Nutritional Status of Adults with HIV in Outpatient Clinics in Vietnam
Assessment Report

National Institute of Nutrition

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ARV	Antiretroviral drug
ART	Antiretroviral therapy
BMI	Body mass index
CED	Chronic energy deficiency
FANTA	Food and Nutrition Technical Assistance III Project
FAO	Food and Agriculture Organization of the United Nations
HIV	Human Immunodeficiency Virus
NIN	National Institute of Nutrition, Vietnam
OI	Opportunistic infection
OPC	Outpatient clinic
RDA	Recommended dietary allowance
SD	Standard deviation
UNAIDS	Joint United Nations Program on HIV/AIDS
USAID	United States Agency for International Development
WHO	World Health Organization

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EXECUTIVE SUMMARY

Vietnam had an estimated 260,000 people living with HIV in 2012 (UNAIDS 2012). Nutrition assessment, counseling, and support are key components of care of people living with HIV (PLHIV). HIV can cause or worsen malnutrition by increasing energy needs while reducing appetite and nutrient absorption and utilization. Adequate diet or treatment of malnutrition can help recover lost weight, strengthen immunity, manage symptoms, increase the effectiveness of antiretroviral therapy (ART), and delay the progression of HIV to AIDS.

Few data have been available on the prevalence of acute malnutrition among PLHIV in Vietnam to inform nutrition programming. In 2011 the National Institute of Nutrition (NIN), with support from the FHI 360 Food and Nutrition Technical Assistance III Project (FANTA), conducted an assessment of nutritional status, food consumption, and factors affecting nutritional status among adult PLHIV in 29 outpatient clinics (OPCs) providing HIV services.

Methodology

The study used two-stage cluster sampling—probability proportional to size, with pre-stratification by location (North/South) and funding source (Government of Vietnam/Global Fund to Fight AIDS, Tuberculosis and Malaria/U.S. President's Emergency Fund for AIDS Relief [PEPFAR]). Participants included 3,912 male and non-pregnant/non-lactating female PLHIV 18 years and older registered at OPCs who either had not initiated ART (1,776) or were active ART patients (2,136). Thirty OPCs were selected for assessment of nutritional status, and fifteen of these were selected for dietary intake assessment.

For the assessment of nutritional status (height and weight and body mass index [BMI]), 160 participants were selected in each OPC (40 males and 40 females on ART and 40 males and 40 females not on ART). For the dietary assessment, 150 participants (75 pre-ART and 75 on ART) were selected for 24-hour dietary recall and 300 (150 pre-ART and 150 on ART) were selected for administration of a food frequency questionnaire. OPC staff were trained to administer the questionnaires, and NIN compared reported dietary intake with the 2012 recommended daily allowance (RDA) for Vietnamese adults and PLHIV.

Interview and anthropometric data were cleaned, coded, and double entered to minimize data entry errors. Food data were converted to edible raw foods based on the NIN food album. Food nutrition values were calculated using the 2007 *Food Composition Table of Vietnam.* Epidata and Access were used for data entry and STATA for analysis. A common statistical test (Anova, t-test, χ) was used where appropriate.

NIN and the FHI 360 Office of International Research Ethics reviewed and approved the protocol for the study. Before the assessment, NIN and FANTA trained the data collectors in research ethics. Informed consent was sought from all participants. Minimal identifiable

information was collected during the study to protect participants' identity, and participants were informed of potential risks and benefits.

Findings

Nutritional status was normal for 69.4 percent of the participants; 26.8 percent were undernourished (18.4 percent mildly, 5.3 percent moderately, and 3.1 percent severely), and 3.8 percent were overweight or obese. The prevalence of undernutrition was highest in participants 20–29 years (29.2 percent) and the second highest in participants 50 years and older (27.6 percent), although the latter had the highest prevalence of severe acute malnutrition (SAM) (6.6 percent). Rates of undernutrition and overnutrition did not differ significantly between males and females or by treatment group. The prevalence of undernutrition among the participants was higher than that reported among Vietnamese adults in the National Nutrition Survey 2009–2010.

In general, reported food consumption did not meet the NIN RDA. Participants with CD4 count <200 had the highest rate of undernutrition (34.3 percent, with 4.5 percent severely undernourished). Patients at Stage 4 of HIV disease had a higher total undernutrition rate (33.8 percent) and rate of SAM (8.9) than those at earlier stages.

Recommendations

1. Integrate nutrition assessment, counseling, and support into routine OPC care and treatment to prevent and manage malnutrition in this vulnerable population group. Support should include specialized food products (ready-to-use therapeutic food for treatment of SAM and fortified-blended food for treatment of moderate malnutrition and prevention of SAM) prescribed for a limited duration, with clear eligibility and exit criteria based on anthropometric measurement.
2. Focus nutrition counseling for ART patients on eating a balanced diet with adequate energy and micronutrients.
3. Prioritize OPC patients less than 25 years old and 50 years and older for nutrition assessment, counseling, and support.
4. Formulate and enforce a strategic government policy to ensure equitable access to food support for groups vulnerable to food insecurity, including PLHIV.

1. BACKGROUND

HIV not only affects the health and economic status of individuals but also has economic, educational, and social impacts on countries over the long term. Despite intense global efforts and evidence of decreasing prevalence in many countries, an estimated 35.3 million people were living with HIV in 2012.[1]

According to UNAIDS, Vietnam had an estimated 260,000 people living with HIV (PLHIV) in 2012.[2] A reported 48,368 people have died of AIDS. Ho Chi Minh City has the highest population of PLHIV, accounting for 23 percent of the total.[3]

Nutrition assessment, counseling, and support are key components of the comprehensive care of people living with HIV (PLHIV). HIV infection can cause or worsen malnutrition by increasing energy needs while at the same time HIV-related symptoms and antiretroviral therapy (ART) side effects decrease appetite, as well as reducing the body's ability to absorb and utilize nutrients. Weakened immunity leaves PLHIV susceptible to opportunistic infections that further deplete nutrient stores. Adequate and balanced food intake or treatment of malnutrition with specialized therapeutic food products are needed to recover lost weight, strengthen the immune system, manage HIV-related symptoms, increase the effectiveness of treatment, and prolong the progression of HIV infection to AIDS.[3,4]

In Vietnam, few donors support nutrition interventions for PLHIV, and such services are not routinely provided in outpatient clinics (OPCs) that provide ART. Although U.S. President's Emergency Fund for AIDS Relief (PEPFAR) implementing partners in Vietnam report high levels of malnutrition among OPC patients, the lack of systematic nutrition assessment as part of routine care and treatment means that few data have been available on the prevalence of acute malnutrition among PLHIV. Studies of nutrition knowledge and dietary practices of PLHIV have been mainly qualitative and among small populations.[5, 6, 7, 8] In order to inform nutrition programming and counseling for PLHIV and procurement of specialized food products to treat malnutrition, evidence was needed on the nutritional status and food intake of this population.

Since 2009 USAID/Vietnam has funded the Food and Nutrition Technical Assistance III Project (FANTA), managed by FHI 360, to work with the Vietnam Administration of HIV/AIDS Control (VAAC), the National Institute of Nutrition (NIN), and PEPFAR/Vietnam partners to strengthen nutrition programming for PLHIV and orphans and vulnerable children (OVC). In 2011 FANTA supported NIN in conducting a study of the prevalence of severe and moderate malnutrition among adult pre-ART and ART patients in 29 OPCs.

Objectives

1. To assess nutritional status and food consumption among non-pregnant/postpartum pre-ART and ART patients registered in OPCs
2. To explore factors affecting the nutritional status of PLHIV

2. METHODOLOGY

The study questions are listed below.

A. What is the point prevalence of severe acute malnutrition (SAM, defined as BMI < 16) and moderate malnutrition (defined as BMI 16.0–18.49) in adult non-pregnant/post-partum PLHIV receiving ART at OPCs in Vietnam?

B. What is the point prevalence of severe acute malnutrition (SAM); defined as BMI < 16) and moderate acute malnutrition (MAM; defined as BMI 16-18.49) in adult non-pregnant PLHIV registered at OPCs in Vietnam, but who have not yet initiated ART?

C. What are the average food consumption patterns and intake of adult PLHIV attending ART clinics, both pre-ART and ART?

Objective 1: Assess the nutritional status and dietary intake of pre-ART and ART patients.

Nutritional status

- Biological variables: Age and sex using the questionnaire in annex 1.
- Anthropometric variables: Weight and height using standardized OMRON electronic scales and SECA height tapes [9]

Food consumption [10]

- 24-hour recall to determine average energy intake/person/day and dietary intake in comparison with the 2012 NIN RDA 2012,[11] using a food survey form and food album developed by NIN (see annex 1)
- Food frequency questionnaire to identify how often participants ate selected food items

Objective 2: Identify factors that affect nutritional status using questionnaires, observation, and cross-checking with patient files.

- Social and cultural factors: Education, occupation, marital status
- Reduced food intake: HIV-related symptoms and drug side effects
- Opportunistic infections (OIs): Fungal infections, TB, upper respiratory infections[12]
- Clinical signs: CD4 count and clinical stage of infection[13]

The study population was adult non-pregnant/post-partum PLHIV registered for ART at OPCs in Vietnam.

Data for the study were collected in 29 OPCs between August and November 2011 (annex 2). One OPC in Ho Chi Minh City dropped out of the assessment because of a lack of staff to assist with data collection. The criterion for inclusion of OPCs in the assessment was at least 75 active ART patients as of 30 June 2010.

The study used a two-stage cluster sample survey—probability proportional to size, with pre-stratification by two variables plausibly associated with malnutrition rates: geographical location (North/South) and funding source (Government of Vietnam [GOV}/Global Fund to Fight AIDS, Tuberculosis and Malaria [GFATM]/U.S. President's Emergency Fund for AIDs Relief [PEPFAR]).

2.1. Questionnaire Design, Training and Data Collection

Data collection forms for anthropometric and dietary assessments (see annex 1) were prepared separately for each OPC, with clear identifiers. NIN and FANTA trained supervisors in the study objectives, research ethics, and methods for the anthropometric and dietary assessments. NAN and FANTA then trained two data collectors from each participating OPC in the study objectives and anthropometric measurement in two courses, one in Hanoi and another in Ho Chi Minh City. NIN staff were trained to administer the 24-hour recall and food frequency questionnaires. NIN and FANTA made site visits to Than Ha in the north and Ben Tre in the south in November 2011 to supervise the assessments.

2.2. Sampling

In this two stage cluster-sample survey, the primary sampling units were randomly selected clusters from OPCs pre-stratified by region (north, south) and funding source (GOV, GFATM, PEPFAR). The secondary sampling units were all PLHIV in the OPCs (those on ART and not yet on ART), and a simple random sample of these individuals

Inclusion criteria

- All non-pregnant adult PLHIV (18 years and over) registered at the OPCs who had not yet initiated ART
- All non-pregnant adults (18 years and over) who had initiated ART at an OPC and had not died, transferred, or been lost to follow-up (active patients).

