequate intake of essential nutrients and promote good health, DD is thought to be very important,

and no single food can contain all nutrients. The more different food types are included in the daily diet, the greater the probability of meeting nutrient requirements⁽³⁾.

Adequate nutrient intake that is necessary for good nutrition has often been associated with the food variety and diet quality of individuals. Micronutrient malnutrition is one form of

Abbreviations: AIDS: acquired immune deficiency syndrome; AOR: adjusted odds ratio; ART: anti-retroviral therapy; CI: confidence interval; DD: dietary diversity; FAO: Food and Agriculture Organization; FHCSH: Felege Hiwot Comprehensive Specialized Hospital; HIV: human immune deficiency virus; IDDS: individual DD score

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malnutrition affecting the lives of millions of people worldwide^(4,5). Micronutrient malnutrition remains a major public health concern in developing countries due to the intake of monotonous, predominantly starchy-based diets that are lacking in diversity⁽⁶⁾, and hence, over 2 billion people are affected worldwide⁽⁵⁾.

Although anti-retroviral therapy (ART) medication-related side effects such as poor appetite, fatigue, and nausea make human immune deficiency virus (HIV)-infected individuals hard to eat well, the nutritional needs of people with HIV are greater because the body has to work overtime to deal with a chronic viral infection and to fight against opportunistic infections⁽⁷⁾. For a healthy, strong, and productive life, good nutrition is of paramount importance. It has been indicated that a diversified diet is an indicator of quality food. The DD score at the individual level is a proxy indicator of adequate intake of energy and micronutrients⁽⁸⁾, which implies that increasing the diversity of foods and food groups in the diet helps to ensure adequate intake of essential nutrients and promotes good health⁽⁹⁾.

HIV is one of the most serious global public health challenges. In 2019, 38 million people were living with HIV/acquired immune deficiency syndrome (AIDS) worldwide (36.2 million adults). Among these, 67 % (25.4 million) were accessing ART globally⁽¹⁰⁾. Nutrition care and support is one of the components of comprehensive care for people living with HIV⁽¹¹⁾ since more than half of people living with HIV are in low- and middle-income countries: 19.6 million (53 %) in eastern and southern Africa, 6.1 million (16 %) in western and central Africa, 5.2 million (14 %) in Asia and the Pacific, and 2.2 million (6 %) in Western and Central Europe and North America⁽¹²⁾. In Ethiopia, the prevalence rate of HIV is 1.15 % (1.4 % urban and 0.6 % rural prevalence), and people living with HIV/AIDS (PLWA) is 737 186. And in Amhara, PLWA is 210 410⁽¹³⁾.

DD is recommended for a healthy life and is an important component of diet quality⁽¹⁴⁾. Globally, in the last half a century, the food diversity consumed around the world deteriorated⁽¹⁵⁾, and repetitive/monotonous low-quality diets are common in resource-limited countries⁽¹⁶⁾.

DD is very important to help people living with HIV/AIDS prevent weight loss or maintain weight, maintain muscle mass, boost immunity and prevent viral progression and opportunistic infection⁽¹⁷⁾.

Studies have shown a wide variation in the magnitude/level of DD (29.5–71.3 %) among adults on ART follow-up in East Africa^(11,18,19).

In Ethiopia, several studies have been carried out focusing on women and children nutrition^(20,21,22,23,24), yet DD in vulnerable groups like people with HIV/AIDS is limited. Besides, to the best of the investigators' knowledge, little is investigated about the DD of people living with HIV and associated factors in Ethiopia, particularly in the Amhara region and Bahir Dar City.

Therefore, this study was conducted to assess DD and associated factors among HIV-positive adults attending the ART clinic at Felege Hiwot Comprehensive Specialized Hospital (FHCSH), Bahir Dar in Northwest Ethiopia. Moreover, the

finding of this study will give evidence on DD and selected factors among HIV-positive adults attending the ART clinic at FHCSH. This will also help to identify and define the intervention areas for the target groups and ART attendants, to ultimately enhance nutrient intake. Hence, it is a vital input for different stakeholders, such as healthcare professionals working in HIV/AIDS care, health facilities, regional health bureau and nutrition-related programme designers at a different level, including the ministry of health and researchers, who are working so as improve the quality of life and better survival in HIV-infected patients.

Methods

Study area and period

The study was conducted in the FHCSH ART clinic, which was found in Bahir Dar city from 6 October 2019 to 15 November 2019.

Bahir Dar city is the capital city of Amhara National Regional State, which is located 565 km in the Northwest of Addis Ababa, Ethiopia.

