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Assessment of Diet as Determinants of Cardiovascular Disease among People Living with HIV Receiving Antiretroviral Therapy in Zamfara

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Abstract

Cardiovascular disease (CVD) is a significant concern among individuals living with HIV receiving antiretroviral therapy (ART). This study aimed to evaluate the impact of dietary habits as determinants of CVD among this demographic in Zamfara. A total of 424 participants, predominantly female (70.3%) and of Hausa ethnicity (75.7%), were examined. The dietary habits of the participants, gauged by their intake of fruits and vegetables, were found to be sub-optimal, with 98.1% consuming less than the WHO recommended five servings of fruits and vegetables per week. The study also identified a high prevalence of consumption of added and processed salts. The use of cardiovascular protective medications, such as aspirin and statins, was analyzed, revealing a gender disparity in their usage. The evaluation of cardiovascular risk using the Framingham Risk Score (FRS) showed that a significant percentage of participants aged over 30 years were at low to moderate risk of CVD. However, older age groups presented with higher risks. The prevalence of raised random blood sugar was relatively low (1.7%). In conclusion, this study highlights the need for targeted dietary and lifestyle interventions among individuals living with HIV receiving ART in Zamfara to mitigate their risk of CVD. Future studies are recommended to investigate the underlying factors influencing these dietary habits.

Keywords: *Antiretroviral Therapy; Cardiovascular Disease; Diet; HIV*

Introduction

Cardiovascular disease (CVD) remains a prominent cause of morbidity and mortality worldwide. Recent research has indicated an increase in CVD prevalence among individuals living with Human Immunodeficiency Virus (HIV) [1]. This observation might be attributed to the chronic inflammation and immune activation associated with HIV infection, as well as the side effects of antiretroviral therapy (ART) [2].

In addition to the viral and treatment-related factors, lifestyle choices, including diet, can play a crucial role in cardiovascular health. Various studies have shown a clear link between diet and CVD outcomes in the general population [3]. However, there has been less focus on the role of diet as a determinant of CVD among people living with HIV, particularly those on ART, in low-resource settings such as Zamfara, Nigeria.

HIV infection and the use of ART have been independently linked to metabolic abnormalities that increase the risk of CVD, such as dyslipidemia, insulin resistance, and changes in body fat distribution [4]. These metabolic alterations, together with traditional risk factors for CVD, including poor diet, lack of physical activity, and tobacco use, may synergistically increase the risk of CVD in this population [5].

Dietary habits of people living with HIV are influenced by multiple factors including food availability, socioeconomic status, cultural beliefs, and practices [6]. In many parts of sub-Saharan Africa, including Nigeria, food insecurity is a major challenge for people living with HIV, and poor nutrition can further compromise their health outcomes [7].

People living with HIV, particularly those on ART, may also have specific dietary needs. For example, some ART drugs can cause gastrointestinal side effects that may affect nutrient absorption and dietary intake [8]. On the other hand, certain nutrients may enhance the effectiveness of ART and improve the overall health of people living with HIV [9].

Despite these complexities, there is limited research on the dietary habits of people living with HIV in low-resource settings, and how these habits might influence their cardiovascular health. This gap in knowledge warrants an in-depth assessment of diet as a determinant of CVD among people living with HIV receiving ART in Zamfara.Top of Form

Research Methodology

Study area

This study was carried out at two tertiary centers in Gusau the capital city of Zamfara state in northwestern region of Nigeria. Federal medical center and Yariman Bakura specialist hospital Gusau. The two tertiary hospitals are situated in Gusau the capital city and the administrative headquarters of Zamfara state, north-western Nigeria. The state has 14 local government areas, it covers a total surface area of 39,762 km^2 with coordinates 12°10′N 6°15′E and an estimated population of 3,278,873 [10]. The centers provide comprehensive HIV treatment, which includes HIV testing, and counseling (HTC), Adult and Pediatric antiretroviral treatment (ART) and prevention of mother to child transmission of HIV (PMTCT). As at the end of 2019, over 5000 patients were receiving HIV testing and treatment in these hospitals. The hospitals received technical support for management of HIV/AIDs from Chemonics international and institute of human Virology Jos.

Figure 1: *Map of Zamfara state.*

Study design

The study was a cross-sectional study design among PLWH attending ART clinics at federal medical centres Gusau and Yariman Bakura Specialist Hospital Gusau, Zamfara state Nigeria.

