https://www.eejournals.org Open Access
EURASIAN EXPERIMENT JOURNAL OF SCIENTIFIC AND APPLIED RESEARCH (EEJSAR) ISSN: 2992-4146
©EEJSAR Publications Volume 4 Issue 1 2023

Physical Activity, Dietary Practices, and Nutrition Status of Hypertensive Patients Attending Rugazi Health Centre IV in Rubirizi District, South Western Uganda

Nasasira Nauce

Faculty of Clinical Medicine and Dentistry Kampala International University Western Campus Uganda.

ABSTRACT

Globally, uncontrolled hypertension is a health priority since it raises the risk for the onsetof renal failure, heart disease, and diabetes. Hypertension complications contribute to high rates of morbidity and mortality. Optimal blood pressure can be achieved by putting in place strategies that encourage routine physical activity engagement and intake of healthy diets among hypertensive patients. Patient-related factors which include unhealthy dietary practices, poor nutrition status, and physical inactivity have been identified to be the main hindrances in hypertension management. This research aimed at determining the dietary practices, physical activity level, and nutrition status of hypertensive patients attending Rugazi Health Centre IV in Rubirizi District, South Western Uganda. A cross-sectional analytical research design was adopted; the respondents were selected using a systematic random sampling method. The study was conducted on a sample of 134 hypertensive patients. Dietary practices were established by the use of a 24-hour dietary recall and a seven-day food frequency questionnaire. The World Health Organisation global physicalactivity questionnaire was used to measure the physical activity level. Anthropometric parameters were used to assess the nutrition status. A pretested questionnaire was used to collect demographic and socioeconomic status data. Data analysis was done by use of a statistical package for social science. The respondent's dietary practices, physical activity level, nutrition status, and demographic and socio-economic characteristics of the studypopulation were described by use of descriptive statistics. The results were presented in the form of graphs and frequencytables. The study population had poor nutrition status as revealed by the high prevalence of overweight and obesity at 82.1%. The majority of the study participants had unhealthy dietary practices with intake of diets high in sugar, cholesterol, and energy-dense snacks and low in vitamins and minerals. Of the 134 respondents, 79.1% had uncontrolled blood pressure. Low physical activity level was reported by most (63.0%) participants. Dietary practices were significantly associated with nutrition status. A positive significant relationship was found between dietary intake of carbohydrates ($r=0.683$, $p<0.001$) and cereals ($r=0.229$, $p=0.008$), and nutrition status. Physical activity was significantly related to nutrition status at ($p<0.001$). The Ministry of Health and other agencies working in the sector for the control and management of hypertension may find the information collected in this study useful.

Keywords: Hypertension, Heart disease, blood pressure, Nutrition status, Physical activity.

INTRODUCTION

Uncontrolled hypertension is the primary cause of cardiovascular disease occurrence which in most cases leads to fatality worldwide [1-4]. According to WHO [5], heart diseases are the second cause of death in Africa. Research data show 54% of stroke and 47% of coronary artery disease incidences globally are a result of hypertension [6-8]. The management of hypertension in Africa remains a challenge due to limited resources. The prevalence of hypertension in Africa continues to increase while its control remains a challenge [9, 10]. According to Vijver [11], most individuals in Uganda are unaware that they have the disease with research statistics indicating that in every ten people, one has hypertension. According to Mohan *et al.* [12], hypertension prevalence is expected to rise in the coming years with projections showing that by 2025 in Africa almost three out of every four people will have hypertension. The rising hypertension prevalence trend is linked to urbanization that has led to changes in lifestyle, and life expectancy [13, 14]. Different factors have been identified as the main contributors to uncontrolled hypertension including a sedentary lifestyle and poor dietary practices [15-17]. Acharya & Chalise [18] in their study on 100 hypertensive

