



AgEcon SEARCH

RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

EFFECT OF FOOD-BASED NUTRITION INTERVENTION ON MANAGEMENT OF NON-COMMUNICABLE DISEASES AMONG PEOPLE LIVING WITH HIV IN BUSIA COUNTY HOSPITAL, KENYA

Akelola R^{1*}, Wamukoya E² and J Situma¹



Ruth Wamatuba Akelola

*Corresponding author email: megashiftnutrition@gmail.com
rakelola@mmust.ac.ke

¹Department of Nutritional Sciences, Masinde Muliro University of Science and Technology, Kenya

²The School of Public Health, Biomedical Science and Technology, Masinde Muliro University of Science and Technology, Kenya



ABSTRACT

Good nutrition optimizes benefits of ART (Antiretroviral therapy) and increases treatment adherence, both prolongs lives of PLHIV (NASCOP, 2014), without proper care and management it exposes them to non-communicable diseases (NCDs). Key objective; to determine the effect of food-based nutrition intervention on the management of NCDs among PLHIV in Busia. The design was experimental using randomized control trial approach. The control group had 30 subjects who were fed on Plumpy'nut while treatment group had 30 subjects who were fed on Power Porridge (PROLCARMIV), for 60 days. Subjects were purposively selected from the Comprehensive Care Clinic (CCC) in Busia County referral hospital- Kenya, further study subjects were randomly selected using simple random sampling, assigned equally to each group. Data were collected using a structured questionnaire analyzed using Social Package for Statistical Sciences version 26. Prevalence of NCDs; 75.5% hypertension; 15.6% diabetes and 8.9% heart disease; post-intervention BMI for intervention group increased; laboratory analyses; Hb post-intervention results; mean levels were higher in intervention group (M=13.62, SD=2.69) p-value = 0.487 compared to control group (12.69, SD=1.24), p value= 0.471. Random Blood Sugar (RBS) were higher in control group (5.96, SD=1.70), with p value= <0.001, intervention group (M=5.79, SD=1.02), with p-value = <0.001. Post-intervention liver function test; TB, AST, and ALT showed higher SD indicating variability. Lipid profile; showed TC mean (4.39 (0.95) for control group; a mean of 3.78(0.94) for the intervention group: p=0.017; HDL for the control group with a mean of 1.58(0.57): mean of 1.14 (0.53) for the intervention group with p=0.036: TG for the control group, mean of 1.50 (0.50): for the intervention group with p= 0.017: mean of 1.14: (0.46): LDL for control group with a mean of 2.26 (0.66): mean of 1.43 (0.42): for the intervention group with p= 0.041: TC, HDL, TG, and LDL all exhibited significant decreases. Kidney function tests; no significant differences between the two groups. Conclusion; Compliance for PROLCARMIV; 82.5%, attracting uptake of CCC services. PROLCARMIV can manage NCDs among PLHIV, answering the alternative hypothesis, this would inform policy.

Key words: Food-Based Nutrition Intervention, HIV, NCDs, PLHIV, PROLCARMIV, Power Porridge



INTRODUCTION

Non-communicable diseases (NCDs) kill 41 million people each year, equivalent to 74% of all deaths globally. Each year, 17 million people die from an NCD before age 70; 86% of these premature deaths occur in low- and middle-income countries [1, 2, 3, 4,]. The risk of developing chronic non-communicable diseases is increasingly recognized as a major public health problem in People Living with HIV (PLHIV). The profile of PLHIV and ART is changing and this has major implications for clinical care and management in urban and rural areas. A proper diet can help those living with HIV improve their quality of life (QoL). In PLHIV, poor nutrition hastens disease development, increases morbidity, and shortens survival time [5].

It is known that the energy requirements [6] of PLHIV increase, hence the need for a balanced and diversified diet. It has also been found that the rates of NCDs appear to be increasing in PLHIV as compared to people living without HIV and this also poses major implications for management, support, and clinical care [7]. This concern is evident, especially in developing countries where dietary and lifestyle risk factors associated with NCDs are becoming more prominent [8]. Both HIV and NCD are conditions that need proper management with a continuum of care that should include Food, Nutrition, and Dietetics which this study has emphasized using locally available foods, laboratory and clinical monitoring, behavioral changes, and adherence support.

