

# Dietary diversity and associated factors among HIV positive adults attending antiretroviral therapy clinics at Hiwot Fana and Dilchora Hospitals, eastern Ethiopia

Fitsum Weldegebreal<sup>1</sup>  
Tesfaye Digaffe<sup>1</sup>  
Frehiwot Mesfin<sup>2</sup>  
Habtamu Mitiku<sup>1</sup>

<sup>1</sup>Department of Medical Laboratory Sciences, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia;

<sup>2</sup>Department of Public Health, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia

**Background:** Nutritional care is considered a crucial component of comprehensive care for people living with HIV/AIDS (PLWHA), particularly in resource-limited settings where malnutrition and food insecurity are endemic problems, and low quality monotonous diets are the norm. The findings of this study provide baseline information on dietary diversity and related factors for health care providers so that they will be able to improve nutritional care and support activity. Therefore, the aim of this study was to assess dietary diversity and associated factors among HIV positive adults (18–65 years old) attending antiretroviral therapy (ART) clinics at Hiwot Fana and Dilchora Hospitals, eastern Ethiopia.

**Patients and methods:** An institution-based cross-sectional study was conducted from November 2015 to February 2016 at the ART clinics of Hiwot Fana and Dilchora Hospitals. Using a systematic random sampling technique, a total of 303 patients were selected from all adults attending the ART clinics. The data were collected with a 95% CI used to show association between dietary diversity and independent factors.

**Results:** A total of 303 adult HIV positive individuals on ART participated in the study and 62.4% were females. The largest numbers of participants (49.5%) were 30–40 years of age. Eighty-seven (28.7%) participants had low dietary diversity ( $\leq 4$  food groups). Duration of antiretroviral treatment was the factor significantly associated with dietary diversity: respondents with a duration of antiretroviral treatment of more than 2 years were almost two times more likely to have high dietary diversity compared with those with less than a year of antiretroviral treatment (adjusted odds ratio = 0.490; 95% CI: 0.091, 0.978).

**Conclusion:** Low dietary diversity was found to be a nutritional problem among HIV positive adults. Duration of antiretroviral treatment was the predictor of low dietary diversity. Therefore, appropriate dietary management of side effects of ART is important.

**Keywords:** dietary diversity, HIV/AIDS, adults, antiretroviral treatment, Ethiopia

## Introduction

Nutrition is an important component of comprehensive care for people living with HIV/AIDS (PLWHA) and it is particularly crucial in resource-limited settings where malnutrition and food insecurity are endemic. There is a similarity in the cellular effects of malnutrition and HIV – the immune system becoming compromised by decreasing CD4 T cells, suppression of delayed hypersensitivity and abnormal B-cell responses.<sup>1</sup> Providing sufficient food and nutrition to meet people's basic needs for health, growth and development has been a long-standing challenge for African countries. This challenge is further

Correspondence: Tesfaye Digaffe  
Department of Medical Laboratory Sciences, College of Health and Medical Sciences, Haramaya University, P.O. Box 235, Harar, Ethiopia  
Tel +251 91 211 1224  
Email [tdigaffe@yahoo.com](mailto:tdigaffe@yahoo.com)

exacerbated by the emergence of HIV/AIDS.<sup>2</sup> Nutritional problems are among the first negative effects of HIV infection. These problems are due to inadequate diet intake and altered metabolic conditions, provoking impaired balance of energy and nutrients in patients even when they are treated with anti-retroviral therapy (ART).<sup>3</sup> The effect of poor nutrition in the case of PLWHA is more urgent as they have to grapple with opportunistic infections. Dietary management of PLWHA is the key to sustaining the ability to continue participating in the workforce and contributing to socioeconomic development.<sup>2</sup> Food insecurity and poor nutritional status may speed up progression of AIDS-related illnesses.<sup>4</sup>

The dietary diversity score at the individual level is a proxy indicator of adequate intake of energy and micronutrients.<sup>5</sup> Eating a diversity of foods (varieties of food groups) is an internationally accepted recommendation for a healthy diet, and is associated with positive health outcomes such as reduced incidence of mortality.<sup>6</sup> Dietary diversity is therefore a key concept that should be promoted in managing the nutritional situation of PLWHA. The relationship between nutrition and HIV infection is very complex and can fluctuate due to factors such as nutritional status, including wasting or weight loss and micronutrient deficiencies, HIV disease stage and other physiological factors and diets.<sup>7</sup> Comprehensive care of HIV infection includes a combination of medical treatment and adjustment, nutritional assessment, management, counseling and ongoing monitoring of outcomes.<sup>8</sup> HIV positive individuals require 20–30% more extra energy than HIV negative individuals of the same age, sex and physical activity level (Shawel, unpublished data, 2013).

