International Journal of Food Science and Nutrition
www.foodsciencejournal.com
ISSN: 2455-4898
Received: 20-02-2025, Accepted: 21-03-2025, Published: 04-04-2025
Volume 10, Issue 2, 2025, Page No. 46-54

Dietary practices and nutrition status of adolescents with HIV attending Kiambu Level Five Hospital, Kiambu County, Kenya

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Abstract
Background: Adolescents living with HIV face unique obstacles that negatively influence their dietary practices, including stigmatization, discrimination, medication side effects, mental health concerns, and limited access to healthy food options. Appropriate dietary practices are key for improving immunity, enhancing optimal nutritional status, and maintaining adherence to antiretroviral therapy (ART). Stunting and weight loss are common signs of under nutrition among people living with HIV. Adolescents with infection are especially prone to malnutrition due to increased nutritional demands associated with puberty and HIV infection.
Objective: The study aimed at establishing the dietary practices and the nutrition status of the adolescents attending Kiambu level five hospital, Kiambu county, Kenya.
Design: The research employed a cross-sectional analytical approach using quantitative and qualitative techniques. The purposive sampling was used to select the Kiambu Level 5 Hospital as the study site due to its high reported HIV cases among adolescents at the comprehensive clinic offering adolescents friendly services. A study sample of 271 adolescents was selected to participate in the study using the systematic sampling. Dietary practices data was collected using 24-hour recall, dietary diversity questionnaire and focused group discussions.
Results: Age distribution showed most respondents were between 15-19 years (69.4%) while 30.6% fit within 10-14 years. Participants were comprised of 271 individuals; 51.3% were male and 48.7% female. Energy intake among 271 participants ranged from 571.17 to 2056.01 kcal with a standard deviation intake of 971.15±387.20 kcal. Protein consumption averaged 39.47±15.99 grams on average and ranged between 17.28 grams and 71.45 grams; fat consumption ranged between 4.40 grams to 114.98 grams while fibre intake varied between 7.41 to 34.49 grams on average. The study found out 26.7% had low diversity scores between 0 and 3, 36.8 % had moderate diversity scores between 4 and 5, and 30.6 % experienced high diversity scoring 6 or 12 on their diversity. Adolescents' diets were characterized by inadequate energy intake, particularly among males. Adolescents relied on carbohydrate-rich foods at the expense of protein and essential micronutrients like iron, folic acid, calcium and zinc. Nutritional status assessments revealed that 48% had normal BMI for age while 46.9% were undernourished.
Conclusion: The dietary practices of the adolescents with HIV were poor. Characterized by inadequate energy intake, particularly among males. Adolescents relied on carbohydrate-rich foods at the expense of protein and essential micronutrients like iron, folic acid, calcium and zinc which are crucial components of immunity function and overall health. Also, Nutritional status assessments revealed that 48% had normal BMI for age while 46.9% were undernourished.

Keywords: Adolescents with HIV, Dietary Practices, Nutritional Status, Kiambu Level five Hospital

Introduction

The World Health Organization recognizes adolescents as individuals aged 10–19 [1]. Adolescents who transition from childhood into adulthood experience significant physical, cognitive, and psychological transformations [2]. Adolescence represents a transitional stage that includes significant changes to physical development, social dynamics, and interpersonal relationships [3]. Global HIV prevalence for adolescents currently stands at 4 percent; 89 percent across Africa, 4.4% in Kenya and most teenagers (85 percent) live in the sub-Saharan region of Africa [4]. The 2022 report by the World Health Organization showed that the epidemic of HIV Among girls was significantly higher, with increased rates of infection over their male counterparts. In the case of a male newly diagnosed, six girls were newly diagnosed [5]. Unhealthy diet practices among adolescents are becoming an increasing cause for concern, leading to decreased nutrition status and consequently poorer physical wellbeing [6]. Poor diet practices among adolescents include limited dietary variety, lower fruit and vegetable consumption, snacking between meals, and overeating sugary beverages [7].Adolescence is a period marked by changing nutrition needs as puberty sets in; further compounded with HIV infection, nutritional requirements increase further still [8].Adolescents living with HIV face unique obstacles that negatively influence their nutritional practices, including stigmatization, discrimination, medication side effects, mental health concerns, and limited access to healthy food options [9].

Dietary practices are an essential element of health and well-being for adolescents living with HIV/AIDS [10]. Appropriate nutrition not only facilitates normal growth and development during adolescence but can also play an instrumental role in optimizing antiretroviral therapy (ART), improving immune function, and decreasing the risk of opportunistic infections [11]. Unfortunately, adolescents living with HIV can face numerous difficulties maintaining adequate dietary practices, which hinder nutritional status and overall health outcomes [12]. Adolescents face unique dietary challenges that may adversely impact their health

outcomes [13]. Nutrition plays an integral part in maintaining immune function and managing HIV symptoms; therefore, understanding their eating practices is paramount to supporting overall wellbeing [14]. Recent research has explored many aspects of adolescent's diets, such as the diversity of meals eaten each weekday (dietary diversity), meal frequency, type, and quality of meal [13].

