



**SCHOOL OF PUBLIC HEALTH**  
**DEPARTMENT OF PUBLIC HEALTH NUTRITION**

**Magnitude of under-nutrition and associated factors among  
HIV positive under-15 age children on follow up at a pediatric  
ART clinic at referral hospitals in Addis Ababa, Ethiopia.**

**By: Bezaneh Belachew (BSC. PH)**

**November, 2022**

**Addis Ababa, Ethiopia**



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**By: Bezaneh Belachew**

**Advisors: - Mrs. Fatimetu Mohammed (MPH. RH)**

**Mrs. Sisay Tanie (M.Sc. Biostatistics)**

**A THESIS SUBMITTED TO THE DEPARTMENT OF PUBLIC HEALTH NUTRITION; PRESENTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTERS OF PUBLIC HEALTH IN NUTRITION; ST. PAUL HOSPITAL MILLENNIUM MEDICAL COLLEGE**

**November, 2022**

**Addis Ababa, Ethiopia**

## Summary

**Background:** Undernutrition and HIV remain significant public health concerns for infants and children and are the leading causes of death for infants and children. Despite the seriousness of the problem, there is no published research done in the study area. Most of the studies done in Ethiopia either overlooked or little are known about the dietary factors for undernutrition, and most of them are single-centered studies. So, this study aims to fill these gaps. Therefore, the goal of this study was to determine the magnitude and associated factors of undernutrition among HIV-positive under-15 children on follow-up at referral hospitals in Addis Ababa.

**Objectives:** To assess the magnitude of under-nutrition and associated factors among HIV-positive under-15 age children on follow-up at a pediatric ART clinic at referral hospitals in Addis Ababa, Ethiopia, from 04 July 2022 to 04 August 2022 G.C.

**Methods:** A health institution-based cross-sectional study was conducted from 04 July 2022 to 04 August 2022 G.C among 459 HIV-positive children below 15 years of age who received highly active antiretroviral therapy in three selected referral hospitals in Addis Ababa. A systematically random sampling technique was used to select the study participants. The collected data were entered into Epi Data 4.6 and exported to SPSS version 26 for analysis, and the anthropometric indices were calculated using WHO Anthro (for 5 year old children) and WHO Anthro-plus (5-15 year old children) software versions 3.2.2. In the multi-variable analysis, variables were considered statistically significant when the p-value was less than 0.05 at 95% CIs.

**Results:** A total of 419 study participants were interviewed, of which 109 (26%) were stunted and 83 (19.8%) were wasted. Parental living status, marital status, family size, caretakers' educational level, and individual dietary diversity were significantly associated with stunting. Parental living status, ART regimen, eating problems, counseling, and individual dietary diversity were all found to be statistically significant predictors of wasting.

**Conclusion:** This study indicated that there is a high burden of undernutrition. Therefore, dietary counseling, early identification and treatment of children with eating problem, giving close attention to HIV-positive children who are on ART second line regimen and financial support need to be provided to alleviate the problem.

**Keywords:** - under-nutrition, wasting, stunting, antiretroviral therapy.

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## Acronyms and Abbreviations

|               |                                          |
|---------------|------------------------------------------|
| <b>AIDS</b>   | Acquired immunodeficiency syndrome       |
| <b>AOR</b>    | Adjusted odds ratio                      |
| <b>ARV</b>    | Antiretroviral                           |
| <b>ART</b>    | Antiretroviral therapy                   |
| <b>CI</b>     | Confidence interval                      |
| <b>HAART</b>  | Highly active antiretroviral therapy     |
| <b>HAZ</b>    | Height for Age Z score                   |
| <b>HIV</b>    | Human immunodeficiency virus             |
| <b>Kg</b>     | kilogram                                 |
| <b>OI</b>     | Opportunistic infection                  |
| <b>PLWHA</b>  | People living with HIV/AIDS              |
| <b>SPHMMC</b> | Saint Paulo's Millennium Medical College |
| <b>SPSS</b>   | Statistical package for social science   |
| <b>TB</b>     | Tuberculosis                             |
| <b>TLC</b>    | Total leukocytes count                   |
| <b>WAZ</b>    | Weight for Age Z score                   |
| <b>WHZ</b>    | Weight for Height Z score                |
| <b>WHO</b>    | World Health Organization                |

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# **1 Introduction**

## **1.1 Background**

Adequate nutrition is an important factor for good health that remains unmet for vast numbers of children, who are thus unable to achieve their full genetic developmental potential (1). Undernutrition is defined as an insufficient intake of energy and nutrients to meet an individual's needs to maintain good health (2). Stunting, wasting, and underweight are indicators of childhood undernutrition. According to the 2006 World Health Organization (WHO) Child Growth Standards, stunting, wasting, and underweight occur when the children's median height-for-age, weight-for-height, and weight-for-age become below -2 standard deviations, respectively (3).

Undernutrition has been shown to be a significant public health problem and contributes to health disruption and death in HIV-positive patients. Due to a reduction in food intake (reduced appetite), nutrient absorption, and by increasing the utilization and excretion of proteins and micro-nutrients, metabolic changes, viral replication, and poor nutrient absorption, HIV-infected children are more susceptible to undernutrition than non-HIV-infected children (4, 5). Undernutrition and HIV are found to be interwoven in a vicious cycle (6). Immune impairment as a result of HIV/AIDS leads to malnutrition. malnutrition leads to immune impairment, worsens the effect of HIV, and contributes to more rapid progression to AIDS (7).

From a clinical point of view, asymptomatic and symptomatic HIV-positive individuals need 10% and 20–30% more energy than their counterpart HIV-negative individuals of the same age, sex, and physical activity level. Low food intake combined with increased energy demands are the major factors in HIV-related weight loss and wasting (7).

Early HIV infection can impair the nutritional status of infected children. Regular and careful assessment of nutritional status (anthropometric measurements, biochemical measurements, clinical assessment, and dietary intake measurement) should be part of HIV infection management. This is essential for early identification of malnutrition (growth faltering), monitoring HIV disease progression, early identification of complications, and treatment efficacy of children on ART, and so offers the opportunity to intervene. Children with HIV

infection require adequate nutritional counseling and supplementation to meet their increased metabolic needs and help in improving health outcomes (8, 9). Dietary diversity was found to be a pro-indicator for micronutrient adequacy and diet quality in supporting children's nutrition, health, and optimal growth and development (10).

## 1.2 Statement of the problem

Globally, close to 2.6 million children younger than 15 years have been infected with the HIV virus and a malnutrition prevalence rate of between 40 and 64% in children with HIV/AIDS has been reported (11). In sub-Saharan Africa, the magnitude of severe under-nutrition, hospitalization, and death rates reaches as high as 20–50% among HIV-infected or exposed children (12).

In Ethiopia, one hospital-based study on the magnitude of stunting, thinness, and associated factors among HIV-positive children receiving chronic HIV care and support at Adama Hospital Medical College found that 13.4% of the children were stunted and 21.8% were wasted (13).

The risk of death in HIV-infected children due to under-nutrition is three times higher than in non-HIV-infected children (12). According to the study on the effects of undernutrition on the survival of HIV-positive children on antiretroviral therapy conducted by Alebel A et al., there was a high rate of mortality. In this study, the overall mortality was found to be 4.4 per 100 child-years (95% CI: 3.2, 6.0), while undernourished children had a lower survival time than well-nourished children. Severe stunting, severe wasting, and advanced disease stage (3&4) (AHR: 2.6, 95% CI: 1.1, 6.6) were found to be predictors of mortality (14).

Previous researchers from different corners of the globe have confirmed that undernutrition among HIV-positive children is a complex interaction between different factors. including socioeconomic risk factors such as low economic status, low maternal education (15) and orphanhood (7). Nutritional factors like food insecurity (15), poor dietary patterns (16) and health-related factors like opportunistic infections (TB coinfection, pneumonia, persistent diarrhea, recurrent oral candidiasis) and wasting syndrome (14), low CD4 count and high viral load (4, 15).

Despite the seriousness of the problem, there is no published research done in the study area. Most of the studies done in Ethiopia to explain the factors of undernutrition among HIV-positive children are either overlooked or little is known about the dietary factors for

undernutrition, and most of them are single-centered studies. So, this study aims to fill these gaps.

### **1.3 The significance of the study**

At present, the recent studies conducted in Ethiopia showed the increment of under-nutrition among children on HAART and also, at the same time, the mortality rate increases from time to time, especially those severely wasted and severely stunted. So, this study is intended to:

- Provide useful information on the Magnitude and associated factors of undernutrition of HIV seropositive children to assist evidence-based decisions to minimize the undesired impact of nutritional status and enhance the quality of life by strengthening the quality of HIV/AIDS care and support services.
- It will shed some light on the issue and provide important information both to clinicians and programmers to manage malnutrition among HIV-infected children.
- Furthermore, it will serve as baseline data for further research.

## **2 Literature Review**

### **2.1 Burden of undernutrition in HIV background**

According to the cross-sectional study conducted in south India on the prevalence of underweight, stunting, and wasting among 0–15-year old children, 63%, 58%, and 16%, respectively (17).

A cross-sectional survey studied in Accra, Ghana in 2021 on malnutrition in HIV-infected children on antiretroviral drugs in a cohort of Ghanaian children showed that 16% had underweight, 13% had wasting, and 28% had stunting (11).

A systematic review done from 22 studies in five different East African countries with 22,074 pediatrics patients stated the pooled prevalence of underweight, wasting, and stunting among HIV positive children using random-effects model analysis was found to be 41.63%, 24.65%, and 49.68% respectively, with the highest prevalence of underweight being in Ethiopia (49.67%) and Rwanda (42%), and the lowest prevalence was seen in Kenya (19.4%), and the prevalence of wasting and stunting was ranged from 7% to 77.1% and 13% to 71.8% respectively (18).

According to the study conducted by Sunguya BF et al., among ART-treated HIV-positive and HIV-negative children and to examine factors associated with undernutrition among ART-treated HIV-positive children in Dar es Salaam, Tanzania, The HIV-positive children under ART had higher rates of all forms of undernutrition compared with their HIV-negative counterparts. About 22% and 13%, respectively, of ART-treated HIV-positive children were underweight and showed signs of wasting. Similarly, about 37% of ART-treated HIV-positive children, compared to about 22% of HIV-negative children, were stunted (19).

One systematic review and meta-analysis study has tried to see the magnitude of undernutrition among children infected with the human immunodeficiency virus in sub-Saharan Africa, which included 38 primary articles published between 2010 and 2021, with 16,790 study participants from more than 16 sub-Saharan African countries. All included studies screened under-weight, wasting, and stunting by using WAZ, WHZ, and HAZ scores below – 2 Z-scores (WHO standard) respectively. The highest prevalence of stunting was reported from a study conducted in Cameron (77.0%), and the lowest was reported from a

study conducted in Ethiopia (5.5%). Similarly, the highest prevalence of underweight was reported from a study in Nigeria (58.6%), and the lowest was from a study in Tanzania (6.8%). The highest (52.0%) and lowest (4%) prevalence of wasting were also reported from a study conducted in Senegal and Uganda, respectively (12).

Haileselassie B et al. conducted an institutional-based cross-sectional study on undernutrition and its associated factors among pediatric age children attending ARV therapy in Eastern Ethiopia, 376 HIV positive children were included in the study. It found that 24.7% (95% CI: 20.7,29.4) of the children were stunted and 28.2% (95% CI: 23.7,32.2) were wasted (20). Another study in southern Ethiopia showed that the prevalence of wasting was 36.3%(95% CI: 31.6, 41.0) and stunting in the same study population was 5.5%(95% CI: 3.4, 7.8) (21).

In a facility-based cross-sectional study conducted on undernutrition and its associated factors among Human Immunodeficiency Virus infected children on follow up in Amhara region referral hospitals, the overall prevalence of undernutrition among children living with HIV who were attending an ART clinic was 30.3% (95% CI 25.3-35.2) with a 19.4%, 19.2% magnitude of stunting and thinness (5). This has also been explored in prior studies conducted by Lata and Beyene in 2020 on factors associated with the nutritional status of human immunodeficiency virus (HIV) infected children Hawassa, out of 455 under-15-age children, about 253 (60.2%) were stunted, 173 (41.2%) were underweight, and 90 (21.4%) were wasted (22).

## **2.2 Factors affecting undernutrition**

Advanced WHO HIV/AIDS clinical staging is significantly associated with stunting among HIV-infected children. Nigussie J, et al. As determined from their systematic review and meta-analysis on undernutrition and associated factors among children infected with HIV in sub-Saharan African countries, the odds of stunting among children with advanced WHO HIV/AIDS clinical staging was 6.74 times (CI: 1.75, 26.02) higher than their counterparts (12). This finding was supported by the findings of Haileselassie et al. This finding was supported by the findings of Haileselassie et al. Children currently with clinical-stage 3 and 4 were about 2.51 times (CI: 1.18–5.34) more likely to develop stunting compared to those with clinical-stage 1 and 2, Dessalegn N et al. [1.77 times (CI: 1.08–2.88)] (5).

One study on under-nutrition and its associated factors among pediatric age children attending antiretroviral therapy in eastern Ethiopia was done by Haileselassie B et al.. household food insecurity (AOR = 5.08; 95%CI: 2.29, 11.26), low hemoglobin (anemia) (AOR = 1.8; 95% CI: 1.02, 3.19), the presence of diarrhea in the past two weeks (AOR = 2.13; 95%CI: 1.18, 3.84) and advanced WHO clinical stage (stages 3 and 4) were found to be significantly associated with stunting in multi-variable logistic regression analysis (20). A similar study was done at Adama hospital medical college. The duration of HIV infection, counseling on nutrition, and presence of opportunistic infections showed a significant association with stunting (23).

In Ethiopia, A cross-sectional study conducted in a pediatric ART clinic of Hawassa University referral hospital to assess the factors associated with the nutritional status of Human Immunodeficiency Virus infected children showed children's underweight in multivariable analysis was significantly associated with their meal pattern, food variety, caregiver dietary counseling, WHO HIV/AIDS clinical stage, and average monthly income of the caregivers (22). In another study, children who had diarrhea that stayed for 2 weeks in the last 6 months were 3.3 times more likely to be malnourished as compared to children who had no diarrhea (AOR=3.30 CI (1.41, 7.72)) (24).