Ready-to-use therapeutic food (RUTF) is a type of highly nutrient-dense spread, a food product high in energy and micronutrients in which all powdered ingredients are suspended in fat and do not require any preparation or addition of water before ingestion. RUTFs, like other highly nutrient-dense spreads, can be stored for long periods, do not require refrigeration and can be individually packaged and used effectively in areas where hygiene conditions are not optimal.<sup>10</sup> Studies have provided evidence for the effectiveness of RUTF for treatment of acute malnutrition in HIV-infected, malnourished adults.<sup>11,12</sup>

Dietary diversity is a qualitative measure of food consumption that reflects household access to a wide variety of food, and is also a proxy of the nutritional adequacy of an individual's diet.<sup>13</sup> The individual dietary diversity score (IDDS) is a proxy measure of the nutritional quality of an individual's diet. The IDDS together with other factors such as the number of dietary intakes, fulfillment of nutrient demands

and anthropometry determinations are factors associated with dietary quality. Socioeconomic, cultural, medical and behavior characteristics of each individual could determine the nutritional quality of patients.<sup>14</sup>

The IDDS aims to capture nutritional adequacy and many studies amongst people of different age groups have shown that its increase is related to increased nutrient adequacy of the diet. Dietary diversity scores have been positively correlated with increased mean micronutrient density adequacy of complementary foods<sup>13</sup> and micronutrient adequacy of the diet in adults.<sup>15,16</sup> Even then there is complex interaction between dietary diversity/intake, immune function and HIV/AIDS and malnutrition. Few studies have been conducted regarding this significant public health problem throughout the country and no study has been conducted in eastern Ethiopia. Therefore, the aim of this study was to assess dietary diversity and associated factors among HIV positive adults (18–65 years old) attending the ART clinics at Hiwot Fana and Dilchora Hospitals.

## Patients and methods

### Study design and setting

An institution-based cross-sectional study design was used. The study was conducted from November 2015 to February 2016 at the ART clinics of Hiwot Fana and Dilchora Hospitals which are two of the eastern Ethiopian governmental hospitals found in Harar and Dire Dawa cities, respectively. Harar is located in the eastern part of the country, 515 km away from the capital, Addis Ababa. The region had a projected total population of 203,438 (male:female=102,369:101,069) in 2010.<sup>17</sup> The Harari region is divided into 19 kebeles and two ethnic zones: Harari dominated and mixed zone. The health service coverage is estimated to be 100%. There are four governmental hospitals, two private hospitals and four health centers in the city.

Dire Dawa (located 515 km from Addis Ababa) is the center of Dire Dawa city administration and is the second largest city in Ethiopia. It is a commercial and industrial center. Dilchora Referral Hospital (DCRH), the only governmental hospital in the region, was established in 1952 and since then has been serving the ever-increasing population of Dire Dawa city and its adjacent regions, Oromiya and Somali.

### Sample size determination and sampling procedure

Sample size was determined using a single population proportion formula by taking a value of 10.3% representing the prevalence estimates of adult malnutrition as a proxy for

dietary quality in sub-Saharan African countries.<sup>18</sup> The final sample size including a 10% non-responding rate was then 303, and all adults (who fulfilled the inclusion criteria) attending ART clinics at the hospitals during the study period were enrolled by a systematic random sampling method using the registration book of the patients as a sample frame. The first study subject was selected using the lottery method. A manual lottery method was used; each subject in the sampling frame (list of adult HIV patients on ART) was assigned a number and then 303 numbers were drawn from the total listed patients. If the selected study participant did not fulfill the criteria another number was drawn randomly. The study participants were allocated proportionally based on the number of ART patients in each hospital (i.e. 162 patients from DCRH and 141 patients from Hiwot Fana Hospital). The inclusion criteria were HIV positive adults aged 18–65 years attending Hiwot Fana and Dilchora Hospitals during the study period who consented to participate in the study. But patients who were too sick and unable to get through the interview, and those whose previous 24-hour meals were unusual such as those eaten at feasts or special occasions away from home, and HIV positive adults with previously diagnosed diabetes mellitus, hypertension and current pregnancy were excluded.

## Data collection methods and procedures

Data on sociodemographic characteristics such as gender, age, ethnicity, religion and occupation were collected using a questionnaire. Data on health and behavioral-related characteristics such as duration on ART, Cotrimoxazole prophylaxis, last (current) CD4 count, World Health Organization (WHO) clinical stage and opportunistic infections were collected by reviewing patient clinical records.