However, the current study sought to go further to adopt an intervention targeting NCDs among PLHIV, with a different approach, using a food-based nutrition intervention, and it is the first of its kind in Kenya used for this cohort.

MATERIALS AND METHODS

Study Area and Population

The study took place in Busia, County in the Western Region of Kenya. The county borders westwards with the Republic of Uganda; this makes the border a business hub hence high chances of having men and women at risk of HIV. Studies have shown that the prevalence of HIV in Busia is higher than the National rates. Study subjects were People Living with HIV (PLHIV) with NCDs, aged 18 years and above. The county has an approximate area of 1261 square kilometers; this includes 137 square kilometers squares, (which is also under permanent water surface).



Sample size Determination by - G* Power

G*Power is a software used to calculate statistical power. The program offers the ability to calculate power for a wide variety of statistical tests including t-tests, F-tests, and chi-square-tests, among others. Additionally, the user must determine which of the many contexts this test is being used, such as a one-way ANOVA versus a multi-way ANOVA. In order to calculate power, the user must know four of five variables: either number of groups, number of observations, effect size, significance level (α), or power ($1-\beta$). G*Power has a built-in tool for determining effect size if it cannot be estimated from prior literature or is not easily calculable.

F tests – MANOVA: Repeated measures, within-between interaction

Options: Pillai V, O'Brien-Shieh Algorithm

Analysis: A priori: Compute required sample size

Input: Effect size $f(V) = 0.5$

α err prob = 0.05

Power ($1-\beta$ err prob) = 0.95

Number of groups = 2

Number of measurements = 2

Output: Non-centrality parameter $\lambda = 13.5000000$

Critical F = 4.0266314

Numerator df = 1.0000000

Denominator df = 52.0000000

Total sample size = 54

Actual power = 0.9500773

Pillai V = 0.2000000

Note: This sample (54) was used with 10% attrition rate.

Target sample (54) subjects with 10% attrition rates = 59 subjects.

Sampling

Approximately 60 subjects purposively selected and then randomly selected and assigned equally to the two arms of the study.



DRYING CHIPPED PUMPKINS



8/24/2023

23

Figure 1: Drying of Chipped Pumpkin ((cucurbita maxima)

Procedure for processing the flour for the feed

The pumpkins were first washed to remove the soil and any unwanted parts. They were then chipped. After the chipping, the pumpkin chips and seeds were then dried outside on a canvas for a maximum of eight (8) hours per day for two weeks. When the chips and seeds were dry and crispy, they were milled using the local milling machine. The flour was then weighed, packed, labeled, and stored in the kitchen store. Likewise, the millet and soya beans were selected dirt removed, washed dried, and roasted to minimize anti-nutrients in readiness for milling into flour.

PROLCARMIV ORGANOLEPTIC TEST



8/24/2023

24

Figure: 2 organoleptic tests for the Power Porridge (PROLCARMIV)

The porridge was prepared for the 30 clients. The cooks served the porridge in designated mugs of 500mls for the treatment group and plumpy'nut was distributed to the control group by nutritionists, care was taken so that the clients did not take feeds that were not meant for them. This was achieved by using a list to call them out then instructed to sit in a designated place.

Study Measurable Variables

The variables analyzed at baseline and post-intervention included anthropometric measurements, dietary practices, cholesterol levels, hemoglobin levels, blood sugar levels, proteins in urine, specific gravity (SG), leucocytes, low-density lipoproteins (LDL), high-density lipoproteins (HDL), triglyceride, alanine transaminase (ALT), aspartate (AST) transaminase, alkaline phosphatase (ALP), gamma glutamyl transferase (GGT), total protein (PT), bilirubin time (BT), and albumin levels.

Statistical analysis

The data entry was done using Microsoft Excel and the analysis was done using SPSS version 26 for Windows. Descriptive statistics for the biochemical variables: means, standard deviation, standard error, range and median were used. Mean change from baseline to post-intervention was obtained for the control and treatment groups.

The t-tests were carried out for differences between the control and treatment groups. The intervention effect and the 95% confidence intervals (CI) were estimated from the differences. Data was tested for equality of variances and the appropriate value for significance (P- value) was applied. The t-test for paired data was used to compare pre- and post-intervention values within each group. P-values <0.05 were considered to be statistically significant.