FHCSH is a tertiary referral hospital with approximately 400 beds and nine operating tables serving over 7 million people from the surrounding area. The hospital provides obstetrics, paediatrics, internal medicine, ophthalmology, general, gynaecology, ENT (ear, nose and throat) and orthopaedic surgery services. The FHCSH ART clinic started functioning since 2002. It has forty-two staff, five out-patient departments and 7500 HIV/AIDS patients registered for ART clinic service.

Study design and population

An institution-based cross-sectional study was conducted. The source population was all HIV-positive adults who are registered for care and support at the FHCSH ART clinic. The study population was all HIV-positive adults who were attending the ART clinic within the data collection period.

HIV positive adults (aged 18–65 years old) who were attending the ART clinic within the data collection period were included in the study, as also HIV-positive adults who were previously diagnosed with diabetes mellitus, hypertension and/or pregnancy. Those who participated in special festivals or special occasions away from home within the last 24 h before the data collection were included. However, adults who took ART less than 3 months before the beginning of the data collection were excluded from the study.

Sample size determination and sampling procedures

Sample size was determined by using a single population proportion formula with a 95 % confidence level and a 5 % desired level of precision and by considering the proportion of adult HIV-positive individuals attending public health facilities in Motta town who consume diversified diet (29.5 %)⁽²⁾. Considering a 10 % non-response rate, the final sample size was 352 adults.

Study participants were selected by the systematic random sampling technique at every k th (sixth) interval, where k is the



sampling fraction, which is calculated as $N/n = 2000/352 \approx 6$. The numerator 2000 was estimated as an average number of HIV-positive clients attending the ART clinic per month (100 pts/d \times 5 d/week \times 4 weeks/month). The starting sample was selected by the lottery method among the first six clients' chart. Then, the procedure continued (the selection of every sixth client as a study subject) until the required sample size was obtained. In the case of exclusion, the next client was taken. Data were collected on every working day except Thursday (to avoid Wednesday fasting influence for Orthodox followers), and one study subject was recruited only once.

A dependent variable is DD (low and high DD).

Independent variables are as follows:

- *Socio-demographic characteristics*: sex, age, religion, current residence, educational status, marital status, employment status, family size, wealth index quantile.
- *Behavioural factors*: alcohol drinking, cigarette smoking, khat chewing, exposure to media sources. Health-related characteristics are co-trimoxazole prophylaxis use, duration of anti-retroviral treatment, CD4 cell count, ART regimen category, World Health Organization (WHO) clinical stage.
- *Nutritional-related factors*: household food insecurity, source of food, nutrition counselling, food preference.

Data collection and quality assurance

Data collection instrument. Data were collected using a structured interviewer-administered questionnaire with chart review. The standardised individual DD score (IDDS) tool with the 24-h food recall method was used to assess the DD of HIV-positive adults.

The questionnaire was adapted from Food and Nutrition Technical Assistance (FANTA)/Food and Agriculture Organization (FAO) and by reviewing the literature^(6,18,25). The questionnaire was first prepared in English by reviewing the literature, then translated into Amharic and then translated back to English to maintain consistency; nutrition experts were consulted for comments and pre-tests were done.

The questionnaire had seven parts: part I, questions on socio-demographic characteristics; part II, behavioural factors; part III, health-related characteristics; part IV, nutritional-related characteristics; part V, DD questions; part VI, household food insecurity; part VII, wealth index.

Data collection personnel. A total of six nurses were recruited: five for data collection and one for supervision. They were trained and oriented for 1 day on the questionnaire and data collection.

Data on health-related characteristics, such as the duration of ART, co-trimoxazole prophylaxis, last CD4 count, WHO clinical stage and opportunistic infections, were collected by reviewing patient clinical records and interviews.

Measurement of IDDS. The standardised IDDS tool, with a 24-h food recall method (FAO), was used to assess the individual DD of study subjects^(6,18).

For the estimation of the IDDS, nine food groups consumed in the study area, i.e. starch staples, dark green leafy vegetables, other vitamin A-rich fruits and vegetables, other fruits and vegetables, meat and/or fish, organ meat, egg, legumes, nuts and seeds, and milk and milk products, were studied.

Study subjects were asked to list all foods he/she consumed at home and outside the home in the last 24 h before the data collection date from breakfast to dinner. Food consumed for breakfast 6:00–10:00, then lunch 12:00–16:00 and dinner 20:00–24:00, while snacks considered to be eaten before or after the major mealtime. Then, food eaten by the respondent was classified into nine food groups.

If the respondent consumed food at least once during the last 24 h within each subgroup, 1 point was scored, and 0 point if they never consumed the food. Food groups that an individual has consumed during the preceding 24 h were counted, and the IDDS was calculated as the sum of food groups consumed over 24 h.

