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The Prevalence and Factors Associated with the Dietary Diversity among HIV Positive Women Attending Art in Kabale District, Uganda

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Abstract

Background: It has long been recognized that HIV causes malnutrition and malnutrition exacerbates the effects of HIV in the body. Women are physiologically, socially and economically vulnerable to HIV related malnutrition. FAO recommends women of reproductive age to consume at least five food groups daily; however, paucity of information exists about the diet quality of this population in Uganda, especially in Kabale district, which is among the chronically food insecure districts in Uganda. The main Objective of the study was to Determine the prevalence and factors associated with the recommended Minimum Dietary Diversity among HIV positive women of reproductive age (18-49) receiving ART in Kabale district, Uganda.

Methods: This was a cross sectional study, which was done in all the ART clinics in the District. PPS sampling was applied to select number of participants per ART clinic and respondents were sampled consecutively in each clinic. A structured questionnaire was used to collect data on the respondent characteristics while the FAO's IDD questionnaire used to collect the 24-hour dietary intake.

Results: Data was analyzed using both MS-excel 2010 and STATA version 14 software. Descriptive statistics were applied for univariate analysis. Modified poisson was used to determine the factors associated with MDD. The study was approved by the Makerere university school of public health review board and informed consent obtained from the respondents before interviews. The response rate was 99.2% and 90.9% of these were Bakiga. Their mean age was 34.8 ± 8.1 years, (47.6%) were married, and (98.0%) came from nuclear families with an average and median number of 4.4 ± 1.9 and 4 members respectively. The mean number of food groups consumed was 4.7 ± 1.7. The prevalence of the MDDS was 48.2%. The most consumed foods included: Roots and tubers, pulses, dark leafy and vitamin A vegetables while milk, eggs and fruits were least consumed. Factors associated with MDDS at multivariate level included; age, type of employment, having nausea, viral load status and HIV clinical stage.

Conclusion: Almost one half of the HIV positive women on ART in the district achieve the minimum dietary diversity and this can be contributed to being middle aged, having casual employment and unsuppressed viral load.

Keywords: Dietary diversity; HIV positive; Women; Health characteristics; Malnutrition

Abbreviations: AIDS: Acquired Immunodeficiency Syndrome; APR: Adjusted Prevalence Rates; CPR: Crude Prevalence Rates; CI: Confidence Intervals; FANTA: Food and Technical Assistance; FAO: Food and Agriculture Organization; GDP: Growth Domestic Product; HIV: Human Immunodeficiency Virus: IDDS: Individual Dietary Diversity Score; MDD: Minimum Dietary Diversity; MDDW: Minimum Dietary Diversity for Women; MPA: Micronutrient Proportional Adequacy; MS: Microsoft; NACS: Nutrition Assessment, Counseling and Support; NAIDS: Nutritionally Acquired Immunodeficiency Syndrome; PI: Principal Investigator; PLHIV: People Living with HIV; PPS: Probability Proportionate to Size Sampling; SOP: Standard Operating Procedures; TB: Tuberculosis; WDDS: Women Dietary Diversity Score; WHO: World Health Organization

Introduction

Malnutrition and HIV are strongly associated, and since the beginning of the pandemic, it was originally referred to as the 'slim syndrome' due to its emanciating effect [1]. The risk of death associated with HIV induced malnutrition is 2-6 fold compared to HIV negative malnourished individuals [2]. Women are particularly vulnerable to HIV related malnutrition due to physiological vulnerability which comes with childbearing. Also, maternal nutrient needs increase during pregnancy and breastfeeding, and when these needs are not met, mothers may experience wasting and fatigue that may limit their ability to fully satisfy infant needs. Increasing the diversity of the diet by consuming multiple food groups has been strongly associated with improved health outcomes among People Living with HIV/AIDS (PLHA) [3].

A positive and dose response relationship between dietary diversity and both mental and physical health among PLHA has been reported among PLHA, where individuals with high dietary diversity have higher mental and physical quality of life than individuals with lower dietary diversity scores [4]. However, poor

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dietary patterns among PLWHA have been reported in Eastern and Western Ethiopia, with 58.8% and 28.7% of HIV positive adults on ART consuming less than the recommended number of groups daily in 2015 and 2018 respectively [5,6]. Similar trends have been shown in Uganda, where the consumption of the recommended number of food groups among HIV positive women in Eastern Uganda has been reported at 39.8% and at 35% among HIV positive adults receiving ART at Mildmay in Kampala [7].

However, there is paucity of information on dietary diversity among this population in Uganda as a whole and more specifically in Kabale district, where 3.1% of the HIV positive women are wasted, in a district that has been ranked among the most food insecure districts in Uganda [8]. In fact, no survey has been done in Uganda to assess HIV positive women's diet quality using the MDD indicator as recommended by FAO and its associated factors in this population. This study will therefore determine the minimum dietary diversity in this population to generate information that will guide health workers at the district and in Uganda to advocate or promote dietary diversification in the district and Uganda as a whole [10].