Dietary diversity, defined as the variety of foods consumed, is a critical component in providing adolescents living with HIV with enough nourishment [15]. A study in Kenya demonstrated that adolescents who consumed foods from multiple food groups such as fruits, vegetables, proteins, and whole grains had better nutritional status [16]. While another study found that those who experienced inadequate dietary diversity were more prone to malnutrition and related health complications [17]. Meal frequency is also an integral aspect of diet practices among adolescents. A study by [18] concluded that meal frequency positively correlated to their nutritional status. Unfortunately, many adolescents living with HIV/AIDS struggle to eat regular meals due to side effects from medication, poverty, or stigma.

Adolescents' dietary practices also heavily depend on the quantity of food they consume [19]. Studies have found many adolescents living with HIV/AIDS struggle with appetite loss and reduced food intake due to medication side effects, nausea, and vomiting [20]. Additionally, poverty and food insecurity can further limit the quantity of food available for this population. A study by [21] found that food insecurity was associated with inadequate dietary intake and increased risk of malnutrition. Studies have indicated that adolescents consume large quantities of processed and fast foods, which lack essential vitamins and nutrients while increasing caloric intake, instead of eating fruits, vegetables, lean proteins, and whole grains to promote immunity while decreasing malnutrition risks [22].

Stunting and weight loss are common signs of under nutrition among people living with HIV [23] Adolescents with infection are especially prone to malnutrition due to increased nutritional demands associated with puberty and HIV infection [16, 24] conducted a comprehensive meta-analysis on 17 studies related to nutrition among adolescents living with HIV on antiretroviral and found an extremely high burden of under nutrition among them. HIV infection leads to malnutrition due to reduced absorption, increasing demand beyond what's necessary for rapid growth and development in early adolescence [25].

Material and Methods

The research employed a cross-sectional analytical approach using quantitative and qualitative techniques. Kiambu Level 5 Hospital served as the study site which is regulated by Kenya's Ministry of Health and located in Township Ward of Kiambu County. It was selected due to having well-established adolescent friendly HIV services that facilitated quick and convenient sample acquisition. Kiambu County lies within Kenya's former Central Province with Thika being its administrative centre; neighbouring Nairobi Kajiado Counties to its south; Machakos on its east; Murang'a north/north, Nyandarua on its north and Nakuru to its west; population totalling 2,417,735. This research focused on the adolescents with HIV who were receiving care and treatment at Kiambu Level 5 Hospital's comprehensive care clinic for at least 6 months and were willing to participate voluntarily in research were recruited for participation. This study did not include adolescents with HIV who had other conditions that might interfere with dietary intake. The [26] was used to calculate the desired sample size; since there are limited data regarding prevalence rates among adolescents living with HIV in Kiambu County, 50% was adopted per Fisher's recommendations; thus, defining the sample size accordingly. To account for potential non-response, 10% was added, resulting in a total sample size of 271. Then, the systematic selection method was applied in which every k^{th} case in the population frame was chosen until 271 subjects were recruited into the sample. Simple random sampling was employed, where each sampling interval (K) was set at an equal proportion of the total population divided by the desired sample size (650/249=2.6); then random numbers were used to select the first respondent before continuing until all 271 participants were successfully recruited into the study. Dietary practices data was collected using 24-hour recall and dietary diversity questionnaires. For the 24-hour recall the respondents were asked to recall all foods eaten since morning until bedtime on that day. Calibrated household measures (cups, plates or spoons) were used as approximations of how much food was eaten that day. To ensure the consistency of the data collection tool in producing consistent results, a test and re-test method was used. Each participant took two tests with a three-day gap between administration by the same research assistant; their correlation between results was then assessed using Cronbach's alpha; an acceptable coefficient of 0.76 was established as per [27] which served as evidence that the questionnaire can be relied upon. The Kenyatta University Graduate School gave permission to the research study, and Kenyatta University Ethics Review Committee issued the research approval. Also, the authorization to conduct the study was granted by the National Commission for Science, Technology, and Innovation (NACOSTI) under the reference number NACOSTI/P/24/34504. The Kiambu County Government also issued permission for conducting research at Kiambu Level Five Hospital. Before carrying out one-on-one interviews consent was sought from caregivers. Assent was sought from adolescents before proceeding further with one-on-one interviews. Respondents' confidentiality throughout the research was ensured.

Results

Dietary practices for 271 participants were collected through a 24-hour recall method and an individual dietary diversity questionnaire. Energy intake among 271 participants ranged from 571.17 to 2056.01 kcal with a standard deviation intake of 971.15± 387.20 kcal. Protein consumption averaged 39.47±15.99 grams on average and ranged between 17.28 grams and 71.45 grams; fat consumption ranged between 4.40 grams to 114.98 grams while fibre intake varied between 7.41 to 34.49 grams on average. When compared with the Recommended Dietary Allowances (RDAs), protein consumption met 53% of its RDA; fat consumption reached around 38% while fibre intake reached roughly 57% of its RDA.

