Original Research Article||

Prevalence and Predictors of Undernutrition among Women of Reproductive Age Receiving Antiretroviral therapy (ART) at Yirgalem Hospital: Evidence from a Cross-Sectional Analysis

Zelalem Tafese[1*] and Hylageghehu Gabiso[1]

[1]*School of Nutrition, Food Science and Technology, College of Agriculture, Hawassa University, P.O. Box: 05, Hawassa, Ethiopia*

Abstract

Background: Human immunodeficiency virus (HIV) and malnutrition are interconnected in a vicious cycle, where each condition can independently cause progressive damage to the immune system. Recent, site-specific evidence on the prevalence and predictors of undernutrition among reproductive-age (15–49 years) women on ART at Yirgalem Hospital is lacking, as most Ethiopian studies focus on broader adult ART populations or other groups, leaving a gap for targeted, facility-level analysis. Assessing nutritional status in ART patients is vital, as it directly affects treatment effectiveness and outcomes, underscoring the need for integrated care.

Method: A cross-sectional study was conducted with randomly sampled reproductive age women (15-49 yrs) on ART (n=268), to examine the prevalence of undernutrition and its correlates from February to May 2023. Data on socio-economic and demographic characteristics, nutrition-related factors, and health indicators—including CD4 count, WHO clinical stage, and opportunistic infections—were collected. Descriptive statistics such as frequency, percentage, mean, and standard deviation were calculated. Associations between socio-demographic and predictor variables were assessed using binary and multivariable logistic regression, with statistical significance set at $p < 0.05$ and 95% confidence intervals.

Result: Nearly 39% of reproductive age women on ART were undernourished (BMI < 18.5 kg/m2). Women with no formal education (AOR=3.10(1.63, 7.60), advanced WHO Clinical stages (AOR=3.30(1.53, 7.11)), poor adherence to ART in past six months (AOR=3.43(1.78, 6.61), and food insecurity (AOR=2.10(1.25, 4.34) were significantly associated with undernutrition.

Conclusion: Undernutrition remains a significant public health issue among reproductive-age women on ART. Key factors such as basic education for mothers, improving ART adherence, and addressing food insecurity are critical in tackling this problem. A longitudinal study is recommended to better understand these factors and develop evidence-based interventions aimed at improving the nutritional and health outcomes of women on ART.

Keywords: Antiretroviral therapy, Adherence, Educational status, Food insecurity, Undernutrition

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***Corresponding author's address:** Zelalem Tafese Wondimagegne, Email: wudasiez@gmail.com

Authors: Hylageghehu Gabiso, Email: haylagegnehu1112@gmail.com

INTRODUCTION

Human immunodeficiency virus (HIV) is a major public health problem and is closely linked to undernutrition, as it increases the risk of nutrient deficiencies and weight loss among affected individuals (Gona et al., 2020; Woldemariam et al., 2015). According to the Joint United Nations Program on HIV/AIDS (UNAIDS), an estimated 38.4 million people are living with HIV worldwide. Of these, 67% are in the African Region, with 1.5 million new infections and 650,000 HIV-related deaths reported globally (UNAIDS, 2022). Furthermore, 53% of people living with HIV/AIDS were women and girls (WHO, 2022), and 46% of all new HIV infections were women and girls of all ages in 2022. In sub-Saharan Africa, women and girls (all ages) accounted for 63% of all new HIV infections (UNAIDS, 2023).

In sub-Saharan Africa, women of reproductive age account for over 60% of adults living with HIV (Ntlansana et al., 2019; Westreich et al., 2011). In Ethiopia, more than half a million people were living with HIV/AIDS in 2017, with women of childbearing age representing the majority (FMOH, 2018; Ayele et al., 2018). Although prevalence varies across regions, the national adult HIV prevalence (ages 15–49) was 0.93% in 2019, with women comprising 61% of infections (FHAPCO, 2023). Women often demand to initiate ART earlier and utilize healthcare services more than men but may face incomplete adherence

due to childcare responsibilities, economic pressures, and lack of partner support (El-Khatib et al., 2011). Pregnancy can further compromise treatment outcomes, potentially due to physiological changes such as increased blood volume and body mass, which may result in under-dosing of ART (Westreich et al., 2011; Momper et al., 2021; Saliya MS, 2018).