According to the study conducted by Tiruneh CM et al. in southern Ethiopia, after adjusting for possible confounders in the multi-variable analysis, history of hospital admission, having a recurrent oral lesion, WHO clinical stage, and current CD4 count were statistically significant associations with stunting of HIV positive children. Having a CD4 count between 350-499 cell/mm<sup>3</sup> (AOR = 3.490; 95%CI: 1.016, 11.985) and children who have recurrent oral lesions (AOR = 3.932; 95%CI: 1.094, 14.126) are more likely to develop stunting as compared to those whose CD4 count is greater than 500 cells/mm<sup>3</sup> and to those children without oral lesions, respectively (21).

Another health institution-based cross-sectional study on the magnitude of stunting, thinness and associated factors among HIV positive children attending chronic HIV care and support in Adama hospital medical college, Adama, Oromia regional state, Ethiopia revealed that age, sex, monthly income of caregivers, and eating problems are significantly associated with wasting (5, 25). In another study, diarrhoea in the previous month and anemia were found to have significant associations with wasting among HIV-infected children in sub-Saharan Africa (12).

A facility-based cross-sectional study was conducted in Amhara region referral hospitals, Ethiopia, in 2020 by Dessalegn N et al. A total of 360 children aged 5 to 14 years old were included in this study. Children who had poor individual dietary diversity were 1.7 times more likely to be undernourished than those children who had good dietary diversity (AOR = 1.73; CI 1.07-2.81) and those children whose caregivers didn't get nutritional counseling were 2 times more likely to be undernourished as compared to those who were getting nutritional counseling by a health professional at an ART clinic (AOR = 2.42; CI 1.45-4.04) (5). This finding is supported by another study conducted by Haileselassie et al. In eastern Ethiopia, Children with low dietary diversity were 2.77 times more likely to be wasted than those with high dietary diversity (AOR = 2.77; 95% CI: 1.44, 5.31) (20).

The study was conducted at the University of Gondar comprehensive specialized hospital pediatrics ART clinic from March to May 2017 entitled “Magnitude of anemia and undernutrition among HIV-infected children who took HAART: a retrospective follow-up study” where the nutritional status of 200 HIV positive children was studied. Out of the total children, 129 (64.5%) and 18 (9%) of them were at WHO clinical stages I and II, and had a history of tuberculosis treatment, respectively. The magnitude of underweight, stunting, and undernutrition have shown decrements at 6 and 9 months of ART initiation when compared to the baseline. At the baseline, the magnitude of underweight was 44.5% (95% CI: 37.6-51.5%), stunting was 49.5% (95% CI: 42.5-56.5%), and undernutrition was 64.0% (95% CI: 57.3-70.7%). However, at 6 and 9-months, the initiation of ART was 54.5%, 44%, 28%, and 48.5%, 41%, and 23.5%, respectively (14, 26). This finding was supported by another similar study conducted in Harar, eastern Ethiopia. The prevalence of underweight, stunted, and wasted children was 51.6% (49/95), 49.1% (53/108), and 31.5% (34/108), respectively, at baseline (before the initiation of ART). The prevalence of underweight, stunted, and wasted children declined to 8.9%, 15.9% (10/63), and 9.8% (6/48), respectively, 1 year after the initiation of ART. The difference for underweight and stunted children was statistically significant (P 0.05) (27).

All the above reviewed literature tried to look at most factors, like socio-demographic and clinical-related factors, which affect the nutritional status of HIV-positive children. However, most studies overlook children under the age of five in situations where HIV-positive children are malnourished. Furthermore, these studies did not downplay the role of dietary factors in undernutrition.

## Conceptual framework

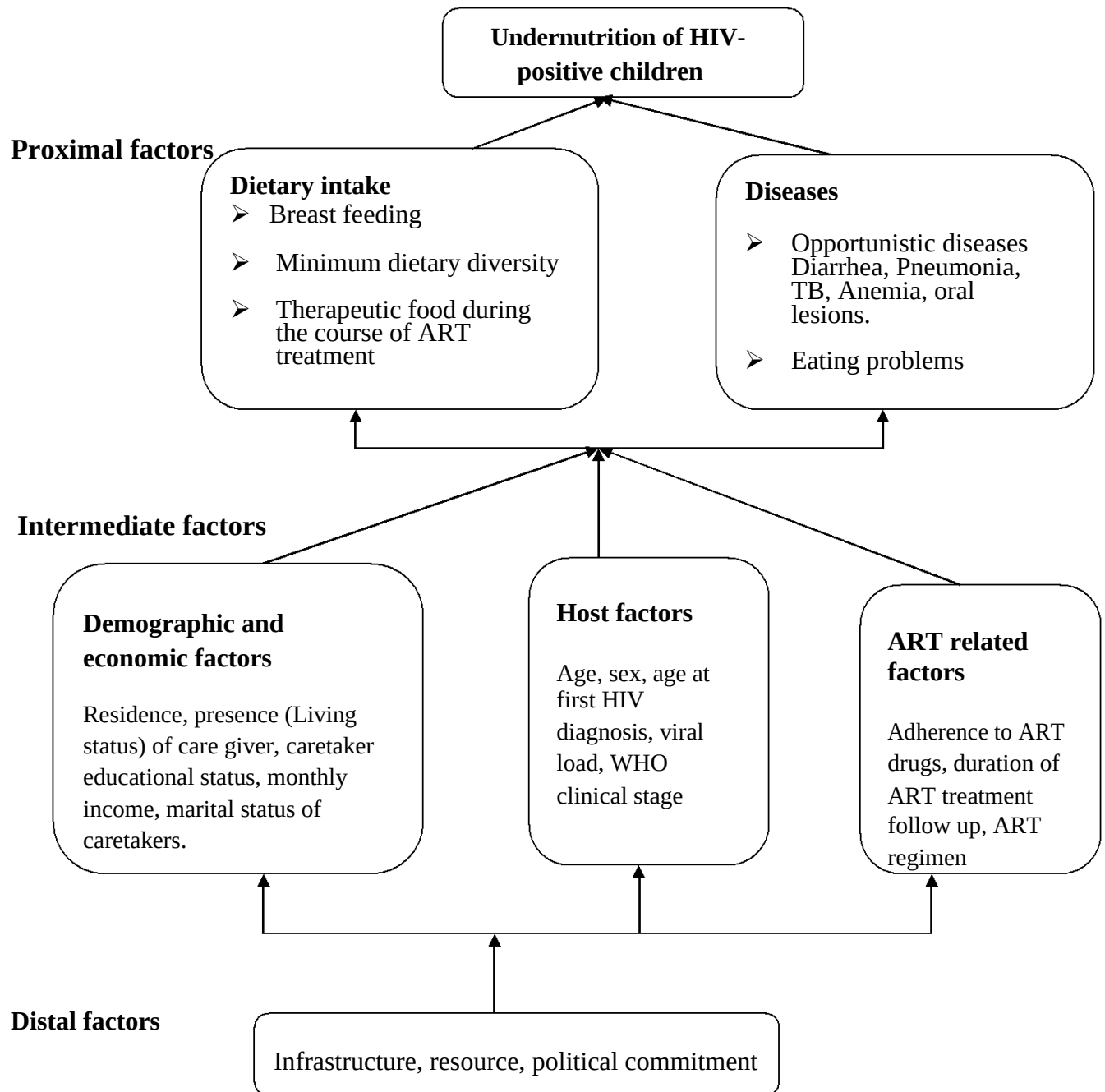


Figure 1. The conceptual framework for under-nutrition among pediatric patients on-ART adapted from literatures (Jeylan, 2018 and UNICEF, 1991).

### **3 Objectives of the study**

#### **3.1 General objective**

- To determine the magnitude of under-nutrition and associated factors among HIV-positive under-15 aged children on follow-up at a pediatric ART clinics at referral hospitals in Addis Ababa, Ethiopia, from 04 July 2022 to 04 August 2022 G.C.

#### **3.2 Specific objectives**

- To determine the magnitude of under-nutrition among HIV-positive under-15 aged children on follow-up at pediatric ART clinics at referral hospitals in Addis Ababa, Ethiopia, from 04 July 2022 to 04 August 2022 G.C.
- To identify factors associated with undernutrition among HIV-positive under-15 aged children on follow-up at pediatric ART clinics at referral hospitals in Addis Ababa, Ethiopia, from 04 July 2022 to 04 August 2022 G.C.

## **4 Methods and materials**

### **4.1 Study setting**

The study was conducted among children aged under-15 years old attending pediatric ART clinics at the referral hospitals in Addis Ababa, which is the capital and largest city of Ethiopia. Addis Ababa city holds 527 square kilometers of area located in the central part of Ethiopia with a 5,026,000 estimated population density. The city has 13 referral hospitals, 7 regional hospitals, and 102 health centers. Among those referral hospitals, eight of them provide ART services for under-15-year-old children.

According to the Addis Ababa city health bureau report in 2014 E.C., currently, there are 1818 under-15-aged children on ART, and more than 98% (1780) of pediatric ART services are provided in those referral hospitals. The study was carried out in three referral hospitals (Zewditu Memorian Hospital (320), St. Paul's Hospital Millennium Medical College (124) and Yekattit 12 Hospital Medical College (280). All three hospitals provide chronic HIV care and follow-up services for HIV-infected clients. Currently, there are approximately 724 under-15-aged children receiving ART follow-up services in these hospitals.

### **4.2 Study period**

The study was conducted from 04 July 2022 to 04 August 2022 G.C at referral hospitals in Addis Ababa.

### **4.3 Study design**

A health institution-based cross-sectional study was conducted among under-15-year old patients who registered and started follow-up at the pediatric ART clinic of referral hospitals.

### **4.4 Population**

#### **4.4.1 Source population**

All HIV-infected under-15-aged children who were under follow-up and treatment in Addis Ababa referral hospitals were the source population of this study.

#### **4.4.2 Study population**

HIV-infected under-15 age children who were under follow up and treatment at selected referral hospitals were the study population.

## Inclusion and exclusion criteria

### Inclusion criteria

- Patients aged below 15 years who enrolled at pediatric ART follow-up clinics before the six-month data collection period and were receiving ART in the referral hospitals were included in the study.

### Exclusion criteria

- Children with physical deformity (like spinal deformity)
- Those children with medical records had no essential information (missing data).

## 4.5 Sample size determination

### Sample size calculation for objective one (1)

The sample size for this study was conducted by using single population proportion formula.

$$n = \frac{(Z_{\alpha/2})^2 \times (p) \times (1-p)}{(d)^2}$$

Considering a similar study conducted on the magnitude and associated factors among HIV-infected children at selected referral hospitals in the Amhara region was 30.3% (5), and with the additional assumption of a 95% confidence interval, a margin of error of 5% (d=0.05).

$$\begin{aligned} n &= \frac{(Z_{\alpha/2})^2 \times (p) \times (1-p)}{(d)^2} \\ &= \frac{(1.96)^2 (0.303) (1-0.303)}{(0.05)^2} \\ &= 0.811311/0.0025 \\ n &= 324.52 \approx 325 \end{aligned}$$

Multiply the minimum sample size (n) by the design effect (DE), which is a correction factor that is used to adjust the required sample size for multistage sampling.

$$\text{SO, } DE \times n$$

$$= 1.5 \times 325 = 487.5 \approx 488$$

Then, with an addition of 10% for possible non-respondents and missing responses, the final required adjusted sample size becomes **537** ( $488+49=537$ ).

Where;

n: The minimum sample size

Z: Standardized deviation for the normal distribution =1.96

P: Proportion of undernutrition among HIV positive children aged under-15 years old =30.3%

d: Expected margin of error (precision) =5%

q:  $q = 1-p = (1-0.303) = 0.697$

DE: design effect

### **Sample size calculation for objective two (associated factors) using double population proportion**

By considering dietary diversity, nutritional counseling (5), and WHO clinical stage (20) as independent factors to determine the sample size, because it was significantly associated with under-nutrition in HIV positive children in the study conducted in Amhara region referral hospitals and Eastern Ethiopia respectively.

Table: 1 sample size calculation for associated factors with under-nutrition among PLWHA children using Epi-info statistical calculator for cohort or cross-sectional.

| Variable as an exposure | Assumptions |      |      |       |       |     | Sample size |
|-------------------------|-------------|------|------|-------|-------|-----|-------------|
|                         | OR          | P1   | P2   | Ratio | Power | CI  |             |
| Dietary diversity       | 1.72        | 25.1 | 36.6 | 1:1   | 80%   | 95% | 540         |
| Nutritional counseling  | 2.2         | 20.9 | 36.8 | 1:1   | 80%   | 95% | 278         |
| WHO clinical stage      | 2.14        | 22.4 | 38.2 | 1:1   | 80%   | 95% | 288         |

Where;

OR: Odds Ratio

P1: Percent of unexposed with the outcome

P2: Percent of Exposed with the outcome

The ratio of sample size: Unexposed/Exposed

The largest number out of the two sample sizes was determined to be **540**. Because the exact number of respondents was less than 10,000, the final sample size was determined using Cochran's correction formula for finite population (< 10,000).

$$n = \frac{n_o}{1 + ((n_o - 1)/N)} \quad \text{where: - } n = \text{corrected sample size}$$

$n_o = \text{sample size calculated early}$

$N = \text{total population in the study area}$

i. e.  $540/1 + ((540 - 1)/1818) = 417$  Then, with an addition of 10% for possible non-respondents and missing responses, the final required adjusted sample size became **459** ( $417 + 42$ ). Samples were taken based on the inclusion and exclusion criteria.