Materials and Methods

Study area and population

A cross sectional study was conducted among HIV positive women attending the ART clinic in HIV care centers in Kabale district. The study was conducted at all HIV support health centers in the district. The district has eight HIV support centers including Kabale regional referral hospital, Rugarama health center IV, Maziba HCIV, Kamuganguzi HCII, Kakomo HC IV, Maziba HC IV, Kamukira HC IV and Rubaya HC IV. The total number of HIV positive women of reproductive age in care was estimated to be 2902 patients. All HIV positive women of reproductive age (15-49) years were included in the study. These were registered in the hospitals' ART clinics and must have visited the hospital more than once and all HIV positive women of reproductive age who had an unusual eating pattern the previous day, for example a feast or who were sick and unable to eat as usual the previous day were excluded from the study [11].

Sample size determination and sampling

The sample size was determined using the formula for cross sectional studies and comparative cross sectional studies [12]. A sample size of 411 respondents was required for the study at 95% confidence interval, prevalence of MDDS among HIV positive women of reproductive age at 39.8 and a non-response rate of 10%. At health center level, the number of respondents was obtained by probability proportional to size sampling procedure to obtain the number of respondents to be interviewed per center. The total number of respondents in all the facilities in the district was 2902 [13]. Within the health centers, respondents who fit in the inclusion criteria were sampled consecutively as they came in the clinic on each clinic day (Table 1).

Table 1: The number of participants sampled per site.

Facility	Number in care	Number sampled
Kabale RRH	1230	174
Kamukira HC IV	566	80
Kamuganguzi HC III	174	25
Rushoroza HC IV	338	48
Rugarama HC IV	345	49
Rubaya HC IV	106	15
Maziba HCIV	78	11
Kakomo HC IV	65	9
Total	2902	411

Study variables

The minimum dietary diversity was measured by using the by FAO method as proposed by where respondents were asked to list all the foods consumed in the past 24 hours prior to the interview and the foods were categorized in 10 food groups, *i.e.,* cereals, pulses, nuts and seeds, meat, poultry and fish, diary, eggs vitamin A vegetables, vitamin A fruits, dark leafy vegetables, other fruits and other vegetables [14]. Each food group consumed by the respondent was given a score of one and the number of food groups consumed was added for each individual to determine the dietary diversity score for each person. Those who had consumed at least five of the ten food groups were classified as to have consumed the recommended minimum dietary diversity and the percentage of those was computed from the following equation [15].

No. of respondents with the Minimum Dietary Diversity Score

Total number of respondents

The factors associated with dietary diversity were classified into three groups, *i.e.,* socio-demographic factors including the age, ethnicity, marital status, household size, gender of household head, socio-economic characteristics include: Source of income, food security status, education level and socio-economic status and health related characteristics including recent illness in the past two weeks, HIV clinical stage, CD4 count, and presence of comorbidities [16].

Data collection methods

Five research assistants were recruited and trained to assist the principal investigator in the data collection exercise. These were registered nurses working in other health centers and conversant with the local language. Training manuals were developed by the principle investigator as per FAO guidelines and the training included revision of all study tools to ensure common understanding of all questions, questioning and probing techniques to help minimize loss of the intended meaning and how to fill in the questionnaires. Face to face interviews were conducted through administration of a structured questionnaire to determine the socio-demographic, socio-economic and health related characteristics, alongside the FAO standard dietary diversity questionnaire to collect the 24-hour recall dietary information [17]. The questionnaire was available both in English and Lunyankole/Rukiga. Interviewers were supervised and the interview process monitored by the principal investigator who doubled as the field supervisor. The principal investigator checked the data for accuracy, consistency and completeness on a daily basis. Anomalies and missing data was corrected appropriately or by contacting respondents by telephone. The questionnaires was properly numbered and coded for easy identification [18].

Data management and analysis

Two data entry clerks were employed to enter the data while in the field and to ensure accuracy and consistency of data in Epidata version 3. Validation checks were applied to check if the responses and codes entered were consistent and within permissible range by running frequency tables and where necessary some fields were edited to create the correct data files. Data was imported to and analyzed using both Microsoft excel 2010 and STATA version 14 for analysis [19]. Normality checks were first applied to check for data distribution to determine the tests for analysis. Univariate analysis was applied to obtain proportions, means, median, frequencies and standard deviations as per data type. Data was presented in tables, and graphs. Cross tabulations were conducted and modified Poisson which provides estimates of prevalence ratios and p-values were used to determine associations and significance at bivariate and multivariate analyses. The strength of associations was determined using the prevalence ratios and confidence intervals.