The standardized IDDS tool, with a 24-hour food recall method (food, nutrition and technical assistance), was used to assess dietary diversity of adult patients living with HIV/AIDS.

## Measurement of dietary diversity score

Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of food groups, and it is also a proxy indicator for nutritional adequacy of the diet of individuals. The dietary diversity questionnaire represents a rapid, user-friendly and easily administered low-cost assessment tool. The dietary diversity scores consist of a simple count of food groups that a household or an individual has consumed during the preceding 24 hours.<sup>19</sup> Since assessment of the nutrient adequacy of the diet is

of primary concern for the study, data were collected at the individual level. Determination of the dietary diversity score of the respondents was completed primarily by listing all food items consumed by respondents (both in and out of home) from those who did not eat at feasts or attend special occasions/ceremonies in the previous 24 hours, starting from breakfast which is considered to be eaten between 6:00 am and 10:00 am, then lunch (12:00 am–4:00 pm) and dinner (8:00 pm–12:00 am) while snacks were considered to be eaten before or after the major meal. Based on the Food and Agriculture Organization (FAO)/Food and Nutrition Technical Assistance Project (FANTA) 2007 recommendation, foods eaten by the respondents were classified into 12 food groups: cereals; oils/fats; sweets/sugar; legumes; white root and tubers; fruits; vegetables; meat and meat products; milk and milk products; eggs; fish and sea foods; and spices, condiments and beverages. Participants received 1 point if they consumed at least once during the last 24 hours any of the foods within each subgroup, and 0 points if they never consumed the food. The IDDS was calculated as the sum of food groups consumed over 24 hours. The total individual food scores were first categorized into terciles; namely, Low IDDS is equivalent to low dietary diversity (1–3 food groups); Medium IDDS is equivalent to 4–5 food groups; and High IDDS means 6 or more food groups. For further analysis these groups were then dichotomized into two categories, where 0–4 were considered low dietary diversity scores and 5 or more food groups were considered high dietary diversity scores.<sup>20</sup>

## Anthropometry (measurement of weight and height)

Weight was measured using a standard 140 kg Seca weighing scale, which is used for weight measurement in the ART clinic. The scale pointer was calibrated at zero before taking measurement. The person was required to dress in light clothes and take off shoes. Women were asked to remove their scarf. The person to be weighed had to stand straight and unassisted on the center of the weighing scale platform. Measurement of weight was recorded to the nearest 0.1 kg and was checked at least two times. Height was measured using the standard scale. The subjects were required to remove their shoes, stand erect, in a horizontal plane looking straight, with feet together and knees straight. The heels, buttocks, shoulder blades and the back of the head should touch the wall. Height was measured at least two times and recorded to the nearest 0.1 cm.

## Data analysis

The data were coded, cleaned, entered into SPSS version 16.0 statistical software (IBM Corporation, Armonk, NY, USA) and analyzed. To keep the quality of data, structured questionnaires, standardized IDDS and 24-hour dietary recall tool were used. The English version of the questionnaire was translated in to local languages (Amharic, Afan Oromo and Somaligna) and then back to English to maintain its consistency for actual data collection purposes. The questionnaire was also pretested at other health centers and hospitals. Full training was given for data collectors (four clinical nurses) and two supervisors. Furthermore, the investigators gave feedback and correction regarding the collected data on a daily basis to the data collectors. Completion, accuracy and clarity of the collected data were checked carefully.

Percentages of respondents with respect to food groups and number of meals eaten by each respondent in a 24-hour recall period were computed. Cross-tabulations were carried out to test the association between respondent characteristics and dietary diversity score, which is represented by the total number of food groups eaten by each respondent in the respective categories of 0–4 and 5+. The strengths of associations between respondent characteristics and IDDS were determined using the OR and 95% CI. Bivariate analysis was used for each variable to check the association between independent variables and dietary diversity, and those variables which were found to have significant association ( $p < 0.05$ ) in the bivariate analysis were entered into a multivariable logistic regression model so as to control the possible effect of confounders, and variables which have significant association were identified on the basis of OR and 95% CI.

## Ethical considerations

Ethical clearance was obtained from the review committee of the College of Health and Medical Science, Haramaya University, and permission to conduct the study was obtained from Hiwot Fana and Dire Dawa Hospitals prior to data collection. Objectives of the study were explained, and written informed consent was obtained from each participant, and confidentiality was maintained at all levels of the study. Participants who were unwilling to participate in the study and those who wanted to withdraw from their participation at any stage were informed to do so without any restriction.