#### **4.6 Sampling procedures and techniques**

There are eight referral hospitals in Addis Ababa city that provide ART clinic services. Since there is a reasonable number of under-15-aged HIV-infected children who were followed up at those referral hospitals, three hospitals were selected by using a simple random sampling method. Then the total sample size was proportionally allocated to each selected hospital. Finally, a systematic random sampling technique was used to select all eligible study participants from each selected pediatric ART clinic. The sampling interval (K) was determined by using:

$$K = \frac{\text{Total number of patients}}{\text{Minimum number of sample size}} \quad \text{where } k = \text{sampling interval}$$

Minimum number of sample size

$$K = 724/459 = 1.57 \approx 2$$

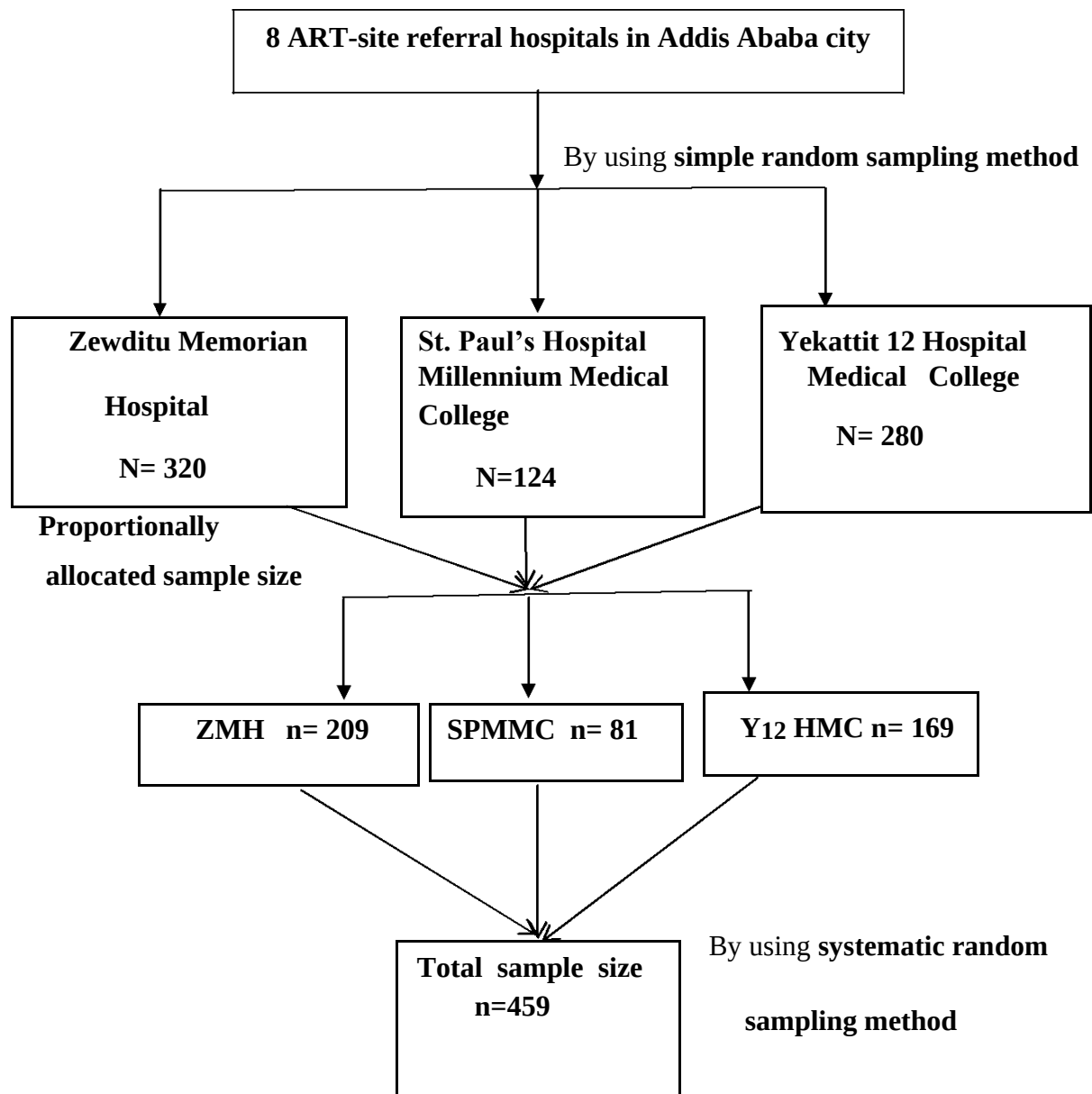


Figure 2: Diagrammatic presentation of sampling procedure in Addis Ababa, Ethiopia, 2022. (n=459)

## 4.7 Measurement

### 4.7.1 Study variables

#### 4.7.1.1 Dependent variable

- Undernutrition indicated by wasting and stunting.

#### 4.7.1.2 Independent variables

- **Socio-demographic and economic characteristics:** - Age, sex of the child, residence, parental living status, caretaker relation with child, marital status of caretaker, Age and sex of caretaker, family size, level of education, occupation and monthly income of caretaker.
- **Clinical status:** - viral load, opportunistic infections (TB, pneumonia, persistent diarrhea, recurrent oral lesions, oesophageal candidiasis and anemia), Age at first HIV diagnosis, Age at HAART started, WHO clinical stage, adherence status to ARV drugs, current ART regimen, INH and cotrimoxazole prophylactic treatment status, ARV toxicity, caregiver HIV status, eating problem.
- **Nutritional related factors:** - Nutritional counseling, nutritional therapy (support), dietary diversity.

#### 4.7.2 Instruments

A structured questionnaire and weight and height measuring instruments were used to collect data. The questionnaire was adopted from prior similar studies with some modifications to fit the pre-set objectives of the study. The questionnaire consisted of four sections (data collection sheets). (1) socio-demographic and economic characteristics of the child and his or her caregiver; (2) HIV infection-related factors (clinical status); (3) nutritional-related factors; and (4) anthropometric measurements (Weight & Height).

The weight of the child was taken by using a pediatric beam balance after undressing the child. Standing weight measurement was used for children who can stand alone, children 2 years of age and older children, and to record the child's weight to the nearest 0.1 kg. The functionality of the standardized weight measurement was checked by using known weight on every data collection date before data collection began, re-setting the reading to zero (calibrated) in between repeated measurements, and twice measurements of a child. A third time repetition was done if there was more than a 50g difference between the two measurements; otherwise, the largest values were used for analysis.

On the other hand, the height of the child was measured by using a length board (sometimes called an infantometer) for children less than 2-years old and a height board (sometimes called a stadiometer) for children greater than 2-years old, and reading the measurement and recording the child's height in centimeters to the last completed 0.1 cm while standing

straight on a smoothly flat horizontal surface with their heels together, eyes straight forward, and touching the standing board at the heels, buttocks, and back of the head (28).

To determine the minimum individual dietary diversity (IDDS) of the child, the caretaker of the child was asked about all foods and drinks the child consumed in the previous 24 hours of data collection. Then, using the Food and Nutrition Technical Assistance (FANTA) individual dietary diversity assessment tool, all foods consumed by the child were classified into eight food groups for children aged 6 to 23 months and nine food groups for children aged 23 months and older (29).

#### **4.8 Data collection and procedures**

Three nurses who had graduated with a Bachelor of Nursing degree were trained as data collectors for three days. The training was about how to conduct interviews, questionnaire content, and how to do anthropometric measurements. The training involved demonstrations and lecturing. There was one supervisor who was qualified with a Bachelor's degree in Public Health and who was already trained in the care and treatment of HIV-infected children. The data was collected by using a structured pretested questionnaire. A structured questionnaire prepared in English was translated into Amharic and re-translated back to the English language to maintain its consistency and facilitate understanding. All the required information was collected in three ways. Firstly, through an interviewer-administered structured questionnaire. Secondly, the most recent laboratory and clinical measurements were determined by recording from the selected records of ART cards, intake, and follow-up forms, and the ART log-book of HIV-positive children, and finally, during their visits, the anthropometric measurements of the children.

#### **4.9 Operational definitions**

1. **Under nutrition:** - defined as the child having either of height-for-age Z-scores of  $< -2$  SD or weight-for-age Z-score is  $< -2$  SD or weight-for-height Z-score is  $< -2$  SD (30).
2. **Stunting:** - if the child's the length/height-for-age Z-scores of  $< -2$  SD of the median WHO reference values (30).
3. **Wasting:** - if the child's weight-for-length/height Z-score is  $< -2$  SD from the median WHO reference value (30).

4. **Adherence:** - The level of compliance to taking ART medications by the patients during ART care (31).
5. **Good Adherence:** - Drug adherence of 95% or  $\leq 2$  missed drug doses of 30 doses or  $< 3$  missed drug doses of 60 doses (31).
6. **Fair Adherence:** - Drug adherence of 85–94% or 3–5 missed drug doses of 30 doses or 4–9 missed drug doses of 60 doses (31).
7. **Poor Adherence:** - Drug adherence of  $< 85\%$  or  $\geq 6$  doses of missed ART drug doses of 30 doses or  $> 9$  doses missed ART drug doses of 60 doses (31).
8. **Dietary diversity score (DDS):** - is defined as the number of food groups consumed by the child the previous day (32).
  - DDS of four is considered the minimum (borderline) DDS.
  - A child with a DDS  $< 4$  is classified as having low dietary diversity
  - DDS  $> 4$  is classified as adequate dietary diversity.

#### **4.10 Data quality control and management**

Before the important data collection time commenced, the data collection instrument (questionnaire) was pretested on a 5% sample size to check for clarity, consistency, validity, and applicability. And after pre-testing the questionnaire, all doubtful, misleading, and wrongly interpreted questions were omitted and revised. Data collectors and principal investigators checked the collected data for its completeness and consistency during and after data collection and entry.

#### **4.11 Data processing and analysis**

##### **4.11.1 Data processing**

The consistency and completeness of the collected data were examined during data processing and analysis. The collected data was checked, coded, and entered into Epi Data 4.6 and exported to SPSS (Statistical Package for Social Science) version 26 for analysis. To calculate the anthropometric indices using the indicators of height-for-age (HAZ) and weight-for-height (WHZ), anthropometric data was entered into WHO Anthro (for those children less than 5 years) and Anthro plus (for children 5–15 years) software version 3.2.2.

#### **4.11.2 Data analysis**

The processed data was analyzed using descriptive statistics. Descriptive statistics, including frequencies, percentages, and summary statistics (mean and SD) and figures, were used to describe the independent variables in relation to the outcome variables.

The bivariate logistic regression was computed for each independent variable and dependent variable. A multivariable logistic regression model was used to control the effects of confounders and identify significant factors. In the multi-variable analysis, variables were considered statistically significant when the p-value was less than 0.05 at 95% CIs. Model fitness was checked by using the Hosmer-Lemeshow goodness of fit test.

Finally, the strength and direction of association between independent and dependent variables was assessed using crude and adjusted odds ratios together with their corresponding 95% confidence intervals.

#### **4.12 Ethical consideration**

Initially, the proposal was ethically approved and a letter of cooperation was received from the Addis Ababa Public Health and Emergency Management Directorate. An official letter was submitted to each selected hospital to obtain permission. Before data collection, the ART clinic focal person and medical record officer communicated, and therefore, the purpose and objectives of the study were clearly explained to each sample population (child & caregiver) to obtain their verbal consent, and the data collectors allowed the caretakers or children consenting or rejecting to take part in the study before the data collection. Participants' confidentiality was strictly maintained during the data collection process, during data processing, and report writing. Study participants' names and other identification numbers were eliminated throughout the process to keep up confidentiality..

#### **4.13 Dissemination of results**

The findings of this study were submitted to SPHMMC of the health science department of public health and Addis Ababa Public Health and Emergency Management Directorate. The results of this study will be sent to professional associations. The result can be used for health care activities by the government and other relevant sectors. And eventually, efforts will continue to publish the paper.

## 5 Result

### 5.1 Study participants' socioeconomic and demographic characteristics

A total of 419 participants were included, with a response rate of 91.3%, of whom 226 (53.9%) were females. Most of the participants 262, 62.5%) were in the age group of 120–180 months, with a mean age of 123.62 months (SD  $\pm$  43.19). All the participants were urban dwellers. Nearly one-third 123 (29.4%) of children have lost either a father or mother, or both, and 311 (74.2%) of caretakers were married. Among the caretakers, almost all were females 383 (91.4%), with the majority of them 261 (62.3%), being aged between 35 and 49 years. 170 (40.6%) were non-governmental workers, and more than two-thirds 171 (40.8%) of the study participants' families earn less than 1,500 ETB/month. Among the caretakers, 79 (18.9%) were completed college and above. Results from the study also showed 177 (42.2%) households had over four family members.