Results

Characteristics of the respondents

A total number of 408 HIV positive women participated in the study, accounting for a response rate of 99.3%. The average age of the respondents was 34.8 ± 8.1 years and nearly half of the respondents were married (47.6%). Respondents who were household heads constituted 46.6% and majority of the respondents were from families with an average household number of 4.4 ± 1.9 members. The respondents were predominantly Bakiga (90.9%) and slightly more than half were Anglicans (53.7%). Almost all of the respondents lived in nuclear families (98.0%) (Table 2).

Table 2: Characteristics of the respondents.

Variable	Frequency (N)	Percentage (%)
Age (years)		
15-20	31	7.6
21-30	85	20.8
31-39	158	38.7
≥ 40	134	32.8
Religion		
Anglican	219	53.7
Pentecostal	20	4.9
Catholic	158	38.7

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Others (Abacwezi, SDA, Moslem)	11	2.7
Ethnicity		
Banyankole	18	4.4
Bakiga	370	90.7
Others (Bafumbira, Bagisu, Baganda)	20	4.9
Marital status		
Never married	40	9.8
Married	194	47.6
Separated/divorced	179	42.7
Household head		
Husband	175	42.8
Respondent	190	46.6
Parent	43	10.5
Type of family		
Nuclear	400	98
Extended	8	1.1
Household number		
≤ 5	310	76.2
>5	97	23.8

Slightly more than a half of them had no formal training (52.9%) and the major form of employment was casual laboring (44.5%) and slightly more than half had a middle social economic status (Table 3).

Table 3: Social economic characteristics of the respondents.

Variable	Frequency (N)	Percentage (%)
Level of education		
None	216	52.9
Primary	142	34.8
Secondary	40	9.6
Tertiary/Institution	12	2.8
Employment status		
Regular/Salary	24	6.1

Self	164	40.3
Casual laborer	181	44.5
Unemployed	37	9.1
Social economic status		
Low	162	39.9
Middle	216	53.2
High	28	6.9
Food Security status		
Food secure	47	11.5
Mildly food insecure	39	9.6
Moderately food insecure	176	43.1
Severely food insecure	146	35.8

Majority of the respondents had been in care for more than 18 months (79.9%), were in the first clinical stage, were still on the first line of treatment (96.3%), had good adherence (95.3%) and suppressed viral load (94.7%). In addition to that, many of them had been well/working in the previous six months (87.3%) and had a normal nutritional status (67.2%). The mean CD4 count was 433.857 ± 240.28 cells/mm (Table 4).

Table 4: Health characteristics of the respondents.

Variable	Frequency (N)	Percentage (%)
Current HIV clinical stage		
Stage 1	358	90
Stage 2	36	9.1
Stage 3 and 4	3	0.8
No. of months in care		
≤ 18	82	20.1
>18	326	79.9
Functional status in the past 6 months (record review)		
Working/Normal	356	87.3
Ambulatory	46	11.3
Bed ridden	6	1.5
Adherence to ART (record review)		
Good	386	95.3
Fair	17	4.2

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Poor	2	0.5
CD4 count (previous 6 months) (record review)		
≤ 350	47	39.5
>350	72	60.5
Viral load (record review)		
Not detected	372	94.7
More than 1000 copies	21	5.34
Nutritional status		
Severely underweight	3	0.8
Moderately underweight	16	3.9
Normal	270	66.1
Overweight	85	21.1
Obese	28	6.9
Line of treatment (record review)		
First line	393	96.3
Second line	15	3.7
Opportunistic infections		
Had nausea	50	12.7
Had diarrhea	69	17.5
Had cough	131	33.2
Had pneumonia	53	13.4
Had fever	92	23.3

Food groups consumed by the respondents

Figure 1 shows the proportion of different food groups consumed by the respondents within the previous 24 hours. The most consumed food groups were grains and tubers (92.1%), pulses (78.4%), dark green vegetables (62.5%), vitamin A fruits and vegetables (58.6%) and other vegetables (54.1%). The least consumed food groups were eggs (15.9%), meat (25.1%) and other fruits (20.9%).

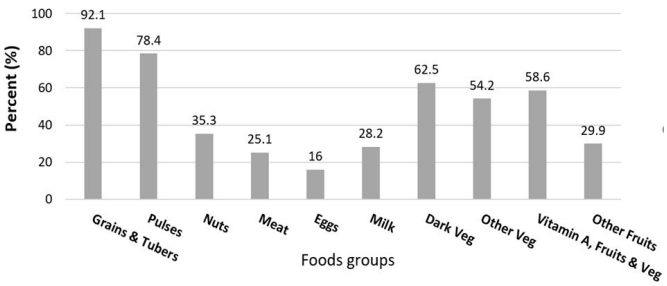

Figure 1: Proportion of food groups consumed by the respondents in the past 24 hours.