Exclusion criteria

- OPCs with fewer than 75 active ART patients were excluded from the study for logistical reasons. At the time of the study, 285 OPCs were providing ART, but 155 of

these (54 percent) supported fewer than 75 active ART patients. These 'smaller' OPCs, however, only provide services to 9.5% of the PLHIV receiving ART at OPCs (3,948 of the 41,546 PLHIV as of 30 June 2010). To reduce the administrative load for the study team, it was agreed to limit the size of OPCs to be included to those with at least 75 active ART patients as at 30 June 2010.

- OPCs and participants that did not meet the above criteria and were not willing to attend the study or comply with the technical requirements of the study were also excluded.

2.2.1. Sample size

- Stage 1: Primary sampling units (OPCs): A sample of 30 clusters (OPCs) [14] was selected for assessment of nutritional status, of which 15 were selected to collect additional dietary intake data.

- Stage 2: Selection of study participants
  - **Assessment of nutritional status**: In each OPC, 160 participants were selected, of whom 80 (40 males and 40 females) were on ART and 80 (40 males and 40 females) were not on ART.
  - **24-hour dietary recall**: In 15 selected OPCs, 150 participants were selected, of whom 75 were on ART and 75 were not, based on the sampling method of Beaton (1979) with a confidence interval (CI) of 95 percent and individual variation of energy intake of 10 percent.[15]
  - **Food frequency questionnaire**: In 15 selected OPCs, 300 participants were selected, 20 participants in each OPC, or whom 10 were on ART and 10 were not on ART.

2.2.2. Sampling method

- Selection of OPCs
  - **Assessment of nutritional status**: selection of 30 OPCs. The sampling frame for primary sampling units (OPCs) was a list of all OPCs in Vietnam with 75 or more active ART patients. Sampling was with replacement—a single OPC could be selected more than once. Application of this method could therefore have meant that the number of OPCs ultimately selected would be smaller than the number of 'clusters' specified in the sample size calculation, as large OPCs could contribute two or more clusters. To avoid including large OPCs several times by chance, a restriction was placed on the maximum number of times each OPC could be selected.

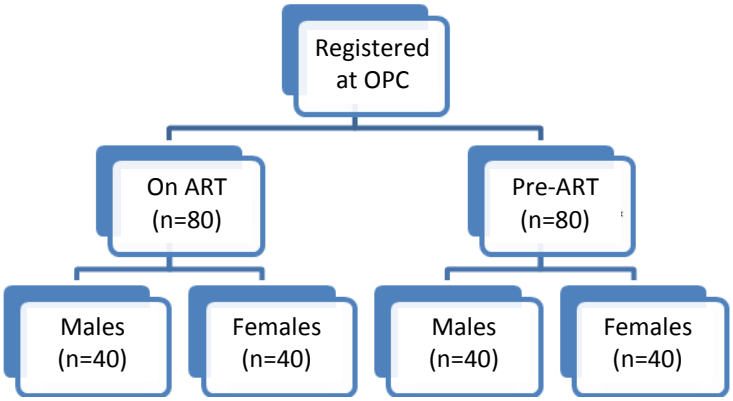
While VAAC has information on the number of PLHIV on ART, it does not have information on those registered who are not on ART (pre-ART). Thus the selection of OPCs was based solely on the number of PLHIV receiving ART. The selected OPCs were used for the sampling of both target groups: PLHIV on ART and PLHIV registered at the OPC but not yet receiving ART. The 30 OPCs selected were ordered by client size within each stratum.

The selection of OPCs from the sampling frame was by probability proportional to size (PPS), performed in SAS 9.1 using the SURVEYSELECT procedure with a randomly chosen seed.

- **Food consumption surveys.** A sub-set of OPCs from the first-phase of sampling was sampled for the 24-hour recall and food frequency questionnaires. To identify the OPCs to be sampled for the dietary assessment component of the study, every other OPC per strata was taken (half the OPCs per strata that were selected at the first phase), giving 15 of the 30 sampled OPCs.

- Selection of participants

All (non-pregnant/non-postpartum) adult PLHIV registered at the OPCs (on ART of pre-ART) were randomly selected as shown in the figure below.



Each OPC was asked to select the first 5–7 patients on 1 day in 1 month for anthropometric measurement and administration of questionnaires until it reached the required sample size (n=80).

Each of the 15 OPCs selected for the food consumption surveys selected 10 participants (5 on ART and 5 not yet on ART) to collect 24-hour recall and food frequency data. Each OPC also randomly selected another 10 participants to collect food frequency data, for a total of 150 24-hour recall records and 300 food frequency records. Based on patient load, each OPC decided the sample interval in order to recruit enough participants for the dietary intake survey within 3 days.

2.3. Data Collection Methods and Tools

2.3.1. Anthropometric measurement[16, 17]

Staff at each OPC were trained to collect anthropometric data using standardized equipment provided by the study.

- **Weight** was measured using OMRON electronic scales with the precision of 100 g. The scales were checked and adjusted before and during use. They were placed on a hard surface and calibrated to zero. Participants were asked to remove extraneous clothing and stand with body weight evenly distributed between both feet. An average weight of clothes was subtracted from the result. Weight was recorded to the nearest 0.1 kg.
- **Height** was measured using stadiometers with the precision of 0.1 cm. Height rules were taped vertically to hard, flat wall surfaces with the bases at floor level. Participants were asked to remove shoes and hair ornaments and to stand with their backs to the height rules and feet together, with the backs of their heads, backs, buttocks, calves, and heels touching the upright, and to look straight ahead. The head pieces of the stadiometers or the sliding parts of the measuring rods were lowered so that hair was pressed flat. Height was recorded to the nearest 0.1 cm.
- **Body mass index (BMI)** was calculated using the formula weight (kg)/height $(m)^2$.

Data collectors classified nutritional status using the 2005 WHO BMI cutoffs (table 1).

Classification	BMI
Malnutrition	**< 18.50**
Severe acute malnutrition (SAM)	< 16.00
Moderate malnutrition	16.00–16.99
Mild malnutrition	17.00–18.49
Normal nutritional status	**18.50–24.99**
Overweight	**≥ 25.00**
Pre-obesity	25.00–29.99
Obesity	**≥ 30.00**

Source: WHO. 1999. *Management of Severe Malnutrition: A Manual For Physicians and Other Senior Health Workers*. Geneva: WHO.

2.3.2. Dietary assessment (see annex 1)[18, 19, 20]

- **24-hour recall** was used to collect data on participants' food intake during the previous 24 hours, including drinks and snacks, and quantities of food consumed. NIN used the same standard methods and measurements that are used during Annual National Nutrition Surveys. Data collectors took to each OPC a set of measuring utensils and pictures of different quantities (e.g., bowls, spoons, cups), as well as a conversion table for measurements.
- **Food frequency** questionaires were used to ask about food items eaten the previous day, week, and month or never eaten.
- **Questionnaires on nutrition-related factors** were administered to collect data on individual/family characteristics and factors influencing health and nutrition status.

Reported dietary intake was compared with the recommended daily allowance (RDA) for Vietnamese adults and PLHIV issued by NIN in 2012.[21]

Statistical tests (Anova, t-test, and X^2) for significance ($p<0.05$) were used to describe the association between nutritional status and food consumption and relevant factors (e.g., clinical/sub-clinical signs).[22, 23]

2.4. Data Analysis

Interview and anthropometric data were cleaned, coded, and double entered to minimize data entry errors. Food data were converted to edible raw foods based on the NIN food album. Food nutrition values were calculated using the 2007 *Food Composition Table of Vietnam.*[24] Epidata and Access were used for data entry and STATA for analysis.

2.5. Ethical Considerations

NIN and the FHI 360 Office of International Research Ethics reviewed and approved the protocol for the study. Before the assessment, NIN and FANTA trained all data collectors in research ethics. Informed consent was sought from all participants. OPC directors provided consent to conduct nutrition assessment and interviews. The data collectors sought verbal informed consent from all patients who participated in the interviews and assessment. All interviews were conducted with adults 18 years or older. Minimal identifiable information was collected during the study to protect the identity of participants. Participants were informed of potential risks and benefits.

Potential risks

- Minimal risk. Measurements of weight and height were normal procedures in OPCs.

Potential benefits

- Study findings could help advocate for nutrition care and treatment of PLHIV.
- Study findings would inform national nutrition and HIV guidelines, counseling materials, and job aids.

Informed consent was requested from each study participant using the form in Annex 3. The researchers provided information to participants in a manner that was understandable. The researchers did not enroll anyone who they were not confident comprehended all information disclosed and who did not agree to procedures described during the informed consent process. All measures to ensure confidentiality of information were taken. Data were in a locked cabinet and only investigators had access.

3. FINDINGS

This section summarizes the results of the study of nutritional status and dietary intake among adult PLHIV in Vietnam. The source of the findings (the specific component) is indicated in each section.

3.1. Sample Characteristics

The study recruited 3,912 non-pregnant, non-lactating adult PLHIV, of whom 2,136 were on ART and 1,776 were not yet on ART and 2,311 were male and 1,601 were female. All the participants were registered in 29 OPCs[1] in Vietnam. Table 1 lists the general characteristics of the study participants.

Table 1 shows that most (53.4 percent) of the participants were between 30 and 39 years old, 31.1 percent were between 20 and 29 years old, and the mean age of the participants was 33.3. Most participants (47.5 percent) had studied only through middle school, 33.9 percent had completed high school, and 16.8 percent had completed only primary school. The smallest group was university students (0.4 percent). Most of the participants (22.2 percent) were farmers, 14.1 percent were small traders, 13.1 percent were laborers, and 13.7 percent were unemployed. Only 9.3 percent were housewives, 2.6 percent were government workers, and 0.9 percent were teachers. Most of the participants (56.9 percent) were married, 22.4 percent were single, 10.2 percent were widowed, 6/2 percent were divorced or separated, and 3.7 percent were living with partners. Three times more participants lived with families than those who lived alone. These characteristics did not differ much between the ART and pre-ART groups.

Table 1. General characteristics of the study participants

Characteristics	Total		ART		Pre-ART	
	n	%	n	%	n	%
Age						
20–29	1,216	31.1	522	24.4	694	39.1
30–39	2,087	53.4	1227	57.4	860	48.4
40–49	486	12.4	307	14.4	179	10.1
≥ 50	123	3.1	80	3.8	43	2.4
Total	3,912	100.0	2,136	100.0	1,776	100.0
Mean age	33.3±6.9		34.3±6.8		32.1±6.8	
Education						
No schooling	56	1.4	31	1.5	25	1.4

[1] One OPC in Ho Chi Minh City dropped out of the study because it did not have enough staff to conduct data collection.