Data quality control. The collected data were reviewed and checked for completeness by data collectors, a supervisor and a principal investigator. The data collectors were given training, and the questionnaire was translated and pre-tested. To assure anonymity, code numbers were written on the completed questionnaires before they were returned to the investigator.

Statistical analysis

The data were cleaned and entered into Epidata manager 4.6, exported and analysed with Statistical Package for the Social Science (SPSS) version 26 software. The characteristics of the study subjects were described by presenting on tables, M and SD. The categorical variables were presented in frequencies and proportions.

To determine the level of individual DD among HIV-positive adults on ART, first, the IDDS was calculated as the sum of food groups consumed over 24 h. Then, based on the mean of the IDDS, the level of individual DD was classified into low DD and high DD.

Wealth index. The wealth status of households was assessed by collecting data on variables related to the ownership of livestock assets, crop produced in the previous year, possession of farmland, valuable domestic assets, the living condition of the house, and sanitation facility. For urban and rural participants, the principal component analysis (PCA) was run separately, and finally, the wealth index score was merged to a common variable (the wealth index score). Then, the wealth index score was generated by using the PCA and the wealth index score was categorised into five distinct wealth quintiles.

Household food insecurity access scale. Nine occurrence and nine frequency of occurrence questions/items of FANTA 2007 was used to examine household food insecurity scale. The frequency of an occurrence item was re-coded to '0' if



the answer for an occurrence item was 'No', and if 'Yes', the response would take one of the options, i.e. 1 (rarely), 2 (sometimes) or 3 (often). Thus, households were grouped based on scores achieved in specific items. Based on the criteria, a food-secure household experienced none of the food insecurity (access) conditions, or just experiences worry, but rarely. Hence, a study participant who responded to the first household food insecurity access scale (HFIAS) item did not worry at all or rarely worried about the availability of enough food for the household in the past 4 weeks and no for the remain items considered as a food-secure household, else re-coded in to food insecure⁽²⁵⁾.

To identify predictors of DD status, the sum of the IDDS was re-coded as low DD (0) and high DD (1) by considering the mean IDDS as a cut-off point (3.86 ± 1.18). Then, a bi-variable binary logistic regression analysis was performed between the dependent variable (DD status) and each of the potential factors to select candidate variables for the multivariable analysis.

Predictor variables with a *P*-value less than 0.20 in bi-variable binary logistic regression were included in the multivariable binary logistic regression analysis. *P*-values less than 0.05 were considered statistically significant in the multivariable analysis. Predictor variables that had a significant association with the DD status were identified using an adjusted odds ratio (AOR) with 95 % confidence interval (CI) and a *P*-value less than 0.05. Hosmer and Lemeshow goodness-of-fit-test of model computed, *P*-value (0.21).

Ethical considerations. This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects/patients were approved by the Bahir Dar University, Institute of Technology, Faculty of Chemical & Food Engineering, and the Department of Applied Human Nutrition (Ref. #BiT/FCFE/816/2011), and the Amhara Public Health Institute gave ethical clearance (Ref. #03/527) to FHCSH for the conduct of the research. Permission was obtained from the administrative body of FHCSH. Finally, verbal consent was obtained from all study participants immediately before the interview, was formally recorded and participation was made voluntary.

Results

Socio-demographic and behavioural-related characteristics of study participants

A total of 352 HIV-positive adults (18–65 years old) attending ART participated, which amounted to a 100 % response rate. The majority of the participants were male, totalling 197 (56 %), those in the age group of 35–44 years totalled 149 (42.3 %), Orthodox religion followers were 279 in number (79.3 %), there were 300 urban dwellers (85.2 %), secondary and above highest educational level achieved was 202 (57.4 %), married persons were 229 (65.1 %) and 211 (60.6 %) lay in the middle and above quintiles of the wealth index. $M \pm SD$ age of participants was $36.9 (M) \pm 8.2 (SD)$ years old and the

mean family size was $3.6 (M) \pm 1.6 (SD)$. Among the study participants, 41 (11.6 %) smoked cigarettes, and 255 (72.4 %) followed news in the media. (Table 1)

Health-related characteristics

More than two-thirds 239 (67.9 %) had no opportunistic infection in the last 1 month before the date of interview, 162 (46.0 %) had treatment stage I, a large proportion of 289 (82.1 %) were taking first-line ART drugs and 177 (50.3 %) had CD4 count ≥ 350 cells/mm³ (Table 2).

Nutritional-related characteristics

The majority of the study participants who had nutritional counselling at a health institution were 298 in number (84.7 %) and 292 (83.0 %) had no food preference for their meals (Table 3).