Table 2:- Socio-demographic characteristics of HIV-Infected children and caregiver on Follow- up at ART Clinic in three referral hospitals, Addis Ababa, Ethiopia, 2022.

| Variables                              | Categories        | frequency | Percentage (%) |
|----------------------------------------|-------------------|-----------|----------------|
| Age of child                           | < 60 months       | 42        | 10.1           |
|                                        | 60-120 months     | 115       | 27.4           |
|                                        | 120-180 months    | 262       | 62.5           |
| Sex of the child                       | Female            | 193       | 46.1           |
|                                        | Male              | 226       | 53.9           |
| Child residence                        | Urban             | 419       | 100            |
|                                        | Rural             | 0         | 0              |
| Parental living status                 | Both alive        | 296       | 70.6           |
|                                        | Mother died       | 25        | 6.0            |
|                                        | Father died       | 60        | 14.3           |
|                                        | Both died         | 38        | 9.1            |
| Caretaker relation with the child      | parents           | 387       | 92.4           |
|                                        | Sister/brother    | 9         | 2.1            |
|                                        | Aunt/ankle        | 18        | 4.3            |
|                                        | Grandparents      | 5         | 1.2            |
| Marital status of parents or caregiver | Single            | 11        | 2.6            |
|                                        | Married           | 311       | 74.2           |
|                                        | Divorced          | 23        | 5.5            |
|                                        | Widowed/separated | 74        | 17.7           |
| Caregiver sex                          | Female            | 383       | 91.4           |
|                                        | Male              | 36        | 8.6            |
| Age of caregiver (years)               | 15-24             | 5         | 1.2            |

|                                     |                     |     |      |
|-------------------------------------|---------------------|-----|------|
|                                     | 25-34               | 144 | 34.4 |
|                                     | 35-49               | 261 | 62.3 |
|                                     | ≥ 50                | 9   | 2.1  |
| Caregiver occupation                | Governmental        | 74  | 17.7 |
|                                     | Non-governmental    | 170 | 40.6 |
|                                     | Merchant            | 160 | 38.2 |
|                                     | Daily laborer       | 15  | 3.6  |
| Monthly income of care taker in ETB | < 1,500             | 171 | 40.8 |
|                                     | 1,500-3,000         | 70  | 16.7 |
|                                     | ≥ 3,000             | 178 | 42.5 |
| Family size                         | < 4                 | 242 | 57.8 |
|                                     | ≥ 4                 | 177 | 42.2 |
| Caretaker educational level         | No formal education | 108 | 25.8 |
|                                     | Primary education   | 130 | 31.0 |
|                                     | Secondary education | 102 | 24.3 |
|                                     | College and above   | 79  | 18.9 |

## 5.2 Clinical and related characteristics of study participants

Among the HIV-positive children, more than half had known their HIV status 226 (53.9%) and started on HAART 221 (52.7%) were below 60-months of age. Almost all children 412 (98.3%) had no history of hospital admission in the past six months, and most of the study participants 390 (93.1%) were currently found in WHO clinical stage one and two. About 19 (4.5%) had opportunistic infections in the past six months. Of these children, 11 (57.9%) had persistent diarrhea  $\geq 2$  weeks in the past six months. According to the review of follow-up cards, the majority of children 363 (86.6%) and 405 (96.7%) were not taking cotrimoxazole and isoniazide prophylaxis. Only 29 (6.9%) HIV-positive children were on second-line ART regimen and most of children 369 (88.1%) had good adherence during their most recent follow-up. All participants had no ARV-drug toxicity in the past six months. One-fourth 116 (27.7%) of children had eating problem in the past six months, of them majority of the children 89 (80.2%) had loss of appetite.

Table 3: - Clinical factors of HIV-Infected children on Follow- Up at ART Clinic in three referral hospitals, Addis Ababa Ethiopia, 2022.

| Variables                                            | Categories                                    | frequency | Percentage (%) |
|------------------------------------------------------|-----------------------------------------------|-----------|----------------|
| Caregiver HIV status                                 | Negative                                      | 19        | 4.5            |
|                                                      | positive                                      | 386       | 92.1           |
|                                                      | unknown                                       | 14        | 3.3            |
| Caregiver on HAART                                   | No                                            | 33        | 7.9            |
|                                                      | Yes                                           | 386       | 92.1           |
| Age at first diagnosis                               | < 60 months                                   | 226       | 53.9           |
|                                                      | 60-120 months                                 | 108       | 25.8           |
|                                                      | 20-180 months                                 | 85        | 20.3           |
| Age at HAART started                                 | < 60 months                                   | 221       | 52.7           |
|                                                      | 60-120 months                                 | 113       | 27             |
|                                                      | 20-180 months                                 | 85        | 20.3           |
| History of hospital admission in the past six months | No                                            | 412       | 98.3           |
|                                                      | Yes                                           | 7         | 1.7            |
| Current WHO clinical stage                           | Stage I, II                                   | 390       | 93.1           |
|                                                      | Stage III, IV                                 | 29        | 6.9            |
| Opportunistic infection in the last six (6) months   | No                                            | 400       | 95.5           |
|                                                      | Yes                                           | 19        | 4.5            |
| Types of opportunistic infection                     | TB                                            | 5         | 26.3           |
|                                                      | Recurrent oral lesion                         | 0         | 0              |
|                                                      | Oesophageal candidiasis                       | 0         | 0              |
|                                                      | Diarrhea $\geq$ 2 weeks over the past 2-weeks | 11        | 57.9           |
|                                                      | Pneumonia                                     | 3         | 15.8           |
| Current viral load (copies/ml)                       | < 1,000                                       | 406       | 96.6           |
|                                                      | $\geq$ 1,000                                  | 13        | 3.1            |
| Taking Cotri-moxazole prophylaxis                    | No                                            | 363       | 86.6           |
|                                                      | Yes                                           | 56        | 13.4           |
| Taking INH prophylaxis                               | No                                            | 405       | 96.7           |
|                                                      | Yes                                           | 14        | 3.3            |
| Current ART regimen                                  | First-line                                    | 390       | 93.1           |
|                                                      | Second-line                                   | 29        | 6.9            |
| ARV drug adherence in the last 6-months              | Poor                                          | 13        | 3.1            |
|                                                      | Fair                                          | 37        | 8.8            |
|                                                      | Good                                          | 369       | 88.1           |
| ARV-drugs toxicity in the last 6-months              | No                                            | 419       | 100            |
|                                                      | Yes                                           | 0         | 0              |
| Eating problems in the past 6-months                 | No                                            | 303       | 72.3           |
|                                                      | Yes                                           | 116       | 27.7           |
| Types of eating disorder                             | Loss of appetite                              | 89        | 80.2           |
|                                                      | Swallowing difficulty                         | 13        | 11.7           |
|                                                      | Nausea/Vomiting                               | 9         | 8.1            |

### 5.3 HIV-infected children's nutritional and dietary factors

Almost half of children and their caretakers 192 (45.8%) report that they didn't receive nutritional counseling and 56 (13.4%) of those children have been taking nutritional therapy from the hospitals. Almost an equal proportion of children had poor 136 (32.5%), borderline 143 (34.1%), and good 140 (33.4%) individual dietary diversity scores.

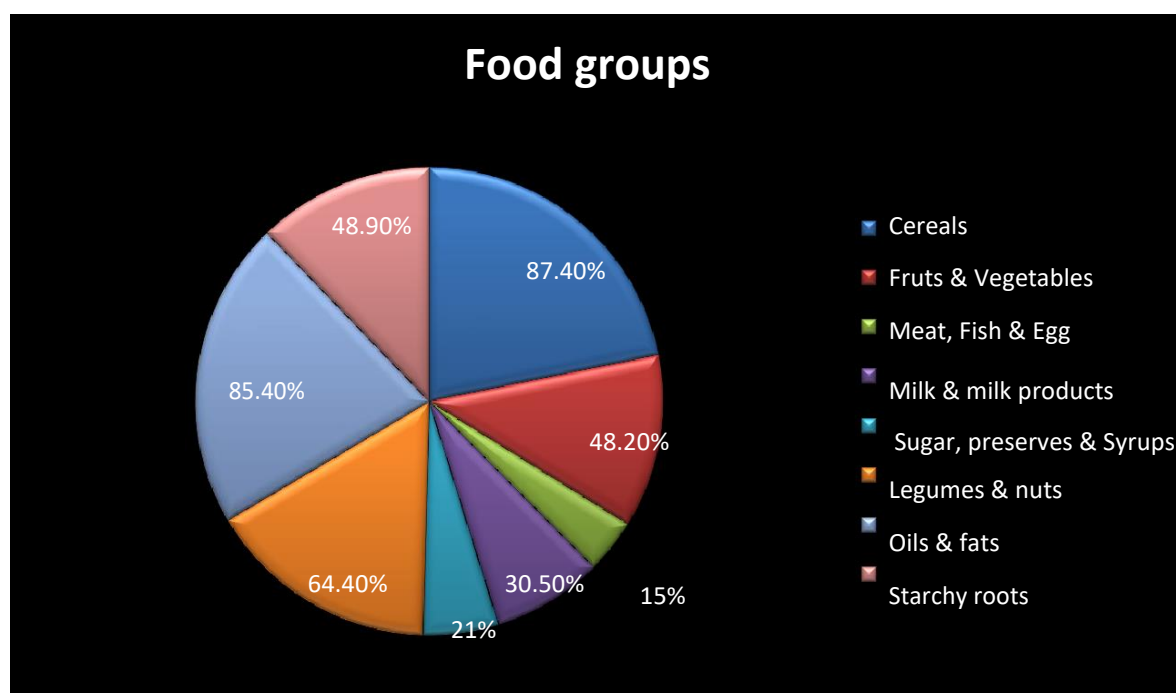


Figure 3: Food groups consumed by the HIV-positive children on follow-up in the previous 24-hr of the data collection time at the selected three referral hospitals Addis Ababa, Ethiopia, 2022.

Table 4:- Nutritional related factors of children on Follow-up at ART Clinic in three referral hospitals, Addis Ababa Ethiopia, 2022.

| Variables                              | Categories           | Frequency | Percentage |
|----------------------------------------|----------------------|-----------|------------|
| Nutritional counseling in the hospital | No                   | 192       | 45.8       |
|                                        | Yes                  | 227       | 54.2       |
| Currently on nutritional therapy       | No                   | 363       | 86.6       |
|                                        | Yes                  | 56        | 13.4       |
| Types of nutritional therapy           | Plumpynut            | 56        | 100        |
|                                        | Therapeutic milk     | 0         | 0          |
| Individual dietary diversity score     | Poor (low)           | 136       | 32.5       |
|                                        | Borderline (minimum) | 143       | 34.1       |
|                                        | Good (adequate)      | 140       | 33.4       |

## 5.4 Magnitude of under-nutrition

The magnitude of stunting (HAZ<-2SD) and wasting (BAZ<-2SD) among the HIV-positive under-15-age children was 109 [26% (95% CI: 21.7-30.3)] and 83 [19.8% (95% CI: 16.0-23.6)], respectively. The highest level of stunting, 74 (67.9%), was observed in the age group of 120–180 months. Almost two-thirds of stunting was observed among male children 67 (61.5%). Similar to stunting, wasting is also predominant in the aged group of 120–180 months, 56 (67.5%), with the highest proportion in males, 48 (57.8%).

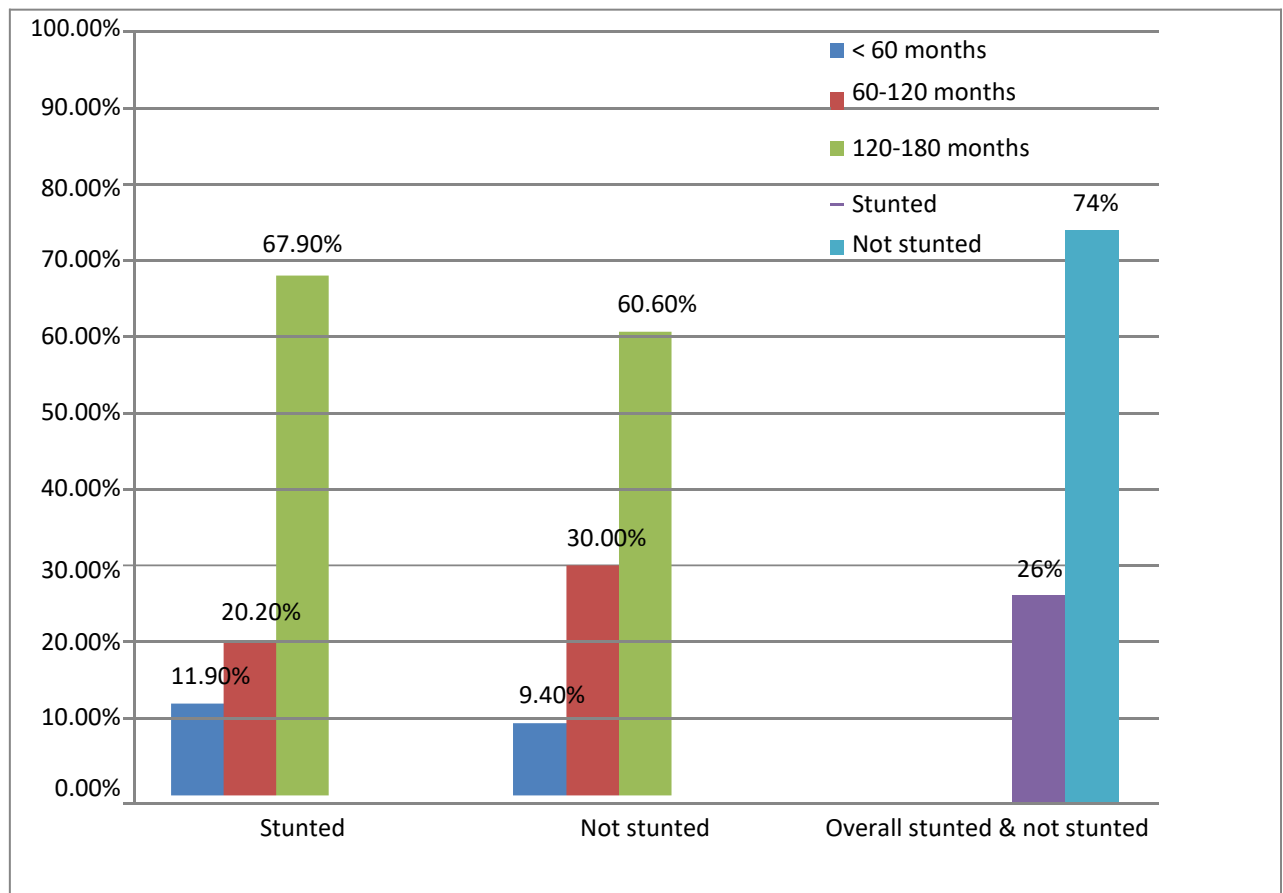


Figure 4: Magnitude of stunting among HIV-positive under-15 aged children in selected referral hospital in Addis Ababa, Ethiopia. (n=419)