patients attending Tribhuvan University Teaching Hospital reported that most (89%) of hypertensive patients were non-vegetarians with 13% being alcoholics. The study also found that hypertensive patients never followed dietary advice and instead followed medication regimens. The risk of cardiovascular disease*s is lowered with optimal blood pressure [19, 20]. For effective hypertension control understanding the factors that hinder the achievement of optimal blood pressure levels is critical [21, 22]. According to Sairafi [23], physical inactivity increases the risk of uncontrolled hypertension. Lifestyle modifications enhance antihypertensive drug efficacy and lower cardiovascular risk [24]. Weight reduction, limited alcohol consumption increased physical activity; dietary changes and reduction of salt intake have been identified as some of the lifestyle modifications for optimal blood pressure [25]. Putting together this data, hypertension-related complications may be avoided thus improving the quality of life for hypertensive patients and better intervention strategies being put in place. Lifestyle modifications have been identified as preventive and management measures against hypertension [26-28]. The prevalence of hypertension in Uganda is expected to double by 2030; the disease remains a public concern with inadequate control [11]. The Government has put in place policies and strategies aimed at early screening and intervention for optimal blood pressure achievement among hypertensive patients. However, despite these efforts research findings have consistently revealed that uncontrolled hypertension prevalence is growing in Uganda. This shows that there is a problem and a gap that exists in the achievement of optimal blood pressure levels among hypertensive patients in Uganda. This study, therefore, sought to fill this knowledge gap. Uncontrolled hypertension damages cells lining coronary vessels resulting in inflammation, vascular weakness, scarring, blood clots, blocked arteries, and plaque formation [29, 30]. Prolonged periods of uncontrolled hypertension affect heart functions by weakening heart muscles and enlarging the heart which may lead to death [31]. Strategies for achieving optimal blood pressure will lower heart disease occurrence. To mitigate the current trends, continuous research to enhance an understanding of the factors affecting hypertension management is critical. However, there is a paucity of data in Uganda on the relationship between dietary practices, physical activity, and nutrition status among hypertensive patients. This study, therefore, sought to give an insight into the relationship between dietary practices, physical activity level, and nutrition status of hypertensive patients attending Rugazi Health Centre IV in Rubirizi District, South Western Uganda.

METHODOLOGY

Research Design

A cross-sectional analytical research design was adopted in this study to gather information on dietary practices, physical activity levels, and nutrition status.

Study Variables

Demographic & Socioeconomic characteristics, dietary practices, and physical activity level were the independent variables while nutrition status and hypertension status were the dependent variables.

Area of Study

The study was carried out at Rugazi health centre IV, Rubirizi district. The health centre serves the entire district that is Bunyaruguru County and Katerera County. The facility was purposively sampled since it attends to many patients offering both outpatient and inpatient services. The health center has an outpatient hypertensive clinic.

Target Population

The target population was hypertensive out-patients aged between 18 years and above attending the outpatient clinic at Rugazi health center IV. The identified patients were on regular medical checkups and follow up at the facility based on their blood pressure levels.

Sample Size

The sample size was arrived at by use of Cochran's (1963) formula $n= Z^2pq/e^2$

Where n=the desired sample size, Z=the standard normal deviate at 95% confidence level (1.96), p=blood pressure control level among hypertensive patients, q=1-p and e = the desired level of precision (0.05), $(1.96)^2$, (0.24), $(0.74)/(0.05)^2 =272$. The sample size was 50 hypertensive patients from the calculations. A 10% of the sample was added to the sample to cater for non-response to make 55; however, data collection was successfully carried out on 50 hypertensive patients.

Research Instruments

A structured questionnaire divided into different sections was used to collect data.

Data Analysis and Presentation

Before data entry, the filled questions were coded, checked and cleaned for consistency. The data were then entered into the computer for analysis. Statistical package for the social science (SPSS) version was used to analyze data from the 24-hour dietary recall, food frequency questionnaire, physical activity level, blood pressure level and anthropometry.

Ethical Considerations

Research approval was sought from Kampala International University. Permission was also sought from Rugazi Health Centre IV management to access the medical records of the patients. Respondents who participated in the research were based upon their informed consent and assurance of confidentiality by the researcher.