Energy intake among participants varied, with male participants meeting 95% of the RDA for HIV management (2275 kcal) while meeting 88% of their normal RDA (2100 kcal), while female participants met 93% of the RDA (2 000 kcal), and 94% of their normal RDA (1987 kcal). Carbohydrate intake exceeded both HIV management (391

grams/day for males and 412 for females) and normal RDA categories (341 g/day for men and 298 g/day for females). Males were found to consume 67% of the Recommended Dietary Allowance (RDA) for HIV management (75 g/day), but only 61% of their normal RDA (63 g/day). Females, on the other hand, consumed 132% of both RDAs: 87% for HIV management (82) g/day and 132% for normal (54 g/day). Fat intake reached nearly 90% for both categories among males; this number only dropped down to 64% among female participants. Participants reached 80% of both RDA categories with regard to fibre consumption in terms of both categories (75g/day) Table 1.

Table 1: Macronutrients intake by the adolescents living with HIV/AIDS

	Participants intake		*RDA for HIV		**Normal RDA	
Nutrient	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Energy (kcal)	1997	1870	2100	2000	1950	1900
Carbohydrates g/day	418	383	391	412	341	298
Protein g/day	50	71	75	82	63	54
Fat (g/day)	70	50	78	78	76	76
Fibre (g/day)	24	21	30	30	30	30
*RDA values are based on guidelines for management of HIV/AIDS in Kenya, 2022						
** WHO/Tufts University, 2002						

The micronutrient intake for the adolescents with HIV especially males had a mean daily intake of vitamin A of 1055.86 ± 528.83 micrograms, exceeding their RDA of 900 micrograms by approximately 25%. Other nutrient intake levels fell short for instance folic acid consumption averaged 150.42 ± 58.60 micrograms which was significantly below 400 micrograms recommended daily intake levels. Calcium consumption was below recommended levels for adolescents at 479.48 ±180.66 mg per day against an RDA of 1300 mg, with average phosphorus intake averaging 731.24± 224.66 mg and zinc intake being 6.25 ± 2.60 mg this was below the RDA recommendations of 11 mg. Iron consumption averaged 8.38 ± 2.87 mg while zinc intake at 6.25+-2.60 mg below RDA recommendations of 11 mg per day. Magnesium consumption averaged 203.50±79.26 mg.

Females consumed 1037.18 ± 538.55 micrograms of vitamin A daily, which was above the recommended daily amount of 700 micrograms. The folic acid intake mean was 150.83± 57.75 micrograms which were below recommended 400 micrograms; 479.90 ±185.56 mg of calcium was consumed, also phosphorus consumed amounts were at 728.73±224.01 less than the daily recommended amount of 1250 micrograms; 6.33±2.67 mg of zinc which also below 9 mg; 8.52±2.88 mg of iron; 206± 60 micrograms magnesium as well as 0.75± 0.33 micrograms of vitamin B1 or thiamine Table 2.

Table 2: Micronutrient intake by the adolescents living with HIV

	*RDA/AI		Participants Mean intake		% met RDA
Nutrient	**Males**	**Females**	**Males**	**Females**	
Vit. A (µg)	900	700	1055.9	1037.2	30
Folic acid(µg)	400	400	150.4	150.8	65
Calcium (mg)	1300	1300	479.5	479.9	43
phosphorus (mg)	1250	1250	731.2	728.7	56
Zinc (mg)	11	11	6.3	6.3	45
Iron (mg)	11	15	8.4	8.5	67
Magnesium (mg)	410	360	203.5	206.0	56
Vit. E (eq.) (mg)	15	15	10.8	11.0	38
Vit. B1 (mg)	1.2	1	0.7	0.8	39
Vit. B2 (mg)	1.3	1	0.9	0.9	45
Vit. B6 (mg)	1.3	1.2	1.1	1.1	74
Vit. C (mg)	75	65	89.3	88.7	48

To assess the individual dietary diversity score, the study used the 2014 FAO guidelines for measuring household and Individual Dietary Diversity [28]. This study found out 26.7% had low diversity scores between 0 and 3, 36.8 % had moderate diversity scores between 4 and 5, and 30.6 % experienced high diversity scoring 6 or 12 on their diversity index scorecard as shown in the table 3.

Table 3: Individual dietary diversity score

Characteristic	Frequency(n=271)	Percentage (%)
Low dietary diversity (0 – 3)	77	26.7
Moderate dietary diversity (4 – 5)	106	36.8
High dietary diversity (6 -12)	88	30.6