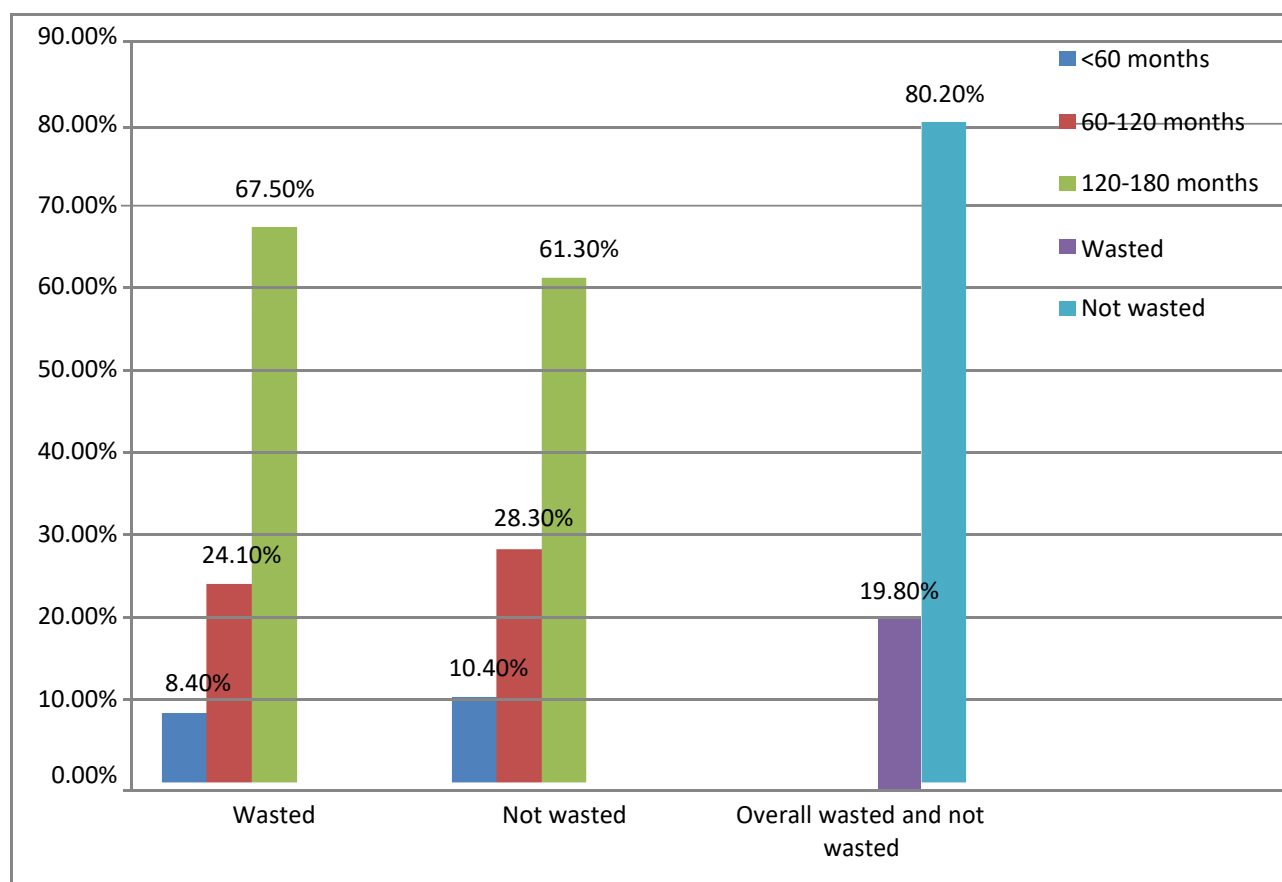


Figure 5: Magnitude of wasting among HIV-positive under-15 aged children in selected referral hospital in Addis Ababa, Ethiopia. (n=419)

## 5.5 Factors associated with undernutrition

### 5.5.1 Factors associated with stunting

In bi-variable logistic regression analysis, age of child, sex, parental living status, marital status, caretaker's age, income, family size, education, caretaker's HIV status, opportunistic infection, viral load, CTM prophylaxis, ART-regimen, ARV-drug adherence, eating problems, counseling, and IDD score were factors with  $p\text{-value} \leq .25$ . All independent variables with a  $p\text{-value} \leq .25$  on bi-variable analysis were moved to multi-variable logistic regression analysis to control the possible potential confounding variables, and those variables with a  $p\text{-value} 0.05$  were considered significantly associated with stunting.

The study findings show that children living with both parents were 71% less likely to be undernourished than those with both parents died [**AOR=0.29 95% CI: 0.09-0.88**]. When it comes to marital status, children whose mothers are single have 96.5% [**AOR = 0.035, 95% CI: 0.00-0.69**] lower odds of developing stunting, while children whose caretakers are

married have 96.0% **[AOR = 0.04, 95% CI: 0.01-0.14]** lower odds of developing stunting than those whose caretakers have lost their partner. Children living in households with a family size < 4 members were 81% less likely to be stunted than those living in households with  $\geq 4$  family members **[AOR = 0.19, 95% CI: 0.09-0.38]**. The odds of stunting were about 13-times more in children who consumed poor diversified food as compared to those who had good diversified food **[AOR = 13.27, 95% CI: 5.57-31.61]**. Additionally, children whose caretakers had no formal education had 2.8 times higher odds of developing wasting **[AOR = 2.88, 95% CI 1.06-7.85]** than caretakers with a complete college education and above education level.

Table 5: Factor associated with stunting among HIV-positive under-15 children at selected referral hospitals in Addis Ababa Ethiopia, 2022.

| Predictor variables  | Categories      | Stunting  |            | COR (95%)          | AOR (95%)                  | P-value        |
|----------------------|-----------------|-----------|------------|--------------------|----------------------------|----------------|
|                      |                 | Yes (%)   | No (%)     |                    |                            |                |
| Age (months)         | < 60            | 13 (11.9) | 29 (9.4)   | 1.14 (0.56, 2.31)  | 1.35 (0.15, 12.03)         | 0.792          |
|                      | 60-120          | 22 (20.2) | 93 (30)    | 0.6 (0.35, 1.03)   | 0.55 (0.27, 1.14)          | 0.110          |
|                      | 120-180         | 74 (67.9) | 188 (60.6) | 1                  | 1                          |                |
| Sex                  | Female          | 42 (38.5) | 151 (48.7) | 0.66 (0.42, 1.03)  | 0.63 (0.35, 1.12)          | 0.115          |
|                      | Male            | 67(61.5)  | 159 (51.3) | 1                  | 1                          |                |
| Living status        | Both alive      | 66 (60.6) | 230 (74.2) | 0.49 (0.24, 1.00)  | <b>0.29 (0.09, 0.88)</b>   | <b>0.029**</b> |
|                      | Mother died     | 7 (6.4)   | 18 (5.8)   | 0.67 (0.22, 1.99)  | 0.23 (0.03, 1.60)          | 0.138          |
|                      | Father died     | 22 (20.2) | 38 (12.3)  | 0.99 (0.43, 2.31)  | 0.57 (0.17, 1.92)          | 0.364          |
|                      | Both died       | 14 (12.8) | 24 (7.7)   | 1                  | 1                          |                |
| Marital status       | Single          | 6 (5.5)   | 5 (1.6)    | 1.67 (0.47, 5.95)  | <b>0.035 (0.00, 0.69)</b>  | <b>0.027**</b> |
|                      | Married         | 62 (56.9) | 249 (80.3) | 0.35 (0.20, 0.59)  | <b>0.042 (0.013, 0.14)</b> | <b>0.000**</b> |
|                      | Divorced        | 10 (9.2)  | 13 (4.2)   | 1.07 (0.42, 2.75)  | 0.182 (0.05, 0.72)         | 0.015          |
|                      | Widowed         | 31 (28.4) | 43 (13.9)  | 1                  | 1                          |                |
| Caretaker' Age       | 15-24 years     | 3 (2.8)   | 2 (0.6)    | 1.88 (0.20, 17.27) | 6.86 (0.11, 436.82)        | 0.364          |
|                      | 25-34 years     | 46 (42.2) | 98 (31.6)  | 0.59 (0.15, 2.29)  | 1.06 (0.08, 14.76)         | 0.965          |
|                      | 35-49 years     | 56 (51.4) | 205 (66.1) | 0.34 (0.09, 1.31)  | 1.76 (0.13, 23.01)         | 0.668          |
|                      | $\geq 50$ years | 4 (3.7)   | 5 (1.6)    | 1                  | 1                          |                |
| Monthly income       | <1,500          | 55 (50.5) | 116 (37.4) | 1.87 (1.15, 3.04)  | 1.23 (0.63, 2.40)          | 0.552          |
|                      | 1,500-3,000     | 18 (16.5) | 52 (16.8)  | 1.37 (0.71, 2.61)  | 1.26 (0.45, 3.51)          | 0.661          |
|                      | >3,000          | 36 (33)   | 142(45.8)  | 1                  | 1                          |                |
| Family size          | < 5             | 53 (48.6) | 189 (61)   | 0.61 (0.39, 0.94)  | <b>0.19 (0.09, 0.38)</b>   | <b>0.000**</b> |
|                      | $\geq 5$        | 56 (51.4) | 121(39)    | 1                  | 1                          |                |
| Education            | Non-formal      | 47 (43.1) | 61 (19.7)  | 3.03 (1.56, 5.92)  | <b>2.88 (1.06,7.85)</b>    | <b>0.038**</b> |
|                      | Primary         | 30 (27.5) | 100 (32.3) | 1.18 (0.6, 2.34)   | 1.68(0.65, 4.33)           | 0.286          |
|                      | Secondary       | 16 (14.7) | 86 (27.7)  | 0.73 (0.34, 1.58)  | 1.35(0.47, 3.86)           | 0.582          |
|                      | College&above   | 16 (14.7) | 63 (20.3)  | 1                  | 1                          |                |
| Caretaker HIV status | Negative        | 7 (6.4)   | 12 (3.9)   | 0.23 (0.05, 1.03)  | 0.82 (0.06, 10.41)         | 0.876          |
|                      | Positive        | 92 (84.4) | 294 (94.8) | 0.13 (0.13, 0.41)  | 0.18 (0.02, 2.11)          | 0.172          |
|                      | Unknown         | 10 (9.2)  | 4 (1.3)    | 1                  | 1                          |                |
| OI                   | No              | 97 (89)   | 303 (97.7) | 0.19 (0.07, 0.49)  | 0.21 (0.04, 1.14)          | 0.071          |
|                      | Yes             | 12 (11)   | 7 (2.3)    | 1                  | 1                          |                |
| Viral load           | <1000           | 101       | 305 (98.4) | 0.21 (0.07, 0.65)  | 0.57 (0.09, 3.62)          | 0.55           |

|                    |             |           |            |                    |                            |                |
|--------------------|-------------|-----------|------------|--------------------|----------------------------|----------------|
| copies/ml          | ≥ 1000      | 8 (7.3)   | 5 (1.6)    | 1                  | 1                          |                |
| CTM prophylaxis    | No          | 90 (82.6) | 273 (88.1) | 0.64 (0.35, 1.17)  | 1.57 (0.19, 12.69)         | 0.673          |
|                    | Yes         | 19 (17.4) | 37 (11.9)  | 1                  | 1                          |                |
| ART regimen        | First line  | 98 (89.9) | 292 (94.2) | 0.55 (0.25, 1.20)  | 0.75 (0.25, 2.27)          | 0.609          |
|                    | Second line | 11 (10.1) | 18 (5.8)   | 1                  | 1                          |                |
| ARV-drug Adherence | Poor        | 8 (7.3)   | 5 (1.6)    | 5.19 (1.65, 16.26) | 0.47 (0.06, 3.69)          | 0.469          |
|                    | Fair        | 14 (12.8) | 23 (7.4)   | 1.97 (0.97, 3.99)  | 1.37 (0.51, 3.67)          | 0.537          |
|                    | Good        | 87 (79.8) | 282 (91)   | 1                  | 1                          |                |
| Eating problems    | No          | 71 (65.1) | 232 (74.8) | 0.63 (0.39, 1.01)  | 0.83 (0.38, 1.82)          | 0.642          |
| Counseling         | Yes         | 38 (34.9) | 78 (25.2)  | 1                  | 1                          |                |
|                    | No          | 59 (54.1) | 133 (42.9) | 1.57 (1.01, 2.44)  | 1.63 (0.92, 2.89)          | 0.095          |
| IDD                | Yes         | 50 (45.9) | 177 (57.1) | 1                  | 1                          |                |
|                    | Poor (low)  | 61 (56)   | 75 (24.2)  | 8.68 (4.39, 17.15) | <b>13.27 (5.57, 31.61)</b> | <b>0.000**</b> |
|                    | Borderline  | 36 (33)   | 107 (34.5) | 3.59 (1.78, 7.24)  | 4.97 (2.12, 11.66)         | 0.000          |
|                    | Good        | 12 (11)   | 128 (41.3) | 1                  | 1                          |                |

**\*\* Significant at p-Value less than 0.05**

**“ 1 ” indicate Reference category**

## 5.5.2 Factors associated with wasting

Living status of parents, caretaker relation with child, marital status, occupation, monthly income, education, caretaker's HIV-status, opportunistic infection, viral load, ART regimen, ARV-drug adherence, eating disorder, counseling, and individual dietary diversity were found to be eligible for multi-variable analysis. After adjusting for potentially confounding variables using multi-variable logistic regression, the living status of parents, ART regimen, eating problems, counseling, and individual dietary diversity were found to be significantly associated with wasting.

Children whose both parents were alive were found to be 72.0% [**AOR = 0.28 95% CI: 0.11-0.73**] less likely to be wasted as compared to children whose both parents died. When compared to their counterparts, children on first-line ART had an 81% lower risk of wasting [**AOR = 0.19, 95% CI: 0.07-0.48**]. As compared to children who had an eating problem in the past six months, children who had no eating problem had 65% [**AOR=0.35 95% CI: 0.17-0.71**] lower odds of being wasted. The odds of wasting among children whose caregivers didn't get nutritional counseling were 2.1 times higher [**AOR = 2.10 95% CI: 1.14-3.89**] compared to their counterparts. The odds ratio showed that children who had poor dietary diversity were 5.3 times more likely to develop wasting than children who had good dietary diversity [**AOR = 5.3 95% CI: 2.27-12.35**].