Measurements of 24 h individual DD and level of individual DD

More than half of the study subjects, 203 (57.7 %), ate three times a day in the past 24 h and near a third, 115 (32.7 %), ate four or more times in a day. The average meal frequency was 3.2 ± 0.8 with a minimum of one time and a maximum of six times a day.

Among nine food groups, starchy staple foods (333, 94.5 %), other fruits and vegetables (291, 82.7 %) and legumes, nuts and seeds (228, 64.8 %) were the most commonly eaten foods, while organ meats were the least (28, 8.0 %) food types eaten in 24 h meals. The mean IDDS was 3.86 ± 1.18 , the median was 4 and a minimum of one and a maximum of eight types of food were eaten (Fig. 1).

The 24-h IDDS was classified into two, low and high DD, by considering the mean IDDS (3.86 ± 1.18) as a cut-off point. Two hundred and nine (59.4 %) study subjects comprised more than the mean food category (high DD).

Household food insecurity

Adults on ART response for household food insecurity items were computed; the overall magnitude of household food insecurity was 134 (38.1 %), and 218 (61.9 %) were food secure. One hundred and twenty-seven (36.1 %) were mildly food-insecure households, and seven (2.0 %) moderately food insecure. One hundred and thirty-six (38.6 %) participants were worried that their households would not have enough food. The frequency of each of the food insecurity items is presented in Table 4.

Factors associated with the level of DD

Candidate variables were fitted into a multivariable binary logistic regression model (forward stepwise method); eight variables were found to be predictors of DD of HIV-positive adults attending the ART clinic. These are mentioned as follows.



Table 1. Socio-demographic and behavioural-related characteristics of HIV-positive adults (18–65 years old) attending ART clinics at FHCSH, Northwest Ethiopia, 2019 (*n* 352)

Variables	Frequency	%
Sex		
Male	197	56.0
Female	155	44.0
Age category (years)		
18–24	17	4.8
25–34	119	33.8
35–44	149	42.3
45–54	53	15.1
55–65	14	4
Religion		
Orthodox	279	79.3
Muslim	24	6.8
Protestant	24	6.8
Catholic	13	3.7
Adventist	11	3.1
Others ^a	1	0.3
Residence		
Urban	300	85.2
Rural	52	14.8
Highest level of education achieved		
No formal education	89	25.3
Primary education	61	17.3
Secondary education and above	202	57.4
Marital status		
Married	229	65.1
Divorced	47	13.4
Single	35	9.9
Widowed	41	11.6
Occupation		
Farmer	42	11.9
Government employee	96	27.3
Housewife	16	4.5
Self-employed	143	40.6
Daily labourer	38	10.8
Unemployed	9	2.6
Student	6	1.7
Others ^b	2	0.6
Family size		
≤4	256	72.7
≥5	96	27.3
Head of household		
Yes	281	79.8
No	71	20.2
Occupation of the household (<i>n</i> 71)		
Farmer	18	25.4
Government employee	17	23.9
Self-employed	25	35.2
Daily labourer	7	9.9
Unemployed	2	2.8
Others ^b	2	2.8
Household main source of food		
Purchase	307	87.2
Farm/garden	45	12.8
Quintiles of wealth index		
Lowest quintile	74	21.0
Second quintile	65	18.5
Middle quintile	72	20.5
Fourth quintile	75	21.3
Highest quintile	66	18.8
Smoke cigarettes		
No	311	88.4
Yes	41	11.6
Drink alcohol		
No	257	73
Yes	95	27

Continued

Table 1. Continued

Variables	Frequency	%
Chew khat		
No	327	92.9
Yes	25	7.1
Follow media (TV/radio/magazine, etc.)		
No	97	27.6

^a Apostolic.

^b Pension.

Table 2. Health-related factors of HIV-positive adults (18–65 years old) attending ART clinics at FHCSH, 2019 (*n* 352)

Variables	Frequency	%
Diagnosed with opportunistic infection in the last 1 month		
No	239	67.9
Yes	113	32.1
Type of opportunistic infections (<i>n</i> 113)		
Chronic cough	48	42.5
Paralysis (any form)	3	2.7
Tuberculosis	16	14.2
Oral and/or oesophageal thrush	44	38.9
Others ^a	2	1.8
WHO clinical stage of the disease		
Stage I (T-1)	162	46.0
Stage II (T-2)	125	35.5
Stage III	63	17.9
Stage IV	2	0.6
Last CD4 cell count (cell/mm ³)		
<200	78	22.2
200–349	97	27.6
≥350	177	50.3
Duration of ART treatment (months)		
≤24	30	8.5
25–48	76	21.6
≥49	246	69.9
ART regimen category		
First line	289	82.1
Second line	63	17.9
Co-trimoxazole prophylaxis		
No	295	83.8
Yes	57	16.2
Any sign of gastrointestinal upset (diarrhea, nausea or vomiting) within 2 weeks		
No	292	83.0
Yes	60	17.0
GI upset (<i>n</i> 60)		
Nausea and vomiting	35	9.9
Stomach burning sensation	25	7.1

T-1, Treatment Stage 1; T-2, Treatment Stage 2.