The dietary diversity of the respondents

Figure 2 below shows the distribution of the different number of food groups as consumed by the respondents over the 24

hour period. The DDS ranged from 1 to 10 food groups per day, most respondents ate at least 4 food groups (24.8%), with the mean number of food groups consumed being 4.7 ± 0.1. The least number of food groups consumed was 10 food groups with less than one percent of the respondents achieving it [20].

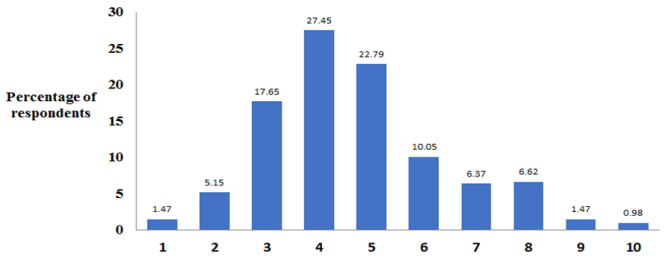

Figure 2: Number of food groups consumed by the respondents in the previous 24 hours.

Minimum dietary diversity score of the respondents

The food groups were further disintegrated into two categories, that is, those who consumed the minimum dietary diversity of at least five food groups and those who consumed less than the recommended five food groups. It was found that less than half of all the respondents (48.2%) had consumed the recommended number of food groups while slightly more than half of them (51.84%) did not reach the five food group mark as recommended by FAO (Figure 3 and Tables 5-7).

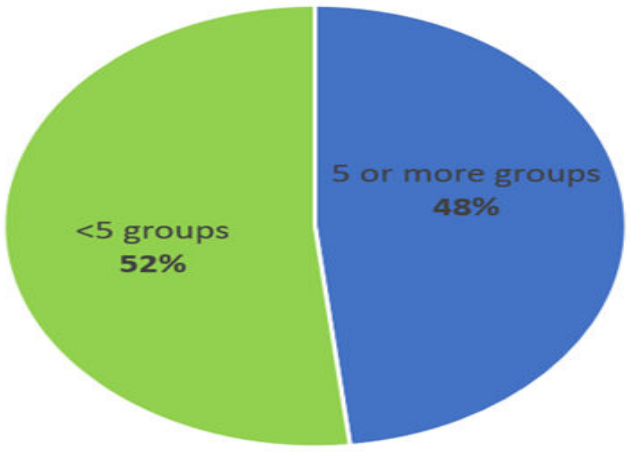

Figure 3: Distribution of the minimum dietary diversity Score by the number of food groups consumed in the past 24 hours.

Table 5: Distribution of the MDDS across social demographic factors.

Factor	Consume MDD N (%)	Do not consume MDD N (%)	Total N (%)	P-value
Age				
15-20	23 (11.5)	8 (3.8)	31 (7.6)	0.068
21-30	46 (23)	39 (18.7)	85 (20.8)	
31-39	65 (32.5)	93 (44.7)	158 (38.7)	
≥ 40	66 (33.7)	68 (32.2)	134 (32.9)	
Marital status				
Never married	21 (10.7)	19 (9.0)	40 (9.8)	0.697
Married	95 (48.5)	98 (46.5)	193 (47.42)	
Separated	80 (40.8)	94 (44.6)	174 (42.8)	
Ethnicity				
Banyankole	8 (4.1)	10 (4.7)	17 (4.4)	0.938
Bakiga	178 (90.8)	19 (90.5)	369 (90.6)	
Others (Bafumbira, Baganda, Bagisu, Madi)	10 (5.1)	10 (4.7)	20 (4.9)	
Religion				
Anglican	109 (55.6)	109 (51.7)	218 (53.7)	0.578

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Pentecostal	7 (3.6)	13 (6.2)	20 (4.9)	
Catholic	74 (37.8)	84 (39.8)	158 (38.8)	
Others (Moslem, SDA, Bachwezi)	6 (3.1)	5 (2.4)	11 (2.7)	
Family type				
Nuclear	192 (97.8)	207 (98.1)	399 (98.0)	0.916
Extended	4 (2.0)	4 (1.9)	8 (1.9)	
Household head				
Husband	85 (43.4)	89 (42.2)	174 (42.8)	0.485
Respondent	94 (47.9)	96 (45.5)	190 (46.7)	
Parent	17 (8.7)	26 (12.3)	43 (10.6)	
Household number				
More than 5	45 (22.9)	51 (24.3)	96 (23.7)	0.75
Less than 5	151 (77.0)	159 (75.7)	310 (76.4)	

Table 6: Distribution of the MDDS and the social economic factors.