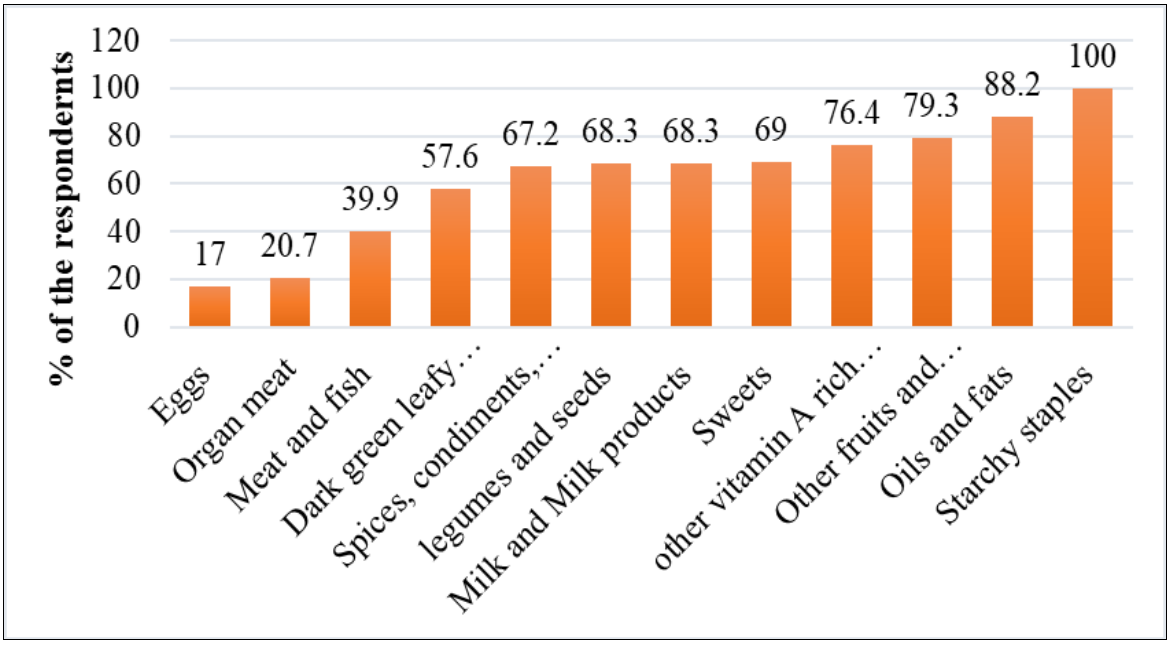

Fig 1: Food groups consumed by the respondents

Eggs were one of the least-consumed food groups among adolescents; only 17% took eggs daily. 20.7% consumed organ meat while 39.9% ate meat and fish products; dark green leafy vegetables made up 57.6% of adolescents' diets while 67.2% enjoyed spices, condiments, beverages, legumes seeds milk products 68.3% also took sweets 69% enjoyed sweets as part of their meals while 88% included oils and fats into daily meals; all adolescents consumed starchy staples food group daily as part of daily meals as shown in the figure 1.

Study participants included 271 individuals with varied levels of appetite. Of those involved, 17% reported having very good appetite while 62% of participants said theirs was good and 21% described it as poor. 62% of respondents reported eating regular meals. Only 46.5% of respondents regularly consume breakfast, with only 62.44% eating lunch regularly and 62.7 % dining on supper as their most consumed meal and 39.1% reported snack consumption. The study revealed that adolescents with HIV were taking nutrition supplements; 26.6% took multivitamins and 34.3% Vitamin C supplements. Dietary restrictions were not widely reported among respondents with 22.1% reporting some form of restriction Table 4.

Table 4: Dietary practices of the adolescents with HIV.

Characteristics	Description	Frequency(n=271)	Percentage (%)
Appetite	Very good	46	17
	Good	168	62
	Poor	57	21
Regular Meals	Yes	168	62
	No	103	38
Took breakfast	Yes	126	46.5
	No	145	53.5
Took Lunch	Yes	169	62.4
	No	102	37.6
Took Supper	Yes	170	62.7
	No	101	37.3
Took Snack	Yes	106	39.1
	No	165	60.9
Nutrition Supplements	None	106	39.1
	Multivitamin*	72	26.6
	Vitamin C	93	34.3
Dietary Restrictions	Yes	60	22.1
	No	211	77.9

*Multivitamin is a combination of vitamins and minerals in form of syrup or tablets form

A chi-square test was carried out to measure the relationship between dietary practices and the five demographic characteristics assessed in this study: sex, age, household size, religion, and relationship status. The results revealed significant associations between dietary practices and four of the five demographic characteristics: sex ($\chi2=7.862$, df=2, p=0.02), age ($\chi2=43.898$, df=2, p=0.001), household size ($\chi2=69.21$, df=6, p=0.001), and religion ($\chi2=9.774$, df=2, p=0.008). No significant relationship was found between dietary practices and relationship status ($\chi2=9.774$, df=2, p=0.154) Table 5.

Table 5: Association between socio demographic characteristics and Dietary practices.

Demographic Characteristic	Description	n=271 (%)	Dietary Practices		
			x	df	P - Value
Sex	Male	139 (51.3)	7.862	2	0.02
	Female	132 (48.7)			
Age (years)	10–14	83 (30.6)			
	15–19	188 (69.4)	43.898	2	0.001
Household size	1-3	104 (38.4)			
	4-6	136 (50.2)	69.21	6	0.001
	4-9	31 (11.4)			
Religion	Christian	268 (98.9)			
	Muslim	3 (1.1)	9.774	2	0.008
Relationship	Single	231 (85.2)			
	Dating	40(14.8)	9.774	2	0.154

The chi-square test for the relationship between socio-economic characteristics and dietary practices among the respondents showed several significant associations. School attendance (χ^2=9.843, df=2, p=0.007) and adolescent education level (χ^2=62.634, df=4, p=0.001) were significantly related to dietary practices, indicating that adolescents who attend school and have higher education levels tend to have better dietary practices. Caregiver occupation (χ^2=19.834, df=4, p=0.001) and income level (χ^2=21.559, df=4, p=0.001) were also significantly related. Housing type (χ^2=13.984, df=4, p=0.007) and house size (χ^2=32.726, df=6, p=0.04) showed significant associations. However, the source of family food (χ^2=1.915, df=2, p=0.384) was not significantly related to dietary practices. Cooking energy type (χ^2=13.972, df=6, p=0.03) was significantly associated with dietary practices, indicating that households using natural gas/LPG have better dietary practices compared to those using other cooking energy types as shown in Table 6.