RESULTS AND DISCUSSION

Objective number one of the study was to establish the prevalence of NCDs among PLHIV at the CCC in Busia County referral hospital, Kenya. The study findings indicate that a high percentage of the respondents were females as compared to males. The highest percentage study population was women, and most of them were living with HIV and NCDs. These results are in agreement with the 7th edition AIDS in Kenya reports which found an HIV prevalence rate of eight percent in adult women and four percent in adult men [10, 17].



What we eat and our nutritional status can affect cardiovascular diseases, some types of cancer, diabetes, and hypertension. Foods, diet, and nutritional status, including overweight and obesity, are associated with elevated blood pressure, blood cholesterol, and resistance to the action of insulin. These conditions are not only risk factors for NCDs but major causes of illnesses themselves [11, 18, 25] Consuming predominantly plant-based diets reduces the risk of developing obesity, diabetes, cardiovascular diseases, and some forms of cancer. Plant-based diets are high in vegetables and fruits, whole grains, pulses, nuts, and seeds, and have only modest amounts of meat and dairy. These diets help to achieve and maintain a healthy weight, reduce blood pressure, and are also rich in sources of dietary fiber, which protects against colorectal cancer [12]. This study looked at the effect of a food-based nutrition intervention that was basically plant-based, it focused on soya, millet, pumpkin, and plumpy'nut, and the effect on the study variables such as Low-Density Lipid, Total Cholesterol, and Triglyceride was decreased right from baseline to post-interventional.

Objective two of the study was to determine anthropometric measurements of PLHIV with NCDs at the CCC in Busia County referral hospital, Kenya.

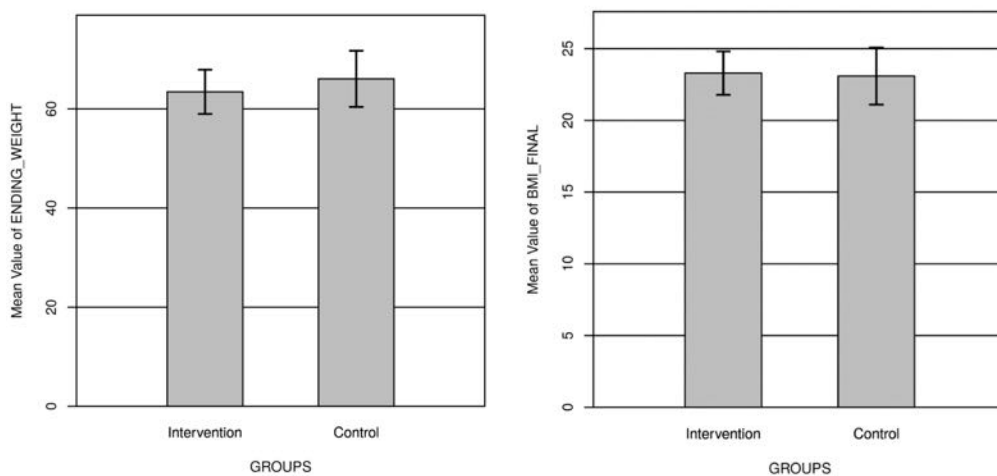


Figure 3: Ending Weight and final BMI for intervention and control groups

The increase in the BMI for the intervention group may be attributed to the compliance rate at which the subjects were feeding on the power porridge. This group's compliance rate was slightly higher, as observed in attendance, and it could be suggested that in this cohort there was an effect of the power porridge on the subject's weight. For post intervention weight, the t-test revealed a significant difference in post-intervention weights between the two groups ($P = 0.044$). Similarly, the mean post-intervention BMI of the intervention group (24.49) was statistically significantly different from that of the control group (23.98) ($P = 0.041$).

Objective three of this study was to assess dietary practices for PLHIV with NCDs at the CCC in Busia County Referral Hospital, Kenya.

Food Consumption Score (FCS) [9] is a proxy for household food security and is designed to reflect the quality of the population's diet. To measure the proportion of the target population with an acceptable FCS, household data on the frequency of eight food groups consumed over the previous seven days were collected.

In this study, the food consumption score was arrived at by using a modified Hellen Keller's food frequency questionnaire. The food consumption score classifies households into three categories namely: Poor (<21), Borderline (21.5-35), and Acceptable (>35) [13]. These study findings indicate that the majority of households of study subjects fell into the borderline category. The majority of the households (71.9%) fell into the 'Borderline' category with scores between 21.5 and 35. A notable 21.4% of the households had a 'Poor' food consumption score, indicating that these households might have inadequate access to a diverse and balanced diet, which may contribute to poor nutritional outcomes.