^a Diarrhea, herpes zoster.

Employment status. Self-employed individuals were 4.60 times more likely to consume a highly diversified diet (AOR 4.60 (95 % CI: 1.72, 12.27)) than unemployed adults on ART.

Quintiles of wealth index. These were other predictors of individual DD; the second (AOR 4.33 (95 % CI: 1.72, 10.89)), middle (AOR 4.40 (95 % CI: 1.71, 11.31)), fourth (AOR 6.60 (95 % CI: 2.36, 18.48)) and in the highest quintile (AOR 9.45 (95 % CI: 3.34, 26.77)) were more likely to have a diversified diet than those individuals in the lowest quintile.



Table 3. Nutritional-related factor of HIV-positive adults (18–65 years old) attending ART clinics at FHCSH, Northwest Ethiopia, 2019 (n 352)

Variable	Frequency	%
Those who had nutritional counselling at a health institution		
No	54	15.3
Yes	298	84.7
Counselling on ... (n 298)		
Drugs	96	32.2
Infection/illness	7	2.3
General feeding	17	5.7
Drugs, infection/illness and general feeding	178	59.7
Those who take ready-to-use therapeutic feeding (RUTF) (plumpy nut) within 1 month		
No	325	92.3
Yes	27	7.7
Taking RUTF on a daily basis (n 27)		
No	6	22.2
Yes	21	77.8
Those who shared RUTF with other family members (n 27)		
No	16	59.3
Yes	11	40.7
Food preferences		
No	292	83.0
Yes	60	17.0
No preference for any of the foods (n 60)		
Legumes	21	6.0
Vegetables	14	4.0
Meat/fatty food	16	4.5
Milk and milk products	9	2.6

Last CD4 count (cell/mm³). Subjects with CD4 count 200–349 cells/mm³ were 8.08 times more likely to diversify their food (AOR 8.08 (95 % CI: 2.93, 22.23)) than those below 200 cells/mm³.

ART regimen category. Individuals taking first-line ART regimen drugs were 4.49 times more likely to diversify their food (AOR 4.49 (95 % CI: 2.19, 9.21)) than those taking second-line ART regimen drugs.

Co-trimoxazole prophylaxis. Subjects who were not taking co-trimoxazole prophylaxis were 6.36 times more likely to

diversify their food (AOR 6.36 (95 % CI: 2.54, 15.88)) than those who were taking co-trimoxazole.

Subjects who had nutritional counselling. Subjects who had nutritional counselling at a health institution were 2.36 times more likely to diversify their food (AOR 2.36 (95 % CI: 1.08, 5.16)) than those who had no nutritional counselling.

Having no food preferences. Adults who had no food preferences were 2.42 times more likely to diversify their food (AOR 2.42 (95 % CI: 1.14, 5.13)) than individuals having food preferences.

Household food insecurity. Subjects who had food-secure households were 3.51 times more likely to diversify their food (AOR 3.51 (95 % CI: 1.85, 6.67)) than their food-insecure counterparts (Table 5).

Discussion

Nearly six in ten (59.4 %) study subjects had high DD (mean IDDS: 3.86 ± 1.18). This was similar to a study done in Kenya (62.7 %)⁽¹⁹⁾. However, this number was higher than that in a study done in Metema hospital (41.2 %) and Motta Town Public Health Facilities (29.5 % participants consumed a diversified diet with mean IDDS: 3.2 ± 1.88)⁽²⁾ and lower than that in a study done at Hiwot Fana and Dilchora Hospitals (71.3 %)⁽¹¹⁾. This discrepancy might be due to variation in the data collection periods, i.e. in Motta and Metema, the data collection period was April to May, which was post-harvest time, and possibly food access will begin to decrease. However, data collection period for the Hiwot Fana & Dilchora Hospitals was November to February, which was harvesting time when there will be better food access. Moreover, the geographical location and feeding habit variation between Eastern (Hiwot Fana and Dilchora Hospitals) and northern Ethiopia may be a potential reason for the discrepancy in this study.