Characteristics	Total		ART		Pre-ART	
	n	%	n	%	n	%
Primary school (1–5 years)	652	16.8	352	16.6	300	17.0
Middle school (6–9 years)	1,845	47.5	1,023	48.2	822	46.7
High school (10–12 years)	1,315	33.9	708	33.4	607	34.5
Undergraduate	17	0.4	9	0.4	8	0.5
Occupation						
Farmer	868	22.2	461	21.6	407	22.9
Government worker	100	2.6	55	2.6	45	2.5
Teacher	36	0.9	16	0.8	20	1.1
Businessperson	550	14.1	282	13.2	268	15.1
Laborer	512	13.1	284	13.3	228	12.8
Housewife	364	9.3	193	9.0	171	9.6
Other	947	24.2	542	25.4	405	22.8
Unemployed	535	13.7	303	14.2	232	13.1
Marital status						
Single	875	22.4	486	22.8	389	22.0
Married	2,222	56.9	1,155	54.2	1,067	60.3
Living with partner	144	3.7	80	3.8	64	3.6
Divorced/separated	241	6.2	143	6.7	98	5.5
Widowed	398	10.2	256	12.0	142	8.0
Other	24	0.6	13	0.6	11	0.6

3.2. Clinical and Sub-clinical Signs

$CD4^+$ T-cell level is an important criterion for categorizing HIV-related clinical conditions and for initiation of antiretroviral therapy (ART) and prophylaxis for opportunistic infections (OIs) among PLHIV. In 2013 WHO recommended raising the CD4 threshold for initiating ART from 350 to 500 cell/mm^3. Table 2 shows that 46.8 percent of the participants had CD4 counts between 200 and 500, 24.3 percent had CD4 counts < 200, and 19.9 percent had CD4 counts > 500. There was a significant difference between the ART and pre-ART groups in CD4 counts < 200 (29.8 percent in the ART group and 17.6 percent in the pre-ART group, $p<0.001$).

Table 2. CD4 counts of the study participants

CD4 count	Total		ART		Pre-ART	
	n	%	n	%	n	%
No test/no results	354	9.1	54	2.5	300	16.9

< 200	950	24.3	637	29.8**	313	17.6**
200–500	1,829	46.8	1,059	49.6*	770	43.4*
> 500	779	19.9	386	18.1	393	22.1
Total	**3,912**	**100**	**2,136**	**100**	**1,776**	**100**

*p<0.01. **p<0.001

Once HIV infection is confirmed by testing, clinical staging is used to monitor progression of the disease. Clinical staging is useful at first diagnosis, or entry into long-term HIV care and in the follow-up of patients in care and treatment. It is used to guide decisions when to start Cotrimoxazole prophylaxis and other HIV-related interventions, including ART. Table 3 shows the WHO clinical stages of HIV infection. [25]

Table 3. WHO clinical staging of established HIV infection

HIV-associated symptoms	Clinical stage
Asymptomatic	1
Mild symptoms	2
Advanced symptoms	3
Severe symptoms	4

Source: WHO. 2007. *WHO Case Definitions of HIV for Surveillance and Revised Clinical Staging and Immunological Classification of HIV-Related Disease in Adults and Children*. Geneva: WHO

Figure 1 shows that 59 percent of the participants were at clinical stage 1, 15 percent were at stage 2, 16 percent were at stage 3, and 10 percent were at stage 4.

Figure 1. Distribution of participants by clinical stage

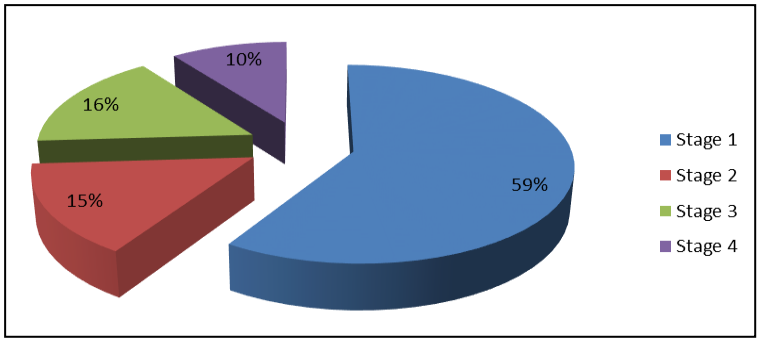


Table 4 compares the distribution of clinical stage among the ART and pre-ART groups. There was a significant difference between stage 1 and stage 3. The proportion of participants at stage 1 was smaller among those on ART (55.8 percent) than those not yet on ART (62.8 percent). Conversely, the proportion of participants at stage 3 was larger among those on ART (19.4 percent) than those not yet on ART (12.0 percent). The proportion of participants at stage 4 was higher among those on ART (11.1 percent) than those not yet on ART (7.7 percent), but the difference was not statistically significant (p>0.1).

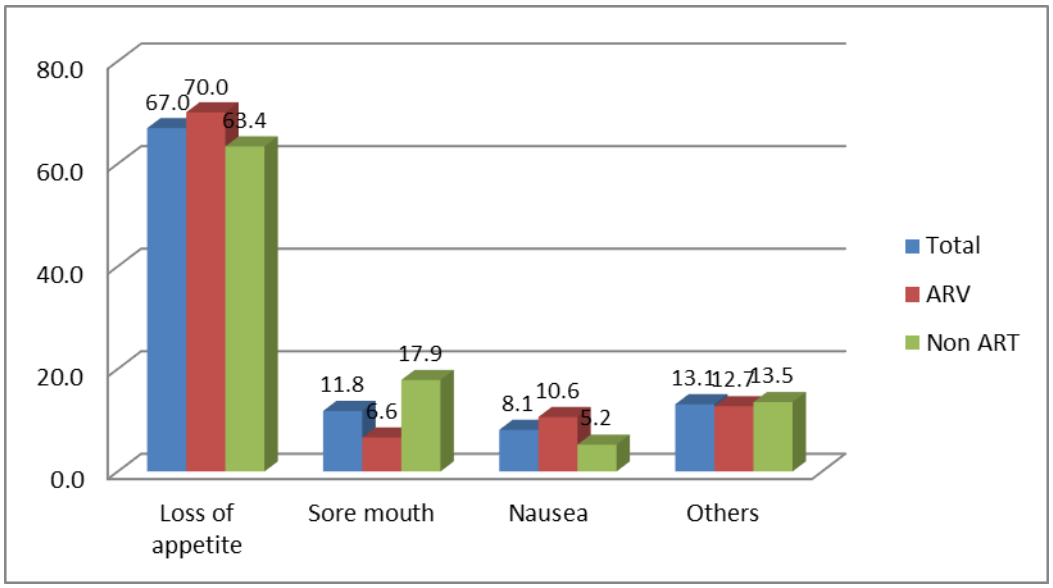
Table 4. Distribution of clinical stage, ART and pre-ART group

Clinical stage	Total		ART		Pre- ART	
	n	%	n	%	n	%
Stage 1	2,222	58.9	1,172	55.8*	1,050	62.8*
Stage 2	582	15.4	289	13.8	293	17.5
Stage 3	609	16.1	408	19.4**	201	12.0**
Stage 4	361	9.6	233	11.1	128	7.7
Total	**3,774**	**100**	**2,102**	**100**	**1,672**	**100**

*p<0.05. **p<0.01

HIV-related symptoms include enlarged lymph glands (lymphadenopathy), unintentional weight loss, upper respiratory infections, herpes zoster, cracked lips, mouth ulcers, skin lesions, dermatitis, fungal infections, chronic diarrhea, persistent fever, oral thrush,
HIV-related symptoms were reported by 702 of 3,912 participants, or 17.9 percent (figure 2). Among these, 67 percent reported loss of appetite, 11.8 reported mouth sores, and 8.1 reported vomiting or nausea. The ART group reported experiencing more HIV-related symptoms (70 percent reported loss of appetite and 10.6 reported vomiting or nausea) than the pre-ART group, of which 63.4 percent reported loss of appetite and 5.2 percent reported vomiting or nausea, but the difference was not statistically significant (p>0.05). In the pre-ART group, 17.9 percent reported mouth sores, compared with 6.6 percent of the ART group, but the difference was not significant (p>0.05).

Figure 2. Distribution of HIV-related symptoms among study participants



People with advanced HIV infection are vulnerable to infections and malignancies that are called "opportunistic" because they take advantage of the weakened immune system. The most common HIV-related opportunistic infections (OIs) are bacterial infections (tuberculosis[TB], bacterial pneumonia, blood poisoning), protozoan diseases (e.g., toxoplasmosis), fungal diseases (e.g., oral thrush), viral diseases (e.g., herpes), and cancer (Kaposi's sarcoma, lymphoma, and squamous cell carcinoma).

Table 5 shows that 24.21 percent of the participants (945 out of 3,912) reported OIs. There was no difference between the ART and pre-ART groups. TB was the most commonly reported OI (4.4 percent), followed by respiratory infections (3.4 percent), oral thrush (2.9 percent), and combined OIs (2.2 percent). The distribution of OIs in the ART and pre-ART groups was similar (p>0.05).

Table 5. Distribution of opportunistic infections among study participants by treatment group

Opportunistic infection	Total		ART		Pre-ART	
	n	%	n	%	n	%
Oral thrush	114	2.9	46	2.2	68	3.8
TB	172	4.4	105	4.9	67	3.8
Upper respiratory infections	131	3.4	73	3.4	58	3.3
Penicillin	9	0.2	7	0.3	2	0.1

Opportunistic infection	Total		ART		Pre-ART	
	n	%	n	%	n	%
Other (hepatitis, mouth ulcers)	492	12.6	279	13.1	213	12.0
More than two OIs	86	2.2	51	2.4	35	2.0
Opportunistic infection						
Total with OIs	**945**	**24.2**	**513**	**24.0**	**432**	**24.3**
Total without OIs or unaware of any OIs	**2,967**	**75.8**	**1,623**	**76.0**	**1,344**	**75.7**
Total	**3,912**		**2,136**		**1,776**	

3.3. Anthropometric Measurements and Nutritional Status

Table 6 shows that the mean height of the participants was 160.1 ± 7.8 cm and the mean weight was 51.5 ± 8.0 kg. The participants in the 40–49 year age group had the highest mean weight (52.5 kg), followed by the 30–39 year age group (52.0 kg), and the participants in the 20–29 year age group had the lowest mean weight (50.2 kg). The difference between the 30–39 year and 40–49 year age groups and the 20–29 year age group was statistically significant ($p<0.001$). The mean height of the 30–39 year and 40–49 year age groups was similar and significantly higher than that of the 20–29 year and over 50-year age groups ($p<0.01$).

Table 6. Mean height and weight of participants by age group

Age group	n	Weight (kg) mean ± SD	Height (cm) mean ± SD
20–29	1,216	50.2 ± 7.9	158.9 ± 7.9
30–39	2,087	52.0 ± 7.9	160.7 ± 7.9
40–49	486	52.5 ± 7.8	160.7 ± 7.7
≥ 50	123	51.4 ± 9.5	158.3 ± 8.2
Total	**3,912**	**51.5 ± 8.0**	**160.1 ± 7.8**

Table 7 shows that 69.4 percent of the participants had normal nutritional status, 26.8 percent were undernourished (18.4 percent mildly, 5.3 percent moderately, and 3.1 percent severely), and 3.8 percent were overweight or obese. The mean BMI of the participants was 20.1.