Study population

The target populations are People living with HIV (PLWH) attending ART centres at federal medical centres Gusau and Yariman Bakura Specialist Hospital Gusau, Zamfara state Nigeria.

Inclusion criteria

The participants who were considered for study have met the following inclusion criteria:

- Patients aged 18 years and above.
- Patients who had received ART for more than 3 months.
- Consented to participate in the study.

Exclusion criteria

- Patients physically or mentally unstable.
- Pregnant women or under 18 years.

Sampling technique

The sampling units or populations are People living with HIV/AIDs receiving ART at Federal medical centre Gusau and Yariman Bakura specialist Hospital Gusau Zamfara. The Kish Leslie formula for descriptive studies (Kish, 1965) was adopted to estimate the needed sample size to determine the prevalence of NCDs and identify risk factors among people with HIV/AIDs receiving ART at Federal medical centre and Yariman Bakura specialist Hospital, Zamfara state. A prevalence of 50% was used to estimate the maximum sample size required:

$$n = \frac{Z^2 \times P \times Q}{d^2}$$

n: The required sample size

Z: Standard normal value at 95% level of confidence (1.96)

P: Prevalence of the NCDs in HIV/AIDs patient selected is unknown (assuming 50%)

d: Allowing an error of 5%

Q: (1-P)

$$n = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.05^2} = 385$$ patients or participants.

The minimum sample size was 385 and was adjusted to 424 to account for non-response rate of 10%.

A random sampling was used to select study participants. All Patients that reported to the twice weekly ART clinics for follow up visits were invited to participate within the study period (from April to May 2020). All patients who agreed to participate were required to complete an informed consent form which was administered by trained research assistants.

Instrumentation

The main instrument used for data collection was a structured questionnaire. This questionnaire was divided into sections that covered demographics, diet, medical history, and cardiovascular diseases.

Validity of the questionnaire

To ensure content and construct validity, the questionnaire was developed in collaboration with experts in HIV care, nutrition, cardiology, and public health. A pilot study was conducted with a small subset of the population (n = 30) to test the clarity and relevance of the questions. Their feedback was incorporated into the final version of the questionnaire.

Reliability of the questionnaire

The reliability of the questionnaire was evaluated using Cronbach's alpha coefficient. This statistical measure assesses the internal consistency of a set of scale items. An alpha value of 0.80 or above was considered satisfactory. The Cronbach's alpha value for the questionnaire was 0.85, indicating a high level of consistency in the responses.

Data collection

The data for this study was collected by six trained data collectors using the slightly modified world health organization Stepwise approach questionnaire for non-communicable diseases surveillance. Experienced data collectors familiar with the HIV/AIDS clinic data were recruited and trained to conduct the interviews. Mostly, part-time staff working within the ART were used as research assistants (RAs). They have bachelor's degree in health-related discipline. Five data collectors and one supervisor were trained for a day at the ART clinic of FMC Gusau. The focus of the training was to understand the following: Overview of the study, what the study was all about, conducting interviews, observing research ethics, introduced to the WHO steps questionnaire, doing a finger prick, how to take BP using automatic BP apparatus and keeping records. During the training mock interviews were conducted and physical measurement before commencement of proper data collection.

Data analysis

All study data was checked for accuracy, completeness and consistency at the end of each working day by the Principal Investigator, and any identified errors were corrected at the same time. Then an excel table was created using the WHO steps questionnaire, all the filled questionnaires were entered in the excel sheet. Thereafter, the data was cleaned and imported into the SPSS (version 23) for Analysis.

Ethical consideration

Relevant ethical clearance was obtained from Zamfara State Ministry of health Ethics committee on research. The study procedure was explained to the patients and informed verbal consent was also obtained from each of the participants and participation was absolutely voluntary. The participants were free to withdraw from the study at any time without any adverse effect on their care. Confidentiality was maintained by using codes on questionnaires with no names and all information and completed questionnaires was kept in a locked safe accessible to only the researcher, the supervisor and examiners when needed.