Table 6: Factor associated with wasting among HIV-positive under-15 children at selected referral hospitals in Addis Ababa Ethiopia, 2022.

| Predictor variables    | Categories      | Wasting   |            | COR (95%)           | AOR (95%)                | P-value        |
|------------------------|-----------------|-----------|------------|---------------------|--------------------------|----------------|
|                        |                 | Yes (%)   | No (%)     |                     |                          |                |
| Living status          | Both alive      | 46 (55.4) | 250 (74.4) | 0.39 (0.19, 0.85)   | <b>0.28 (0.11, 0.73)</b> | <b>0.009**</b> |
|                        | Mother died     | 7 (8.4)   | 18 (5.4)   | 0.84 (0.28, 2.55)   | 0.57 (0.13, 2.62)        | 0.472          |
|                        | Father died     | 18 (21.7) | 42 (12.5)  | 0.93 (0.39, 2.24)   | 0.67 (0.23, 1.97)        | 0.461          |
|                        | Both died       | 12 (14.5) | 26 (7.7)   | 1                   |                          |                |
| Caretaker relation     | Parents         | 66 (79.5) | 317 (94.3) | 0.88 (0.09, 8.02)   | 2.34 (0.03, 214.50)      | 0.712          |
|                        | Sister/brother  | 5 (6)     | 4 (1.2)    | 5.00 (0.39, 64.39)  | 3.52 (0.02, 573.10)      | 0.628          |
|                        | Aunt/Uncle      | 7 (8.4)   | 11 (3.3)   | 2.55 (0.23, 27.71)  | 3.18 (0.03, 335.98)      | 0.627          |
|                        | Grandparents    | 1 (1.2)   | 4 (1.2)    | 1                   |                          |                |
| Marital status         | Single          | 5 (6)     | 6 (1.8)    | 3.28 (0.88, 12.21)  | 1.09 (0.08, 14.33)       | 0.943          |
|                        | Married         | 58 (69.9) | 253 (75.3) | 0.90 (0.48, 1.70)   | 0.92 (0.41, 2.06)        | 0.834          |
|                        | Divorced        | 5 (6)     | 18 (5.4)   | 1.09 (0.35, 3.42)   | 0.55 (0.11, 2.73)        | 0.462          |
|                        | Widowed         | 15 (18.1) | 59 (17.6)  | 1                   |                          |                |
| Occupation             | Government      | 10 (12)   | 64 (19)    | 0.31 (0.09, 1.11)   | 0.89 (0.175, 4.51)       | 0.886          |
|                        | Non-government  | 27 (32.5) | 143 (42.6) | 0.38 (0.12, 1.19)   | 0.98 (0.23, 4.29)        | 0.983          |
|                        | Merchant        | 41 (49.4) | 119 (35.4) | 0.69 (0.22, 2.14)   | 1.65 (0.39, 7.01)        | 0.501          |
|                        | Daily laborer   | 5 (6)     | 10 (3)     | 1                   |                          |                |
| Monthly income         | <1,500          | 49 (59)   | 122 (36.3) | 3.00 (1.71, 5.27)   | 1.95 (0.94, 4.07)        | 0.075          |
|                        | 1,500-3,000     | 13 (15.7) | 57 (17)    | 1.71 (0.80, 3.63)   | 0.79 (0.28, 2.22)        | 0.656          |
|                        | >3,000          | 21 (25.3) | 157 (46.7) | 1                   |                          |                |
| Education              | Non-formal      | 31 (37.3) | 77 (22.9)  | 2.04 (0.99, 4.23)   | 0.99 (0.34, 2.96)        | 0.994          |
|                        | Primary         | 25 (30.1) | 105 (31.3) | 1.21 (0.58, 2.53)   | 1.14 (0.42, 3.08)        | 0.797          |
|                        | Secondary       | 14 (16.9) | 88 (26.2)  | 0.81 (0.36, 1.83)   | 0.84 (0.28, 2.47)        | 0.748          |
|                        | College & above | 13 (15.7) | 66 (19.6)  | 1                   |                          |                |
| Opportunistic          | No              | 70 (84.3) | 330 (98.2) | 0.09 (0.04, 0.27)   | 0.28 (0.08, 1.01)        | 0.053          |
|                        | Yes             | 13 (15.7) | 6 (1.8)    | 1                   |                          |                |
| Viral load (copies/ml) | <1000           | 77 (92.8) | 329 (97.9) | 0.27 (0.09, 0.84)   | 1.41 (0.31, 6.47)        | 0.655          |
|                        | ≥1000 l         | 6 (7.2)   | 7 (2.1)    | 1                   |                          |                |
| ART regimen            | First line      | 66 (79.5) | 324 (96.4) | 0.14 (0.07, 0.32)   | <b>0.19 (0.07, 0.48)</b> | <b>0.001*</b>  |
|                        | Second line     | 17 (20.5) | 12 (3.6)   | 1                   |                          |                |
| ARV-drug Adherence     | Poor            | 9 (10.8)  | 4 (1.2)    | 11.14 (3.33, 35.98) | 1.39 (0.21, 9.07)        | 0.734          |
|                        | Fair            | 12 (14.5) | 25 (7.4)   | 2.38 (1.13, 4.98)   | 2.06 (0.78, 5.43)        | 0.143          |
|                        | Good            | 62 (74.7) | 307 (91.4) | 1                   |                          |                |
| Eating disorder        | No              | 45 (54.2) | 258 (76.8) | 0.36 (0.22, 0.59)   | <b>0.35 (0.17, 0.71)</b> | <b>0.004**</b> |
|                        | Yes             | 38 (45.8) | 78 (23.2)  | 1                   |                          |                |
| Counseling             | No              | 45 (54.2) | 147 (43.8) | 1.52 (0.94, 2.47)   | <b>2.10 (1.14, 3.89)</b> | <b>0.018*</b>  |
|                        | Yes             | 38 (45.8) | 189 (56.3) | 1                   |                          |                |
| IDD                    | Poor (low)      | 46 (55.4) | 90 (26.8)  | 4.6 (2.39, 8.87)    | <b>5.3 (2.27, 12.35)</b> | <b>0.000*</b>  |
|                        | Borderline      | 23 (27.7) | 120 (35.7) | 1.73 (0.85, 3.51)   | 1.86 (0.77, 4.47)        | 0.165          |
|                        | Good (adequate) | 14 (16.9) | 126 (37.5) | 1                   |                          |                |

\*\* Significant at p-Value less than 0.05

'1' indicate Reference category

## 6 Discussion

Undernutrition is a critical condition that has a significant effect on the progression and survival of HIV-infected individuals. This study attempted to assess the magnitude and factors associated with undernutrition (wasting and stunting) among HIV-infected children. The result of this study showed that stunting and wasting were 26% and 19.8%, respectively.

The level of stunting was low compared to the study conducted in South India (58%) (17), Tanzania (36.6%) (19), East Africa (49.7%) (18) and Hawassa (60.2%) (22). The magnitude of stunting is also in line with the study conducted in Eastern Ethiopia (24.7%) (20), Ghana (28%) (11). But, it is of a higher magnitude when compared to Southern Ethiopia (5.5%) (21) and Adama (13.4%) (23). The sources of discrepancy for both higher and lower prevalence might be due to differences in age categories of the source population, socio-economic characteristics of participants and study setting, sample size differences, and differences in study design.

On the other hand, the magnitude of wasting was comparable with the Amhara region (19.2%) (5), Hawassa (21.4%) (22) and Adama (21.8%) (23). There was a slightly higher magnitude of wasting compared to the studies conducted in Ghana (13%) (11), South India (16%) (17) and Tanzania (13.6%) (19). but lower than the study conducted in East Africa (24.65) (18). Southern Ethiopia (36.3%) (21) and Eastern Ethiopia (28.2%) (20). The difference could be attributed to clinical differences such as the presence of opportunistic infections, particularly persistent diarrhea and recurrent oral lesions in the previous six months, and a relatively higher number of children found in advanced WHO clinical stages by study conducted in Southern Ethiopia and Eastern Ethiopia, respectively.

According to this study, children who had poor individual dietary diversity had significantly associated with undernutrition. This result is equivocal with studies conducted in the Amhara region (5) and Eastern Ethiopia (20). This might be due to the fact that an inadequate and undiversified diet leads to undernutrition and, in turn, predisposes to opportunistic infection and severe disease (10).

The odds of having undernutrition were higher in children whose caretakers had not received nutritional counseling compared to those who had received nutritional counseling. This finding was supported by other studies (5). This might be due to the fact that those caretakers

who have had routine nutritional counseling will have a positive attitude toward dietary diversity, significantly improving the dietary consumption and feeding practices of the child.

Similarly, those children who had an eating problem were more likely to be wasted than those who did not have an eating problem. This finding is in line with a study conducted in Adama Hospital (23). This is because eating problems like loss of appetite decrease food intake, which leads to a failure to attain recommended nutrient intake. Low food intake combined with increased energy demands are the major factors in HIV-related weight loss and wasting (7).

In this study, family size was significantly associated with undernutrition. Children living in households with a family size  $\geq 4$  members were more likely to be undernourished than those living in households with less than 4 family members. This finding was similarly reported in a study conducted in Amhara region hospitals (5). The possible justification may be due to high family members decreasing the per capita human input, child bearing, and having limited access to adequate and diversified nutritious foods.

The odds of wasting among children who were on first-line ART regimens were lower compared to their counterparts. No previous study supports this finding. This is most likely due to the presence of a high viral load which in turn leads to opportunistic infection (eating problems) in children on second-line ARV drug regimens, which can result in undernutrition.

Similar to one study (21), caretakers' education level was statistically significant with undernutrition. Children whose caretakers had no formal education have higher odds of developing undernutrition than caretakers with a complete college education and an above-average educational level. The reason for this might be that educated caretakers are more likely to have higher-paying jobs and income and are more receptive and aware of child nutrition and can practice it.

In the present study, children living with both parents were less likely to be undernourished than those whose parents died. In fact, this is due to the fact that children living without two parents are more likely to be extremely poor, receive less social and medical care, and may have poor drug adherence.

Findings from this study also revealed that children whose caretakers had lost their partner (widowed) were more prone to undernutrition than compared to those married. There are no

previous studies that support this finding. This may be due to the fact that widowed parents may have less income and have less time to care for their children.

## **7 Limitation of the study**

Due to the presence of previous 24 hour food intake questions for the dietary assessment, it was prone to recall bias. And as the study used a single cross-sectional study, it didn't establish a cause and effect casual association between the dependent and independent variables..

## **8 Conclusion**

This study indicated that there is a high burden of wasting and a low magnitude of stunting when compared to the level of malnutrition in children in Ethiopia Mini Demographic and Health Survey (33). Parental living status, marital status, family size, caretaker educational level, and individual dietary diversity were found to be significantly associated with stunting. On the other hand, the living status of parents, ART regimen, eating disorder, counseling, and individual dietary diversity were found to be statistically significantly associated with wasting.

## **9 Recommendation**

### **For health facilities**

- Since dietary counseling is an integral part of treating malnutrition, the ART clinic should emphasize nutritional counseling and assess its adequacy and effectiveness.
- Include the assessment of IDDS and HDDS parameters in their nutritional counseling program.
- Give close attention to HIV-positive children who are on an ART second-line regimen.
- Improving the detection of clients with undernutrition and start nutritional therapy on time for those who required.
- Strengthening linkages of HIV-positive children who lost both parents with sub-city women, children and youth affairs and other stakeholders for financial support.

- Early identification and treatment of children with eating problems.

**Policy maker**

- Since underprivileged children are more prone to undernutrition, policy makers should make policy to address those children in their food and nutrition policy

**Researchers**

- Prospective study design will avoid the limitation of this study.

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## 11 Declaration

I, the undersigned, student declare that this research project is my original work in partial fulfillment of the requirements for master of public health in **public health nutrition**. I also declare that it has never been presented in this or any other higher institution and that all resources material used in the research work have been duly acknowledged.

Name of the student: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

### **Approval of advisors**

This research work has been submitted for examination with my approval.

#### **Approval of the Primary Advisor**

Name of the primary advisor: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

#### **Approval of the Co-Advisor**

Name of the co-advisor: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## 12 Annexes

### 12.1 Annex I: Participant information sheet form Saint Paul's millennium college

#### School of public health

You have been chosen as the participant in this study which is under-nutrition and its associated factors among HIV-positive under-15 age children on follow-up at pediatric ART clinic at referral hospitals in Addis Ababa. Please read carefully through all the information before deciding on your participation.

1. **Topic:** under-nutrition and its associated factors among HIV-positive under-15 age children on follow up at pediatric ART clinic at referral hospitals in Addis Ababa.
2. **Objective of the study:** the objective of the study is to assess the prevalence of undernutrition and associated factors among HIV-positive under-15 age children on follow-up at pediatric ART clinic in referral hospitals in Addis Ababa, Ethiopia.
3. **Participation procedure and guidelines:** you are expected to fill in some questionnaire and take the weight and height measurements of your child and it may take approximately 15-20minutes. All the information you give is anonymous and confidential.
4. **Participation benefit and risk:** you will be nutritionally advised and recommended by the ART focal person to have your child nutritional support based on your child's nutritional assessment. Your involvement in the study does not involve any risk.
5. **Study design:** health institution-based cross-sectional study from 04 July 2022 to 04 August 2022 G.C.
6. **Right to refuse or withdraw:** You may also refuse to answer any of the questions I ask you. And there will be no pressure to answer.
7. **Right as participants:** You will have the opportunity to discuss your participation and to debrief on the research once it has been conducted and analyzed.

Don't hesitate to ask me if you are not sure about anything mentioned above.

Bezaneh Belachew

Saint Paulo's millennium medical college, school of public health

Phone no. \_\_\_\_\_

Thank you.