RESULTS

Demographic and Socio-economic Characteristics of Hypertensive Patients Majority (69.4%) of the respondents

were women and only 30.6% were men. The age group with the largest number of respondents 38.8% was 50-57 years old. In this study, itwas observed that the majority (60.4%) of the respondents were married with only 2.2% of the respondents being divorced or separated (Table 4.1). In regard to the number of members in ahousehold, 50.7% of the respondents came from households with 3 persons. In this study, the socioeconomic characteristics of the respondents were determined by looking at the education, occupation and monthly income levels of the respondents as indicatedin Table 4.1. The education levels of respondents ranged from lack of formal education to tertiary education. A big proportion (47.0%) of the study participants had primary-level education while a significant number (35.8%) of the respondents lacked formal educationand only 17.2% had tertiary education. In regard to occupation, most (41.0%) of the respondents were engaged in business and only 6.7% were in formal employment. Incomelevels varied with a majority (53.0%) of respondents having a monthly income of less than Ugx. 500,000 and only 6.0% had an income of more than Ugx. 2,000,000.

Table 1: Demographic & Socio-economic Characteristics of Respondents

	Male		Female		Total	
	n	%	n	%	N	%
Age in Years						
18-25	6	14.6	14	15.1	20	14.9
26-33	5	12.2	9	9.7	14	10.4
34-41	5	12.2	20	21.5	25	18.7
42-49	10	24.4	13	14.0	23	17.2
50-57	15	36.6	37	39.8	52	38.8
Marital status						
Married	32	78	49	52.7	81	60.4
Widowed	4	9.8	25	26.9	29	21.6
Single	5	12.2	16	17.2	21	15.7
Divorced/separated	0	0	3	3.2	3	2.2
Parity						
No children	9	22	18	19.4	27	20.1
1-3	10	24.3	20	21.5	30	22.4
4-6	14	34.1	43	46.2	57	42.5
7 and above	8	19.6	12	12.9	20	15.0
Education						
None	11	26.8	37	39.8	48	35.8
Primary	23	56.1	40	43.0	63	47.0
Tertiary	7	17.1	16	17.2	23	17.2
Occupation						
Business	17	41.5	38	40.9	55	41.0
Farmer	15	36.6	29	31.2	44	32.8
Casual laborer	8	19.5	6	6.5	14	10.4
Unemployed	6	14.6	32	34.4	38	28.4
Formal employment	4	9.8	5	5.4	9	6.7
Monthly Income (Kshs.Ugx)						
<500,000	18	43.9	53	57.0	71	53.0
500,001-1,000,000	14	34.1	18	19.4	32	23.9
1,000,001-15,000,000	3	7.3	11	11.8	14	10.4
15,000,001-20,000,000	2	4.9	7	7.5	9	6.7
> 20,000,0000	4	9.8	4	4.3	8	6.0

Dietary Practices of Respondents

Dietary practices were assessed by use of a seven-day food frequency questionnaire, nutrient adequacy by use of 24-hour dietary recall and diet quality by use of individual dietary diversity score.

Table 2: Respondents' Dietary Intake based on 7-day

Food group	Frequency of consumption				
	Never	1-2 days	3-4 days	5-6 days	everyday
Cereals	0	0	0	0	134 (100.0)
Oil and fat	16 (11.9)	8 (6.0)	9 (6.7)	29 (21.6)	72 (53.7)
Milk and milk products	19 (14.2)	18 (13.4)	13 (9.7)	44 (32.8)	40 (29.9)
Other fruits	83 (53.0)	20 (14.9)	17 (12.7)	14 (10.4)	0
Other vegetables	58 (43.3)	41 (30.6)	16 (11.9)	0	19 (14.2)
Legumes, nuts and seeds	12 (9.0)	25 (18.7)	7 (5.2)	11 (8.2)	79 (59)
Dark green leafy vegetables	24 (17.9)	89 (66.4)	21 (15.7)	0	0
Eggs	103 (76.9)	24 (17.9)	0	0	7 (5.2)
Flesh meat	110 (82.1)	18 (13.4)	0	0	6 (4.5)
Vitamin A-rich fruits	99 (73.9)	14 (10.4)	9 (6.7)	0	12 (9.0)
White tubers	74 (55.2)	57 (42.5)	0	0	3 (2.2)
Vitamin A-rich vegetables & tubers	87 (64.9)	26 (19.4)	9 (6.7)	6 (4.5)	6 (4.5)
Organ meat (iron-rich)	127 (94.8)	4 (3.0)	3 (2.2)	0	0
Fish	130 (97.0)	4 (3.0)	0	0	0