Results

The largest age group are those aged 30 - 39 years, the majority are females (70.3%), the most common ethnic group is Hausa (75.7%), a majority are married (57.8%), and a large number have no formal schooling (45.8%) (Table 1). The average days of consumption for both fruits and vegetables combined falls around 3.4 days per week across age groups (Table 2). Most participants (98.1% for fruit and 98.6% for vegetables) did not meet the WHO recommended serving of 5 or more servings of fruits and vegetables per week (Table

3). Table 4 shows that a small percentage of the study population has elevated random blood sugar (RBS) levels, which could indicate diabetes or pre-diabetes. The overall percentage across both sexes is 1.7%. Most respondents (89.1%) fall into the low-risk category (FRS < 10%) (Table 5).

Demographic Characteristics	Frequency (n = 424)	Percentage (%)
Age group		
18 - 29	93	21.9
30 - 39	164	38.7
40 - 49	108	25.5
50 - 59	44	10.4
≥ 60	15	3.5
Gender		
Male	126	29.7
Female	298	70.3
Ethnic group		
Hausa	321	75.7
Yoruba	41	9.7
Igbo	20	4.7
Others	42	9.9
Marital Status		
Never Married	35	8.3
Married	245	57.8
Separated	54	12.7
Divorced	19	4.5
Widowed	79	16.5
Cohabiting	1	0.2
Refused	0	0
Educational level		
No formal schooling	194	45.8
Primary school	45	10.6
Secondary school completed	131	30.9
College/University graduate	51	12.0
Postgraduate	2	0.5
Refused	1	0.2

Table 1: *Socio-demographic distribution of study participants.*

Age group	N	Fruits consumption			Vegetables consumption			Combined Fruits and Vegetables		
		n	Mean number of days	95% CI	n	Mean number of days	95% CI	n	Mean number of days	95% CI
18 - 29	93	72	3.7	3.3 - 4.1	79	3.1	2.7 - 3.5	151	3.4	2.7 - 4.0
30 - 39	164	135	3.3	3.1 - 3.6	136	3.3	3.0 - 3.6	271	3.3	3.1 - 3.6
40 - 49	108	85	3.2	2.8 - 3.6	94	3.2	2.9 - 3.6	179	3.2	2.8 - 3.6
50 - 59	44	35	3.4	2.7 - 4.0	32	2.9	2.2 - 3.7	67	3.2	2.9 - 3.6
≥ 60	15	10	3.5	1.7 - 5.3	12	3.8	2.2 - 5.3	22	3.7	3.3 - 4.1
Total	424	337	3.4	2.7 - 4.0	353	3.3	3.0 - 3.6	690	3.4	1.1 - 3.9

Table 2: *Mean number of days in a typical week fruit and vegetables consumed by study participants.*

Age group	N	Fruits consumption						Vegetables consumption					
		n	% of less than 5 servings	95% CI	n	% of more than 5 servings	95% CI	n	% of less than 5 servings	95% CI	n	% of more than 5 servings	95% CI
18 - 29	93	92	21.7	18.1-26.1	1	0.2	0.0-0.7	90	21.5	17.3-25.1	2	0.5	0.0-1.7
30 - 39	164	162	38.2	34.3-43.6	2	0.5	0.0-1.1	159	38.0	32.9-42.1	2	0.5	0.0-1.7
40 - 49	108	104	24.5	20.9-29.2	4	0.9	0.0-1.9	105	25.1	20.7-28.9	2	0.5	0.0-1.7
50 - 59	44	44	10.4	7.6 -13.5	0	0.0	0.0-0.0	43	10.3	7.2-13.0	0	0.0	0.0-0.0
≥ 60	15	14	3.3	1.6 -5.1	1	0.2	0.0-0.3	15	3.6	1.8-5.3	0	0.0	0.0-0.0
Total	424	416	98.1	1	8	1.9	0.6-3.2	412	98.6	95.6-98.6	6	1.4	0.3-2.5

Table 3: *Proportion of participants who consumed WHO recommended servings of fruits and vegetables per week by age group.*