Table 7. Nutritional status of participants by BMI

Nutritional status	n	Prevalence (%)
Overweight/obese	149	3.8
Normal	2,715	69.4
Undernourished (total)	1,048	26.8
Mildly	719	18.4
Moderately	208	5.3
Severely	121	3.1
Mean BMI	**20.1 ± 2.5**	
Total	**3912**	

Table 8 shows the nutritional status of the participants by age group. The highest rates of undernutrition were found in participants 20–29 years old (29.2 percent), followed by participants over 50 years old (27.6 percent), participants 30–39 years old (26.5 percent), and participants 40–49 years old (22.0 percent). The highest rates of overnutrition were found in participants over 50 years old (8.1 percent), followed by those 30–39 years old (3.0 percent) and those 40–49 years old (4.0 percent).

Table 8. Classification of nutritional status by age group

Nutritional status / Age group	Malnourished		Normal		Overweight/obese	
	n	%	n	%	n	%
20–29 years (n=1,216)	355	29.2	824	67.8	37	3.0
30 –39 years (n=2,087)	552	26.5	1452	69.6	83	4.0
40–49 years (n=486)	107	22.0	360	74.1	19	3.9
≥ 50 years (n=123)	34	27.6	79	64.2	10	8.1
Total (n=3,912)	**1,048**	**26.8**	**2,715**	**69.4**	**149**	**3.8**

Table 9 shows the mean weight and height of the ART and pre-ART groups. ART participants 40-49 years old (52.4 ± 7.8 kg) and 30–39 years old (52.2 ± 8.1 kg) and pre-ART participants 50 years and older (53.7 ± 10.4 kg) had the highest mean weight. The lowest mean weight was found in participants 20–29 years old (49.8 ± 7.5 kg in the ART group and 50.5 ± 8.2 kg in the pre-ART group). The difference was significant ($p<0.001$).

The highest mean height was found in ART participants 30–39 years old (160.8 ± 7.8 cm) and pre-ART participants 40–49 years old (161.6 ± 7.6 cm). The lowest mean height was found in

participants 50 years and older in both the ART group (158.7 ± 8.3 cm) and pre-ART group (157.6 ± 7.9 cm).

Mean weight and height were not significantly different in the two treatment groups, both total and by age group.

Table 9. Comparison of mean weight and height by treatment group

Age group	ART			Non ART		
	n	Weight (kg) mean ± SD	Height (cm) mean ± SD	n	Weight (kg) mean ± SD	Height (cm) mean ± SD
20–29 years	522	49.8 ± 7.5	159.3 ± 8.0	694	50.5 ± 8.2	158.7 ± 7.7
30–39 years	1227	52.2 ± 8.1	160.8 ± 7.8	860	51.7 ± 7.6	160.5 ± 7.6
40–49 years	307	52.4 ± 7.8	160.2 ± 7.6	179	52.8 ± 7.9	161.6 ± 7.6
≥ 50 years	80	50.2 ± 8.8	158.7 ± 8.3	43	53.7 ± 10.4	157.6 ± 7.9
Total	**2136**	**51.6 ± 8.0**	**160.3 ± 7.9**	**1776**	**51.4 ± 8.0**	**159.8 ± 7.8**

Figure 3 compares the nutritional status of the two treatment groups. Undernutrition was higher in the ART group (27.9 percent) than in the pre-ART group (25.5 percent) but not significantly ($p>0.05$). The proportion of overweight participants was similar in the two treatment groups (3.7 percent of the ART group and 3.9 percent of the non-ART group).

Figure 3. Comparison of nutritional status by treatment groups

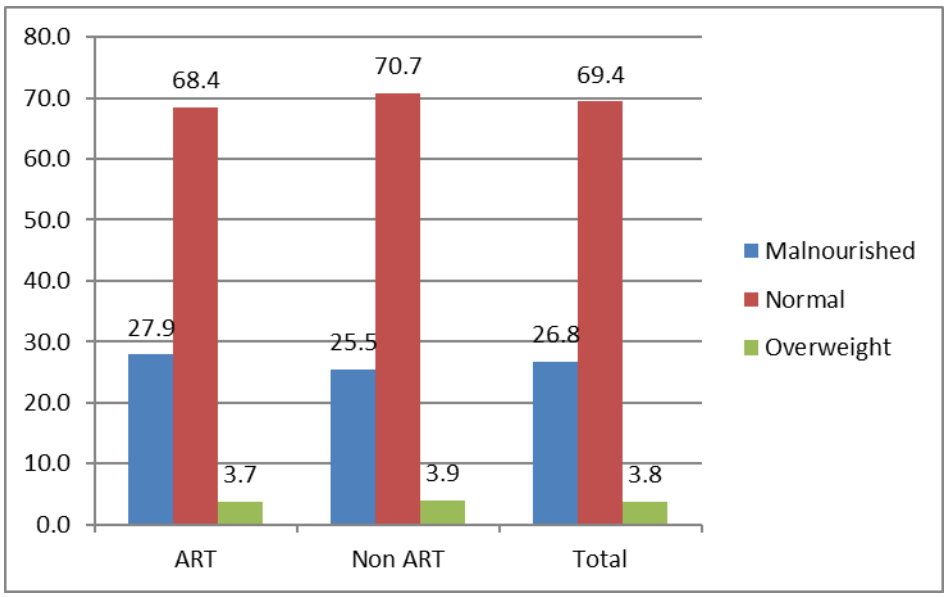


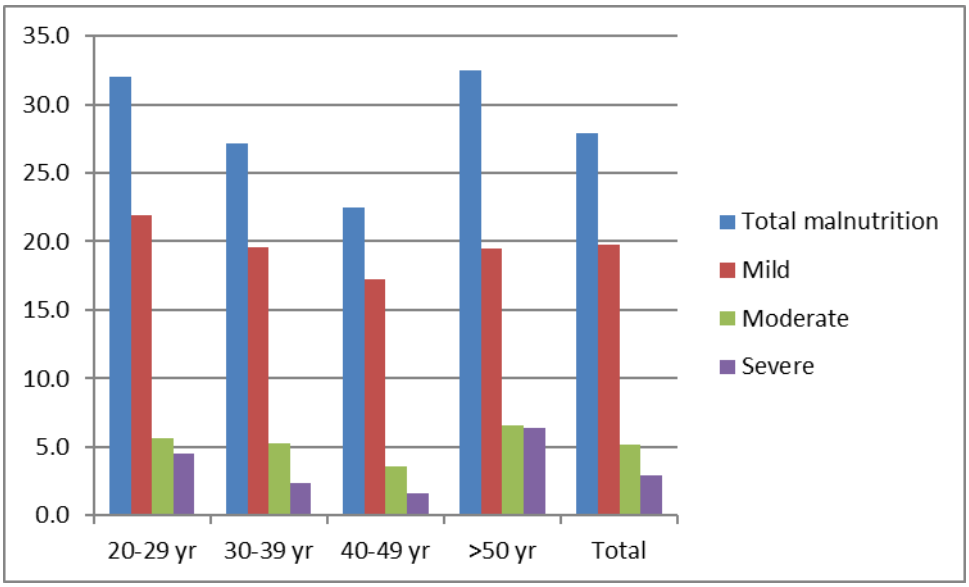
Table 10 compares the nutritional status of the two treatment groups by age group. The rate of undernutrition was highest among participants 50 years and older in the ART group (32.5 percent) and participants 20-29 years old in the pre-ART group (27.1 percent), followed by participants 20–29 years old in the ART group (32.0 percent) and participants 30–39 years old in the pre-ART group (25.4 percent). The lowest rate of undernutrition was found in participants 40–49 years old in the ART group (22.5 percent) and participants 50 years and older in the pre-ART group (18.6 percent). In the ART group, participants 50 years and older in the ART group had the highest rate of overweight (5.0 percent) and participants 20–29 years old had the lowest (1.9 percent). In the pre-ART group, the highest rate of overweight was found in participants 50 years and older (14.0 percent) and the lowest rate in participants 40–49 years old (3.4 percent). In general, underweight was more common in the younger groups and overweight was more common in the older groups.

Table 10. Classification of nutritional status in by treatment group and age group

Nutritional status	**ART**						**Non ART**					
	Undernourished		**Normal**		**Overnourished**		**Undernourished**		**Normal**		**Overnourished**	
Age group	n	%	n	%	n	%	n	%	n	%	n	%
20–29 years (n=1,216)	167	32.0	345	66.1	10	1.9	188	27.1	479	69.0	27	3.9
30–39 years (n=2,087)	334	27.2	840	68.5	53	4.3	218	25.4	612	71.2	30	3.5
40–49 years (n=486)	69	22.5	225	73.3	13	4.2	38	21.2	135	75.4	6	3.4
≥ 50 years(n=123)	26	32.5	50	62.5	4	5.0	8	18.6	29	67.4	6	14.0
Total (n=3,912)	**596**	**27.9**	**1460**	**68.4**	**80**	**3.7**	**452**	**25.5**	**1255**	**70.7**	**69**	**3.9**

Figures 4 and 5 show the severity of undernutrition in the ART and pre-ART groups (in general and by age group). In the ART group, 19.8 percent of participants were mildly undernourished, 5.1 percent were moderately undernourished, and 2.9 percent were severely undernourished (figure 4). The rate of severe acute malnutrition (SAM) was highest in participants 50 years and older (6.4 percent), followed by those 20–29 years old (4.5. percent), and lowest in participants 40–49 years old (1.6. percent).

Figure 4. Severity of undernutrition by age group, ART group



In the pre-ART group, 16.8 percent were mildly undernourished, 5.3 percent were moderately undernourished, and 3.4 percent were severely undernourished (figure 5). The rate of SAM was highest in participants 50 years and older (7.0 percent), followed by those 20–29 years old (3.7 percent), and lowest in those 30–39 years old (2.8 percent).