Objective number four of this study was to establish baseline lipid profile, random blood sugar levels, hemoglobin levels, and liver and kidney function of PLHIV with NCDs at the CCC in Busia County referral hospital, Kenya.

The laboratory analysis of the following variables Hb, LDL, HDL, TG, DB, AST, ALT, ALB, ALP, TP, urea, creatinine, Na, K, CL and RBS was conducted at baseline and post-intervention to determine the effect of use of standard food product (Plumpy'Nut) and treatment food product (PROLCARMIV) among PLHIV with NCDs at the CCC in Busia County referral hospital in western region of Kenya.

There was an elevation of Hb levels following the intervention baseline (M = 13.27, SD = 1.99) vs. post-intervention (M = 13.91 SD 2.79), $p = 0.009$. This finding indicates that the intervention led to a significant change in Hb levels within the intervention group from baseline to post-intervention (HB), the average level was slightly higher in the intervention group (M = 13.07 SD 2.10) than in the control group (M = 12.96, SD = 1.83). Additional laboratory chemistry test results for the control and experimental groups showed the following: Total Cholesterol (TC), for both the intervention and control groups, there was a significant decrease in TC levels from baseline to post-intervention ($p < .001$). The intervention group showed a mean decrease of 53.83 mmol/L (SD = 5.37) with a large effect size ($d = 11.48$),



while the control group had a mean decrease of 59.76 mmol/L (SD = 5.38) with a similar effect size ($d = 12.46$). However, the TC mean was 4.39 (0.95) for the control group: 3.78 (0.94) was the mean for the intervention group with a $p=0.017$; HDL for the control group, the mean was 1.58 (0.57): 1.14(0.53), for the intervention group $p=0.036$: TG for the control group mean was 1.50 (0.50): for the intervention group $p= 0.017$: mean was 1.14: (0.46); LDL mean was 2.26(0.66) for the control group: the mean 1.43(0.42) for the intervention group $p= 0.041$: TC, LDL, HDL, TG exhibited significant decreases.

This study is indicative of the positive gains of the food-based nutrition intervention which was plant based in the reduction of TC, LDL, HDL and TG that were measured in the study subjects, it revealed that a high dietary intake of phytochemicals with vegetables, fruits, nuts, legumes, and whole grains is associated with a reduced risk for cardiovascular and other diseases [13]. Research has focused on the possible mechanisms of action of phytochemicals in preventing or treating NCDs, cancer, and heart diseases [14].

In recent years the role of some secondary metabolites such as phenols, polyphenols, phenolic, and tannins as protective dietary constituents has become an increasingly important area of human nutrition research. Unlike traditional vitamins, they are not essential for short-term well-being, but there is increasing evidence that modest long-term intakes can have favorable impacts on the incidence of cancers and many chronic diseases, including cardiovascular disease and type II diabetes, which are occurring in Western populations with increasing frequency [15].

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The study aimed to investigate the effect of a food-based intervention on the management of NCDs among PLHIV in Busia. The results indicate that the most common NCD among the study subjects is hypertension. Further, findings showed that there was decreased total cholesterol, triglycerides, low density lipids and high density lipids, indicating that PROLCARMIV can be used successfully in the management of NCDs among people living with HIV. High compliance in the intervention group, attracted adherence to CCC services, high attendance was observed as shown in the results, making the food-based intervention key in contributing to the quality of life (QoL) of the study subjects.

However, there was also elevated RBS in both control and experimental, prompting the need to do further research to isolate whether the effect was caused



by ARVS or PROLCARMIV or the standard food product that was used in the study. Other effects were increased Hb and BMI; subsequently the dietary practices among the subjects were such that staple porridge, maize meal, and vegetables were consumed on a daily basis which is not in line with the national guidelines on healthy diets and lifestyles vthat recommends consumption of a diversified diet [16].

ACKNOWLEDGEMENTS

The Author wishes to thank the Masinde Muliro University of Science and Technology, The National Commission for Science, Technology & Innovation (NACOSTI), Busia County Referral Hospital, and finally my family for supporting my research financially.