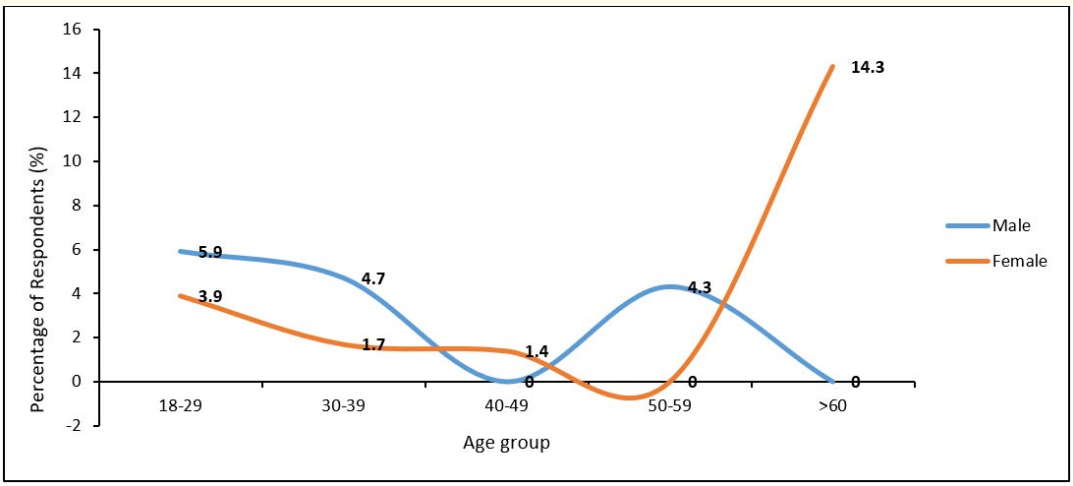

Figure 2: *Percentage of always consuming added salt and processed food high in salt among study participants.*

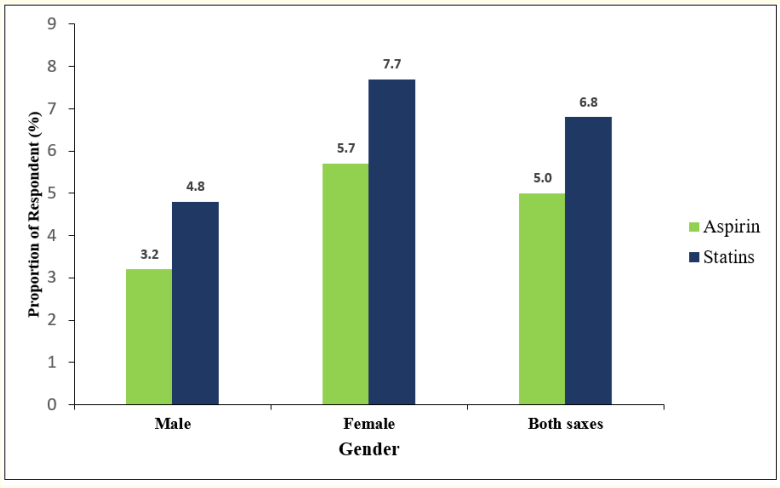

Figure 3: *Percentage of respondents currently taking regularly aspirin or/and statins to prevent or treat heart disease, by Gender among PLWH in Zamfara.*

Variables Age group	Percentage of respondents with Raised random blood sugar (RBS) ≥ 11.1mmol/L								
	Male			Female			Both sexes		
	N	% raised RBS	95% CI	n	% raised RBS	95% CI	n	% raised RBS	95% CI
18 - 29	0	0.0	0.0-0.0	0	0.0	0.0-0.0	0	0.0	0.0-0.0
30 - 39	2	1.6	0.0-3.8	0	0.0	0.0-0.0	2	0.5	0.0-1.1
40 - 49	1	0.8	0.0-2.3	3	1.0	0.0-2.2	4	0.9	0.1-1.9
50 - 59	0	0.0	0.0-0.0	1	0.3	0.0-1.0	1	0.2	0.0-0.7
≥ 60	0	0.0	0.0-0.0	0	0.0	0.0-0.0	0	0.0	0.0-0.0
Overall	3	0.7	0.0-1.5	4	1.3	0.9-1.9	7	1.7	0.4-2.9

Table 4: *Percentage (%) and 95% CI of respondents with Raised random blood sugar (RBS ≥ 11.1 mmol/L).*