Dietary Intake Based on 24-hour Dietary Recall

The majority (40.4%) of the respondents consumed 2000 to 2500 kilocalories. Comparing intake by gender, most (63.4%) of the women were meeting their energy requirements cumulatively while only (21.9%) of the men were meeting their energy requirements. Thetotal energy intake was about 99% of the RDA. The males were consuming more energy, fats and carbohydrates compared to the women though there was no significant differencein the consumption of the three nutrients between the two genders. The contribution of fat to caloric intake was slightly higher than the RDA (<30%) for both groups with men getting31.6% of calories from fat while women obtained 31.1% of their calories from fat. The percent of calories intake from carbohydrates was 51.6% for men and 59.1% for women which was close to RDA of at least 60%. The intake of cholesterol and saturated fatty acids for both men and women was above the RDA.

Table 3: Respondent's estimated dietary intake based on a 24-hour dietary recall

Nutrient	Male Mean	RDA	Female Mean	RDA
Carbohydrates (g)	329.2 ± 105.5		295.8 ± 39.8	
% of total KCal	52.6 %	60%	59.1 ± 61.3	60%
Fats	87.8 ± 9.9		69.3 ± 11.1	
% of total KCal	31.6	< 30%	31.1	< 30%
Protein (g)	93.7 ± 10.8	56	44 ± 8.5	46
% of total KCal	14.9	10-15 %	8.8	10-15 %
Total energy intake	2481.0 ± 304.5	2500	1982.9 ± 343.7	2000
Intake of KCal as % of RDA	99.2 ± 14.3		99.1 ± 14.6	
Dietary fibre (g)	28.6 ± 13.16	25	29.7 ± 13.57	30
Cholesterol (mg)	312.13 ± 221.04	< 200	405.18 ± 340.63	< 200
Saturated fatty acids (g)	17 ± 8.7	5-10	16.7 ± 8.5	5-10
PUFA (g)	11.51 ± 13.23		12.16 ± 10.06	
MUFA (g)	18.2 ± 13.4		18.1 ± 13.2	
Na (mg)	1085 ± 89.6	2300	1367 ±660	2300
K (mg)	696 ± 15.6	2000	1216 ± 750	2000
Ca (mg)	163 ± 53.7	800	497.3 ± 306	800
Vitamin C (mg)	36.3 ± 33.4	75	38.7 ± 32.6	60

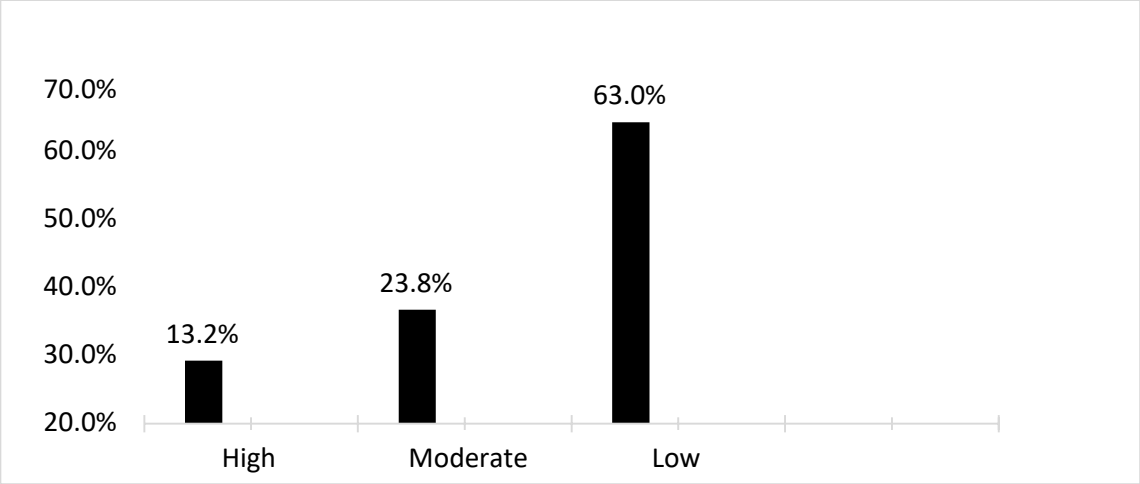
Energy intake	Male n	Male %	Female n	Female %	Total n	Total %
<500	3	7.3	5	5.3	8	5.9
501-1000	7	17.0	6	6.5	13	9.7
1001-1500	4	9.7	13	14.0	17	12.6
1501-2000	16	39.0	14	15.0	30	22.5
2001-2500	9	21.9	45	48.4	54	40.4
> 2501	2	4.8	10	10.8	12	8.9