Table 6: The relationship socio-economic characteristic and dietary practices

Characteristics	Description	n=271 (%)	Dietary practices		
			χ^2	df	p-value
Attending school	Yes	203 (74.9)			
	No	68 (25.1)	9.843	2	0.007
Adolescent Education level	Primary School	86 (31.7)	62.634	4	0.001
	Secondary School	121(44.6)			
	College/university	64 (23.6)			
Caregiver education level	No formal education	14 (5.2)	74.975	6	0.001
	Primary	93 (34.3)			
	Secondary	94 (34.7)			
	College/University	70 (25.8)			
Caregiver occupation	Formal employment	105 (38.7)	19.834	4	0.001
	Informal employment	142 (52.4)			
	Agriculture/farming	24 (8.9)			
Caregiver level of income	5,000-10,000 KES	14 (5.2)	21.559	4	0.001
	10,000-20,000 KES	103 (38)			
	20,000-30,000 KES	154 (56.8)			
Housing	Owned	61 (22.5)	13.984	4	0.007
	Rented	202 (74.5)			
	Informal settlement	8 (3)			
House size (rooms)	1	98 (36.2)	32.726	6	0.04
	2	80 (29.5)			
	3	57 (21)			
	4 or more	36 (13.3)			
Source for family food	Purchase	222 (81.9)	1.915	2	0.384
	Farm Produce	49 (18.1)			
Cooking energy	Electricity	32 (11.9)	13.972	6	0.03
	Firewood	25 (9.2)			
	Natural gas/LPG	166 (61.3)			
	Charcoal	48 (17.7)			

The results from chi-square tests showed significant associations between dietary practices and the nutrition status of the respondents. High dietary diversity (p=0.001) was associated with good nutrition status. Supplement intake (p=0.001) also showed a significant association, indicating that taking supplements is linked to good nutrition status. Also, regular meal intake was significantly associated with nutrition status (p=0.001), indicating that regular meals are associated to good nutrition status. Furthermore, appetite level was significantly associated with nutrition status, with very good and good appetites (p=0.001) indicating good nutrition status (table 7).

Table 7: Relationship between dietary practices and nutrition status

Characteristic	Description	n=271 (%)	P-value
Dietary diversity score	Low dietary diversity (0 – 3)	8(2.8)	0.001
	Moderate dietary diversity (4 – 5)	129(44.8)	
	High dietary diversity (6 -12)	134 (46.5)	
Supplements	No	106(36.8)	0.001
	Yes	165(57.3)	
Regular Meals	Yes	168(58.3)	0.001
	No	103(35.8)	
Appetite	Very good	46(16)	0.001
	Good	168(58.3)	
	Poor	57(19.8)	

A binary logistic regression analysis results indicated that dietary diversity score, supplement intake, regular meal consumption, and appetite level were significant predictors of nutrition status. Participants with moderate High diversity (8) (AOR: 0.813; CI: 0.070-0.406; p=0.001) and moderate dietary diversity (6-12) (AOR: 0.213; CI: 0.090-0.506; p=0.001) were likely to have good nutrition status compared to those with low dietary diversity (0-3). Those who consumed supplements were more likely to have good nutrition status (AOR: 0.70; CI: 0.28-0.172; p=0.001). Participants who did not consume regular meals were more likely to have poor nutrition status compared to those who consumed regular meals (AOR: 3.262; CI: 1.616-6.586; p=0.001). Respondents with a very good appetite were more likely to have good nutrition status compared to those with a poor appetite (AOR: 6.316; CI: 2.926-13.635; p=0.00). These findings suggest that higher dietary diversity, supplement intake, and very good appetite are associated with good nutrition status, while lack of regular meals is associated with poor nutrition status.

Table 8: Regression analysis between dietary practices and nutrition status

Characteristic	Description	AOR (CI)***	P**
Dietary diversity score	Low dietary diversity (0 – 3) (ref)		0.002***
	Moderate dietary diversity (4 – 5)	0.813(0.070-.406)	0.001***
	High dietary diversity (6 -12)	0.213(0.090-0.506)	0.001***
Supplements	No (ref)		
	Yes	0.70(0.28-0.172)	0.001***
Regular Meals	Yes (ref)		
	No	3.262(1.616-6.586)	0.001***
Appetite	Poor (ref)		
	Good	2.565 (.0.912-7.213)	0.74
	Very good	6.316(2.926-13.635)	0.001***

** p stands for p-value: significance level at $p < 0.05$

***AOR [CI] is an acronym for adjusted odds ratio with their confidence intervals. It was adjusted for gender, marital status and education

****significant relationship

Discussion

Good nutrition plays a fundamental role in improving the overall health and well-being of adolescents living with HIV/AIDS [19]. Nutrition plays an essential role in maintaining immune function, supporting growth and development, fighting infections and recovering from illness [5]. Adolescents living with HIV face unique nutritional challenges due to the demands of HIV infection, side effects of antiretroviral therapy (ART), and the potential of malnutrition exacerbating its progression [29]. Therefore, there is a need for proper nutrition for these adolescents in managing their conditions, improving quality of life, and decreasing risks [30].