Figure 5. Severity of undernutrition by age group, pre-ART group

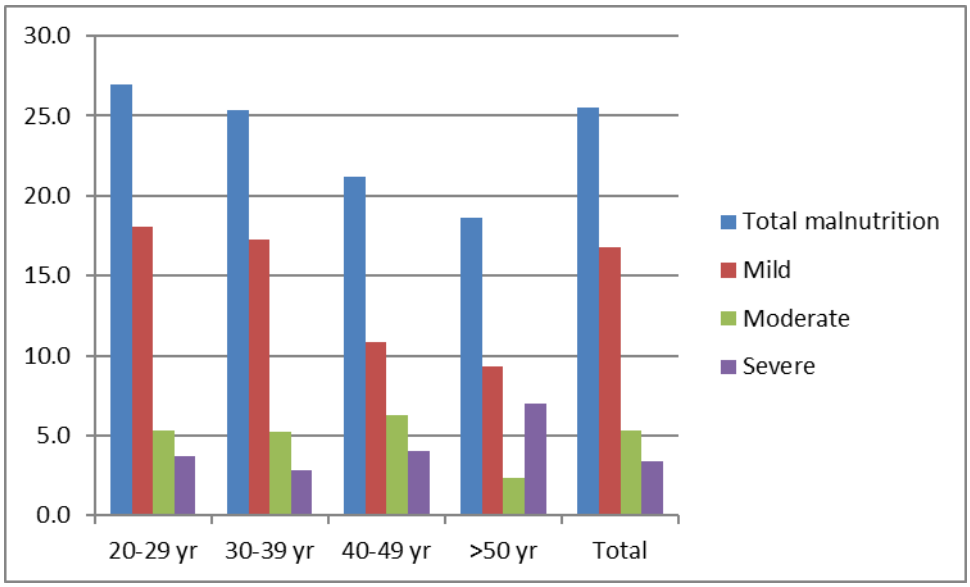


Table 11 compares the nutritional status of male and female participants. Rates of undernutrition and overweight did not differ between males and females ($p>0.05$).

Table 11. Nutritional status of participants by sex

Nutritional status	Male		Female	
	n	%	n	%
Undernourished	624	27.0	424	26.5
Normal	1599	69.2	1116	69.7
Overweight/obese	88	3.8	61	3.8
Total	**2311**	**100.0**	**1601**	**100.0**

Figure 6 compares the nutritional status of males and females in each treatment group. No difference was found between the two sexes or the two treatment groups.

Figure 6. Comparison of nutritional status of 2 treatment groups by sex

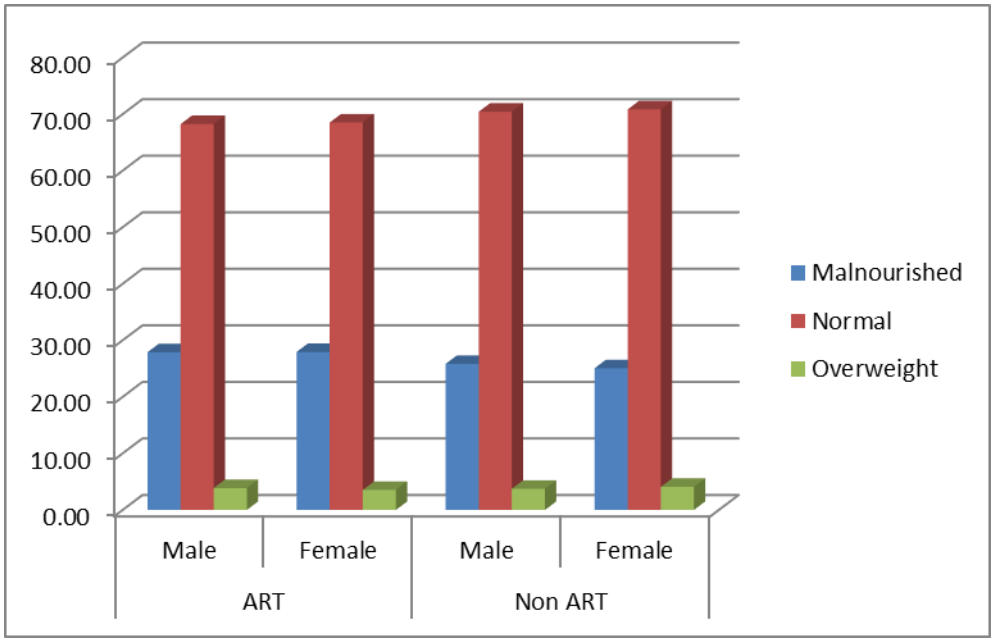


Table 12 shows the nutritional status of the participants by CD4 count. Participants with CD4 < 200 had the highest rates of undernutrition in general (34.3 percent) and SAM (4.5 percent). Those with CD4 > 500 had the lowest rates of undernutrition (22.3 percent, with 2.2 percent SAM), but the difference from those with CD-4 200–500 was not significant ($p>0.05$).

Table 12. Nutritional status of participants by CD4 count

	Undernourished				Normal	Overweight
CD4 count	**Total**	Mild	Moderate	Severe		
No test/don't know	**28.8**	18.1	5.7	5.1	69.2	2.0
< 200	**34.3** [a.b]	22.5 [c.d]	7.3 [e.f]	4.5 [g.h]	62.8	2.8
200–500	**24.4** [a]	17.2 [c]	4.8 [e]	2.4 [g]	71.2	4.4
> 500	**22.3** [b]	16.2 [d]	4.0 [f]	2.2 [h]	73.3	4.4
p	***a,b<0.001***	*c,d<0.001*	*e,f<0.001*	*g,h<0.01*		

Table 13 shows the nutritional status of the participants by clinical stage. Rates of undernutrition (total and SAM) increased by clinical stage and were highest in participants at stage 4 (33.8 percent total undernutrition and 8.9 percent SAM). There were significant differences in total, mild, and moderate undernutrition between stage 1 and the other stages, but no difference was found among stages 2, 3, and 4. SAM was highest at stage 4 and significantly different from stage 3.

Table 13. Nutritional status of participants by clinical stage

Clinical stage	Undernourished				Normal	Overweight
	Total	Mild	Moderate	Severe		
Stage 1	22.8 [a]	16.5 [b]	4.5 [c]	1.8 [d.e]	71.7	5.5
Stage 2	30.4 [a]	21.8 [b]	6.4 [c]	2.2	68.0	1.6
Stage 3	34.2	21.8	7.4	4.9 [d.f]	64.9	1.0
Stage 4	33.8	19.1	5.8	8.9 [e.f]	63.4	2.8
p	*a<0.001*	*b<0.001*	*c<0.001*	*d,e,f<0.01*		

Table 14 shows the classification of nutritional status by the presence of OIs and HIV-related digestive symptoms (diarrhea, nausea, or vomiting). The prevalence of undernutrition was surprisingly lower among the 945 patients with OIs than among those without OI (23.5% vs. 27.8%, p<0.01). Among 702 patients with nausea, diarrhea, or vomiting, the prevalence and severeity of undernutrition was significantly higher than among those without these symptoms (38.9% vs. 24.1%).

Table 14. Nutritional status of participants by presence of opportunistic infections and HIV-related symptoms

Factor	Undernourished (%)				Normal	Overweight/ obese
	Total	Mild	Moderate	Severe		
Opportunistic infections						
No (n=2,967)	27.8	18.8	5.8	3.2	68.3	3.9
Yes (n=945)	23.5	16.9	3.9	2.7	73.0	3.5
p	*<0.01*					
HIV-related symptoms						
No (n=3210)	24.1	17.2	4.4	2.5	71.7	4.1
Yes (n=702)	38.9	23.8	9.4	5.7	58.8	2.3
p	*<0.001*	*<0.001*	*<0.001*	*<0.001*		

3.4. Dietary Intake

Nutrient needs depend on age, physical changes such as pregnancy and breastfeeding, and level of activity. For PLHIV, energy requirements are influenced by viral load. Asymptomatic adults with HIV need to consume 10 percent more energy than healthy adults, and symptomatic PLHIV need to consume 20–30 percent more energy than HIV-negative people of the same age, sex, and physical activity level. According to WHO, PLHIV should consume the same proportion of protein in their diet as healthy non-infected people of the same age, sex and physical activity level. They should increase protein intake proportionally as they increase fat and carbohydrate intake to meet their increased energy needs. There is no evidence that PLHIV need more fat than the normal requirements, but they may consume additional fat as they increase their energy intake. People on ART or with persistent diarrhea may need to eat less fat when they have diarrhea or are taking certain drugs.[26]

Table 15 shows the dietary characteristics of the adult PLHIV in this study. The average total energy intake was 1849.8 kcal/person/day. The average protein intake was 84.4 g/person/day, of which 51.1 g was from animal sources. The average lipid (fat) intake was 46.3 g/person/day, of which 14.0 g was from plant sources.

According to WHO, PLHIV have the same micronutrient requirements as people without HIV, that is, 1 recommended dietary allowance (RDA) per day. Average calcium intake was 558.6 mg/person/day and average iron intake was 13.7 mg/person/day, both lower than the 2102 NIN RDA. Average vitamin intake was 646.8 mcg/person/day for vitamin A, 129.1

g/person/day for vitamin C, 17.1 g/person/day for vitamin B3, 1.4 g/person/day for vitamin B1, and 0.9 g/person/day for vitamin B2. Most of the vitamin intake met 1 RDA.

Table 15. Dietary characteristics of PLHIV

Indicators	Nutritive values	NIN RDA* 2012
	Mean ± SD	
Energy (kcal)	1849.8 ± 737.8	2376
Ratio protein:fat: carbohydrates	18.3:21.7:60.0	12-14:18-25: 60–65
Protein		
Total (g)	84.4 ± 42.9	72.6
Animal-source protein (g)	51.1 ± 38.7	30-35%
Lipid		
Total (g)	46.3 ± 34.5	
Plant-source lipids (g)	14.0 ± 16.4	>40%
Carbohydrates	272.7 ± 105.0	
Minerals		
Calcium (mg)	558.6 ± 568.4	1,000
Phosphorus (mg)	1029.0 ± 501.3	700 (male), 1250 (female)
Iron (mg)	13.7 ± 7.0	18.3 (male) 39.2 (female)
Vitamin		
Vitamin A (mcg)	646.8± 863.5	600
Vitamin C (mg)	126.4 ± 99.0	70
Vitamin B3 (mg)	15.6 ± 10.2	16
Vitamin B1 (mg)	1.4 ± 0.8	1.2
Vitamin B2 (mg)	0.9 ± 0.5	1.3

*NIN RDA for asymptomatic adult PLHIV

Table 15 compares the participants' dietary intake with the NIN RDA. Food intake met 77.1 percent of the RDA for adult PLHIV. Energy intake met 65.9 percent of the requirement for symptomatic PLHIV. Protein intake met 122 percent of the RDA. The average

protein:fat:carbohydrate ratio was 18.3:21.7:60.0. The proportion of protein was higher than the NIN recommendation (12–14 percent). The ratio of animal-source protein to total protein was 115.6 percent higher than the NIN recommendation. The proportion of fat was within the range recommended by NIN (18–25 percent), but the ratio of plant-source fats to total fat intake was lower than the NIN recommendation. Participants reported consuming more foods providing protein and fat than foods providing carbohydrates. The ratio of calcium and phosphorus was 0.54, lower than recommended.