A significant proportion of individuals who require antiretroviral therapy (ART) are malnourished because of low energy intake combined with increased energy demands due to HIV and other related infections (Seid et al., 2023). Undernutrition constitutes an important threat to the success of HIV programs in sub-Saharan Africa (Fuseini et al., 2021). HIV affects nutrition by reducing food consumption, impairing digestion and nutrient absorption; causing changes in metabolism, directly attacking and destroying the cells of the immune system (Kotler, 2000). HIV/AIDS incidentally occurs in populations where malnutrition is already an epidemic. In Africa, early evidence suggested that HIV infection has a direct effect on nutritional status (Koethe et al., 2010).

A low body mass index (BMI) is a well-established indicator of poor nutritional status and has been consistently linked to reduced immune recovery, advanced HIV disease, and increased mortality among people on ART (Fuseini et al., 2021; Steinhart, 2001; Crum-Cianflone et al., 2011). Evidence from southern Ethiopia, including Hawassa and surrounding areas, shows that women and adolescents on ART frequently experience poor dietary diversity and high levels of undernutrition, largely due to persistent food insecurity and limited access to nutrient-rich foods (Shiferaw and Gebremedhin, 2020; Markos et al., 2020). Despite national and regional initiatives to incorporate nutrition services into HIV care in Ethiopia (FMOH, 2018) and the availability of regional studies documenting the burden of undernutrition among individuals on ART (Gebremichael, 2018; Gebru et al., 2020), there remains a notable gap in facility-level assessments that evaluate the effectiveness of targeted interventions aimed at mitigating undernutrition among adults receiving ART. In response to these challenges, this study was designed to assess the prevalence and associated factors of undernutrition among reproductive-age women receiving ART at Yirgalem General Hospital.

MATERIALS AND METHODS

Study Design and Period

An institution-based cross-sectional study was carried out at Yirgalem General Hospital in the Sidama region of Ethiopia from February to May 2023. The hospital, which is situated in Yirgalem town, is located 47 km southeast of the regional capital, Hawassa, and 260 km from Addis Ababa, the capital of Ethiopia at a latitude of 6°45′N, a longitude of 38°25′E, and an elevation of 1,725 meters above sea level (SZBoFED, 2007). During the study period, 700 HIV-positive women of reproductive age were receiving ART services at the hospital.

Source and Study Population

The source populations were all HIV-positive women from 15 to 49 years old were attending at ART clinic of the Yirgalem General Hospital. The study populations were randomly selected HIV-positive women from 15-49 years old, and fulfilling the inclusion criteria and attending ART clinic at Yirgalem General Hospital during the study period.

Inclusion and Exclusion Criteria

All HIV-positive women aged 15–49 years and receiving ART at least for six months and visiting the ART clinic at Yirgalem General Hospital during the study period were considered eligible for inclusion in the study. Pregnant and lactating women, as well as those who were seriously ill and unable to participate, were excluded to avoid confounding factors related to pregnancy, lactation, or severe illness.

Sample size Determination

We calculated the sample size separately for the two objectives, estimating prevalence and identifying associated factors—using the single population proportion formulae and selected the larger estimate.

For the first objective, the sample size was computed using the single population proportion formula, a 95% confidence level ($Z\alpha/2 = 1.96$), a 5% margin of error ($d = 0.05$), and the prevalence of undernutrition reported from Humera Hospital, Ethiopia (Hadgu et al., 2013), with an additional 10% for non-response. Given that approximately 700 HIV-positive reproductive-age women attended ART services at Yirgalem General Hospital during the study period, a population correction formula was applied, yielding a final sample size of 268.

For the second objective, the sample size was determined using the double population proportion formula in Epi Info 7.2, based on findings from a study conducted in public health facilities in West Shewa Zone, central Ethiopia on food insecurity and

nutritional status among people living with HIV/AIDS (Gebremichael et al., 2018). Using a 95% confidence level, 80% power, a 1:1 ratio of exposed to unexposed, the estimated proportion of outcome among the unexposed, and a 10% non-response rate, the calculated sample size was 172. After comparing the results from both objectives, the larger sample size—268—was selected as the final sample size for this study.