The study revealed that energy intake among adolescents living with HIV varied, with both male and female participants generally falling short of their recommended daily allowances (RDA) for energy intake. Adolescents need adequate caloric intake to support growth, maintain body weight, and sustain immune function [31]. The adolescents living with HIV the need for sufficient energy is even more pressing since its increased metabolic demands require even higher caloric requirements [32]

The small energy deficit observed in this study could lead to negative health outcomes such as weight loss, reduced muscle mass, and compromised immunity (Ssewanyana *et al*., 2018). These findings echo other research that has linked inadequate energy intake among HIV-positive adolescents with reduced immunity and vulnerability to opportunistic infections [32].

Carbohydrate consumption was high among participants in this study which indicates that adolescents were relying more on carbohydrate-rich foods which are accessible and cost-effective than protein and fat-rich alternatives. These results agree with the studies that have shown diets high in carbohydrates but lacking other macronutrients may not provide adolescents living with HIV with enough essential vitamins and minerals to promote immune health and overall well-being [33]

Adolescents require protein for muscle development, immune function and tissue repair - essential requirements when living with HIV thus adequate protein consumption is critical to counteract muscle atrophy associated with HIV as well as strengthening its capacity to fight infection and strengthen the immune system's response capability. Protein intake among participants fell well below recommended levels, particularly among male adolescents. This result aligns with the results of the study done by [29] that demonstrated how inadequate protein consumption among HIV-positive individuals leads to poor health outcomes such

as higher rates of opportunistic infections and delayed recovery.

This study found significant differences in micronutrient consumption by adolescents living with HIV as compared to the recommended guidelines. Male and females participants consuming adequate levels of vitamin A. However, levels of other essential nutrients such as folic acid, calcium, phosphorus and zinc as well as iron, magnesium and vitamin B1 below recommended levels. These deficiencies are a concern as these nutrients are essential in supporting immunity and maintaining overall health. Lack of iron and folic acids intake has been linked with worsening anemia, as well as further weakening of immune systems already compromised by HIV infection [34].

Based on the food group intake this study this noted that there was low intake of protein-rich foods like eggs, organ meats and fish which are crucial for growth, immunity and overall health. This pattern of under-consumption mirrors findings from studies conducted in similar populations, where economic and food security challenges often limit access to nutritious food sources [32]. Low protein intake is particularly challenging for HIV-infected individuals as an adequate amount is crucial in maintaining muscle mass, supporting immune function, and aiding recovery from secondary infections [35]. Contrarily, this study found that starchy staples and energy-dense foods like oils and fats were consumed at higher rates; this pattern can also be observed in studies on low resource environments [36].

Dietary diversity is crucial for adolescents living with HIV/AIDS as it ensures they receive essential nutrients that support immune function, improve ART efficacy and enhance overall health outcomes. A healthy diet provides all the essential vitamins, minerals, and macronutrients to meet the challenges associated with HIV, such as maintaining a healthy weight, decreasing risk for opportunistic infections, and encouraging growth and development. In this study, the adolescents demonstrated wide variations in dietary diversity; some demonstrated low diversity, much moderate diversity and nearly half experienced high diversity - findings consistent with those found by [37] found that many adolescents maintained moderate to high diet diversity, meaning a balanced intake of various food groups. Dietary diversity among participants indicates that many adolescents can still access a wide variety of foods that help maintain good nutrition status and overall health

Most adolescents reported having an excellent appetite, consistent with findings of that noted appetite can be affected by both antiretroviral therapy (ART) side effects and psychological factors in HIV-positive adolescents. Food consumption was generally consistent throughout the day, with lunch and supper being most frequently eaten and breakfast often ignored. According to research by [38], adolescents in similar settings frequently miss breakfast due to time or food availability issues. Furthermore, Onyango found that snack consumption among those in lower-income homes was relatively low reflecting economic challenges such as snack privilege.

The intake of nutritional supplements was noted among adolescents with some using multivitamins and vitamin C supplements, while others chose not to consume any supplements. This result was consistent with the study by [39], which reported that access and regular usage of supplements is often limited by financial considerations and a lack of awareness [40]

Conclusion

Adolescents' diets were characterized by inadequate energy intake, particularly among males. Adolescents rely on carb-rich foods at the expense of protein and essential micronutrients like iron, folic acid, calcium, and zinc which are crucial components of immunity function and overall health. This dietary deficiency is characterized by health risks given the increased metabolic demands caused by HIV infection. Furthermore, gaps were discovered in micronutrient intake whereby deficiencies were noted for essential minerals like iron folic acid, calcium, and zinc which are vital to immune health.

Even with their many challenges, many adolescents demonstrated moderate to high dietary diversity, reflecting consumption of numerous food groups. Unfortunately, the study also discovered that many adolescents were at risk of undernutrition with a small portion being overweight. This double burden represents malnutrition within this population. The study identified a positive association between demographic variables such as sex, age, and household size with the nutritional status of adolescents living with HIV/AIDS.