## Results

### Sociodemographic and economic characteristics

In this study, 303 HIV positive adults participated with a response rate of 100%. Of these, 189 (62.4%) were females.

About half (49.5%) of the study participants were 30–40 years old and the mean age of respondents was 37.92 years ( $SD = \pm 8.890$ ). Two hundred and three (67.0%) participants were Orthodox Christians, 142 (46.9%) were single and 143 (47.2%) had completed their primary education. The majority (97.4%) of respondents were from urban Kebeles and most of them (73.9%) did not have formal education. The majority (95.4%) of the study participants were living in a family with fewer than five members and the mean family size was 2.89 with SD of 1.583. For more than half (53.5%) of the study participants the main source of income was earning from professional salary/remittance and the main household source of food for almost all (98%) of the study participants was accessed through purchasing from a market (Table 1).

### Health-related, behavioral and nutritional characteristics

The majority (80.2%) of HIV positive adults have been taking ART for more than 2 years and 175 (57.8%) of the participants have been/were taking Cotrimoxazole prophylaxis. Two hundred and eighty-two (93.1%) participants had a CD4 count  $\geq 200$  cells/dL, and 159 (52.5%) participants were in WHO clinical stage I. Two hundred and fifty-eight (85.1%) participants were not infected with opportunistic infections (OI), but tuberculosis was the common OI among the HIV positive adults infected with OI. Six (2%), seven (2.3%) and 34 (11.2%) of the total study participants drank alcohol, smoked cigarettes or chewed khat respectively (Table 2). Out of the total study participants, only 41 (13.5%) were underweight and 293 (96.7%) had received nutritional counseling on general feeding, ART and other drugs and OI at the ART clinic and pharmacy (Table 3).

### Dietary diversity scores of the respondents

#### Number of meals eaten by respondents per day

Of the total respondents, only 135 ate four times within 24 hours, and almost all of the study participants ate breakfast, lunch and dinner within the 24 hours before data collection (Figures 1 and 2).

#### Variety of foods eaten by respondents within the past 24 hours

According to the terciles category of the total individual food scores, about half of participants (47.2%, 143/303) had a medium IDDS (4–5 food groups), followed by 35% (107/303) with a high IDDS (6 or more food groups) and

**Table 1** Sociodemographic characteristics of HIV positive adults (18–65 years old) attending antiretroviral therapy clinics in two public hospitals, eastern Ethiopia, 2016 (n=303)

Variables		Frequency	Percentage	
Gender	Male	114	37.6	
	Female	189	62.4	
Age	18–29 years	54	17.8	
	30–40 years	150	49.5	
	>40 years	99	32.7	
Ethnicity	Oromo	100	33.0	
	Amhara	153	50.5	
	Harari	9	3.0	
	Tigre	19	6.3	
	Gurage	7	2.3	
	Other	15	5.0	
	Religion	Orthodox	203	67.0
	Muslim	74	24.4	
	Catholic	25	8.3	
	Other	1	0.3	
Occupation	Farmer	6	2.0	
	Government employee	54	17.8	
	Waiter	4	1.3	
	Unemployed	11	3.6	
	Merchant	111	36.6	
	Daily laborers	32	10.6	
	House wife	15	5.0	
	Non-governmental employee	70	23.1	
	Marital status	Married	40	13.2
		Single	142	46.9
	Divorced	78	25.7	
	Widowed	43	14.2	
Educational status	Cannot read and write	31	10.2	
	Read and write only	19	6.3	
	Primary education	143	47.2	
	Secondary and above	110	36.3	
Number of people in household	<5	289	95.4	
	≥5	14	4.6	
Monthly family income	<200 birr	9	3.0	
	200–500 birr	60	19.8	
	500–1000 birr	116	38.3	
	>1000 birr	118	38.9	
Main source of income	Agriculture (crop)	15	5.0	
	Livestock	1	0.3	
	Trader	108	35.6	
	Professional (salary/remittance earner)	162	53.5	
	House rent	17	5.6	
Main source of food	Purchase	297	98	
	Own farm/garden	6	2.0	

17.5% (53/303) with a low IDDS (1–3 food groups) per 24 hours before data collection. According to the dichotomous category of the total individual food scores, 87 (28.7%) participants had low dietary diversity ( $\leq 4$  food groups) and 216 (71.3%) had high dietary diversity ( $\geq 5$  food groups) per 24 hours before data collection.