Factor	Consume MDD N (%)	Do not consume MDD N (%)	Total N (%)	P-value
Education level				
None	82 (41.8)	133 (63.0)	215 (52.8)	<0.001
Primary	82 (41.8)	60 (28.4)	142 (34.9)	
Secondary	25 (12.8)	10 (4.7)	35 (8.6)	
Tertiary	3 (1.5)	5 (2.4)	8 (2.0)	
Type of employment				
Regular/salary	17 (8.7)	8 (3.8)	25 (6.2)	0.023
Self employed	88 (44.9)	76 (36.2)	164 (4.4)	
Casual laborer	74 (37.8)	106 (50.5)	180 (44.3)	
Unemployed	17 (8.7)	20 (9.5)	37 (9.1)	
Social economic status				
Low	81 (41.8)	81 (38.4)	162 (40.0)	0.574
Middle	98 (50.5)	117 (55.1)	215 (53.1)	

High	15 (7.7)	13 (6.2)	28 (6.9)	
Food security status				
Food secure	29 (14.8)	18 (8.5)	47 (11.6)	0.081
Mildly insecure	23 (11.7)	16 (7.6)	39 (9.6)	
Moderately insecure	78 (39.8)	98 (46.5)	176 (43.2)	
Severely insecure	66 (33.7)	79 (37.4)	145 (35.6)	

Table 7: Distribution of the MDDS across the health related characteristics.

Factor	Consume MDD N (%)	Do not consume MDD N (%)	Total N (%)	P-value
Number of months in care				
0-18 months	40 (20.4)	42 (19.9)	82 (20.2)	0.899
More than 18 months	156 (79.6)	169 (80.1)	325 (79.9)	
Functional status (past 6 months)				
Working	166 (85.1)	185 (87.7)	351 (86.5)	0.607
Ambulatory	20 (10.3)	20 (9.5)	40 (9.9)	
Bed ridden	9 (4.6)	6 (2.8)	15 (3.7)	
Adherence status (record review)				
Poor	1 (0.5)	1 (0.5)	2 (0.5)	0.86
Fair	7 (3.6)	10 (4.76)	17 (4.2)	
Good	186 (95.9)	199 (94.8)	385 (95.3)	
CD4 count (past 6 months)				
<350	17 (39.5)	30 (39.5)	47 (39.5)	0.995
>350	26 (60.5)	46 (60.5)	72 (60.5)	
Viral load				
Undetectable	186 (97.9)	185 (91.6)	371 (94.6)	0.006
More than 1000 copies	4 (2.1)	17 (8.4)	21 (5.4)	
WHO HIV stage				
Stage 1	174 (91.1)	183 (89.3)	357 (90.2)	0.007
Stage 2	15 (7.9)	21 (10.2)	36 (9.1)	
Stage 3 and 4	2 (1.1)	1 (0.5)	1 (0.8)	

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Opportunistic infections Nausea				
Yes	32 (16.67)	18 (8.9)	50 (12.7)	0.021
No	160 (83.3)	184 (90.1)	344 (87.3)	
Diarrhea				
Yes	41 (21.6)	28 (13.9)	69 (17.5)	0.05
No	151 (78.6)	174 (86.14)	325 (82.5)	
Cough				
Yes	72 (39.5)	59 (29.2)	131 (33.25)	0.081
No	120 (62.5)	143 (70.8)	263 (66.8)	
Fever				
Yes	51 (26.6)	40 (19.8)	91 (23.1)	0.111
No	141 (73.4)	162 (80.2)	303 (76.9)	
Pneumonia				
Yes	33 (17.2)	19 (9.4)	52 (13.2)	0.023
No	159 (82.1)	183 (90.6)	342 (86.8)	

Factors associated with the minimum dietary diversity among the respondents

Table 8 shows the factors associated with the minimum dietary diversity score of the respondents at both bivariate and multivariate analyses. Binary logistic regression showed that age, religion, level of education, type of employment, food security status, viral load, HIV clinical stage, opportunistic infections, *i.e.,* diarrhea, pneumonia, nausea, cough, fever and type of regimen were significantly associated with the MDDS at P<0.2. At this level, being middle aged was found to be statistically associated with MDDS whereby the middle aged adults were 1.10 (CPR=1.10; 95% CI: (1.03-1.15)) times more likely to achieve the MDDS compared to young HIV positive women.

Also, religion was statistically and significantly associated with the MDDS. The Pentecostals were 1.1 (CPR=1.1; 95% CI: (0.96-1.25)) times more likely to achieve the MDDS compared to the Anglicans. Employment status was also associated with the MDDS at the P value <0.2. Being a casual laborer or unemployed was a contributing factor to consume a more diversified diet as compared to being formally employed. That is, casual laborers and the unemployed were 1.02 (CPR=1.02; 95% CI: (1.04-1.40)) and 1.17 (CPR=1.17, 95% CI: (0.98-1.39)) more likely to achieve the minimum dietary diversity respectively, compared to the employed.