Table 16. Nutritive values and dietary balance of participants' dietary intake compared with NIN RDAs (2012)

Indicator	Study results	NIN RDA 2012*	% meeting the RDA
Energy (kcal)	1849.8	2,376	77.1
Protein (g)	84.4	72.6	115.6
Ratio animal-source protein:total protein	56%	30–35%	187
Ratio plant-based lipids:total lipids	34%	> 40%	85
Ratio protein:fat: carbohydrates	18.3:21.7:60.0	12–14:18–25:60–65	
Ration calcium: phosphorus	0.54	> 0.8	

*NIN RDA for asymptomatic adult PLHIV

Table 17 shows how often the study participants reported eating different foods. Rice was the main food participants (99.0 percent) reported eating the previous day, followed by vegetables (83.0 percent) and fruit (49.3 percent). Among animal-source protein foods, meat was reported most frequently (by 46.7 percent), followed by eggs (15 percent), and seafood (15 percent). Consumption of beans/peas the previous day was reported by 17.7 percent and consumption of fats/oils was reported by 61.7 percent; 20.7 percent reported taking a micronutrient supplement the previous day; 73.7 percent of participants reported never eating processed food, 63.0 percent reported never taking micronutrient supplements, 51.7 percent reported never eating corn, 22.3 percent reported never eating wheat flour, and 18.7 percent reported never consuming milk or milk products.

Table 17. Food frequency

Food	Eaten the previous day		Eaten the previous week		Never eaten	
	n	%	n	%	n	%
Rice	297	99.0	3	1.0	0	--
Corn	9	3.0	46	15.3	155	51.7
Wheat flour	60	20.0	95	31.7	67	22.3
Other tubers	20	6.7	123	41.0	38	12.7
Vegetables	249	83.0	42	14.0	4	1.3
Fruits	148	49.3	120	40.0	12	4.0
Meats	140	46.7	243	81.0	0	-
Eggs	45	15.0	189	63.0	22	7.3
Aquatics	45	15.0	221	73.7	23	7.7
Beans/peas	53	17.7	148	49.3	15	5.0
Milk products	91	30.3	139	46.3	56	18.7
Fats/oils	185	61.7	91	30.3	11	3.7
Sugar/honey	64	21.3	111	37.0	63	21.0
Processed food	3	1.0	15	5.0	221	73.7
Micronutrient supplements	62	20.7	12	4.0	189	63.0

There were no significant differences in the nutritive values of the diets of the ART and pre-ART participants (table 18). The pre-ART group reported consuming more energy, protein, lipids, carbohydrates, vitamins and minerals than the ART group, although the difference was not significant ($p>0.05$).

Table 18. Comparision of food intake between the ART and pre-ART groups

Indicator	Nutritive value				p
	ART		Pre-ART		
	Mean	SD	Mean	SD	
Energy (kcal)	1803.9	782.4	1895.8	692.6	>0.05
Ratio protein:fat:carbohydrates	18.5:23.0:58.5		17.9:20.3:61.8		

Indicator	Nutritive value				p
	ART		Pre-ART		
	Mean	SD	Mean	SD	
Protein					
Total (g)	82.8	43.2	86.1	42.8	>0.05
Animal-source protein (g)	49.4	38.8	52.9	38.8	>0.05
Animal-source protein/total protein	59.7%		61.4%		
Lipid					
Total (g)	48.1	34.6	44.4	34.6	>0.05
Plant-based lipids (g)	16.3	20.4	11.7	10.7	>0.05
Plant-based lipids/total lipids	33.9%		26.4%		
Carbohydrates	259.9	108.9	285.4	100.0	>0.05
Minerals					
Calcium (mg)	523.4	408.6	593.4	692.1	>0.05
Phosphorus (mg)	998.4	469.5	1059.1	532.1	>0.05
Iron (mg)	14.4	7.6	13.0	6.3	>0.05
Vitamins					
Vitamin A (mcg)	575.9	633.3	717.7	1044.1	>0.05
Vitamin C (mg)	127.2	110.2	125.6	87.1	>0.05
Vitamin B3 (mg)	15.3	9.7	15.9	10.7	>0.05
Vitamin B1 (mg)	1.3	0.8	1.3	0.8	>0.05
Vitamin B2 (mg)	0.9	0.5	0.9	0.6	>0.05

Table 19 shows a significant difference between the diets of male and female participants, with nutrient intake higher in females than in males. Energy intake was also higher in females (2,003.5 kcal) than in males (1,741.6 kcal) ($p<0.01$). The same was true of protein and lipid intake ($p<0.01$). Females consumed a higher proportion of animal-source protein (58 percent of total protein) than males (54 percent of total protein). Intake of important minerals and vitamins was also significantly higher in females than in males.

Table 19. Nutritive values of food intake of study groups by sex

Indicators	Nutritive values				p
	Male n=88		Female n=62		
	Mean	SD	Mean	SD	
Energy (kcal)	1741.6	629.4	2003.5	850.8	**<0.05**
Ratio protein:fat:carbohydrates	17.7:19.8:62.5		19.9:24.1:56.0		
Protein					
Total (g)	76.4	32.7	95.8	52.4	**<0.01**
Animal-source protein (g)	43.6	26.3	61.8	49.8	**<0.01**
Animal-source protein/total protein	54%		58%		
Lipid					
Total (g)	38.8	24.8	56.8	42.9	**<0.01**
Plant-based lipids (g)	13.0	13.9	15.4	19.5	>0.05
Plant-based lipids/total lipids	36%		31%		
Carbohydrates	271.3	103.0	274.6	108.6	>0.05
Minerals					
Calcium (mg)	525.0	472.7	607.2	684.7	>0.1
Phosphorus (mg)	937.4	394.3	1161.1	603.6	**<0.01**
Iron (mg)	13.1	6.9	14.6	7.0	>0.05
Vitamins					
Vitamin A (mcg)	531.8	591.3	810.1	1129.8	>0.05
Vitamin C (mg)	121.2	91.5	133.8	109.0	>0.1
Vitamin B3 (mg)	14.0	8.1	17.8	12.3	**<0.05**
Vitamin B1 (mg)	1.2	0.8	1.4	0.8	>0.05
Vitamin B2 (mg)	0.8	0.5	1.0	0.7	>0.05

Table 20 shows the association between food intake and nutritional status in the adult PLHIV who participated in this study. There was no significant difference in the nutritive values of food consumed by participants with different nutritional status, but the overweight group tended to have higher energy intake (2,120.0 kcal) than the groups with undernutrition (1,863.0 kcal) and normal nutritional status (1,822.2 kcal) and proportionally higher protein, fat, and carbohydrate intake ($p>0.05$). There were no clearly observed differences in food intake between the groups with undernutrition and normal nutritional status ($p>0.05$).

Table 20. Association between food intake and nutritional status of study participants

Nutritional status / Nutritive values	Malnourished n=36		Normal n=105		Overweight/obese n=9		p
	Mean	SD	Mean	SD	Mean	SD	
Energy (kcal)	1863.0	796.7	1822.2	721.0	2120.2	714.9	>0.05
Ratio protein:fat:carbohydrates	17.1:18.5:64.4		18.6:22.8:58.6		17.6:20.5:61.9		
Protein							
Total (g)	81.6	49.6	84.8	41.5	91.7	32.1	>0.05
Animal-source protein (g)	48.2	43.5	52.0	38.0	51.9	28.3	>0.05
Animal-source protein/total protein	52%		57%		55%		
Lipid							
Total (g)	39.8	32.4	48.1	35.3	50.4	33.9	>0.05
Plant-based lipids (g)	11.2	9.6	15.2	17.9	11.3	19.4	>0.05
Plant-based lipids/total lipids	37%		34%		23%		
Carbohydrates	292.3	114.4	261.3	99.5	326.7	112.5	>0.05
Minerals							
Calcium (mg)	517.5	386.8	573.9	640.4	547.1	176.4	>0.05
Phosphorus (mg)	1027.3	573.5	1021.3	481.8	1124.6	457.9	>0.05
Iron (mg)	13.8	8.0	13.7	6.8	14.4	5.4	>0.05
Vitamins							
Vitamin A (mcg)	818.0	1449.5	579.6	578.3	746.6	381.9	>0.05
Vitamin C (mg)	140.3	103.9	121.2	100.4	132.1	55.5	>0.05
Vitamin B3 (mg)	14.7	9.8	15.9	10.7	16.0	5.8	>0.05
Vitamin B1 (mg)	1.2	0.7	1.3	0.8	1.7	1.1	>0.05
Vitamin B2 (mg)	0.9	0.8	0.9	0.5	1.1	0.6	>0.05

Table 21 shows the nutritive values of the reported diets of the participants by clinical stage. Although no significant difference was found, participants at stage 2 tended to have higher intake of both macronutrients and micronutrients than those at other stages.

Table 21. Association of food intake and clinical stages

Clinical stage	**Mean**		**SD**		**Mean**		**SD**	
Food intake (n=145)	**Energy (kcal)**		**Protein (g)**		**Carbohydrates (g)**		**Lipid (g)**	
1 (n= 80)	1856.0	756.3	86.0	41.5	274.7	108.9	44.5	33.4
2 (n=18)	2095.4	1057.2	97.6	62.6	291.9	130.9	60.5	54.9
3 (n=37)	1773.2	516.2	77.0	38.2	273.6	80.1	41.7	25.5
4 (n=10)	1737.6	737.3	81.6	34.6	250.7	108.8	43.8	28.5
p (ANOVA)	0.468		0.417		0.801		0.279	
Food intake (n=145)	**Iron (g)**		**Vitamin A (mcg)**		**Calcium (g)**		**Vitamin C (g)**	
Clinical stage	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
1 (n= 80)	13.6	6.6	635.3	736.5	13.6	6.6	635.3	33.4
2 (n=18)	16.2	9.2	970.1	1770.3	16.2	9.2	970.1	54.9
3 (n=37)	12.4	5.5	546.5	505.1	12.4	5.5	546.5	25.5
4 (n=10)	15.6	9.4	601.5	480.6	15.6	9.4	601.5	28.5
p (ANOVA)	0.225		0.396		0.225		0.396	

4. DISCUSSION

There is an established cyclical relationship between poor nutrition and infections such as HIV. Malnutrition weakens the immune system, which worsens the effects of infection, which increases the likelihood of malnutrition. Infections can reduce appetite, decrease the body's absorption of nutrients, and make the body use nutrients faster than usual to repair the immune system. Because a severely malnourished person does not consume enough nutrients, the body meets energy needs by mobilizing tissue reserves of fat and protein from muscle, skin, and the gut. To conserve energy, the body reduces physical activity and growth, turnover of protein, functional organ reserves, the number of cell membranes, and inflammatory and immune responses. This process:

1. Reduces the liver's ability to make glucose and excrete excess dietary protein and toxins
2. Reduces the kidney's ability to excrete excess fluid and sodium
3. Reduces the size, strength, and output of the heart
4. Slows the body's sodium/potassium chemical pump, causing sodium to leak into the cells and potassium to leak out of the cells and be lost in the urine
5. Reduces the gut's acid and enzyme production, flattening the villi and reducing their motility
6. Affects safe storage of iron liberated from red blood cells, promoting the growth of pathogens and harmful free radicals
7. Reduces muscle mass, leading to loss of intracellular nutrients and glucose stores
8. Reduces the immune system's ability to respond to infection2

Inadequate intake of protein and energy results in proportional loss of skeletal and myocardial muscle. As myocardial mass decreases, the ability to generate cardiac output decreases.