Table 1: The ingredients and amounts for serving 30 adults -PLHIV with NCDs

PLUMPY'NUT = 30 SACHETS	POWER PORRIDGE = 18LITERS
Standard Food	Treatment Food
Peanut paste, vegetable oil, powdered milk, powdered sugar, vitamins, minerals 1 Sachet - Plumpy'Nut = 92 gms 1 sachet per person per day	Pumpkin flour = 300gms Soya bean Flour= 385 gms Millet flour = 300gms Sugar = 900gms Sun flower oil = 25 mls Water 19 liters 1 cup = 500mls per person per day of porridge

Organoleptic tests were done for taste, color, consistency, and texture, adjustments and improvements were made accordingly

Table 2: Socio-demographic characteristics

Relation to the household head	Household head	26 (57.8)
	Spouse/wife	19 (42.2)
Gender	Female	28 (62.2)
	Male	17 (37.8)
Age group, years	50 ≤	24 (53.3)
	>50	21 (46.7)
Marital status	Married	30 (66.7)
	Single	3 (6.7)
	Widowed	12 (26.7)
Religion	Catholic	9 (20.0)
	Muslim	2 (4.4)
	Protestant	34 (75.6)
	College	7 (15.6)
Level of education	Lower primary	1 (2.2)
	Not attended school	2 (4.4)
	Secondary	10 (22.2)
	Upper primary	25 (55.6)
	Not applicable	2 (4.4)
Occupational status	Temporary employed	10 (22.2)
	Unemployed	33 (73.3)
	Artisan/Jua kali	3 (6.7)
	Business	20 (44.4)
Type of work	Casual laborer	12 (26.7)
	Farming	4 (8.9)
	Not applicable	6 (13.3)

Socio-demographic data are presented as n (%) number of participants (percentage)



Table 3: Baseline food consumption scores for control and intervention groups

Food consumption score (FCS)	Control n =23	Intervention n =22	COR (95% CI)	AOR (95% CI)	P
Poor <21	4 (8.0)	6 (13.3)	1.00 (ref)	1.00 (ref)	-
Borderline (21.5-35)	17 (37.7)	15 (33.3)	2.22 (1.01 - 4.88)	1.89 (0.86 - 4.14)	0.073
Acceptable >35	2 (4.4)	1 (2.2)	1.46 (0.61 - 3.47)	1.32 (0.55 - 3.17)	0.524

COR = crude odds ratio, AOR = adjusted odds ratio, CI = confidence interval. The P-value represents the statistical significance

Table 4: Two-tailed independent Samples t-test for anthropometric parameters by groups

Variable	Control M (SD) n=23	Intervention M (SD) n=22	P
Baseline Weight (kg)	65.96 (14.03)	62.84 (10.84)	0.411
Post-intervention Weight (kg)	66.07 (13.86)	64.89 (11.32)	0.044
Height (m)	1.68 (0.14)	1.68 (0.08)	0.823
Baseline BMI (kg/m ²)	23.05 (4.96)	23.08 (3.77)	0.642
Post-intervention BMI (kg/m ²)	23.9 8 (3.62)	24.4(6.34)	0.041

Note: Data are presented as mean (SD), the p-value is set at 0.05

Table 5: Baseline Health & Nutrition

		N (%)
Do you have a local name for NCDs if yes, what is	No	39 (86.7)
	Yes	6 (13.3)
What is the most common NCDs in your community	Diabetes	7 (15.6)
	Hypertension	34 (75.6)
	Malaria	4 (8.9)
	Arthritis	2 (4.4)
Have you suffered from any of the above-mentioned NCDs, which one	Congenital hearing loss	2 (4.4)
	Heart disease	4 (8.9)
	Hypertension	32 (71.1)
	No	5 (11.1)
Do you attend the clinic of any of the above-mentioned NCDs, which ones	No	25 (55.6)
	Yes	20 (44.4)
Have you received any supplementation	No	41 (91.1)
	Yes	4 (8.9)
What type of food products have you received for your condition for the last 3 months	None	45 (100.0)
	1	1 (2.2)
	2	2 (4.4)
How many times a day do you typically eat	3	42 (93.3)
	Coffee, tea, soda, energy drinks	2 (4.4)
	Tea	43 (95.6)
Do you consume caffeinated beverages on a regular basis	Alcohol, fats oils	16 (35.6)
	Breads	2 (4.4)
	Fish	3 (6.7)
	Fruits	3 (6.7)
Do you avoid any of the following foods	Red meat	5 (11.1)
	Sweets	16 (35.6)
	Amaranth white tea	2 (4.4)
	Fish	2 (4.4)
	Grains, fruits and Kienyeji	12 (26.7)
Foods you especially like	Spider plant, amaranth, pumpkin leaves	3 (6.7)