The results also showed that HIV positive women who were moderately food insecure were 1.16 (CPR=1.16; 95% CI: (1.00-1.26)) times more likely to consume the recommended minimum dietary diversity and the severely food insecure were also 1.12 (CPR=1.12; 95% CI: (0.99-1.25)) times more likely to consume the MDD as compared to HIV positive women who were food secure. The prevalence of the MDDS among HIV positive women who had unsuppressed viral load was 1.21 (CPR=1.21; 95% CI: (1.09-1.33)) times as compared to women with suppressed viral load. They were 1.21 more likely to consume a diversified diet compared to women with suppressed viral load [21].

To note also is that having opportunistic infections was strongly associated with less likelihood of consuming the minimum dietary diversity. The opportunistic infections included nausea, cough, diarrhea, fever and pneumonia. HIV positive women with any of these opportunistic infections were less likely to have consumed the MDD the previous day with the following prevalence ratios for diarrhea. Those with nausea were 0.99 (CPR=0.99 95% CI: (0.92-0.99)), times less likely to achieve the MDDS, those with cough were 0.94 (CPR=0.94; 95% CI: (0.88-1.01)), times less likely to achieve the MDDS, those with pneumonia were 0.89 (CPR=0.89; 95% CI: (0.80-0.98)), times less likely to achieve the MDDS, those with fever were 0.94 (CPR=0.94; 95% CI: (0.87-1.02)), times less likely to achieve the MDDS and those with diarrhea were also 0.88 (CPR=0.88; 95% CI: (0.79-0.98)) times less likely to consume the MDDS compared to those without opportunistic infections. Also, women who were on the second line regimen of ART were 1.1 (CPR= 1.1; 95% CI: (0.95-1.28)) times more likely to consume the recommended MDD as compared to those on first line ART.

Multivariate analysis

The age of the respondents was statistically and significantly associated with the consumption of the MDDS, whereby those in the age 21-29 bracket were 1.10 times more likely to achieve the MDDS compared to the 15-20 age group (APR=1.10; 95% CI (0.97-1.25)). For the type of employment, casual laborers and the unemployed were found to be 1.19 and 1.22 times more likely to consume a more diversified diet than those with regular or formal employment (APR=1.19; 95% CI (1.01-1.40)), [APR=1.22; 95% CI (1.13-1.36)) respectively. The prevalence of the MDDS was more among the casual laborers and the unemployed compared to the employed.

Viral load, that is whether someone had a suppressed or unsuppressed viral load, was also significantly associated with the MDDS. HIV positive women who had unsuppressed viral load of more than 1000 copies were 1.17 times more likely to consume the recommended MMDS as compared to women with suppressed viral load, (APR=1. 17; 95% CI (1.04-1.31)). It was observed that HIV positive women in HIV clinical stage III and IV 0.74 were times less likely to have consumed a diversified diet to meet the recommended MDDS (APR=0.74; 95% CI (0.059-0.092)). It was also observed that HIV positive women who had opportunistic infections, especially nausea, were 0.87 (APR=0.87; 95% CI (0.78-0.98)) times less likely to consume the minimum dietary diversity compared to those without opportunistic infections [22].

Table 8: Unadjusted and adjusted prevalence ratio.

Variable	Unadjusted Prevalence Ratio (95% CI)	P-value	Adjusted Prevalence Ratio (95%CI)	P-value
Age				
15-20	1	-	-	-
21-30	1.10 (1.03-1.15)	0.031	1.10 (0.97-1.25)	0.041
31-39	1.06 (0.98-1.16)	0.221	1.02 (0.95- 1.06)	0.504
>40	1.05 (0.96-1.14)	0.303	1.08 (0.98- 1.23)	0.231
Employment type				
Employed	1	-	1	-
Self-employment	1.12 (0.96-1.29)	0.174	1.16 (0.98-1.36)	0.081
Casual laborer	1.20 (1.04-1.40)	0.012	1.19 (1.01-1.40)	0.030
Unemployed	1.17 (0.98-1.39)	0.081	1.22 (1.02-1.46)	0.022
Viral load				
Less than 1000 copies	1	-	1	-
More than 1000 copies	1.21 (1.09-1.33)	<0.001	1.17 (1.04-1.31)	0.010
HIV clinical stage (record review)				
Stage 1	1	-	1	-
Stage 2	1.05 (0.94-1.17)	0.405	0.96 (0.87-1.08)	0.565
Stage 3 and 4	0.66 (0.64-0.68)	<0.001	0.74 (0.64-0.86)	<0.001
Opportunistic infections/symptoms				
None	1	-	1	-