The majority of the respondents had an adequate dietary intake of calories, proteins, carbohydrates,and fat as per RDA. The RDA for dietary fibre and vitamin C was not met by both group,with only 31.7% and 5.4% of the men and women respectively with adequate dietary fibre intake. The majority of the men 85.4% and women 81.7% were not meeting the RDA for vitamin C. Chi-square test revealed significant differences across gender in RDA for energyand vitamin C. More women than men had adequate intake of energy (p=0.014) and vitamin C (p=0.017).

Physical Activity Level

The WHO global physical activity questionnaire was used to assess the physical activity levelof the study population. The questionnaire collected data on the type, frequency, duration andintensity of physical activity during work, transportation and leisure time of respondents. This study revealed that the majority (63.0%) of the respondents had low levels of physical activity (Figure 1)

Figure 1: Physical activity levels of respondent

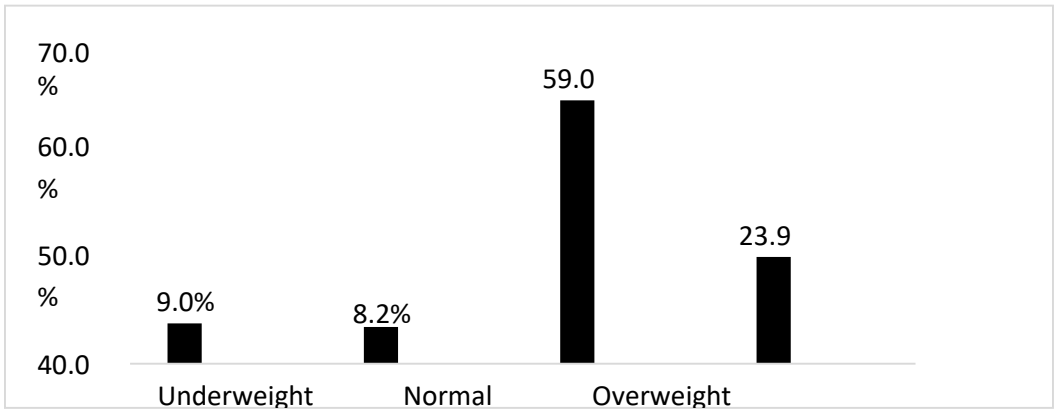


Nutrition Status of the Respondents

The nutrition status of the study subjects was determined by the use of WHO (2004) BMI cut-off points. The average BMI of the study respondents was 27.63±1.12. The study findings indicated that the majority (59.0%) of the respondents were overweight, while 23.9%

Were obese (Figure 2) **Figure 2: Nutrition status of respondents**

Blood Pressure Level & Hypertensive Characteristics of Respondents Approximately 79.1% of respondents had a SBP equal to or greater than 140 mmHg while72.4% had a DBP equal to or greater than 90 mmHg. Overall 76.1% of therespondents had been diagnosed with hypertension in less than 5 years with the



majority(64.2%) visiting the hypertensive clinic for the second time.

Relationship between Dietary Practices and Nutrition Status

The mean IDDS of respondents in this study was 2.486±0.62. There was a significant relationship between mean IDDS and gender with the female having a lower (2.51) dietarydiversity score compared to the male 2.78.

Relationship between Physical Activity and Nutrition Status

As shown in Table 4, a negative significant relationship was found between physical activity and nutrition status (r=-0.356, p=<0.001).

Table 4: Relationship between Physical Activity and Nutrition Status

Physical Activity	*R*	p-value
Nutrition status	-0.356**	<0.001

**Correlation is significant at the 0.01 level (2-tailed).

Logistic regressions were performed to determine the odds of being overweight and obese;the logistic model explained 78.9% of the variance and correctly classified 89.6% of overweight and obese cases. This was done to explain physical inactivity as a risk factor for overweight and obesity. In women, the odds were that someone who was physically inactive was 0.28 times more likely to be obese than individuals who were physically active while in men, the odds were 3.50 times.