## 12.2 Annex II: Participant information sheet form in Amharic

### የቅዱስ ጳውሎስ ሚሊኒየም ኮሌጅ

#### የህዝብ ጤና ትምህርት ቤት

በዚህ ጥናት ውስጥ በአመጋገብ ላይ የሚገኘው እና ተያያዥ ምክንያቶች በአዲስ አበባ ከተማ በተመረጡ የ ሪፈራል ሆስፒታሎች የህፃናት ART ክሊኒክ ክትትል በሚደረግላቸው በኤች አይ ቪ ከተያዙ ከ15 አመት በታች ህፃናት መካከል ተሳታፊ ሆነው ተመርጠዋል ። በተሳትፎ ላይ ውሳኔ ከማድረግዎ በፊት እባክዎ ሁሉንም መረጃ በጥንቃቄ ያንብቡ።

1. **ርዕስ:-** ከ15 አመት በታች ኤችአይቪ ፖዘቲቭ ሆነው በተመረጡ ሪፈራል ሆስፒታሎች የህፃናት ART ክሊኒክ ክትትል እያደረጉ ባሉ ህፃናት ላይ የተመጣጠነ ምግብ እጥረት እና በአመጋገብ ስር ያሉ እና ተያያዥ ምክንያቶች በአዲስ አበባ፣ ኢትዮጵያ 2014 ዓ.ም.
2. **ዓላማ:-** የጥናቱ ዓላማ ፡ በአዲስ አበባ፣ ኢትዮጵያ በተመረጡ የሪፈራል ሆስፒታሎች ውስጥ በሕፃናት ሕክምና ART ክሊኒክ ውስጥ በኤች አይ ቪ ቫይረስ የተያዙ ከ 15 ዓመት በታች የሆኑ ሕፃናት ከአመጋገብ በታች ያለውን ስርጭት እና ተያያዥ ምክንያቶችን ለመገምገም ነው።
3. **የተሳትፎ ሂደት እና መመሪያዎች :-** መጠይቁን እንዲሞሉ እና የልጁን የአመጋገብ ግምገማ ለመወሰን ዓላማ ያደረገ የልጅዎን ክብደት እና ቁመት ለመለካት እጠይቅዎታለሁ። ከ15-20 ደቂቃዎች ሊወስድ ይችላል። ሁሉም የሚሰጡት መረጃ የማይታወቅ እና ሚስጥራዊ ነው።
4. **የተሳትፎ ጥቅማጥቅሞች እና ስጋት:-** በአመጋገብ ምክር ይሰጥዎታል እና በልጅዎ የአመጋገብ ግምገማ መሰረት የልጅዎ ሐኪም የልጅዎን የአመጋገብ ድጋፍ እንዲያገኝ ይመክራሉ። በጥናቱ ውስጥ ያለዎት ተሳትፎ ምንም አይነት አደጋን አያካትትም።
5. **የጥናት ንድፍ:-** በጤና ተቋም ላይ የተመሰረተ አቋራጭ ጥናት ከሀምሌ 04 ቀን 2014 እስከ ነሐሴ 04 ቀን 2014 ዓ.ም።
6. **የተሳታፊው መብት:-** እንዲሁም የምጠይቃቸውን ማንኛውንም ጥያቄዎች ለመመለስ እምቢ ማለት ይችላሉ። እና መልስ ለመስጠት ምንም ግፊት አይኖርም።
7. **በጥናቱ ውስጥ ያለመሳተፍ መብት:-** ስለ እርስዎ ተሳትፎ ለመወያየት እና በጥናቱ ላይ አንድ ጊዜ ተካሂዶ እና ከተተነተነ በኋላ ለማብራራት እድል ይኖርዎታል።

ከላይ ስለተጠቀሰው ነገር እርግጠኛ ካልሆኑ እባክዎን እኔን ለመጠየቅ አያመንቱ።

ቤዛነህ በላቸው

ስልክ ቁጥር. \_\_\_\_\_

አመሰግናለሁ።

### 12.3 Annex III: Questionnaire by the English version

**General direction:-** please circle the appropriate code of the participants response number after reading carefully

Name of the hospital \_\_\_\_\_ Age in months \_\_\_\_\_

#### Part I:- Socio-demographic and economic characteristics

| No.  | Questions                                           | Categories                                                                                                             | Code                            | Skip |
|------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------|------|
| 1.1  | Age of child (in months)                            | < 60 months<br>60-120 months<br>120-180 months                                                                         | 1<br>2<br>3                     |      |
| 1.2  | Sex of the child                                    | Female<br>Male                                                                                                         | 0<br>1                          |      |
| 1.3  | Child residence                                     | Urban<br>Rural                                                                                                         | 1<br>2                          |      |
| 1.4  | Parental living status                              | Both alive<br>Mother died<br>Father died<br>Both died                                                                  | 1<br>2<br>3<br>4                |      |
| 1.5  | What is the caretaker relation with the child?      | Parents<br>Sister/brother<br>Aunt/ankle<br>Grandparents<br>Others (specify) _____                                      | 1<br>2<br>3<br>4<br>5           |      |
| 1.6  | What is the marital status of parents or caregiver? | Single<br>Married<br>Divorced<br>Widowed                                                                               | 1<br>2<br>3<br>4                |      |
| 1.7  | Caregiver sex                                       | Female<br>Male                                                                                                         | 0<br>1                          |      |
| 1.8  | Age of caregiver (years)                            | 15-24<br>25-34<br>35-49<br>≥50                                                                                         | 1<br>2<br>3<br>4                |      |
| 1.9  | Caregiver occupation                                | Government<br>Non-government<br>Merchant<br>Farmer<br>Housewife/unemployed<br>Daily laborer<br>*Others (specify) _____ | 1<br>2<br>3<br>4<br>5<br>6<br>7 |      |
| 1.10 | Monthly income of care taker in ETB                 | <1,500<br>1,500-3,000<br>>3,000                                                                                        | 1<br>2<br>3                     |      |
| 1.11 | Family size                                         | < 4<br>≥ 4                                                                                                             | 1<br>2                          |      |
| 1.12 | Caregiver educational level                         | No formal education                                                                                                    | 1                               |      |

|                                                                              |                                                                           |                                                                                                                                |                            |                            |
|------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------------------|
|                                                                              |                                                                           | Primary education                                                                                                              | 2                          |                            |
|                                                                              |                                                                           | Secondary education                                                                                                            | 3                          |                            |
|                                                                              |                                                                           | College and above                                                                                                              | 4                          |                            |
| <b>Part II:- Clinical status of the child and caretaker (secondary data)</b> |                                                                           |                                                                                                                                |                            |                            |
| 2.1                                                                          | Caregiver HIV status                                                      | Negative<br>positive<br>unknown                                                                                                | 0<br>1<br>2                |                            |
| 2.2                                                                          | If the answer for 2.1 is —11, is currently a caregiver on HAART?          | No<br>Yes                                                                                                                      | 0<br>1                     | Otherwise, skip to Q. 2.3  |
| 2.3                                                                          | Age at first diagnosis                                                    | < 60 months<br>60-120 months<br>120-180 months                                                                                 | 1<br>2<br>3                |                            |
| 2.4                                                                          | Age at HAART started                                                      | < 60 months<br>60-120 months<br>120-180 months                                                                                 | 1<br>2<br>3                |                            |
| 2.5                                                                          | History of hospital admission in the past six months                      | No<br>Yes                                                                                                                      | 0<br>1                     |                            |
| 2.6                                                                          | Current WHO clinical stage                                                | Stage I, II<br>Stage III, IV                                                                                                   | 1<br>2                     |                            |
| 2.7                                                                          | Did the child have an opportunistic infection in the past six (6) months? | No<br>Yes                                                                                                                      | 1<br>2                     | Otherwise, skip to Q. 2.10 |
| 2.8                                                                          | If the answer for 2.8 is —11, What type of OI                             | TB<br>Recurrent oral lesion<br>Oesophageal candidiasis<br>Diarrhea $\geq$ 2 weeks over the past 2-weeks<br>Pneumonia<br>others | 1<br>2<br>3<br>4<br>5<br>6 |                            |
| 2.9                                                                          | Current viral load (copies/ml)                                            | <1,000<br>$\geq$ 1,000                                                                                                         | 1<br>2                     |                            |
| 2.10                                                                         | Taking Cotri-moxazole prophylaxis                                         | No<br>Yes                                                                                                                      | 0<br>1                     |                            |
| 2.11                                                                         | Taking INH prophylaxis                                                    | No<br>Yes                                                                                                                      | 0<br>1                     |                            |
| 2.12                                                                         | Current ART regimen                                                       | First-line<br>Second-line<br>Third-line                                                                                        | 1<br>2<br>3                |                            |
| 2.13                                                                         | ARV drug adherence in the last 6-months                                   | Poor<br>Fair<br>Good                                                                                                           | 1<br>2<br>3                |                            |
| 2.14                                                                         | Did the child have ARV toxicity in the last 6-months?                     | No<br>Yes                                                                                                                      | 0<br>1                     |                            |
| 2.15                                                                         | Did the child have eating problem (disorder) in the past 6-months?        | No<br>Yes                                                                                                                      | 0<br>1                     |                            |
| 2.16                                                                         | Types of eating problem.                                                  | Loss of appetite                                                                                                               | 1                          |                            |

|                                               |                                                                  |                       |   |  |
|-----------------------------------------------|------------------------------------------------------------------|-----------------------|---|--|
|                                               |                                                                  | Swallowing difficulty | 2 |  |
|                                               |                                                                  | Nausea/Vomiting       | 3 |  |
|                                               |                                                                  | Others (specify)_____ | 4 |  |
| <b>Part:- III Nutritional related factors</b> |                                                                  |                       |   |  |
| 3.1                                           | Did the child get nutritional counselling in the hospital?       | No                    | 0 |  |
|                                               |                                                                  | Yes                   | 1 |  |
| 3.2                                           | Do the child currently on nutritional therapy?                   | No                    | 0 |  |
|                                               |                                                                  | Yes                   | 1 |  |
| 3.3                                           | If the answer for —3.2 is —1, what types of nutritional therapy? | Plumpynut             | 1 |  |
|                                               |                                                                  | Therapeutic milk      | 2 |  |
|                                               |                                                                  | Other (Specify)       | 3 |  |
| 3.4                                           | Individual Dietary Diversity Score (IDDS) *                      | Poor (low)            | 1 |  |
|                                               |                                                                  | Borderline (minimum)  | 2 |  |
|                                               |                                                                  | Good (adequate)       | 3 |  |
| <b>Part IV:- Anthropometric assessment</b>    |                                                                  |                       |   |  |
| 4.1                                           | Weight (kg)                                                      | Current               |   |  |
| 4.2                                           | Height (cm)                                                      | Current               |   |  |

**\* Dietary Diversity Questionnaire**

Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients.

| breakfast | Snack<br>(in between) | Lunch | Snack (in<br>between) | Dinner | Snack (after<br>dinner) | Outside<br>home |
|-----------|-----------------------|-------|-----------------------|--------|-------------------------|-----------------|
|           |                       |       |                       |        |                         |                 |
|           |                       |       |                       |        |                         |                 |
|           |                       |       |                       |        |                         |                 |
|           |                       |       |                       |        |                         |                 |
|           |                       |       |                       |        |                         |                 |
|           |                       |       |                       |        |                         |                 |
|           |                       |       |                       |        |                         |                 |

| * | Age categories of child              |   |                               |
|---|--------------------------------------|---|-------------------------------|
|   | 6-23 months                          |   | Above 24-months               |
|   | Food groups                          |   |                               |
| 1 | Breast milk                          | 1 | Cereals                       |
| 2 | Grains, roots, and tubers            | 2 | Starchy roots                 |
| 3 | Legumes and nuts                     | 3 | Legumes                       |
| 4 | Dairy products                       | 4 | Vegetables and fruits         |
| 5 | Flesh foods                          | 5 | Sugars, preserves, and syrups |
| 6 | Eggs                                 | 6 | Meat, fish, and eggs          |
| 7 | Vitamin A-rich fruits and vegetables | 7 | Milk and milk products        |
| 8 | Other fruits and vegetables          | 8 | Fats and oils,                |
|   |                                      | 9 | Beverage                      |

## 12.4 Annex IV: Amharic version of questionnaire

### መጠይቅ

የመጠይቁ ቅጽ መለያ ቁጥር: \_\_\_\_\_

መመሪያ :- እባክዎን በጥንቃቄ ካነበቡ በኋላ ተገቢውን ኮድ ቁጥር ያክብቡ

የሆስፒታሉ ስም \_\_\_\_\_ ዕድሜ \_\_\_\_\_

### ክፍል I: - ማህበረ-ሕዝብ ባህሪያት

| ቁጥር  | ጥያቄዎች                         | ምድቦች                                                     | ኮድ                    | ዝላል |
|------|-------------------------------|----------------------------------------------------------|-----------------------|-----|
| 1. 1 | የልጁ ዕድሜ (በወራት)                | <60 ወራት<br>60-120 ወራት<br>120-180 ወራት                     | 1<br>2<br>3           |     |
| 1. 2 | የልጁ ጾታ                        | ሴት<br>ወንድ                                                | 0<br>1                |     |
| 1. 3 | የልጁ መኖሪያ                      | ከተማ<br>ገጠር                                               | 1<br>2                |     |
| 1. 4 | የወላጆች ሁኔታ                     | ሁለቱም በህይወት አሉ<br>እናት ሞታለች<br>አባት ሞታል<br>ሁለቱም ሞተዋል        | 1<br>2<br>3<br>4      |     |
| 1. 5 | የተንከባካቢው/ዋ ከልጁ ጋር ያላት/ው ግንኙነት | ወላጆች<br>እህት/ወንድም<br>አክስት/አክስት<br>አያት<br>ሌሎች (ይግለጹ) _____ | 1<br>2<br>3<br>4<br>5 |     |
| 1. 6 | የወላጆች ወይም የአሳዳጊ የትዳር ሁኔታ      | ያላገባ<br>ያገባ/ች<br>የተፋታ/ች<br>ባል የሞተባት                      | 1<br>2<br>3<br>4      |     |
| 1. 7 | የተንከባካቢ/የአሳዳጊ ጾታ              | ሴት<br>ወንድ                                                | 0<br>1                |     |
| 1. 8 | የተንከባካቢ/የአሳዳጊ ዕድሜ (በዓመት)      | 15-24<br>25-34<br>35-49<br>≥50                           | 1<br>2<br>3<br>4      |     |
| 1. 9 | የተንከባካቢው/ዋ ስራ/ሙያ              | የመንግስት ስራ<br>መንግሥታዊ ያልሆነ ስራ<br>ነጋዴ                       | 1<br>2<br>3           |     |