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Nausea	0.88 (0.79-0.98)	0.024	0.88(0.78-0.98)	0.032
Diarrhea	0.92 (0.84-0.99)	0.051	-	-
Cough	0.94 (0.88-1.01)	0.084	-	-
Pneumonia	0.89 (0.80-0.98)	0.022	-	-
Fever	0.94 (0.87-1.02)	0.123		
Food security status				
Food secure	1	-	-	-
Mild insecurity	1.02 (0.88-1.83)	0.8	-	-
Moderate insecurity	1.26 (1.00-1.26)	0.043	-	-
Severe insecurity	1.12 (0.99-1.25)	0.061	-	-
Regimen				
First line	1	-	-	-
Second line	1.10 (0.95-1.28)	0.192	-	-
Religion				
Anglican	1	-	-	-
Pentecostal	1.10 (0.96-1.25)	0.160	-	-
Catholic	1.02 (0.95-1.09)	0.54	-	-
Other	0.96 (0.78-1.19)	0.771	-	-

Discussion

The most consumed food groups were grains, pulses and vitamin vegetables and other vegetables. This is not surprising since matooke, maize and other grains are Kabale's staple foods and are consumed during most of the meals. Also, legumes and vegetables are cheaper to have and are readily available since Kabale district is one of the major vegetable production areas in Uganda [23,24]. Other studies about dietary diversification among HIV positive adults conducted in Uganda at Mildmay HIV care center in Kampala and in rural eastern Uganda have also shown that grains/cereals/tubers, pulses and vegetables were the mostly consumed among HIV positive adults receiving ART [25].

The least consumed food groups among the respondents were food of animal origin; eggs, milk and meat as well as other fruits. It is not surprising however that these were the least consumed since they are generally more expensive compared to staples, legumes and vegetables; yet most of the respondents were in the middle social economic status, meaning they could only afford basic food needs, and therefore, could probably not afford the expensive foods [26]. Similar results have been shown among adults living with HIV in Uganda, Kenya and Nigeria [27,28].

The prevalence of the MDDS was 48.2%, showing that most of the women consumed less than the recommended number of five food groups; the mean number of food groups consumed were 4.7 ± 0.1 food groups. This prevalence is much higher than the prevalence reported by other researchers, for example studies among HIV positive adults attending ART from Urban settings in Kampala and eastern Uganda reported prevalence of 35% and 39.8% and respectively [29,30]. However, these studies considered consumption of six or more food groups as a cut off for good/high dietary diversity, which is higher than the cut off considered for this study. Therefore, the smaller prevalence in previous studies could be explained by the higher number of food groups set by researchers [31].

These studies have also shown that most of the respondents consumed an average of 4.99 ± 1.3 food groups [32]. The difference in the results could however be attributed to the difference in the study settings as these studies were conducted in urban settings and it has been shown that urban residents are more likely to consume a more diversified diet compared to those from rural areas; due to the presence of markets with a

wide of range of food products to choose from, compared to villages [33-35].

Factors associated with the minimum dietary diversity among the respondents

The age of the respondents was associated with the MDDS whereby the middle aged HIV positive women were more likely to achieve the recommended MDDS. Similar results have been reported in Mexico and eastern Uganda, which showed that dietary diversity, was strongly associated with age of the respondent, as middle aged women (15-30) were more likely to consume a more diversified diet compared to younger or older women. However, some studies have reported contradicting findings regarding age and dietary diversity. For example, found a negative association between age of women and dietary diversity score, where by younger women consumed more diversified diets than older women [36].

Results show that employment is strongly associated with MDDS whereby the unemployed and casual laborers were more likely to consume a more diversified diet compared to the employed. These findings are consistent with those reported by during a study assessing the factors associated with dietary diversity among HIV positive adults receiving ART in Ethiopia [37]. However, other scholars have reported that PLHA with regular employment and the self- employed were more likely to consume more diversified diets compared to the unemployed and casual laborers because they have more purchasing power due to a constant and reliable source of income [38,39].

Casual laboring among women in Kabale district is characterized by exchange of labor for food and therefore, it is more possible to acquire different types of food, hence consuming a more diversified diet, and this may in turn be cheaper than paying for it out of pocket since laboring for money pays cheaply yet food is generally expensive. And so, the women who exchange labor for food obtain it cheaply and end up consuming a more diversified diet compared to their employed counterparts [40].