DISCUSSION

Socio-demographic Characteristics of Hypertensive Patients

Age is both a risk factor for the onset of hypertension and uncontrolled hypertension. In this study majority of the respondents were in the age group of 50-57 years. Blood pressure level increases with age [32]. A study by Joubert and Bradshaw [33] in South Africa reported that hypertension prevalence was high in populations aged 50 years and above. In the current study, age was found to influence nutrition status establishing a trend of increased weight with age, findings that are in agreement with those reported by Babiker *et al.* [34] in Sudan which linked weight gain to age. Another study by Mungreiphy *et al.* [35] in India on the association between BMI, blood pressure, and age reported that BMI increased with age. The majority (69.4%) of the current study respondents were women. The dominance of females in this study is similar to a study by Joyner *et al.* [36] in the USA involving 310 hypertensive patients. Joyner *et al.* [36] reported that 65.5% of the study population were women explaining that women tend to attend hospitals more regularly compared to men. Research on hypertension reveals that hypertension is more common in men than women before the age of 45 years [37]. However, with the onset of menopause which is common after the age of 45 years, the prevalence of hypertension increases in women [38].

Physical Activity Level of Hypertensive Respondents

Physical inactivity has been linked to overweight, obesity, and uncontrolled hypertension. Overall the current study population had low levels of physical activity with more women than men being physically inactive. These findings are in agreement with those of previous studies that found the majority of female hypertensive patients to be physically inactive compared to male patients [23]. In the current study physical activity level was evaluated to determine its relationship with nutrition status and hypertension. In this study, a statistically significant negative association was found between physical activity and nutrition status. Similar findings have been reported by Hankinson *et al.* [39]. Abid [40] in a study in Pakistan involving 179hypertensive patients reported that physical inactivity resulted in obesity. In addition, the aforementioned authors reported that BMI increased with decreased physical activity levels.

Dietary Practices of Hypertensive Respondents

The most consumed food group in this study was cereals (100.0%). Sanusi et al. (2010) reported that 92.1% of the hypertensive population consumed cereals daily. A diet rich in cereals is known to hinder micronutrient absorption since it contains phytates [42]. Animal foods were consumed rarely by the respondents as evidenced by low consumptionlevels of organ meat and fish. Animal foods are sources of trace elements including zinc that have an antioxidant role. Antioxidants improve endothelial function by binding free radicals that would otherwise cause organ damage [43, 44]. Of concern in this study was the high consumption of plant foods which in most instances have high phytates content that bind micronutrient absorption. In regard to snack consumption, cakes, and soft drinks were the most consumed while fruits were eaten by the minority of the respondents. This finding is comparable to Reyhani *et al.* [45] who reported the majority of hypertensive patients were taking energy-dense snacks. Dietary variety and the nature of foods consumed affect the nutrition status of hypertensive patients. The mean IDDS obtained in this study was 2.49 which was lower than the 3.58 reported by Mehrabani *et al.* [46] in cardiac patients. In this study, no significant relationship was found between IDDS and BMI.

Nutrition Status of Study Population

Nutrition status is important in hypertensive patients for the maintenance of optimal blood pressure levels. Obesity affects the renin-angiotensin-aldosterone system increasing absorption of renal sodium which results in elevated blood pressure. Obesity is also known to cause insulin resistance leading to sodium retention [40]. Sodium retention raises sympathetic nervous system activity leading to hypertension [47]. In this study, 82.9% of the respondents were both overweight and obese, a value comparable to the 78.4% reported by Achieng *et al.* [48] on 783 hypertensive patients in Kenyatta National Hospital. The relationship between hypertension and obesity has been documented globally [49-56]. Another studies by [50-56] reported a significant relationship between BMI and blood pressure levels. The aforementioned author also found a significant relationship between dietary habits and nutrition status. The predictors of obesity and overweight in this study

were established to be the dietary intake of carbohydrates, protein, meat, dark green leafy vegetables, and physical activity.