The most commonly eaten foods within the past 24 hours before data collection were cereals (303/303, 100%), oil and fat (303/303, 100%), fruits (268/303, 88.4%) and legumes, nuts and seeds (223/303, 73.6%), and the least eaten food group was fish and other seafoods (4/303, 1.3%). The food groups eaten by less than 50% of the participants were fish and other seafoods, milk and milk products, spices, condiments and beverages, and white tubers and roots (Figure 3).

### Factors associated with level of dietary diversity

In both bivariate and multivariate analyses, the only significant factor associated with dietary diversity was duration of antiretroviral treatment. After controlling possible confounders, the result of multivariate analysis revealed that duration of antiretroviral treatment remained significantly associated with dietary diversity of HIV positive adults. Respondents with duration of antiretroviral treatment for more than 2 years were almost two times likely to have dietary diversity compared with those who have less than a year of antiretroviral treatment (adjusted odds ratio AOR =0.490; 95% CI: 0.091, 0.978) (Table 4).

### Discussion

In this study, 87 (28.7%) of the study participants had low dietary diversity, which is lower than the reports from a study in Metema Hospital, in Jimma University specialized hospital in Ethiopia and in eastern Uganda with 58.8%, 55.8% and 59% of the study participants having low dietary diversity respectively.<sup>21–23</sup> This shows that HIV positive adults attending in the present study area had adequate dietary intake compared to what is revealed in the previous studies, with dietary diversity, i.e. the number of foods consumed across and within food groups over a reference period, widely recognized as a key indicator of nutrient adequacy.<sup>22,24–26</sup>

The duration of antiretroviral treatment was significantly associated with dietary diversity. It was noticed that HIV positive adults who were on ART for less than 1 year and 1–2 years were more likely to have low dietary diversity

**Table 2** Health-related and behavioral characteristics of HIV positive adults (18–65 years old) attending antiretroviral therapy clinics in two public hospitals, eastern Ethiopia, 2016 (n=303)

Variables		Frequency	Percentage
ART status (on ART)	Yes	303	100
Duration on ART	≤1 year	26	8.6
	1–2 years	34	11.2
	>2 years	243	80.2
Cotrimoxazole prophylaxis	Yes	175	57.8
	No	127	41.9
Last CD4 count	≤50 cells/mm <sup>3</sup>	3	1.0
	51–199 cells/mm <sup>3</sup>	18	5.9
	≥200 cells/mm <sup>3</sup>	282	93.1
WHO clinical stage	I	159	52.5
	II	28	9.2
	III	115	38.0
	IV	1	0.3
Opportunistic infections (OI)	Zoster	7	2.3
	Bacterial pneumonia	14	4.6
	PTB	12	4.0
	EPTB	4	1.3
	Thrush – oral, vaginal	2	0.7
	Ulcers – mouth, genital	2	0.7
	Diarrhea chronic/acute	3	1.0
	Pneumocystis pneumonia	1	0.3
	No OI	258	85.1
Cigarette smoking	Yes	7	2.3
	No	296	97.7
Drinking alcohol	Yes	6	2.0
	No	297	98.0
Chewing khat	Yes	34	11.2
	No	269	88.8

**Abbreviations:** ART, antiretroviral therapy; PTB, pulmonary tuberculosis; EPTB, extrapulmonary tuberculosis; WHO, World Health Organization.

**Table 3** Nutrition-related characteristics of HIV positive adults (18–65 years) attending antiretroviral therapy clinics in two public hospitals, eastern Ethiopia, 2016 (n=303)

Variables		Frequency	Percentage
BMI	<18.5 kg/m <sup>2</sup>	41	13.5
	≥18.5 kg/m <sup>2</sup>	262	86.5
Taking RUTF	Yes	11	3.6
	No	292	96.4
RUTF use daily	Yes	11	3.6
	No	292	96.4
Sharing RUTF with others	Yes	8	72.7
	No	3	27.3
Nutritional counseling	Yes	293	96.7
	No	10	3.3

**Abbreviations:** BMI, body mass index; RUTF, ready-to-use therapeutic food.

than those on ART for more than 2 years. This finding was consistent with the study finding in Metema Hospital.<sup>21</sup> This might be due to the fact that most antiretroviral drugs can lead to reduced food intake or reduced nutrient absorption