Variables Age group	N	Percentage of respondents (Aged > 30 years) with a 10-year CVD risk using FRS								
		FRS < 10% (Low risk)			FRS 10-20% (moderate risk)			FRS >20% (High risk)		
		n	% with FRS < 10%	95% CI	n	% with FRS 10-20%	95% CI	n	% with FRS > 20%	95% CI
30 - 40	202	201	99.5	98.5-100.0	1	0.5	0.0-2.7	0	0	0.0-0.0
41 - 50	93	79	77.4	68.9-85.9	12	12.9	6.1-19.7	2	2.1	0.0-5.1
51 - 60	22	11	50.0	2.9.1-70.9	9	40.1	20.3-61.5	2	9.1	0.0-21.1
≥ 61	14	4	28.6	4.9-52.2	5	35.7	10.6-60.8	5	35.7	10.6-60.8
Overall	331	295	89.1	85.8-92.4	27	8.2	5.2-11.1	9	2.7	0.9-4.5
Sex										
Male	109	82	75.2	67.1-83.3	20	18.4	11.1-25.6	7	2.1	0.6-3.7
Female	222	213	96.0	93.3-98.5	7	3.2	0.8-5.5	2	0.6	0.0-2.1

Table 5: *Percentage of PLWH (Aged > 30 years) with a 10-year CVD risk using FRS.*

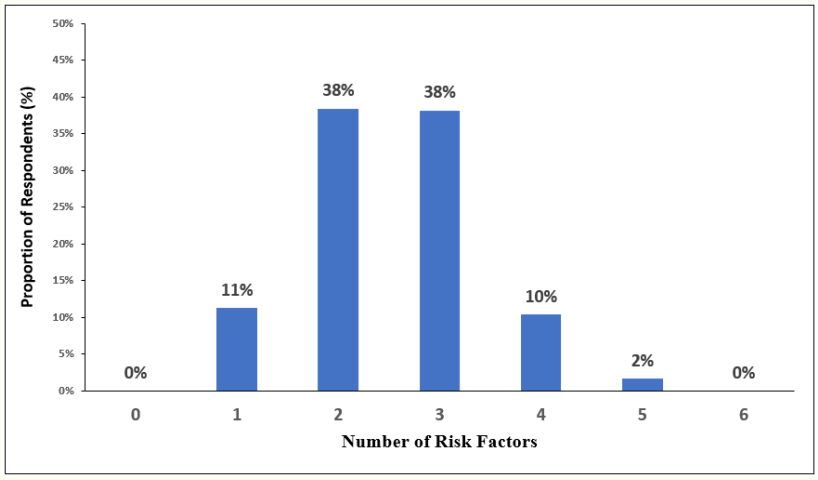

Figure 4: *Prevalence of multiple risk factors among respondents.*

Discussion

This present study endeavored to explore the intricate connections between dietary patterns and cardiovascular disease (CVD) incidence among people living with HIV (PLWH) under antiretroviral therapy (ART). The study becomes relevant in the backdrop of a well-established association of HIV and ART with an escalated risk of CVD [11].

Socio-Demographically, most of the study participants were within the age group of 30 - 39 years (38.7%), with a higher representation of females (70.3%) over males (29.7%). The primary ethnic group was Hausa (75.7%), and the majority were married (57.8%). The level of education was low among participants, with 45.8% having no formal schooling. These demographic characteristics are important to consider in the context of dietary behaviours and health outcomes, as they can be influenced by age, sex, ethnicity, marital status, and educational level [12,13].

The mean number of days in a week when study participants consumed fruits and vegetables was assessed. The World Health Organization (WHO) recommends a minimum intake of 400g of fruit and vegetables per day, excluding potatoes and other starchy tubers, to lower the risk of chronic diseases such as heart disease [14]. The participants, however, displayed inadequate fruit and vegetable consumption. There was a pattern of low fruit and vegetable intake, with an overall mean of 3.4 days for combined fruit and vegetable consumption. This inadequate fruit and vegetable intake can heighten the risk of cardiovascular disease, particularly among PLWH who already face an elevated risk due to HIV infection and ART [15].

The percentage of participants who consumed less than the WHO recommended servings of fruits and vegetables per week was alarmingly high. Almost 98.1% of participants consumed less than the recommended servings of fruits, and a similar pattern was noted for vegetables, at 98.6%. These dietary habits, characterized by low fruit and vegetable consumption, are associated with an increased risk of cardiovascular disease (CVD) [16]. This remarkably high percentage of individuals not reaching the recommended fruit and vegetable intake underscores the urgency of nutritional intervention to aid in the prevention of cardiovascular disease in this vulnerable population [17,18].