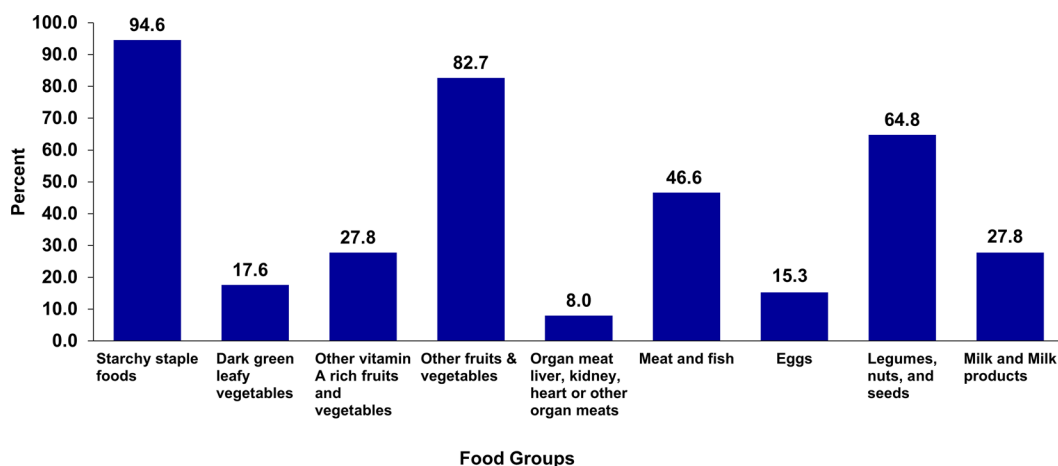


Fig. 1. Bar graph showing food groups consumed in 24 h among HIV-positive adults (18–65 years old) attending ART clinics at FHCSH, Northwest Ethiopia, 2019 (n = 352).



Table 4. Household food insecurity of HIV-positive adults (18–65 years old) attending ART clinics at FHCSSH, Northwest Ethiopia, 2019 (n 352)

	Occurrence		Frequency of occurrence (if yes for occurrence)							
	Yes		No		Rarely (once or twice in the past 4 weeks)		Sometimes (three to ten times in the past 4 weeks)		Often (more than ten times in the past 4 weeks)	
	n	%	n	%	n	%	n	%	n	%
Households worried about having enough food	136	38.6	216	61.4	69	50.7	58	42.6	9	6.6
Self or a household member unable to eat the kinds of foods preferred because of a lack of resources	137	38.9	215	61.1	56	40.9	27	19.7	54	39.42
Self or a household member has eaten a limited variety of foods due to a lack of resources	150	42.6	202	57.4	58	38.7	26	17.3	66	44.0
Self or a household member has eaten some foods that they did not want to eat because of a lack of resources to obtain other types of food	147	41.8	205	58.2	63	42.9	44	29.9	40	27.2
Self or a household member has eaten a smaller meal than they felt they needed because there was not enough food	110	31.3	242	68.8	43	39.1	40	36.4	27	24.5
Self or a household member has eaten fewer meals in a day because there was not enough food	82	23.3	270	76.7	49	59.8	26	31.7	7	8.5
There was no food of any kind to eat in the household because of a lack of resources to get food	46	13.1	306	86.9	30	65.2	12	26.1	4	8.7
Self or household member goes to sleep at night hungry because there was not enough food	37	10.5	315	89.5	25	67.6	9	24.3	3	8.1
Self or household member spends a whole day and night without eating anything because there was not enough food	29	8.2	323	91.8	21	72.4	6	20.7	2	6.9

The present study showed that employment status had a significantly associated factor with DD. Self-employed adults (having their own work) on ART were more likely to have high DD than those unemployed. This finding was supported by a study done by Amare and his colleagues in Metema hospital⁽¹⁸⁾ and Mukabana B. & Masika F. in Uasin Gishu District Hospital in Kenya⁽¹⁹⁾.

Regarding the quintiles of wealth index, a statistically significant association was found between quintiles of wealth index and DD. From second to the highest quintile, there was an increase in the high DD compared with the lowest quintile. This can be credited to the fact that household assets have been used as a proxy indicator of the socio-economic status of a household that links the purchasing capacity of a variety of foods and diversified food. This was in line with the finding of the Metema hospital study⁽¹⁸⁾. Besides, wealth was also mentioned as a factor for increasing DD in a study done in Tanzania⁽²⁶⁾, and households in the richest wealth quintile had the highest DD in Ghana⁽²⁷⁾.

Another factor that was found to be associated with DD was the CD4 cell count. Subjects who had a CD4 cell count of 200–349 cells/mm³ had a better DD than those who had CD4 cell counts less than 200 cells/mm³. This was due to poor nutritional status (particularly micronutrients can lead to immunosuppression), advanced HIV clinical stage, or disturbance of the metabolic system and loss of appetite⁽²⁸⁾. This was similar to the study done in Uganda, which reveals that consumption of diversified diet was positively associated with higher CD4 cell count⁽²⁹⁾.