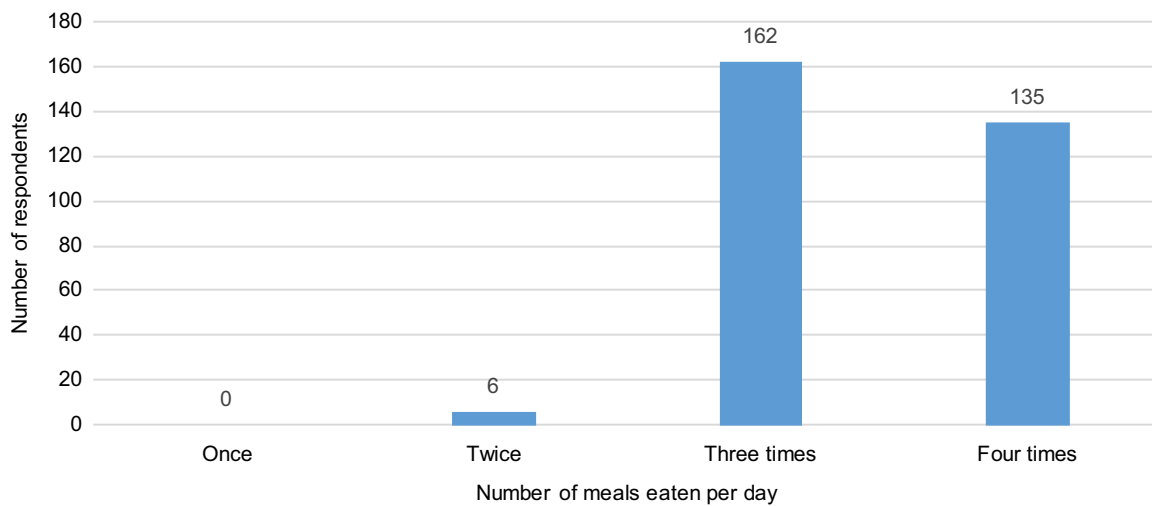
which exacerbates the weight loss and nutritional problems experienced by PLWHA. Antiretroviral side effects, such as nausea, taste changes and loss of appetite, may reduce food consumption, while side effects such as diarrhea and vomiting may increase nutrient losses.<sup>27</sup>

Studies revealed that knowledge of nutrition influences dietary diversity.<sup>28,29</sup> As an individual's nutritional knowledge increases, the consumption of foods from different food groups also increases. As a result, a variety of nutrients are obtained and thus nutrient adequacy is attained.<sup>28</sup> Nutrition information should thus be a key component to the care of PLWHA and should be initiated at the entry point to comprehensive care. Nutrition education should be continuous throughout the period of care. Nutrition interventions that educate low-income families on inexpensive, healthy eating should be embraced. Changes at policy level should be well thought-out to increase affordability and accessibility of healthful food in low-income settings.<sup>29</sup> Even though no statistically significant associations were observed between dietary diversity and nutritional counseling provided to patients by health providers in the present study area, the great majority (96.7%) of study participants had nutritional counseling from health providers. This counseling service might have contributed to the high level of dietary diversity in the present study.

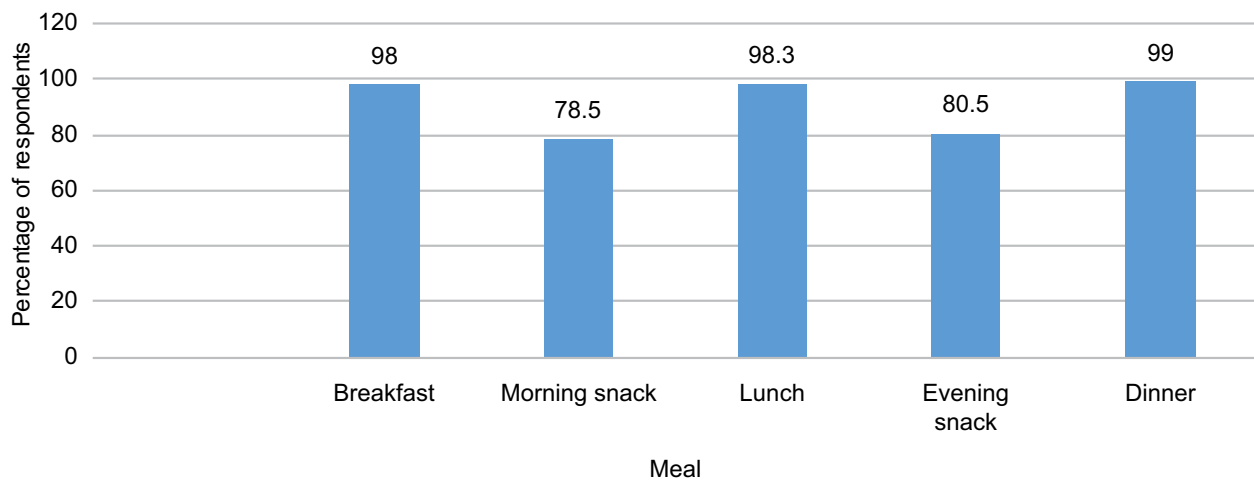
This study found that all study participants (100%) consumed foods made up of cereals which are generally cheaper than animal products such as meat over a 24-hour period. All participants also reported that they use fats and oils during food preparation to fry their food. This finding is similar to findings from studies conducted in Metema (Ethiopia) and Uganda, which found that the most commonly eaten foods were cereals and oils and fats (Carol, unpublished data, 2004).<sup>21</sup> The other most commonly consumed foods groups were fruits (88.4%) and legumes, nuts and seeds (73.6%). This was similar to findings from a survey carried out in Metema (Ethiopia)<sup>21</sup> and Tanzania.<sup>29</sup> The food group eaten least by the respondents in the 24 hours prior to the study was fish (1.3%). This may be due to absence of this food source in this study area.