	Ugali amaranth, fruits, bananas	2 (4.4)
	Ugali vegetable	11 (24.4)
	Vegetables	10 (22.2)
	White meat	3 (6.7)
	Alcohol	7 (15.6)
	Alcohol and Kunde	4 (8.9)
	Alcohol, fast food	4 (8.9)
	Fast food	5 (11.1)
Foods you especially dislike	Fish	3 (6.7)
	N/a	9 (20.0)
	Pork, alcohol	2 (4.4)
	Pork, bread	2 (4.4)
	Red meat and alcohol	9 (20.0)

Note: Data are presented as n= number of participants, percentage diseases suffered, and food intake

The above study subjects were asked about their knowledge and experience of Non-Communicable Diseases (NCDs).

Table 6: Medical History

Medical history	N (%)	
Please list any past or current medical condition that has or is currently being treated for	Arthritis	7 (15.6)
	Congenital hearing loss	4 (8.9)
	Hypertension	33 (73.3)
	Sickle cell disease	1 (2.2)
	Dietary modification	6 (13.3)
	Folic acid	3 (6.7)
List any medication that you are currently taking	Hydrochlorothiazide (Hctz)	12 (26.7)
	None	14 (31.1)
	Nefidipine	8 (17.8)
	Septin	2 (4.4)
Do you have any vitamin /mineral/herbal/food supplements	No	45 (100.0)
	Yes	0 (0.0)
Do you smoke	No	45 (100.0)
	Yes	0 (0.0)
Do you drink alcohol?	No	42 (93.3)
	Yes	3 (6.7)

Note: Data are presented as n- number of participants in percentages

The medical history data provided a crucial backdrop against which was used to interpret the effect of the standard and treatment of food products on the health of PLHIV with NCDs in this population.



Table 7: Physical Activity History

Physical Activity History		N (%)
Are you currently physically active?	No	13 (28.9)
	Yes	32 (71.1)
How often?	0	13 (28.9)
	2	1 (2.2)
	3	3 (6.7)
	4	2 (4.4)
	5	16 (35.6)
	6	2 (4.4)
	7	8 (17.8)
		Cycling
Type of activities	Dancing	2 (4.4)
	Farming	8 (17.8)
	Inactive	13 (28.9)
	Lifting	3 (6.7)
	Running	3 (6.7)
	Walking	9 (20.0)
	Weight lifting	2 (4.4)
	Yoga	3 (6.7)
Please rate the average intensity of your workouts	Inactive	12 (26.7)
	Light	14 (31.1)
	Moderate	16 (35.6)
	Vigorous weight lifting	3 (6.7)
	Carrying heavy things	3 (6.7)
	Cycling	2 (4.4)
	Dancing	2 (4.4)
	Farming	8 (17.8)
What type of exercise do you do	Inactive	13 (28.9)
	Jogging	1 (2.2)
	Running	3 (6.7)
	Walking	10 (22.2)
	Yoga	3 (6.7)
Do you smoke a cigarette	No, I have never smoked	45 (100.0)
Do you drink alcohol	No, I have never done alcohol	39 (86.7)
	Yes, currently	6 (13.3)

Note: Data are presented as n= number of participants and percentage activities undertaken

A considerable majority of study subjects reported being physically active (71.1%, n=32), while 28.9% (n=13) were not.



Laboratory Analysis

The results of a two-tailed paired samples t-test comparing the baseline and post-intervention Hemoglobin (Hb) levels within the intervention group. There was an elevation of Hb levels following the intervention baseline (M = 13.27, SD = 1.99) vs post-intervention (M = 13.91 SD 2.79), P = 0.009. This finding indicates that the intervention led to a significant change in Hb levels within the intervention group from baseline to post-intervention.

The lack of intervention did not lead to a significant change in Hb levels within the control group from baseline to post-intervention. It suggests that without any intervention, the participants' Hb levels remained relatively stable.