Moreover, adults who were taking first-line ART were four times more likely to diversify their diet compared with those who were on second-line ART. The possible reason would be that first-line ART drugs have less side effects such as lower gastrointestinal upset which will contribute to better appetite, feeding and DD⁽³⁰⁾.

This study showed that adults who were not taking co-trimoxazole prophylaxis were more likely to have high DD. The possible reason would be linked to co-trimoxazole-induced nausea and vomiting⁽³¹⁾, which potentially reduce appetite and thereby affect DD. This finding was in line with the Metema hospital study, which indicated that adults on co-trimoxazole were more likely to have low DD than those who did not take the drug⁽¹⁸⁾.

Besides, those adult patients who had nutritional counselling at a health institution were found to have a diversified diet than adults who did not get nutritional counselling. The possible reason would be health education/information on nutrition possibly helps them to diversify their diet. This was in line with Addisu Tesfaw and his colleague's study in Motta⁽²⁾.

Food preference, the new variable added into this study, was a statistically significant predictor of DD among adults on ART. Adults who had no food preference were two times more likely to diversify compared with those who had food preferences for their meal. This would be because people who prefer food will eat selectively specific foods that influence food intake and finally end up with limited food variety and low DD. This finding was also supported by Jamie Hale



Table 5. Bi-variate and multivariable binary logistic regression analyses of variables with individual DD status among HIV-positive adults (18–65 years old) attending ART clinics at FHCSH, Northwest Ethiopia, 2019 ($n = 352$)

Variable	DD		Crude			Adjusted			
	High	Low ^a	Odds ratios (95 % confidence intervals)		P-value	Odds ratios (95 % confidence intervals)			P-value
Sex									
Male	136	61	2.50	1.62	3.88				<0.001
Female	73	82	Reference						
Age category (years)									0.050
18–24	8	9	Reference						
25–34	60	59	1.14	0.41	3.17				
35–44	99	50	2.23	0.81	6.12				
45–54	35	18	2.19	0.72	6.63				
55–65	7	7	1.13	0.27	4.64				
Religion									0.041
Christian	190	138	Reference						
Muslim	19	5	2.76	1.01	7.57				
Residence									0.38
Urban	181	119	1.30	0.72	2.36				
Rural	28	24	Reference						
Educational status									<0.001
No formal education	37	52	Reference						
Primary education	32	29	1.55	0.81	2.98				
Secondary and above	140	62	3.17	1.89	5.32				
Marital status									0.001
Married	152	77	Reference						
Divorced	23	24	0.49	0.26	0.92				
Single	20	15	0.68	0.33	1.39				
Widowed	14	27	0.26	0.13	0.53				
Employment status									0.001
Self-employed	123	62	3.47	1.60	7.51	4.60	1.72	12.27	
Government employee	59	37	2.79	1.23	6.33	1.51	0.51	4.50	
Daily labourer	15	23	1.14	0.44	2.99	0.94	0.27	3.30	
Unemployed	12	21	Reference			Reference			
Family size									0.28
≤4	28	43	Reference						
≥5	181	100	1.26	0.82	1.94				
Head of household									<0.001
Yes	28	43	2.78	1.63	4.75				
No	181	100	Reference						
Source of food									0.66
Purchase	181	126	1.15	0.60	2.18				
Farm	28	17	Reference						
Quintiles of wealth index									<0.001
Lowest quintile	22	52	Reference			Reference			
Second quintile	34	31	2.59	1.29	5.20	4.33	1.72	10.89	
Middle quintile	45	27	3.94	1.98	7.85	4.40	1.71	11.31	
Fourth quintile	58	17	8.06	3.87	16.82	6.60	2.36	18.48	
Highest quintile	50	16	7.39	3.48	15.67	9.45	3.34	26.77	
Smoke cigarettes									0.001
No	169	142	Reference						
Yes	40	1	33.61	4.56	247.55				
Drink alcohol									0.010
No	142	115	Reference						
Yes	67	28	1.94	1.17	3.21				
Chew khat									0.005
No	185	142	Reference						
Yes	24	1	18.42	2.46	137.80				
Follow media (TV/radio/magazine, etc.)									0.002
No	45	52	Reference						
Yes	164	91	2.08	1.30	3.35				
WHO clinical stage of the disease									0.039
Stage I (T-1)	83	79	Reference						
Stage II (T-2)	83	42	1.88	1.16	3.05				
Stage III	42	21	1.90	1.04	3.50				
Stage IV	1	1	0.95	0.06	15.48				
Last CD4 count (cell/mm ³)									<0.001
<200	38	40	Reference			Reference			
200–349	81	16	5.33	2.66	10.69	8.08	2.93	22.29	