References

1. O WH. WHO Nutrition counselling for adolescents and adults with HIV/AIDS [Internet]. Available from: http://www.who.int/elena/titles/nutrition_hiv/en/
2. WHO. Global health estimates: Leading causes of death among adolescents., 2023,
3. Singh JA, Siddiqi M, Parameshwar P, Chandra-Mouli V. World Health Organization Guidance on Ethical Considerations in Planning and Reviewing Research Studies on Sexual and Reproductive Health in Adolescents. The Journal of Adolescent Health [Internet],2019:64(4):427–9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6496912/
4. UNICEF. Adolescent HIV prevention [Internet]., 2022. Available from: https://data.unicef.org/topic/hivaids/adolescents-young-people/
5. WHO. HIV and adolescent girls and young women, 2023 GLOBAL AIDS UPDATE FACTSHEET [Internet]., 2023. Available from: https://www.who.int/publications/m/item/9789231004810,
6. Tanaka LF, Latorre M do RD de O, Silva AM da, Konstantyner TCR de O, Mendes EC, Marques HHS. Poor diet quality among Brazilian adolescents with HIV/AIDS. J Pediatr (Rio J) [Internet],2015:91:152–9. Available from: http://www.scielo.br/j/jped/a/hFhhvm4GYBhHfzVWzfhDHWh/
7. Weldegebreal F, Digaffe T, Mesfin F, Mitiku H. Dietary diversity and associated factors among HIV positive adults attending antiretroviral therapy clinics at Hiwot Fana and Dilchora Hospitals, eastern Ethiopia. HIV/AIDS - Research and Palliative Care [Internet],2018:10:63–72. Available from: https://www.dovepress.com/dietary-diversity-and-associated-factors-among-hiv-positive-adults-att-peer-reviewed-fulltext-article-HIV
8. Ochola S, Masibo PK. Dietary intake of schoolchildren and adolescents in developing countries. Ann Nutr

Metab [Internet],2014:64:2:24–40. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25341871
9. Das JK, Salam RA, Thornburg KL, Prentice AM, Campisi S, Lassi ZS, *et al*. Nutrition in adolescents: physiology, metabolism, and nutritional needs. Ann N Y Acad Sci [Internet],2017:1393(1):21–33. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/nyas.13330
10. Coles L. Clinical nutrition: the interface between metabolism, diet, and disease [Internet]. Toronto, [Waretown,] New Jersey: Apple Academic Press, 2014. Available from: files/394/Coles -, 2014 - Clinical nutrition the interface between metaboli.pdf
11. Weiser SD, Palar K, Hatcher AM, Young S, Frongillo EA, Laraia B. Food insecurity and health: A Conceptual framework. Food Insecurity and Public Health, 2015, 23–50.
12. Williams PL, Jesson J. Growth and Pubertal Development in HIV-Infected Adolescents. Curr Opin HIV AIDS [Internet],2018:13(3):179–86. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5928799/
13. Tekelehaimanot AN, Belachew T, Gudina EK, Getnet M, Amdisa D, Dadi LS. Intention Toward Dietary Diversity Among Adult People Living With HIV in Public Hospitals in Southwest Ethiopia Using Theory of Planned Behavior. A Mixed Methods Study. Inquiry [Internet],2021:58:00469580211060805. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8721683/
14. Gebrie M, Perry L, Xu X, Kassa A, Cruickshank M. Nutritional status and its determinants among adolescents with HIV on anti-retroviral treatment in low- and middle-income countries: a systematic review and meta-analysis. BMC Nutr [Internet],2023:9(1):60. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10053752/
15. Dietary Diversity Is a Good Predictor of the Micronutrient Density of the Diet of 6- to, 23-Month-Old Children in Madagascar1, 2,3 | Enhanced Reader.
16. Christian P, Smith ER. Adolescent Undernutrition: Global Burden, Physiology, and Nutritional Risks. Ann Nutr Metab [Internet],2018:72(4):316–28. Available from: https://www.karger.com/Article/FullText/488865
17. Hyle EP, Martey EB, Bekker LG, Xu A, Parker RA, Walensky RP, *et al*. Diet, physical activity, and obesity among ART-experienced people with HIV in South Africa. AIDS Care [Internet], 2021 [cited, 2024 Oct, 28], 35(1):71. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9200895/
18. Weiser SD, Young SL, Cohen CR, Kushel MB, Tsai AC, Tien PC, *et al*. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. Am J Clin Nutr [Internet], 2011, 94(6):1729S-1739S. Available from: files/464/Weiser *et al*, 2011. - Conceptual framework for understanding the bidirec.pdf
19. Sparrow R, Agustina R, Bras H, Sheila G, Rieger M, Yumna A, *et al*. Adolescent Nutrition—Developing a Research Agenda for the Second Window of Opportunity in Indonesia. Food Nutr Bull [Internet], 2021, 42(1_suppl):S9–20. Available from: http://journals.sagepub.com/doi/10.1177/0379572120983668
20. Alderman EM, Breuner CC, ADOLESCENCE CON, Grubb LK, Powers ME, Upadhya K, *et al*. Unique Needs of the Adolescent. Pediatrics [Internet],2019:144(6):e20193150. Available from: https://publications.aap.org/pediatrics/article/144/6/e20193150/37985/Unique-Needs-of-the-Adolescent
21. Ivers LC, Health S, Advisor P. Food Insecurity and Public Health., 2015 [cited, 2024 Oct, 28], Available from: https://www.taylorfrancis.com/books/mono/10.1201/b18451/food-insecurity-public-health-louise-ivers
22. Unicef. The global strategy for women's, children's and adolescents' health (2016-2030) [Internet]., 2019. Available from: http://www.who.int/pmnch/media/events/2015/gs_2016_30.pdf
23. Senbanjo IO, Oshikoya KA, Odusanya OO, Njokanma OF. Prevalence of and Risk factors for Stunting among School Children and Adolescents in Abeokuta, Southwest Nigeria. J Health Popul Nutr [Internet], 2015, 29(4):364–70. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3190367/
24. Weber AZ, Pellowski JA, Brittain K, Harrison A, Phillips TK, Zerbe A, *et al*. "This is my life we are talking about": Adaptive Strategies for HIV Care Retention and Treatment Adherence among Postpartum Women Living with HIV in Cape Town, South Africa. Matern Child Health J [Internet], 2020 [cited, 2024 Nov 12], 24(12):1454. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8205112/
25. Naswa S, Marfatia YS. Adolescent HIV/AIDS: Issues and challenges. Indian J Sex Transm Dis AIDS [Internet], 2020, 31(1):1. Available from: https://ijstd.org/article.asp?issn=2589-0557
26. Fisher's exact test [Internet]. In: Wikipedia., 2022. Available from: https://en.wikipedia.org/w/index.php?title=Fisher%27s_exact_test&oldid=1073180540
27. Gliem JA, Gliem RR. Calculating, Interpreting, And Reporting Cronbach's Alpha Reliability Coefficient For Likert-Type Scales [Internet]., 2003 [cited, 2024 Oct 31], Available from: https://hdl.handle.net/1805/344
28. FAO. Guidelines for measuring household and individual dietary diversity | Enhanced Reader., 2014,
29. Mehta S, Finkelstein J. Nutrition and HIV: Epidemiological Evidence to Public Health [Internet]. CRC Press,, 2018. Available from: https://books.google.ie/books?id=PjL3DwAAQBAJ
30. Ssewanyana D, Abubakar A, van Baar A, Mwangala PN, Newton CR. Perspectives on Underlying Factors for Unhealthy Diet and Sedentary Lifestyle of Adolescents at a Kenyan Coastal Setting. Front Public Health, 2018, 6.
31. Kolisa YM, Yengopal V, Shumba K, Igumbor J. The burden of oral conditions among adolescents living with HIV at a clinic in Johannesburg, South Africa. PLoS One, 2019, 14(10).
32. Pereira FB, Miraglia F, Schmitz CB, da Silva CLO, Lazzarotto AR. The most significant deficiencies in macro and micro nutrients in adolescents living with