## Limitations of the study

Limitations of our study include its cross-sectional nature, which did not allow us to infer causality. The other was that even though using the 24-hour food recall method minimizes recall bias, it only provides a snapshot of information rather than the trend of dietary habits. Some important patient characteristics (viral load and length of being HIV infected) were also not assessed in this study because of the absence of



**Figure 1** Frequency of meals per respondent per day of HIV positive adults (18–65 years) attending antiretroviral therapy clinics in two public hospitals, eastern Ethiopia, 2016 (n=303).



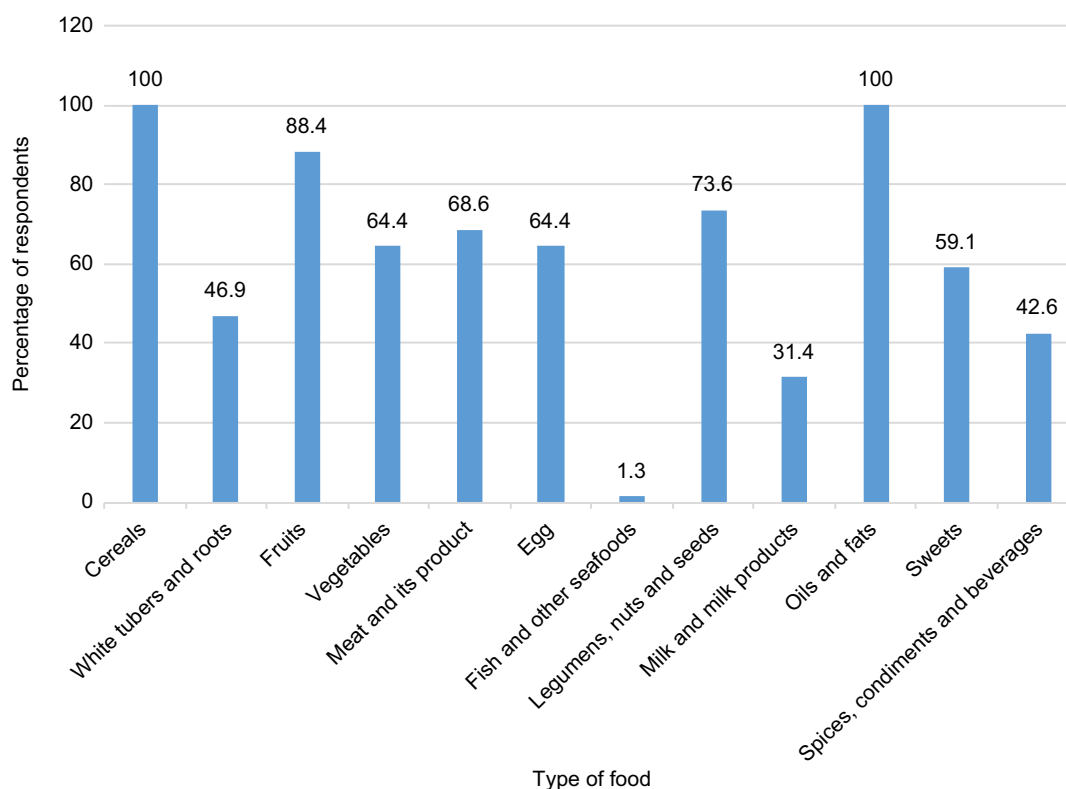
**Figure 2** Meals eaten within 24 hours for HIV positive adults (18–65 years) attending antiretroviral therapy clinics in two public hospitals, eastern Ethiopia, 2016 (n=303).

facilities to measure the viral load of patients and the length of being HIV infected for each patient was not well documented on the patient's clinical records. Therefore, this study tried only to correlate dietary diversity with ART. However, this study was limited in its ability to show dietary diversity compared with non-infected people or HIV-1 positive patients who are not on ART.