Table 1. Sample size estimation for identifying associated factors using the single population proportion formula

Variables	Assumption	Percent unexposed with outcome	Sample size	Final sample size after adding non-response rate
WHO clinical stage III/V	Power 80, CI 95, unexposed to exposed ratio 1, OR=3.3	71	76	86
Food security status	Power 80, CI 95, unexposed to exposed ratio 1, OR=5.3	47	152	172

Sampling technique

Participants were selected randomly from reproductive-age women (15–49 years) attending ART follow-up care at Yirgalem General Hospital between February and May 2023, using predefined inclusion criteria to ensure that every eligible woman had an equal chance of being included rather than being chosen based on convenience or personal judgment. After identifying eligible patient medical records, relevant clinical, laboratory, and demographic information were collected using a data abstraction form designed to capture these details. The data abstraction form was developed based on the ART entry and follow-up forms being used in the ART clinic at Yirgalem General Hospital and by the Ministry of Health of Ethiopia. A pretest was conducted to gain insights into the data abstraction process, assess how information was extracted from medical records, and refine the form before finalizing it for the study.

Data Collection

Data were collected using a pre-tested, structured questionnaire administered through face-to-face interviews to capture socio-demographic, behavioral, and anthropometric information. Nutritional status was assessed using BMI, calculated from weight and height measurements, with a BMI <18.5 kg/m² indicating undernutrition (Gibson and Meredith-Jones, 2024). Household food insecurity was measured using the nine-item Household Food Insecurity Access Scale (HFIAS) (Coates et al., 2007; MOH, 2018), while dietary intake was evaluated via a 24-hour recall determining dietary diversity and meal frequency (FAO, 2016). ART adherence was categorized as good (≥95%) or poor (≤94%) based on documented missed doses (Gebru et al., 2020). Two trained nurses from Yirgalem General Hospital collected primary data under the supervision of a senior health professional, with training provided on study objectives, data collection principles, and ethical considerations. Primary data were obtained directly from participants through interviews and anthropometric measurements, while secondary data were extracted from hospital records such as patient charts.

Variables

The main outcome of this study was undernutrition, assessed using body mass index (BMI), calculated as weight in kilograms divided by height in meters squared. The study's independent variables encompassed various socio-demographic and economic factors, including age, sex, ethnicity, religion, marital status, education level, monthly income, and occupation Additionally, factors like internalized stigma, living conditions, and social support were considered, as these variables may influence the respondents' experiences and perceptions related to food insecurity or financial constraints, nutritional-related factors (nutritional counseling) medical factors (CD4 count, HIV/AIDS stages, HIV-related disease).

Data Quality Procedures

To ensure data quality, the principal investigator closely supervised all stages of data collection, monitoring completeness, accuracy, and reliability. The questionnaire was initially prepared in English, translated into Amharic, and back translated into

English to ensure consistency. It was pre-tested on 5% of participants in a similar setting to assess clarity, sensitivity, and completeness, with modifications made as needed. Data collectors, including nurses, health officers, and human nutrition professionals, received training on questionnaire of two days and anthropometric measurements. Weight and height were measured to the nearest 10 g and 0.1 cm, respectively. Daily feedback and corrections were provided by the supervisor to maintain high data quality throughout the collection process.

Data Analysis

Data was entered into EpiData version 3.1 and analyzed using SPSS version 26. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize participant characteristics. Associations between undernutrition and potential predictors were assessed using bivariate and multivariable logistic regression, with adjusted odds ratios (AOR) and 95% confidence intervals (CI) reported. Statistical significance was set at $p < 0.05$, and multicollinearity was checked using variance inflation factors (VIFs). To ensure data quality, the principal investigator provided daily supervision and feedback to data collectors, and all completed questionnaires and abstraction forms were regularly checked for completeness, accuracy, and consistency, with any discrepancies addressed promptly.

RESULTS AND DISCUSSION

Socio-economic and Demographic Characteristics of Respondents

All 268 selected women participated in the study, yielding a 100% response rate. The respondents had a mean age of 37.7 (±7.03) years. About one-third (33.6%) were of Sidama ethnicity, and most participants (71.3%) resided in urban areas. Nearly 72% reported a monthly income of less than 700 ETB. (Table 1).

Clinical and Health-related Characteristics of the Respondents

The majority, 79.1% of the study participants, were on ART at least for one year, and 20.9% of the clients reported having gastrointestinal symptoms in the past six months. Only 18.3% of the respondents experienced eating difficulty in the past six months. Nearly 31.4% of the respondents were in WHO clinical stage I, and the majority, 72.8% of the clients had good adherence to ART in the past six months (Table 2).

Nutritional, Food Security, and Behavioral Characteristics of the Participants

The dietary assessment showed that most participants consumed cereals, legumes, and dark green vegetables within the 24 hours preceding the survey. In contrast, the intake of animal-source foods, including meat/fish, milk and milk products, and eggs—was notably low (Figure 1). Nearly three-quarters of the respondents (74%) consumed three or more meals during the same period. Despite this, approximately 35% of households experienced food insecurity, and the prevalence of undernutrition (BMI < 18.5 kg/m^2) among the women was high at 39.2%. Moreover, the vast majority of participants (83.6%) reported no current alcohol consumption (Table 3).

