Dietary diversity and associated factors among HIV positive adults attending antiretroviral therapy clinics at Hiwot Fana and Dilchora Hospitals, eastern 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 (≤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. 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...
Factors associated with increased mean micronutrient density adequacy of complementary foods and micronutrient adequacy of the diet in adults. 

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 and micronutrient adequacy of the diet in adults. 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. 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. 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. 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.

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 Somaliga) 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 (\( \text{SD}=\pm 8.890 \)). 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 under-weight 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
Dietary diversity and associated factors among HIV positive adults

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 (≤4 food groups) and 216 (71.3%) had high dietary diversity (≥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 ration 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.21–23 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.22,24–26

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)               |           |            |
| 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/mm³                     | 3         | 1.0        |
| 51–199 cells/mm³                  | 18        | 5.9        |
| ≥200 cells/mm³                    | 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/m²                       | 41        | 13.5       |
| ≥18.5 kg/m²                       | 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         | 27.3       |
| 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.21 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.27

Studies revealed that knowledge of nutrition influences dietary diversity.26,29 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.28 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.29 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).21 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)21 and Tanzania.29 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...
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

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**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).

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**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).
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                              | Female            |         |                      |         |
|                            | 30 (26.3)                         | 57 (30.3)         |         |                      |         |
| Educational status         | Cannot read and write             | Read and write only |         |                      |         |
|                            | 6 (19.4)                          | 6 (31.6)          |         |                      |         |
|                            | Read and write only               | Primary education |         |                      |         |
|                            | 37 (25.9)                         | 106 (74.1)        |         |                      |         |
|                            | Secondary and above               |                   |         |                      |         |
|                            | 38 (34.5)                         | 72 (65.5)         |         |                      |         |
| WHO clinical stage         | I                                 | II                | III     |                      |         |
|                            | 46 (28.9)                         | 11 (39.3)         | 29 (25.2) |                      |         |
|                            | 113 (71.1)                        | 17 (60.7)         | 86 (74.8) |                      |         |
| On cotrimoxazole prophylaxis | Yes                            | No               |         |                      |         |
|                            | 46 (52.9)                         | 41 (47.1)         |         |                      |         |
| Duration on ART            | ≤1 year                           | 1–2 years         | >2 years |                      |         |
|                            | 13 (48.1)                         | 14 (41.2)         | 60 (24.8) |                      |         |
|                            | 14 (51.9)                         | 20 (58.8)         | 182 (75.2) |                      |         |
| Age                        | 18–29 years                       | 30–40 years       | >40 years |                      |         |
|                            | 24 (44.4)                         | 34 (22.7)         | 34 (22.7) |                      |         |
|                            | 30 (55.6)                         | 116 (87.3)        | 70 (70.7) |                      |         |

Note: **The reference category is high dietary diversity.
Abbreviations: ART, antiretroviral therapy; WHO, World Health Organization.
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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