Table 8: Two-tailed Paired Samples t-test for the Difference between Baseline HB and post-intervention HB in the intervention group

Test	Baseline M (SD), n=23	Post-intervention M (SD), n=22	P
Hb	13.07 (2.10)	13.91 (2.79)	0.009

Note. N = 22. Degrees of Freedom for the t-statistic = 21.

Note: Data are presented as mean (SD), P- value set at 0.5

Table 9: Two-tailed independent samples t-test for post-intervention laboratory chemistry test results by groups

Test	Control M (SD), n=23	Intervention M (SD), n=22	P
TP	69.56 (5.38)	69.27 (5.37)	0.858
ALB	40.05 (4.46)	39.41 (4.27)	0.630
TB	11.03 (7.86)	10.43 (9.86)	0.822
DB	3.99 (2.20)	3.85 (2.80)	0.856
AST	28.28 (14.03)	27.96 (15.31)	0.942
ALT	24.27 (24.24)	16.76 (16.50)	0.233
GGT	42.99 (27.57)	43.73 (32.95)	0.935
TC	4.39 (0.95)	3.78 (0.94)	0.017
HDL	1.58 (0.57)	1.41 (0.53)	0.036
TG	1.50 (0.52)	1.14 (0.46)	0.071**
LDL	2.26 (0.66)	1.43 (0.42)	0.041
UREA	4.34 (1.04)	4.63 (1.82)	0.516
Na	75.10 (9.88)	80.50 (33.47)	0.462
K	137.48 (6.30)	136.15 (5.41)	0.453
Cl	4.19 (0.36)	4.14 (0.37)	0.675

Note. N = 45. Degrees of Freedom for the t-statistic = 43. d represents Cohen's d. TP: Total Protein; ALB: Albumin; TB: Total Bilirubin; DB: Direct Bilirubin; AST: Aspartate Aminotransferase; ALT: Alanine Aminotransferase; ALP: Alkaline Phosphatase; GGT: Gamma-Glutamyl Transferase; TC: Total Cholesterol; HDL: High-Density Lipoprotein; TG: Triglycerides; LDL: Low-Density Lipoprotein; UREA: Blood Urea Nitrogen; Na: Sodium; K: Potassium; CL: Chloride

Note: Data are presented as mean (SD), p-value set at 0.5

The table above provides the results of the two-tailed paired samples t-test, which compares the baseline and post-intervention laboratory chemistry test results for



different groups. The t-test results provide valuable insights into the changes observed in laboratory chemistry test results between baseline and post-intervention for different groups.

Table10: Data Analysis and presentation

Data collected at the CCC Objectives 1- 5	Method of Analysis
To establish the prevalence of NCDs among PLHIV	Percentages, Mean, Chi-square, P- values
To determine anthropometric measurements among PLHIV with NCD	Frequencies, percentages, crude odds ratio, Adjusted Odds ratio, P -values, Confidence Interval, mean, SD, t-test
To assess dietary practices among PLHIV with NCD	Frequencies, percentages, crude odds ratio, Adjusted Odds ratio, P -values, Confidence Interval, mean, SD, t-test
To establish a baseline lipid profile, random blood sugar level, haemoglobin level, liver and kidney function of PLHIV with NCDs	Frequencies, Percentages, Mean, SD, Correlation, t-test
To determine the effect of use of standard food product and treatment food product among PLHIV with NCDs	Descriptive statistics Analysis of Variance, t-test