As PLHIV people are staying on ART for longer periods, new nutrition challenges are emerging, including high blood pressure, dyslipidemia, insulin resistance, heart disease, and osteoporosis. Diabetes is part of a growing epidemic of non-communicable diseases that impose a double burden of malnutrition (undernutrition and overweight/obesity).

TB is the leading bacterial cause of death in humans and the second leading cause of death among infectious diseases after HIV. People with active TB often have decreased appetite, weight loss, and micronutrient deficiencies, which increase the risk of progression from TB infection to active TB. The dual epidemics of TB and HIV are of growing concern in Asia. TB is

[2] Tomkins, A, and F Watson. 1989. *Malnutrition and Infection–A Review.* Nutrition Policy Discussion Paper No. 5. Geneva: United Nations Administrative Committee on Coordination–Subcommittee on Nutrition (ACC/SCN).

a major cause of death among PLHIV. Management of TB/HIV co-infection and increasing levels of multi-drug resistant TB are a growing challenge in Asia.

4.1. Nutritional Status

The prevalence of undernutrition among the pre-ART and ART patients assessed was 26.8 percent, with 3.1 percent severely undernourished. The highest prevalence of undernutrition was found in participants 20–29 years (29.2 percent) and the second highest in participants 50 years and older (27.6 percent), although the latter had the highest prevalence of SAM (6.6 percent).

The prevalence of undernutrition was higher in the ART group than in the pre-ART group, but the difference was not statistically significant. The severity of undernutrition was similar in the two groups.

Rates of undernutrition and overnutrition (overweight) were not significantly different between males and females in general or by treatment group. The prevalence of undernutrition among the adult PLHIV in the study was higher than that found among Vietnamese adults in the National Nutrition Survey 2009–2010, both for males (27.0 percent vs. 15.8 percent) and females (26.5 percent vs. 18.5 percent).[27] The study found the highest prevalence of undernutrition in participants less than 25 years old and more than 55 years old. The prevalence of overweight in the adult PLHIV in the study was lower (3.8 percent in both males and females) than that in the general Vietnamese adult population (4.9 percent in males and 36.3 percent in females). In both population groups, the prevalence of overweight was highest in people more than 50 years old. Undernutrition was more common in the younger participants in the study, similar to findings in the general population. Younger people work more and are more active, but they often pay insufficient attentio to eating a balanced diet. PLHIV over 50 years old in the study had a higher rate of underweight but also the highest rate of overweight, indicating nutritional imbalances at both ends of the spectrum.

The mean weight of adult PLHIV in this study was comparable to that found in a study by Le and Nguyen (2005) in Hanoi among non-pregnant female patients (n=300) over 16 years old (52.7 ± 5.1 kg).[28] A study in two districts in Kenya (Kuria et al. 2008) found that 23.6 percent of PLHIV (n=174 both males and females) had BMI < 18.5.[29] Another study in Botswana (Nyepi et al. 2008) found that 28.5 percent of 145 HIV-positive patients were undernourished.[30] Those findings are not much different from those of this study. The prevalence of undernutrition among the HIV-positive population studied in Botswana was a bit higher than that among the PLHIV in this study (26.8 percent). A possible reason could be the higher incidence of HIV-related digestive symptoms (42.2 percent) than in the NIN study (17.9 percent).

Nutritional status was associated with CD4 count, clinical stage of HIV disease, and the presence of OIs and HIV-related digestive symptoms. Specifically, participants with CD4 count <200 had the highest rate of undernutrition (34.3 percent, with 4.5 percent severely undernourished). Patients at Stage 4 had a higher total undernutrition rate (33.8 percent) and SAM rate (8.9) than those at earlier stages. However, participants with OIs had a lower rate of undernutrition than those without. A possible reason is that they may have received more health and nutrition care and support than those without symptoms. These findings again highlight the links between nutrition and HIV: severity, clinical stage, and symptoms influence nutritional status and vice versa.

4.2. Dietary Intake

Reported food intake varied among study participants, but the small sample size for the dietary survey did not allow an association between food intake and related factors.

In general, the reported food consumption did not meet the NIN RDA. Carbohydrates accounted for 77.1 percent of dietary intake reported by asymptomatic participants and 65.9 percent reported by symptomatic participants without weight loss. Protein accounted for 122 percent, particularly animal protein, which more than the recommended allowance. Reported mineral intake (calcium, iron) was lower than the RDA, but most reported vitamin intake met the recommended requirements for healthy adults.

The results also showed that PLHIV in the pre-ART group tended to have higher food intake (see table 17) and better nutritional status (see figure 6) than those on ART. As ART usually increases appetite and weight gain, the reason may be decreased appetite and nutrient absorption from ARV side effects.

The proportion of carbohydrates (60 percent) in total food intake reported by the particiants was at the lower end of the recommended 60–65 percent. Rice was the main staple food, reportedly eaten by 99 percent of participants the day before the study. Other starchy foods were reportedly consumed weekly or monthy. The second most commonly consumed food was green vegetables (reportedly eaten by 83 percent the day before the study), followed by fats and oils (reportedly eaten by 61.7 percent) and fruit (reportedly eaten by 49.3) (see table 16). High intake of rice and vegetables/fruit provided PLHIV with adequate nutrients from the energy and protective food groups. Among protein-rich foods, meat was reportedly eaten most often the day before the study (reported by 46.7 percent), followed by milk and milk products (reported by 30.3 percent), eggs (reported by 15.0 percent), and seafood (reported by 15.0 percent).

WHO does not recommend that PLHIV consume a higher proportion of protein in their diets than people without HIV. The proportion of protein in the total food intake reported by

participants in this study was higher than the recommended amount, possibly because PLHIV with appetite loss ate fewer staple foods while maintaining or even increasing their intake of protein- and fat-rich foods. The high proportion of protein consumed led to lower calcium intake than recommended and loss of body calcium, concomitant with high energy intake. The ratio of calcium to phosphorus was 0.54, compared with the recommended ratio of over 0.8. Body calcium would be lost because of a disproportionately high intake of protein. WHO does not recommend that PLHIV consume a higher proportion of protein in their diets than peole without HIV.

A study in South Africa of dietary intake of PLHIV by Vorster et al. (2004) found calcium intake of 408–448 mg and phosphorus intake of 955–1214 mg, lower than the 558.6 mg of calcium and 1,029 mg of phosphorus reported by participants in this study. The South Africa study also found an imbalance in the ratio of calcium to phosphorus.[31] A study by Tran in 2005 among 170 HIV-positive women of reproductive age in Hanoi found that the average energy intake was 1785.3 ± 568.4 kcal, lower than that among women in this study (2003,5 ± 805,8*).* Fat in Tran's study accounted for 68.5 percent of dietary intake, compared with 69.0 percent in this study. Vitamin A intake in Tran's study was 100.9 mg/capita/day, lower than the 133.8 mg/capita/day in this study, and iron intake was 11.2 mg/capita/day, lower than the 14.6 mg/capita/day in this study[32] (see table 18).

4.3. Factors Affecting Nutritional Status

The study found an association between poor nutritional status and CD4 count, clinical stage, and presence of digestive disorders. The prevalence and severity of undernutrition was highest in participants with CD4 < 200 (34.3 percent undernourished and 4.5 percent severely undernourished) and lowest in those with CD4 > 500 (22.3 percent undernourished and 2.2 percent severely undernourished).

The prevalence of undernutrition (total and SAM) tended to increase with clinical stage, highest in Stage 4 (33.8 percent total and 8.9 percent SAM) and lowest in Stage 1 (22.8 percent total and 1.8 percent SAM). The prevalence of SAM in participants with Stage 4 disease was significantly different from that in participants with Stage 3 and earlier ($p<0.01$).

The prevalence of undernutrition was suprisingly lower in the 945 participants with OIs (23.5 percent) than in those without OIs (27.8 percent, $p<0.01$). Among the 702 participants with one or more digestive disorders, the prevalence and severity of undernutrition were significantly higher (38.9 percent) than in those without such disorders (24.1 percent).

These findings are consistent with the vicious circle of undernutrition: impaired immune function (indicated by low CD4 count) reduces the body's capacity to fight disease and nutrient needs increase to fight infection, but HIV-related symptoms and ART side effects

reduce appetite and nutrient absorption, making it difficult to meet nutrient needs (especially the increased energy needs caused by HIV).

5. CONCLUSIONS

The average weight of the study participants was 51.5 ± 8.0 kg, and the average height was 160.1±7.8 cm. According to their BMI, 3.8 percent of the participants were overweight, 69.4 percent had normal nutritional status, and 26.8 percent were undernourished. Of the undernourished participants, 18.4 percent were mildly undernourished, 5.3 percent were moderately undernourished, and 3.1 percent were severely undernourished. There was no significant difference in nutritional status between the undernourished men and women.

Percentage of study participants who were malnourished, by age group and ART status				
Nutritional status	20–29 years	30–39 years	40–49 years	50 years and older
Undernutrition (BMI < 18.5)	29.2%	26.5%	22.0%	27.6%
Overnutrition (overweight; BMI ≥ 25.0)	3%	4%	3.9%	8.1%

The difference in the proportion of ART patients (27.9 percent) and pre-ART patients (25.5 percent) who were malnourished was not statistically significant.

Percentage of study participants who were undernourished, by ART status				
ART status	20–29 years	30–39 years	40–49 years	50 years and older
Pre-ART (25.5%)	27.1%	25.4%		18.6%
ART (27.9%)	32.0%		22.5%	32.5%

The prevalence of overweight was similar in the pre-ART and ART groups and highest in those over 50 (14 percent among pre-ART patients and 5 percent among ART patients).

The food intake of the adult PLHIV participating in the study was inadequate in both quantity and quality. Energy intake was low (1849.8 ± 737.8 kcal/person/day), meeting 77.1 percent of the 2012 NIN RDA for adult asymptomatic PLHIV. Participants reported consuming more protein in relation to other macronutrients than the NIN recommendation. Consumption of some nutrients important for immune function, including iron and calcium, did not meet the 2012 NIN RDA.

An association was found between poor nutritional status and higher CD4 count, higher clinical stage, and the presence of HIV-related symptoms and OIs. No association was found between nutritional status and food intake, but participants on ART tended to consume less than those not yet on ART.

6. RECOMMENDATIONS

Good nutrition is especially important for PLHIV because of their reduced food intake, increased energy needs, and poor nutrient absorption. Malnutrition can hasten the progression of HIV and worsen its impact by weakening the immune system and reducing the effectiveness of treatment. Malnutrition can also increase the risk of mother-to-child transmission of HIV. Stunted growth, failure to thrive, and frequent common childhood illnesses are common in HIV-positive children.

Nutrition assessment of PLHIV can identify nutrition problems early, inform counseling on dietary intake and management of HIV-related symptoms and drug side effects that affect nutritional status in order to improve nutritional status, boost immune response, and improve response to treatment. People whose malnutrition is not treated early have longer hospital stays, slower recovery from infection and complications, and higher morbidity and mortality.