Factors Associated with Undernutrition among Respondents

Of the eight variables with a p-value <0.25 in the bivariate analysis, only four—educational level, WHO clinical stage, ART adherence in the past six months, and household food security status—remained significant predictors of undernutrition in the multivariable logistic regression model (Table 4). Women with no formal education were over three times more likely to be undernourished compared to those with formal education (AOR = 3.10; 95% CI: 1.62–7.60). Similarly, participants at WHO clinical stage four had a 3.3-fold higher likelihood of undernutrition than those at stage one (AOR = 3.30; 95% CI: 1.53–7.11). Poor adherence to ART in the past six months increased the odds of undernutrition by more than three times compared to good adherence (AOR = 3.43; 95% CI: 1.78–6.61). Additionally, food insecurity was associated with more than double the risk of undernutrition compared to food-secure households (AOR = 2.10; 95% CI: 1.25–4.34).

DISCUSSION

In this study, the prevalence of undernutrition among adult women on ART was 39.2%, which is lower than figures reported in earlier studies by Mulu et al. (2016) and Hadgu et al. (2013), which documented prevalences of 46.8% and 42.3%, respectively. However, this finding is higher than reports from other parts of Ethiopia, including studies by Kenea et al. (2015) 27%, Alebel et al. (2020) 26%, Gemede et al. (2021) 31.2%, Regassa and Gudeta (2022) 16%, and Gedle et al. (2015) 25%. These discrepancies may reflect differences in socioeconomic conditions, dietary patterns, and regional variations in food security and access to healthcare services.

Educational status emerged as a significant predictor of nutritional status among women on ART in this study. Women with no formal education were more likely to be undernourished compared to those who had received formal schooling, a finding that is consistent with reports from previous studies (Nanewortor et al., 2021; Thapa et al., 2015; Anlay et al., 2016). This association may be explained by the fact that education enhances awareness of proper nutrition, health-seeking behavior, and self-care practices, all of which contribute positively to maintaining good nutritional status. These findings suggest that improving women's educational opportunities should be considered an important component of comprehensive HIV care.

The WHO clinical stage was also found to be significantly associated with undernutrition in this study. Women in WHO clinical stage II and above had a higher likelihood of being undernourished compared with those in stage I. This result aligns with findings from studies conducted in southwest Ethiopia, Tigray, and Asella, as well as national and regional meta-analyses (Hadgu et al., 2013; Teklu et al., 2020; Tesfa et al., 2021; Regassa and Gudeta, 2022; Seid et al., 2023). Advanced clinical stages reflect compromised immunity and increased susceptibility to opportunistic infections, which can impair food intake and nutrient absorption. In addition, the combined effects of infections, antibiotic use, and ART-related side effects may reduce appetite and further exacerbate undernutrition.

In this study, poor adherence to ART over the previous six months was significantly associated with undernutrition. Women with poor adherence were more than three times as likely to be undernourished compared with those who maintained good adherence, a finding consistent with reports from Bench Sheko Zone, southwest Ethiopia, and Arba Minch (Shifera et al., 2022; Kalil et al., 2020; Negussie and Sultan, 2020). Poor adherence may promote viral replication and CD4 cell depletion, leading to weakened immunity and disease progression, which in turn can impair dietary intake and nutrient absorption, ultimately contributing to undernutrition.

Food insecurity is another factor predicting undernutrition in the present study. Our result showed that food-insecure women on ART were more than twice likely to be undernourished. This finding was similar to other studies in Ethiopia and elsewhere (Tolasa et al., 2015; Gedle et al., 2015; Oluma et al., 2020; Schaible & Kaufmann, 2007; Nnyepi, 2009). This was clearly due to a lack of access to sufficient food to meet dietary needs resulting in undernutrition. Evidence indicates that HIV/AIDS exacerbates existing food insecurity, adversely affecting the nutritional status of individuals on ART and contributing to weight loss and wasting. These findings underscore the impact of food insecurity on undernutrition and call for comprehensive interventions by ART program implementers and nutrition stakeholders. Integrated strategies combining nutrition support, food security initiatives, and educational programs for women on ART are needed. Policies that promote nutritional counseling, strengthen ART adherence, and address socioeconomic vulnerabilities could help mitigate undernutrition and improve overall health outcomes in this population.