It was also observed that the unemployed were more likely to consume a diversified diet compared to their employed counterparts. Interestingly to note is that this category of people were mostly farmers, who grow their own food, and a study done in Malawi showed that people who grow their own food are more likely to consume diversified diets as they have a wide range of food stuffs to choose from [41,42]. HIV positive women whose viral load was more than 1000 copies were more likely to consume a diversified diet compared to those with suppressed viral load. Although unsuppressed viral has strongly been associated with reduced immune function and hence suscepting the body to opportunistic infections like diarrhea and nausea which reduce appetite lowering food consumption hence eating a less diversified diet, results from this study differ from those reported by other researchers [43,44]. This could probably be explained by the fact that HIV positive women with unsuppressed viral load in Kabale usually receive nutritional counseling at every visit and are followed up to make sure that they adhere to consumption of a nutritious, diversified diet, which is an exception for patients whose viral load is suppressed. This empowers those with un suppressed viral load to possess adequate nutritional knowledge about food choices, hence consuming a more diversified diet compared to their counterparts [45-48].

HIV clinical stage was also significantly associated with the MDDS whereby those in advanced HIV stages were less likely to consume a diversified diet compared to those in stage one. As the disease progresses, the virus weakens the immune system and the body is attacked by opportunistic infections which reduce food intake, hence consuming a less diversified diet [49]. In addition to that, as the disease progresses, there is continued deterioration in productivity among PLWHA in these households, resulting mainly from increased opportunistic infections and this is most likely to increase the inability of affected households to put enough food on the table and hence consuming less diversified diet [50-52].

Opportunistic infections were also strongly associated with the MDDS whereby HIV positive women with opportunistic infections especially those who had nausea were less likely to have consumed a diversified diet compared to those without opportunistic infections [53]. Similar results have been reported among HIV positive adults receiving ART in various settings both in Uganda, Kenya and Ethiopia [54,55]. Since the discovery of the disease, opportunistic infections, especially those affecting the digestive system have strongly been associated with low food intake, for example in Abidjan, a cross-sectional study with 100 HIV-infected people at different stages of the infection showed that dietary intakes of the respondents were worsened by clinical events such as anorexia [56-58]. Although the multivariate analysis excluded religion as a factor associated with the MDDS, bivariate analysis showed that Seventh Day Adventists were less likely to consume a diversified diet compared to other religions. Since time in memorial, SDAs have been mostly vegetarians and therefore are less likely to add meats to their diet, hence eating less diversified diets [59]. Although available data shows a contradiction between dietary diversity and religion, some studies have shown a positive correlation between the consumption of diversified diets and religion for example in his study about backyard gardening and dietary diversity in India, found out that Muslim households consumed more diversified foods compared to Hindus.

Conclusion

Almost one in every two of the HIV positive women receiving ART in Kabale district consumes the recommended MDDS. The mostly consumed food groups are majorly staples and vegetables whereas meats and fruits are the least consumed. The low consumption of the recommended MDDS can be contributed to being regularly or self- employed, having nausea and being in HIV clinical stage 3 and 4.

Study Limitations

- Because the data was based on the respondent's memory, it is unavoidable or even impossible to control for memory loss as it is difficult to verify for information accuracy, but the

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research assistants were trained on the different ways to probe for more details from the respondents to help them to remember.

- It was not easy to come up with food groups especially quantifying food groups in mixed dishes as some foods may be eaten in very small quantities, or foods which were used as condiments for example silver fish, pepper. However, the enumerators were trained on how to quantify the ingredients.
- It was hard to quantify foods eaten in very small amounts; yet such foods may be rich in micronutrients. However, the enumerators were trained to quantify the food items and exclude items weighing less than 15 g.
- This is a cross sectional study and therefore, hard to infer causation.

Recommendations

Effective interventions to address poor feeding among HIV positive women attending ART in Kabale should focus on consistent nutrition education and counseling provided to patients with emphasis put on those with advanced disease, nausea, the self-employed and those with regular or formal employment. Emphasis should be put more on consumption of animal source foods as well as fruits.

Ethical Considerations

The research was approved by Makerere University school of Public Health Research Ethics committee to allow the investigator to conduct the study. In addition to that, permission was sought from the District Health Officer and at each of the health centers' administration. Informed consent was also sought from the participants before the interviews. Consent for minors was obtained from the older persons who would have escorted them to the health center on a particular day and ascent was also obtained from them. The respondents were assured of confidentiality for all the information given and the questionnaire was only available to the research team. The entered data was password protected on the computer. For participants who refused to consent were assured of no penalty and they were also assured that they could withdraw at any time. Questionnaires had unique identifiers which were used to enter the questionnaires into the computer software to ensure confidentiality of the respondents.

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Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations Ethics Approval and Consent to Participate

Permission to carry out the study was granted by the district health officer, Kabale district, as well as health facility in charges at the respective health units. Prior to any enrolment to the study, informed and signed consent was obtained from the participants. Ethical approval was granted by Makerere university school of public health research ethics committee.

Competing Interests

The authors declare that they have no competing interests.

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