Recommendation 1. Nutrition care and support should be integrated into both clinic- and community-based services for PLHIV to prevent and manage malnutrition in this vulnerable population group. The components of this support should include:

- Nutrition assessment, counseling, and support provided as part of routine OPC care and treatment
- Specialized food products (RUTF for treatment of SAM and fortified-blended food for treatment of moderate malnutrition and prevention of SAM) prescribed for a limited duration, with clear eligibility and exit criteria based on anthropometric measurement. Such products must be safe, effective, of consistent high quality, palatable, easy to digest, culturally appropriate, cost effective, and feasible to deliver to clients. They must be simple to prepare without requiring large amounts of water, nutrient dense, and free of contamination and meet acceptable standards for daily energy, micronutrient and protein content and microbiological safety.

Recommendation 2. Nutrition counseling for ART patients should focus on a balanced diet, with adequate energy and micronutrient intake.

Recommendation 3. OPC patients less than 25 years old and 50 years and older should be prioritized for nutrition assessment, counseling, and support, given that these age groups had the highest prevalence of undernutrition in this study.

Recommendation 3. The Government and its development partners should formulate and enforce a strategic policy to ensure equitable access to food support for groups vulnerable to food insecurity, including PLHIV.

ANNEX 1. DATA COLLECTION FORM

I. GENERAL INFORMATION

N	QUESTIONS	RESPONSE (CODING)
1.	Province (filled by the respondent)	… … … … … … … … … … … … … … … | _ _ _ |
2.	Name of OPC (filled by the respondent)	… … … … … … … … … … … … … … … … | _ _ _ | | _ _ _ |
3.	Funding source (filled by the respondent)	PEPFAR … … … … … … … … … … … … . . 1 Global Fund … … … … … … … … … … … … … … 2 Government … … … … … … … … … … … … … … 3
4.	Full name	
5.	On ARVs?	Yes … … … … … … . . … … … … … … … … … … 1
		No … … … … … . . … … … … … … … … … … . . 2
6.	Gender	Male … … … … … … . . … … … … … … … … … … 1
		Female … … … … … . . … … … … … … … … … … . . 2
7.	Age	|___|___||
8.	Ethnic group	
9.	Education	Grade finished...................................... |___|___| Don't know… . . … … … … … … … … … … … … . . 97 No response… … … … … … … … … … … … … … . . 98
10.	Current job	Farmer … … … … … … … … . . … … … … … . 1
		Government Officer........ … … … … … … … … . 2
		Teacher … … … … … … … … … … … … . … … . … . . 3
		Business...4
		Worker...5
		Housewife… . … … … … … 6
		Others (Detailed) . 7 .
		Unemployed … … … … … … … … … … . 8
		Don't know … . . … … … … … … … … … … … … . . 97 No response … … … … … … … … … … … … … … . . 98
11.	Marrital status	Single.. 1
		Married...2
		Live without marriage.…………………………..........................3
		Divorced… … … … … … … … … … … … 4
		Separate… … … … … … … … … … … … 5

		Widow……6
		Others (detailed)……7
		Don't know …… ……97
		No response ……98
12.	In the past week, did you have any of these opportunistic infections (according to clinical diagnosis)?	Sore mouth……1
		TB ……2
		Debilitated ……3
		Respiratory infection ……4
		Diseases caused by Penicillum……5
		Diarrhea ……6
		Others (detailed)……7
		Don't know …… ……97
		No response ……98
13.	At any time during the past month, were you hungry because of lack of food?	Yes ……1
		No ……2
		Don't know …… ……97
		No response ……98
14.	At any time during the past month, did you reduce your meals for any of these reasons?	Lack of money to buy food……1
		Can't eat ……2 (Skip to Question 15)
		No ……3
		Don't know …… ……97
		No response ……98
15.	If you reduced your meals because you were unable to eat, what symptom made it difficult for you to eat?	Loss of appetite……1
		Sore mouth……2
		Nausea ……3
		Others (detailed)……4
		Don't know …… ……97
		No response ……98
16.	In the past month, did you receive any food support?	Yes ……1 (skip to Question 17)
		No ……2
		Don't know …… ……97

		No response ……..98
17.	If you received food support, what was the reason?	Malnutrition …… 1 Lack of food …… 2 Don't know …….. ……..97 No response ……..98
18.	Have you ever been counseled on nutrition?	Yes …… 1
		No …… 2
		Don't know …….. ……..97 No response ……..98

II. ANTHROPOMETRIC AND CLINICAL DATA

19.	Weight (kg)	……|___||___||___|.|___|___||
20.	Height (cm)	……|___||___||___|.|___|___||
21.	Mid-upper arm circumference (cm)	……|___||___|.|___|
22.	CD4 (latest test) (Check the records of the OPC)	…….cell/mm3
		Date: ……
23.	Clinical period (Check the records of the OPC)	1.↑ 2.↑ 3.↑ 4.↑ Others:
24.	Current clinical symptoms (detailed) (Check the records of the OPC)	

III. FOOD CONSUMPTION

Which of the following foods did you eat yesterday/last week/last month?

No.	Food group	Food	Last month			
			Yesterday	Last week	Last month	Did not eat
A	Cereals	Rice				
		Corn				
		Wheat flour (bread…)				
B	Tubers	Sweet potatoes				

No.	Food group	Food	Last month			
			Yesterday	Last week	Last month	Did not eat
		Potatoes				
		Cassava				
		Others				
C	Vegetables (including bean sprout, beans, etc.)					
D	Fruits					
E	Meat	Pork				
		Poultry (chicken, goose, duck…)				
		Buffalo, beef, goat…				
		Organ meat				
F	Eggs					
G	Seafood	Fish				
		Shrimp				
		Mussels, snails				
		Crab				
H	Beans	Beans				
I	Milk and milk products	Yoghurt				
		Canned milk				
		Soya milk				
		Fresh milk				
		Other milk products				
J	Oils/fat					
K	Sugar, honey					
L	Other	Spices				
		Tea/coffee				
		Soft drinks				
		Other beverages				
M	RUTF					
N	Multivitamin supplement					

Food intake in the past 24 hours

Meal (main or supper)	Food	Food ingredients	Cooked food				Equivalent of cooked food to uncooked food (g)	Food coding
			Measurement unit	# unit	Weight /unit	Total weight of cooked food (g)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Meal (main or supper)	Food	Food ingredients	Cooked food				Equivalent of cooked food to uncooked food (g)	Food coding
			Measurement unit	# unit	Weight /unit	Total weight of cooked food (g)		

ANNEX 2. OUTPATIENT CLINICS INVOLVED IN THE STUDY

Code	Province	Outpatient Clinic (OPC)	Number of participants	Male	Female	ART	Pre-ART
1	Bac Ninh	Provincial Hospital	142	77	65	68	74
2	Ha Noi	Central Hospital for Tropical Diseases	143	72	71	73	70
3	Hoa Binh	Provincial Hospital	119	76	43	74	45
4	Nghe An	Provincial Hospital	149	95	54	75	74
5	Quang Ninh	Provincial Hospital	150	76	74	75	75
6	Quang Ninh	Cam Pha District Hospital	148	124	24	75	73
7	Ba Ria – Vung Tau	Le Loi Hospital	129	71	58	64	65
8	Ho Chi Minh City	Hospital for Tropical Diseases	137	43	94	70	67
9	Ho Chi Minh City	District 4 OPC	145	89	56	75	70
10	Ho Chi Minh City	District 10 OPC	142	95	47	72	70
11	Ho Chi Minh City	Binh Thanh District OPC	141	69	72	74	67
12	Ho Chi Minh City	Hoc Mon Health Center	145	80	65	75	70
13	Ho Chi Minh City	District 1 Health Center	148	87	61	74	74
14	Ho Chi Minh City	Pham Ngoc Thach Hospital	150	102	48	75	75
15	Bac Giang	Provincial Hospital	116	48	68	75	41
16	Hung Yen	Provincial AIDS Committee (PAC)	147	84	63	75	72
17	Ninh Binh	PAC	150	83	67	75	75
18	Ben Tre	Nguyen Dinh Chieu Hospital	129	71	58	75	54
19	Binh Duong	Provincial Hospital	146	95	51	72	74
20	Da Nang	Dermatology Hospital	109	55	54	73	36
21	Hai Duong	Chi Linh Health Center	104	63	41	75	29
22	Hai Phong	Hong Bang Health Center	142	109	33	86	56
23	Thai Nguyen	Dai Tu Health Center	147	103	44	75	72

24	Thai Nguyen	Hospital A	135	68	67	75	60
25	Thanh Hoa	Ngoc Lac OPC	150	104	46	75	75
26	Dak Lak	Provincial Hospital	81	44	37	74	7
27	Tay Ninh	Trang Bang Health Center	146	87	59	75	71
28	Ho Chi Minh City	District 5 Preventive Health Center	85	59	26	74	11
29	Ho Chi Minh City	Phu Van (Centers 05 and 06)	137	82	55	63	74
		TOTAL	3,912	2,311	1,601	2,136	1,776

ANNEX 3. INFORMED CONSENT FORM

Name of the research: Assessment of the nutritional status of adult PLHIV registered at outpatient clinics in Vietnam

The National Institute of Nutrition (NIN) is responsible for developing and providing guidance on the implementation of nutrition programs in Vietnam. NIN would like to develop guidelines and materials that improve the nutritional status of people living with HIV (PLHIV).

NIN would like do an assessment of the nutritional status of adult PLHIV registered at outpatient clinics in Vietnam. This study will look at the prevalence of malnutrition and household food insecurity among PLHIV and the dietary quality of PLHIV.

You are invited to participate in this study by having your weight, height, and mid-upper arm circumference (MUAC) recorded during a visit to the OPC. You may also be asked what you ate the past month and/or past 24 hours.

All anthropometric data will be collected by staff at this OPC. Dietary information (if requested) will be collected by NIN staff. None of the procedures are experimental.

Although you will not benefit directly from participating in this study, you will make a major contribution to knowledge about the prevalence of malnutrition among people living with HIV and AIDS as well as the factors related to malnutrition. In the future, other people living with HIV and AIDS may benefit because there may be better care and treatment guidelines and materials on nutrition care and treatment for PLHIV.

A research assistant at this OPC will keep your information in a secure database. Only the professional staff at the NIN will know the identity of study participants.

If you are asked to participate in the dietary assessment, you will be paid VND 20,000 for your time. If you have any questions about the study, please contact Dr. Pham Thi Thuy Hoa of NIN (48A Tang Bat Ho, Ha Noi, tel. 84-912357799).

Your signature on this form means that you understand the information presented and that you want to participate in the study. You understand that participation is voluntary and you may withdraw from the study at any time.

_____ _____

Signature of participant Date

Full name: Age:

Address:

CODE |___|___||___|___|

ENDNOTES

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