HIV/AIDS in antiretroviral therapy. Nutr Hosp, 2016, 33(1).
33. Wilfred M, 1& K, Charles, Mbakaya FL, Makokha A, Mbugua GG, *et al*. Nutritional Status of Adolescent and Adult PLWHA on Anti-Retroviral Treatment, Attending Various Comprehensive Care Centres in Nairobi County, Kenya. Journal of Health, 2016, 26.
34. Kamau SG, Akatusasira R, Namatovu A, Kibet E, Ssekitto JM, Mamun MA, *et al*. The level of antiretroviral therapy (ART) adherence among orphan children and adolescents living with HIV/AIDS: A systematic review and meta-analysis. PLoS One, 2024, 19(2 February).
35. Dietary diversity and associated factors among HIV positive adults attending antiretroviral therapy | Enhanced Reader.
36. World Health Organization. Key facts HIV/ AIDS. World Health Organization, 2022.
37. DJR, KM, PP, CW. Executive summary-nutritional care of HIV-infected adolescents and adults, including pregnant and lactating women: What do we know, what can we do, and where do we go from here? American Journal of Clinical Nutrition, 2011, 94(6).
38. Kimani-Murage EW, Muthuri SK, Oti SO, Mutua MK, Van De Vijver S, Kyobutungi C. Evidence of a Double Burden of Malnutrition in Urban Poor Settings in Nairobi, Kenya. PLoS One [Internet], 2015 [cited,2024:10(6):e0129943. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0129943
39. Mesic A, Halim N, MacLeod W, Haker C, Mwansa M, Biemba G. Facilitators and Barriers to Adherence to Antiretroviral Therapy and Retention in Care Among Adolescents Living with HIV/AIDS in Zambia: A Mixed Methods Study. AIDS Behav, 2019, 23(9).
40. Okonji EF, Wyk B Van, Hughes GD, Mukumbang FC. Implementation of a Psychosocial Support Intervention for Adolescents on Antiretroviral Treatment: Challenges and Experiences from Ehlanzeni District, South Africa. J Int Assoc Provid AIDS Care, 2022, 21.;