Salt consumption is known to significantly contribute to hypertension and cardiovascular diseases. According to the data in figure 2, a large percentage of participants reported always consuming added salt and processed food high in salt. This is worrisome, considering

the American Heart Association recommends limiting daily sodium intake to 1,500 mg to prevent heart disease [19]. High salt intake has been consistently linked to hypertension and cardiovascular diseases [20,21].

The percentage of respondents currently taking regularly aspirin or/and statins to prevent or treat heart disease was also analyzed (As shown in figure 3). These medications are known to reduce the risk of cardiovascular events, particularly in high-risk individuals. The results of this study emphasize the need to address the factors contributing to low intake of these preventive medications in this population [22].

Regarding the biochemical parameters, the percentage of PLWH with raised random blood sugar (RBS ≥ 11.1 mmol/L) was very low (1.7%). Despite this, elevated blood glucose levels, even if they do not meet the threshold for diabetes, are associated with an increased risk of CVD [23].

Framingham Risk Score (FRS), an algorithm used to estimate the 10-year cardiovascular risk of an individual, showed a significant proportion of participants aged 51 and above to have moderate to high CVD risk. More males had moderate to high risk compared to females, indicating gender differences in cardiovascular risk among PLWH, aligning with prior studies [24]. The Framingham Risk Score is a gender-specific algorithm used to estimate the 10-year cardiovascular risk of an individual [25].

The findings of this study underscore the need for lifestyle interventions aimed at promoting healthier eating habits, especially increased intake of fruits and vegetables, and reduced salt consumption among PLWH in Zamfara. Additionally, preventive pharmacotherapy for CVD should be explored, particularly in individuals with moderate to high FRS. There is also a need to address the gender differences in CVD risk among PLWH. It's worth noting that the risk of CVD among people living with HIV is typically higher than that in the general population due to a complex interplay of traditional cardiovascular risk factors, HIV-related factors, and antiretroviral therapy [2].

Conclusion

This research conducted among the people living with HIV receiving antiretroviral therapy in Zamfara indicates some key findings that shape our understanding of the dietary determinants of cardiovascular disease (CVD). The majority of the study participants were female (70.3%), aged between 30 - 39 years (38.7%), belonging to the Hausa ethnic group (75.7%), and had no formal schooling (45.8%). The mean number of days for fruit and vegetable consumption was 3.4 and 3.3, respectively, per week, indicating that the majority of the participants do not meet the World Health Organization's (WHO) recommended 5 servings of fruits and vegetables per day. This shortfall is more pronounced in the younger age groups. Moreover, the high percentage (98.1%) of participants consuming less than 5 servings of fruits and only a very small proportion (1.9%) consuming more than 5 servings, suggests a need for interventions aimed at increasing fruit and vegetable intake. Notably, a very low percentage of participants had raised random blood sugar levels (1.7%), potentially due to the controlled diet or the effects of the antiretroviral therapy. However, according to the Framingham Risk Score (FRS), approximately 89.1% of the participants had a low 10-year CVD risk (< 10%), while 8.2% had a moderate risk (10 - 20%) and 2.7% had a high risk (> 20%). This risk was more pronounced in males and older age groups.

Recommendations

a. **Nutrition education**: Given the suboptimal intake of fruits and vegetables among the study population, interventions should focus on enhancing nutritional education, particularly emphasizing the importance of a balanced diet rich in fruits and vegetables. This could be done through community outreach programs, clinics, and collaboration with local schools and institutions.

b. **Dietary guidelines**: Government and health authorities should create and disseminate specific dietary guidelines targeted at people living with HIV. This could help manage not only their HIV status but also decrease the risk of developing associated conditions such as CVD.

c. **Gender-specific approaches**: As the majority of the participants were females and at a lower risk of CVD according to FRS, targeted interventions could be designed for men, who seem to be at a higher risk of developing CVD.

d. **Age-specific approaches**: The risk of CVD increases with age, hence, the intervention programs should also focus on older age groups, particularly those above 40 years of age, to manage and prevent CVD effectively.

e. **Regular health screenings**: Regular health screenings for all individuals receiving antiretroviral therapy should be implemented to monitor and control blood sugar levels and assess cardiovascular risks. This would help in the early detection and treatment of any potential health issues.

f. **Further research**: Further research is needed to understand the effects of specific antiretroviral therapies on cardiovascular health, as well as the possible interaction between diet, HIV, and CVD. This could lead to more personalized treatment and dietary plans.

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