Continued



Table 5. Continued

Variable	DD		Crude			Adjusted		
	High	Low ^a	Odds ratios (95 % confidence intervals)		P-value	Odds ratios (95 % confidence intervals)		P-value
>350	90	87	1.09	0.64	1.86	0.67	0.26	1.71
Duration of ART (months)					0.37			
≤24	21	9	1.74	0.77	3.95			
25–48	47	29	1.21	0.71	2.05			
≥ 49	141	105	<i>Reference</i>					
ART regimen category								
First line	185	104	2.89	1.65	5.07	4.49	2.19	9.21
Second line	24	39	<i>Reference</i>			<i>Reference</i>		
Co-trimoxazole prophylaxis								
No	190	105	3.62	1.99	6.60	6.36	2.54	15.88
Yes	19	38	<i>Reference</i>			<i>Reference</i>		
Those who had nutritional counselling at a health institution					0.017			0.032
No	24	30	<i>Reference</i>			<i>Reference</i>		
Yes	185	113	2.05	1.14	3.68	2.36	1.08	5.16
Food preferences					0.029			0.022
No	181	111	1.86	1.07	3.26	2.42	1.14	5.13
Yes	28	32	<i>Reference</i>			1.00		
Household food insecurity status								
Food insecure	49	85	<i>Reference</i>			<i>Reference</i>		
Food secure	160	58	4.79	3.01	7.60	3.51	1.85	6.67

The forward stepwise elimination binary logistic regression model was run adjusting for the variables significant at $P < 0.20$ in the unadjusted model (bi-variate) which included variables shown in the table.

^a The reference category is low DD.

and Eertmans's reviews on food likes and dislikes on human eating behaviour, which clarify that food preference has a notable contribution to make to individual food intake and change in dietary patterns^(32,33).

Moreover, household food insecurity was found to be a statistically significant determinant of DD among adults on ART. Adults from food-secure households were nearly four times more likely to have a highly diversified diet than their food-insecure counterparts. Dietary diversity is an indicator of food security as the inability of households to obtain access to enough food eminently enforce to have monotonous feeding habit which compromises DD. This was in line with a study done in Jimma, Ethiopia⁽³⁴⁾ and in Nepal, a study done among lactating mothers⁽³⁵⁾ that showed people with low DD tend to have food insecurity.

Limitation of the study

Some limitations should be considered while using the results of this study. Even though the study site gives ART service for clients coming from multiple places, the research conducted at a single site may have a limitation that may be attributed to a particular factor related to the institution. Hence, future researchers shall consider multiple sites in their studies.

Strength of the study

Data were collected on non-fasting days to avoid the possible effect of fasting on the DD of study participants. Additionally, new variables were added to the study.

Conclusion

In summary, this study finding revealed that DD was below two-thirds among adults attending the anti-retroviral treatment clinic. Moreover, self-employment status, quintiles of wealth index, last CD4 count, first-line ART regimen category, adults not taking co-trimoxazole prophylaxis, those having nutritional counselling at a health institution, the absence of food preferences and household food insecurity were found to be statistically significant factors for individual DD of adults taking ART. Therefore, the stakeholders concerned shall work to sustain patients' treatment on first-line ART regimen category through different mechanisms like strictly adhering to the ART guidelines, strong counselling and regular support of people on ART to avoid defaulting or dropout from treatment and drug resistance.

Hospitals and health professionals working at the ART clinic shall strengthen their efforts to sustain the nutritional counselling service at the clinic through regular updating of the staff working there, adhering to the appropriate counselling methods by considering the background and situation of adults on ART and using different modalities like experience sharing among people on ART, and preparing model sites or simulation areas and educating them through these.

Health professionals working at the ART clinic shall encourage the patients to avoid food preference for their meals unless it is a cultural/religious taboo.

Government organisations and/or NGOs shall ensure household food security for adults on ART by providing food item support or creating job opportunities to those who are jobless.



Acknowledgments

We thank FHCSH ART Clinic staff, data collectors, study participants and the supervisor for their support for the successful data collection. We are also thankful to Bahir Dar University, Institute of Technology, Faculty of Chemical & Food Engineering, and the Department of Applied Human Nutrition for facilitating the research work.

H.A.S., G.T. and T.D.T. have actively participated in the study protocol design, acquisition of data, and analysis and interpretation of data. All authors read and approved the final version of the manuscript.

The datasets used and/or analysed during the present study are available from the corresponding author on reasonable request.

The authors declare that they have no conflicts of interest.

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