## Conclusion

Low dietary diversity was a nutritional problem among HIV positive adults attending the antiretroviral treatment clinics in the present study area. The finding of the present study also reveals that duration of ART was significantly associated with dietary diversity. In the early periods of

initiation of ART, patients may face challenges in adapting to the antiretroviral drugs' side effects that can lead to reduced food intake or reduced nutrient absorption as compared to those taking ART for a longer period. Mood changes as a result of the introduction of lifelong treatment may also result in suppressed appetite, which in turn may result in low dietary intake and low dietary diversity. Appropriate dietary management of common side effects of ART (nausea, vomiting, diarrhea, anorexia, fever and change or loss of taste) include: taking medication with food; eating a small quantity of food at frequent intervals; drinking plenty of fluids and continual eating; eating small, frequent meals; drinking plenty of fluids and eating energy and nutrient dense foods; using flavor enhancers such as



**Figure 3** Variety of food eaten within 24 hours for HIV positive adults (18–65 years) attending antiretroviral therapy clinics in two public hospitals, eastern Ethiopia, 2016 (n=303).

**Table 4** Factors associated with dietary diversity of HIV positive adults (18–65 years old) attending antiretroviral therapy clinics in two public hospitals, eastern Ethiopia, 2016 (n=303)

Variables		Individual dietary diversity score		Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
		Low dietary diversity, number (%)	High dietary diversity,** number (%)				
Sex of respondent	Male	30 (26.3)	84 (73.7)	1.180 (0.658, 2.117)	0.456	0.848 (0.472, 1.520)	0.579
	Female	57 (30.3)	132 (69.7)				
Educational status	Cannot read and write	6 (19.4)	25 (80.6)	2.082 (0.752, 5.765)	0.121	0.480 (0.173, 1.331)	0.202
	Read and write only	6 (31.6)	13 (68.4)	1.087 (0.358, 3.299)		0.920 (0.303, 2.793)	
	Primary education	37 (25.9)	106 (74.1)	1.456 (0.818, 2.592)		0.687 (0.386, 1.223)	
	Secondary and above	38 (34.5)	72 (65.5)				
WHO clinical stage	I	46 (28.9)	113 (71.1)	0.919 (0.087, 0.998)	0.002	0.989 (0.509, 0.992)	0.001
	II	11 (39.3)	17 (60.7)	0.913 (0.192, 0.991)		0.903 (0.218, 0.988)	
	III	29 (25.2)	86 (74.8)				
On cotrimoxazole prophylaxis	Yes	46 (52.9)	41 (19.00)	1.612 (0.924, 2.814)	0.085	0.620 (0.355, 1.082)	0.093
	No	41 (47.1)	175 (81.00)				
Duration on ART	≤1 year	13 (48.1)	14 (51.9)	0.417 (0.189, 0.916)		0.490 (0.091, 0.978)	
	1–2 years	14 (41.2)	20 (58.8)	0.382 (0.147, 0.992)		0.501 (0.008, 0.807)	
	>2 years	60 (24.8)	182 (75.2)				0.029
Age	18–29 years	24 (44.4)	30 (55.6)	0.739 (0.334, 1.635)	0.082	1.354 (0.612, 2.996)	
	30–40 years	34 (22.7)	116 (87.3)	1.665 (0.900, 3.078)		0.601 (0.325, 1.111)	
	>40 years	29 (29.3)	70 (70.7)				0.089

**Note:** \*\*The reference category is high dietary diversity.

**Abbreviations:** ART, antiretroviral therapy; WHO, World Health Organization.

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salt, spices, or lemon; and chewing food well and moving it around the mouth to stimulate receptors. Health care providers should provide appropriate counseling and support during initiation of ART in order to overcome mood changes like anxiety and depression that result in suppressed appetite, which in turn result in low dietary intake and low dietary diversity. This study recommends a further case–control study of dietary diversity ART patients compared with non-infected people or HIV-1 positive patients who are not on ART.

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## Author contributions

All authors participated in proposal writing, data collection, analysis, interpretation and critical review of the manuscript. All authors also read and approved the final manuscript.

## Disclosure

The authors report no conflicts of interest with this work.

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