Strength and limitations

The present study used anthropometric measurement and dietary assessment to evaluate under-nutrition among women on ART. However, there might be a memory lapse, and recall bias on the ART adherence data. Moreover, potential social desirability may bias the food insecurity assessment responses. The nature of the cross-sectional study design couldn't establish cause and effect relationship between dependent and independent variables.

CONCLUSIONS and RECOMMENDATIONS

This study found a substantial burden of undernutrition among women of reproductive age receiving ART, indicating a serious public health concern in the study setting. Undernutrition was significantly associated with lack of formal education, advanced WHO clinical stage, poor ART adherence in the preceding six months, and household food insecurity. These findings emphasize the need for integrated and targeted interventions that strengthen food security, promote sustained ART adherence, and improve women's access to education and nutritional counseling. Furthermore, future longitudinal studies are recommended to better clarify causal pathways and to support the design of more effective, evidence-based nutritional interventions for women on ART.

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design, data acquisition, analysis, and interpretation. Z.T. prepared the draft manuscript, while H.G. critically reviewed and edited it. Both authors reviewed and approved the final manuscript.

Disclosure Statement

The authors declare that they have no conflicts of interest.

Data Availability

All necessary data used for this study are available from the corresponding author upon a reasonable request.

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Table 1. Socioeconomic and demographic characteristics of 15-49yrs old women on ART at Yirgalem General Hospital, Sidama region, Ethiopia, 2023 (n=268)

Variables	Frequency(n)	Percentage (%)	Mean (SD)
Age, y			33.7(7.1)
Ethnicity			
Wolaita	90	33.6	
Gurage	80	29.9	
Sidama	29	10.8	
Oromo	25	9.3	
Amhara	14	5.2	
Other	30	11.2	
Marital status			
Not married	76	28.4	
Married/living together	125	46.6	
Divorced/Widowed/separated	67	25	
Residence			
Urban	191	71.3	
Rural	77	28.7	
Educational Status			
Secondary school and above	129	48.4	
Primary school(1-8)	71	26.49	
No formal education	68	25.37	
Occupation			
Government employed	60	22.4	
Merchant	51	19	
Daily laborer	89	33.2	
Farmer	48	17.9	
Student	20	7.5	
Average monthly income (ETB)			
<700	194	72.39	
701-1500	47	17.54	
>1500	27	10.07	

1. 1USD=59ETB

Table 2. Clinical stage and Health related characteristics of 15-49yrs old women on ART at Yirgalem General Hospital, Sidama region, Ethiopia, 2023 (n=268)

Variables	Frequency	Percentage
Duration on ART		
<12 months	56	20.9
≥12 months	212	79.1
Had Cotrimoxazole prophylaxis		
Yes	219	81.7
No	49	18.3
Gastro intestinal symptoms in past six month		
Yes	56	20.9
No	212	79.1
Disclosed HIV status		
Yes	224	83.6
No	44	16.4
Eating difficulty in last six months		
Yes	49	18.3
No	219	81.7
History of TB in the last six months		
Yes	7	2.6
No	261	97.4
WHO clinical stage		
Stage I	84	31.4
Stage II	65	24.3
Stage III	53	19.8
Stage IV	66	24.5
Recent CD4 count		
≥500 cells/mm3	51	19.0
200-499 cells/mm3	190	70.9
<200 cells/mm3	27	10.1
Adherence to HAART in past six month		
Good adherence	195	72.8
Poor adherence	73	27.2
Opportunistic infection in last six month		
Yes	41	15.3
No	227	84.7

3.

Table 3. Nutritional, Dietary, and Behavioral Characteristics of 5-49yrs old women on ART at Yirgalem General Hospital, Sidama region, Ethiopia, 2023 (n=268)

Variables	Frequency	Percentage
Number of meal/24 hr		
≥3	199	74.3
<3	69	25.7
Change in feeding after tested positive for HIV		
Yes	160	59.7
No	108	40.3
Types of change in feeding style		
Quality feeding	45	28.3
Frequency	69	27.5
Feeding cooked food	16	6.0
Quantity	29	10.8
Had nutritional counseling		
Yes	226	84.3
No	42	15.7
Food security status		
Food secure	175	65.3
Food insecure	93	34.7
Nutritional status		
Not undernourished	160	60.8
Undernourished	105	39.2
History of cigarette smoking		
Yes	15	5.6
No	253	94.4
History of alcohol intake		
Yes	44	16.4
No	224	83.6