|                                      |                                                        |                                                                                                       |                            |                      |
|--------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------------|----------------------|
|                                      |                                                        | ገበሬ                                                                                                   | 4                          |                      |
|                                      |                                                        | የቤት እመቤት / ሥራ አጥ                                                                                      | 5                          |                      |
|                                      |                                                        | የቀን ሰራተኛ                                                                                              | 6                          |                      |
|                                      |                                                        | *ሌሎች (ይጥቀሱ)_____                                                                                      | 7                          |                      |
| 1. 10                                | የአሳዳጊው/ዋ ወርሃዊ ገቢ (በብር)                                 | <1,500                                                                                                | 1                          |                      |
|                                      |                                                        | 1,500-3,000                                                                                           | 2                          |                      |
|                                      |                                                        | ≥3,000                                                                                                | 3                          |                      |
| 1. 11                                | የቤተሰብ መጠን                                              | < 4                                                                                                   | 1                          |                      |
|                                      |                                                        | ≥ 4                                                                                                   | 2                          |                      |
| 1. 12                                | የወላጅወይም የአሳዳጊው/ዋ የትምህርት ደረጃ                            | መደበኛ ትምህርት የሌለው/ላት                                                                                    | 1                          |                      |
|                                      |                                                        | የመጀመሪያ ደረጃ ትምህርት                                                                                      | 2                          |                      |
|                                      |                                                        | የሁለተኛ ደረጃ ትምህርት                                                                                       | 3                          |                      |
|                                      |                                                        | ኮሌጅ እና ከዚያ በላይ                                                                                        | 4                          |                      |
| <b>ክፍል III: - ጤና ነክ ሁኔታዎች እና ሌሎች</b> |                                                        |                                                                                                       |                            |                      |
| 2.1                                  | የተንከባካቢው/ዋ የኤች አይቪ ምርመራ ውጤት ሁኔታ                        | ነጭብ<br>ፖዘቲቭ<br>ያልተመረመረ/ የማይታወቅ                                                                        | 0<br>1<br>2                |                      |
| 2.2                                  | 2.1 መልስ — I   ከሆነ፣ በአሁኑ ስዓት የፀረ-ኤች አይ ቪ መድሀኒት ይጠቀማል?   | አይ<br>አዎ                                                                                              | 0<br>1                     | አለበለዚያ ወደ ቁ.2.3 ይዝለሉ |
| 2.3                                  | ልጁ በመጀመሪያ ተመርምሮ ሻይረሱ በ ደሙ ውስጥ እንዳለበት የታወቀበት ዕድሜ        | < 60 ወራት<br>60-120 ወራት<br>120-180 ወራት                                                                 | 1<br>2<br>3                |                      |
| 2.4                                  | ልጁ የፀረ-ኤችአይ ቪ መድሀኒት መውሰድ የጀመረበት/ችበት ዕድሜ                | < 60 ወራት<br>60-120 ወራት<br>120-180 ወራት                                                                 | 1<br>2<br>3                |                      |
| 2.5                                  | ባለፉት ስድስት ወራት ውስጥ ሆስፒታል ውስጥ ተኝቶ/ታ ያውቃል/ታውቃለች           | አይ<br>አዎ                                                                                              | 0<br>1                     |                      |
| 2.6                                  | በአሁኑ ጊዜ ልጁ ያለበት የዓለም ጤና ድርጅት የኤድስ ደረጃ                  | ደረጃ I, II<br>ደረጃ III, IV                                                                              | 1<br>2                     |                      |
| 2.7                                  | ባለፉት ስድስት ወራት ውስጥ በአፖርቼኒስቲክ(ተያያዥ በሽታዎች) ኢንፌክሽን ታሞል?    | አይ<br>አዎ                                                                                              | 0<br>1                     | አለበለዚያ ወደ ቁ.2.9 ይዝለሉ |
| 2.8                                  | 2.8 መልስ — I   ከሆነ ምን አይነት አፖርቼኒስቲክ (ተያያዥ በሽታዎች) ኢንፌክሽን | ቲቢ /የሳንባ ነቀርሳ<br>ተደጋጋሚ የአፍ ቁስለት/ህመም<br>የፖርኖ ቁስለት/ህመም<br>ከ 2 ሳምንታት በላይ የቆየ ተቆማጥ<br>የሳንባ ምች<br>ሌሎች----- | 1<br>2<br>3<br>4<br>5<br>6 |                      |

|                                             |                                                                        |                                                                  |                  |                      |
|---------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------|------------------|----------------------|
|                                             |                                                                        |                                                                  |                  |                      |
| 2.9                                         | በአሁኑ ጊዜ የሻይረስ ቁጥር ብዛት/ጭነት (copies/ml)                                  | <1,000<br>≥ 1,000                                                | 1<br>2           |                      |
| 2.10                                        | የ ኮትሪሞክሳሶል Cotri-moxazole ፕሮፊላክሲስ                                      | አይ<br>አዎ                                                         | 0<br>1           |                      |
| 2.11                                        | የ INH ፕሮፊላክሲስ                                                          | አይ<br>አዎ                                                         | 0<br>1           |                      |
| 2.12                                        | አሁን ያለው የፀረ-ኤች አይ ቪ መድሀኒት ስርዓት ደረጃ                                     | የመጀመሪያ ደረጃ<br>ሁለተኛ ደረጃ<br>ሶስተኛ ደረጃ                               | 1<br>2<br>3      |                      |
| 2.13                                        | ባለፉት ስድስት ወራት ውስጥ ከ ፀረ-ኤች አይ ቪ መድሀኒት ጋር ያለው ቁርኝት (adherence) ምን ይመስላል? | ደካማ ቁርኝት<br>መካከለኛ ቁርኝት<br>ጥሩ ቁርኝት                                | 1<br>2<br>3      |                      |
| 2.14                                        | ባለፉት ስድስት ወራት ውስጥ የ ፀረ-ኤችአይ ቪ መድሀኒት የጎንዮሽ ጉዳት ነበር/አለ?                  | አይ<br>አዎ                                                         | 0<br>1           |                      |
| 2.15                                        | ህፃኑ ባለፉት 6 ወራት ውስጥ የአመጋገብ ችግር ገጥሞታል?                                   | አይ<br>አዎ                                                         | 0<br>1           |                      |
| 2.16                                        | 2.15 መልስ 1   ከሆነ፣ የአመጋገብ ችግሮች ዓይነቶች የትኞቹ ናቸው?                          | የምግብ ፍላጎት ማጣት<br>ምግብ የመዋጥ ችግር<br>ማቅለሽለሽ/ትዉከት<br>ሌሎች (ይግለጹ) _____ | 1<br>2<br>3<br>4 | አለበለዚያ ወደ ቁ.2.167ይዝሉ |
| <b>ክፍል III : - ከአመጋገብ ጋር የተያያዙ ምክንያቶች</b>   |                                                                        |                                                                  |                  |                      |
| 3.1                                         | ህጻኑ በሆስፒታል ውስጥ የአመጋገብ ምክር አግኝቷል?                                       | አይ<br>አዎ                                                         | 0<br>1           |                      |
| 3.2                                         | ህጻኑ በአሁኑ ጊዜ በአመጋገብ ህክምና ላይ ነው?                                         | አይ<br>አዎ                                                         | 0<br>1           |                      |
| 3.3                                         | ለ "3.2" መልሱ "1" ከሆነ ምን ዓይነት የአመጋገብ ሕክምና ዓይነቶች?                         | Plumpynut<br>ቴራፒዩቲክ ወተት<br>ሌሎች (ይጥቀሱ) _____                      | 1<br>2<br>3      | አለበለዚያ ወደ ቁ.3.4 ይዝሉ  |
| 3.4                                         | የግለሰብ የአመጋገብ ልዩነት ነጥብ (*)                                              | ዝቅተኛ<br>በቂ<br>ጥሩ                                                 | 1<br>2<br>3      |                      |
| <b>ክፍል IV: - የአንትሮፖሜትሪክ ግምገማ (የልኬት ሁኔታ)</b> |                                                                        |                                                                  |                  |                      |
| 4.1                                         | ክብደት (ኪ.ግ)                                                             | በአሁኑ ግዜ                                                          |                  |                      |

|     |           |         |  |  |
|-----|-----------|---------|--|--|
| 4.2 | ቁመት (ሴ.ሜ) | በአሁኑ ጊዜ |  |  |
|-----|-----------|---------|--|--|

**\* የአመጋገብ ልዩነት መጠይቅ**

የተጠቀሱትን ምግቦች እና መጠጦች በሙሉ ይፃፉ :: የተዋሃዱ ምግቦች በሚጠቀሱበት ጊዜ የእቃዎቹን ዝርዝር ይጠይቁ::

| ቁርስ | በቁርስ እና በምሳ መካከል | ምሳ | መክሰስ | እራት | ከእራት በኋላ | ከቤት ውጭ |
|-----|------------------|----|------|-----|----------|--------|
|     |                  |    |      |     |          |        |
|     |                  |    |      |     |          |        |
|     |                  |    |      |     |          |        |
|     |                  |    |      |     |          |        |
|     |                  |    |      |     |          |        |

## 12.5 Annex V: Participant consent form

**Title of the project:** - Undernutrition and its associated factors among HIV-positive under-15 age children on follow up at pediatric ART clinic at referral hospitals in Addis Ababa, Ethiopia, 2022.

My name is Bezaneh Belachew, and I am a postgraduate student at saint Paulo's Millennium College (SPMMC). If you agree to take part in this research, I will ask you to fill out some questionnaires and take weight and height measurements of your child to determine the nutritional assessment of the child. It may take approximately 15-20 minutes. Your participation in this research is completely voluntary. You may also refuse to answer any of the questions I ask you. And there will be no pressure to answer.

All the information you give will be anonymous and confidential and only used for this research and will be accessible to me. No third parties will have access to any of the information you provide.

You will have the opportunity to discuss your participation and to debrief on the research once it has been conducted and analyzed.

Do not hesitate to ask me if you are not sure about anything mentioned above.

Name of principal investigator: \_\_\_\_\_ Date: \_\_\_\_\_ Signature: \_\_\_\_\_

Email: \_\_\_\_\_ phone no. \_\_\_\_\_

### **Agreement: -**

If you agree to participate, you will be asked to sign a consent form. The consent form will not ask you to fill your name. It will be filled separately from all other information.

I have read the procedure described above. I voluntarily give permission for me and my child to participate in the study, and I have received a copy of this description.

Name of participant: \_\_\_\_\_ Date: \_\_\_\_\_ signature: \_\_\_\_\_

Thank you very much for your time.

## 12.6 Annex VI: Amharic version of the Participant consent form

### የተሳታፊዎች የፍቃድ ቅጽ

በተሳትፎ ውሳኔ ላይ ከመወሰንዎ በፊት እባክዎ ሁሉንም መረጃ በጥንቃቄ ያንብቡ ።

**የፕሮጀክቱ ርዕስ:-** ከ15 አመት በታች ኤችአይቪ ፖዘቲቭ ሆነው በተመረጡ የሪፈራል ሆስፒታሎች የህጻናት ART ክሊኒክ ክትትል እያደረጉ ባሉ ህፃናት ላይ የተመጣጠነ ምግብ እጥረት እና በአመጋገብ ስር ያሉ እና ተያያዥ ምክንያቶች በአዲስ አበባ፣ ኢትዮጵያ 2022

ስሜ ጌዛነህ በላቸው እባላለሁ። እኔ የቅዱስ ጳውሎስ ሚሊኒየም ኮሌጅ (SPMMC) የድህረ ምረቃ ተማሪ ነኝ። በዚህ ጥናት ላይ ለመሳተፍ ከተስማሙ መጠይቁን እንዲሞሉ እና የልጁን የአመጋገብ ግምገማ ለመወሰን ዓላማ ያደረገ የልጅዎን ክብደት እና ቁመት ለመለካት እጠይቅዎታለሁ። ከ15-20 ደቂቃዎች ሊወስድ ይችላል። በዚህ ጥናት ውስጥ ያለዎት ተሳትፎ ሙሉ በሙሉ በፈቃደኝነት ነው። እንዲሁም የምጠይቃቸውን ማንኛውንም ጥያቄዎች ለመመለስ እምቢ ማለት ይችላሉ። እና መልስ ለመስጠት ምንም ግፊት አይኖርም።

ሁሉም የሰጡት መረጃ ስም-አልባ እና ሚስጥራዊ እና ለዚህ ጥናት ዓላማዎች ብቻ ይውላል እና ለእኔ ብቻ ተደራሽ ይሆናል። የትኛውም ሶስተኛ ወገን እርስዎ ያቀረቡትን ማንኛውንም መረጃ ማግኘት አይችሉም።

ጥናቱ ተካሂዶ ከተተነተነ በኋላ ስለተሳትፎዎ ለመወያየት እና በጥናቱ ላይ ለማብራራት እድል ይኖርዎታል።

ከላይ ስለተጠቀሰው ነገር እርግጠኛ ካልሆኑ እባክዎን እኔን ለመጠየቅ አያመንቱ።

የዋናው መርማሪ ስም:- \_\_\_\_\_ ቀን: \_\_\_\_\_ ፊርማ: \_\_\_\_\_

ኢሜል: \_\_\_\_\_ ስልክ ቁጥር: \_\_\_\_\_

### ስምምነት

ለመሳተፍ ከተስማሙ የስምምነት ፎርም እንዲፈርሙ ይጠየቃሉ። የፍቃድ ቅጹ እርስዎን ለመለየት ጥቅም ላይ አይውሉም። ከሌሎች መረጃዎች ሁሉ ተለይቶ ይሞላል።

ከላይ የተገለፀውን አሰራር አንብቤያለሁ እኔ እና ልጄ በጥናቱ እንድንሳተፍ ፈቃዴን በፈርማዬ እሰጣለሁ እናም የዚህ መግለጫ ቅጂ ደርሶኛል።

የተሳታፊው ስም: \_\_\_\_\_ ቀን: \_\_\_\_\_ ፊርማ: \_\_\_\_\_

ለጊዜዎ እና ለእርዳታዎ በጣም እናመሰግናለን።