REFERENCES

1. **WHO.** World Health Organization Statistics, 2022.
2. **WHO.** World Health Statistics 2013.
3. **WHO.** Global Health Observatory Data, 2018. NCD mortality and morbidity. 2018 [Available from: http://www.who.int/gho/ncdmortality_morbidity/en/ Accessed February 2023.
4. **World Health Organization.** Non-communicable diseases country profiles 2014. Geneva, Switzerland: World Health Organization; 2014. [Google Scholar].
5. **Fathima AS, Maxima M, Kumar VU, Dhingra S, Kumar N, Singh S, Ravichandiran V and K Murti** Nutritional Aspects of People Living with HIV (PLHIV) Amidst COVID-19 Pandemic: An Insight. *PubMed.* 2022. PMID: 35966952 PMCID: PMC9362559 <https://doi.org/10.1007/s40495-022-00301-z>
6. **NASCOP.** Kenya Nutrition and HIV guidelines (2014).
7. **Mathebula RL, Maimela E and SN Nthembelihle** The prevalence of selected non-communicable disease risk factors among HIV patients on anti-retroviral therapy in Bushbuckridge sub-district, Mpumalanga province. *PubMed.* 2020. PMID: 32070315 PMCID: PMC7029468 <https://doi.org/10.1186/s12889-019-8134-x>
8. **Chhoun P, Ngin C, Tuot S, Pal K, Steel M, Dionisio J, Pearson H, Mburu G, Brody C and S Yi** Non-communicable diseases and related risk behaviors among men and women living with HIV in Cambodia: findings from a cross-sectional study. *PubMed.* 2017. PMID: 28705242 PMCID: PMC5513209 <https://doi.org/10.1186/s12939-017-0622-y>
9. **WFP/FAO.** 2008. WFP /FAO Rapid Food Security Assessment – June/July 2008.
10. **NACC.** Kenya HIV estimates. 2017.
11. **Sanjay B** International table of glycemic index and glycemic load values: 2002 World Cancer Research Fund International, 2014.



12. **Leitzmann C** Characteristics and Health Benefits of Phytochemicals. *PubMed*. 2016. PMID: 27160996 <https://doi.org/10.1159/000444063>
13. **Crozier A** An evaluation of flavonoids and phenolic compounds in commercial fruit juices and juice drinks. *Journal of Agricultural and Food Chemistry*, 2007; **55**: 3148–3157 (HN).
14. **MOH**. Food-based dietary guidelines – Kenya. 2017.
15. **Achwoka D, Waruru, A and T Chen** Non-communicable disease burden among HIV patients in care: a national retrospective longitudinal analysis of HIV treatment outcomes in Kenya, 2003-2013. *BMC Public Health* **19**: 372 (2019).
16. **Bloomfield GS, Alenezi F, Barasa FA, Lumsden R, Mayosi BM and EJ Velazquez** Human Immunodeficiency Virus and Heart Failure in Low- and Middle-Income Countries. 2015; **3**: 579–90.
17. **Divala OH, Amberbir A and Z Ismail** The burden of hypertension, diabetes mellitus, and cardiovascular risk factors among adult Malawians in HIV care: consequences for integrated services. *BMC Public Health*, 2016; **16**: 1243.
18. **Edwards JK, Bygrave H, Van den Bergh, Kizito W, Cheti E and RJ Kosgei** HIV with non-communicable diseases in primary care in Kibera, Nairobi, Kenya: characteristics and outcomes. *Trans R Soc Trop Med Hyg*. 2015; **109(7)**: 440-6.
19. **Eugenin EA, Morgello S, Klotman ME, Mosoian A, Lento PA and JW Berman** Human immunodeficiency virus (HIV) infects human arterial smooth muscle cells in vivo and in vitro: implications for the pathogenesis of HIV-mediated vascular disease. *Am J Pathol*. 2008; **172(4)**: 1100–11.
20. **Faul F, Erdfelder E, Buchner A and A-G Lang** Statistical Power Analyses. Using G*Power 3.1: Tests for Correlation and Regression Analyses. 2009.
21. **Hing M, Hoffman RM, Seleman J, Chibwana F, Kahn D and C Moucheraud** 'Blood pressure can kill you tomorrow, but HIV gives you time': Illness perceptions and treatment experiences. 2019.
22. **Ministry of Health**. Kenya National Strategy for the prevention and control of non-communicable diseases 2015 - 2020. Nairobi: Ministry of Health, 2015. [Google Scholar].



23. **National AIDS and STI Control Programme (NAS COP)**. Preliminary KENPHIA 2018 Report. Nairobi: NAS COP; 2020.
24. **Brown TT, Cole SR, Li X, Kingsley LA, Palella FJ and SA Riddler** Antiretroviral therapy and the prevalence and incidence of diabetes mellitus in the multicenter AIDS cohort study. *Arch Intern Med.* 2005; **165(10)**: 1179–84.
25. **Gobbens RJ** Associations of ADL and IADL disability with physical and mental dimensions of quality of life in people aged 75 years and older. *Peer J.* 2018 Aug 9; 6:e5425. PMID: 30123720; PMCID: PMC6087617
<https://doi.org/10.7717/peerj.5425>