Table 4. Bivariate and Multivariable Analysis of Factors Associated with Undernutrition Among 15-49yrs old Women on ART, Yirgalem Hospital, 2023 (n=268)

Variables	Undernutrition		COR 95% CI	AOR 95% CI	P value
	Yes	No			
Educational status					
College/University and above [a]	19	35	1	1	
Secondary school	30	45	1.22(0.59,2.53)	0.50(0.62,3.62)	
Primary school	16	55	0.43(0.24,1.17)	0.59(0.23,1.51)	
No formal education	40	28	2.63(1.25,5.50) *	3.10(1.63,7.60) *	0.013
WHO clinical stage					
I [a]	34	50	1	1	
II	12	53	0.33(0.15,0.71) *	0.33(0.14,0.75)	
III	11	42	0.38(0.17,0.85) *	0.31(0.13,0.75)	
IV	48	18	3.92(1.95,7.85) **	3.30(1.53,7.11) **	0.002
Age in years					
20-29	27	56	0.97(0.54-1.72)	0.96(0.51-1.80)	
30-39	52	62	1.97(1.02-3.71)*	1.89(0.93-3.83)	
40-49	26	45	1	1	
Residence					
Urban	73	118	0.87 (0.50-1.49)	1.15(0.62-2.14)	0.61
Rural	32	45	1	1	
Adherence to ART in the last six months					
Good adherence [a]	62	133	1	1	
Poor adherence	43	30	3.07(1.76,5.34) **	3.43(1.78,6.61) **	0.000
Eating difficulity					
Yes	15	34	0.63(0.32-1.22)	1.40(0.68-2.84)	
No	90	129	1	1	
Food security status					
Secure [a]	57	118	1	1	
Insecure	48	45	2.32(1.31,3.70) **	2.10(1.25,4.34) **	0.008
Meal frequency					
≥3 meals/day	79	121	1	1	
<3 meals/day	26	41	1.02(0.58-1.81)	1.35(0.02-5.60)	

Abbreviations: AOR, adjusted odd ratio; COR, crude odd ratio. * Statistically significant P < .05; ** Statistically significant P < .001 [a] Reference categories;

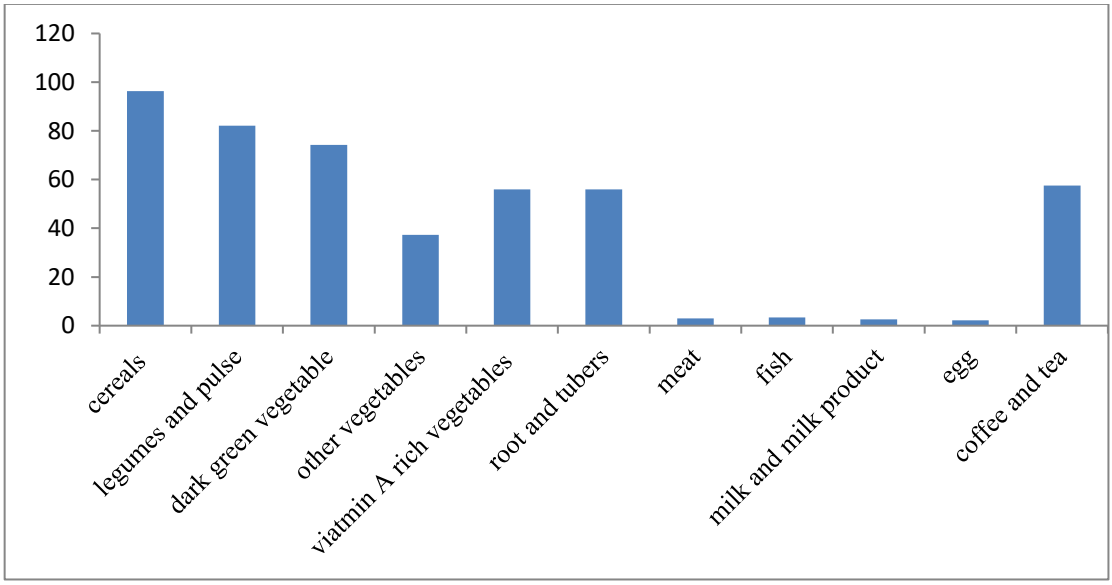

Figure 1. Consumption patterns of food-groups among 15-49yrs old women on ART at Yirgalem, General, Hospital, Sidama region, Ethiopia, 2023 (n=268)