CONCLUSION

In this study foods of plant origin were most consumed with cereals being consumed by allthe respondents. The majority of the respondents had low IDDS. From BMI measures in the current study, most of the respondents were found to be overweight. The RDA for sodium,calcium, and Vitamin C was not met by the majority of the hypertensive patients. Dietaryintake of saturated fatty acids and cholesterol was above the RDA. The majority of the respondents in this study had low levels of physical activity and high levels of uncontrolled hypertension. BMI was influenced by age, gender, education level, physical activity level, and dietary intake. In the current study, various factors were found to influence the blood pressure level of hypertensive patients. Blood pressure levels increased with increased BMI. Increased dietary intake of energy and cereals also led to an increase in BP levels.A significant negative relationship was found between physical activity and blood pressure level. From the result of this study, therefore demographic and socio-economic characteristics, dietary practices, and physical activity influence the nutrition status and blood pressure level of hypertensive patients.

REFERENCES

1. Offor, C. E., Anyanwu, E., Alum, E. U. and C. Egwu. Effect of Ethanol Leaf-Extract of *Ocimum basilicum* on Plasma Cholesterol Level of Albino Rats. *International Journal of Pharmacy and Medical Sciences*, 2013; **3 (2):** 11-13.
2. Aja, P. M., Nwuguru, M. E., Okorie, U. C., Alum, E. U. and Offor, C. E. Effect of Decoction Extract of *Whitfieldia lateritia* on Lipid Profiles in Hypercholesterolemic Albino Rats. *Global Veterinaria*, 2015; **14**(3): 448-452.
3. Aja, P M., Chiadikaobi, C D., Agu, P C., Ale, B A., Ani, O G., Ekpono, E U. et al. Cucumeropsis mannii seed oil ameliorates Bisphenol-A-induced adipokines dysfunctions and dyslipidemia. Food Science & Nutrition, 2023; 00: 1–12.
4. Ezeani N.N., Edwin N., Alum E.U., Orji O.U., Ugwu Okechukwu P. C. Effect of Ethanol Leaf Extract of *Ocimum gratissmum* (Scent Leaf) on Lipid Profile of Alloxan-Induced Diabetic Rats. *International Digital Organization for Scientific Research Journal of Experimental Sciences*, 2017; **2(1):** 164-179.
5. World Health Organization. Global report Non- communicable diseases country profiles, 2011.
6. Obeagu, E. I., Chijioke, U. O., & Ekelozie, I. S. Hypertension a great threat to human life. *Int. J. Adv. Res. Biol. Sci*, 2018; *5*(10), 159-161.
7. Shiri, T., Birungi, J., Garrib, A. V., Kivuyo, S. L., Namakoola, I., Mghamba, J., ... & Niessen, L. W. Patient and health provider costs of integrated HIV, diabetes and hypertension ambulatory health services in low-income settings—an empirical socio-economic cohort study in Tanzania and Uganda. *BMC medicine*, 2021; *19*(1): 1-15.
8. Obeagu, E. I., Chukwueze, C. M., Ibekwe, A. M., & Famodimu, I. P. Evaluation of Haematological Parameters of Hypertensive Patients Based on Gender in Federal Medical Center, Owo, Ondo State. *Asian Hematology Research Journal*, 2022; *6*(2): 23-26.
9. Agbafor, K. N., Onuoha, S. C., Ominyi, M. C., Orinya, O. F., Ezeani, N. and Alum, E. U. Antidiabetic, Hypolipidemic and Antiathrogenic Properties of Leaf Extracts of Ageratum conyzoides in Streptozotocin-Induced diabetic rats. *International Journal of Current Microbiology and Applied Sciences*, 2015; **4(11):** 816-824.
10. Obeagu, E. I., Ali, M. M., Alum, E. U., Obeagu, G. U., Ugwu, O. P. C. and Bunu, U. M. An Update of Aneamia in Adults with Heart Failure. INOSR Experimental Sciences, 2023; 11(2):1-16.
11. van de Vijver S, Akinyi H, Oti S, Olajide A, Agyemang C, Aboderin I, Kyobutungi C. Status report on hypertension in Africa--consultative review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. Pan Afr Med J. 2013; 16:38.
12. Mohan S, Campbell N, Chockalingam A. Time to effectively address hypertension in India. Indian J Med Res. 2013;137(4):627-31.
13. Jaffar, S., Ramaiya, K., Karekezi, C., Sewankambo, N., Katahoire, A. R., Kraef, C., ... & Smith, P. G. Controlling diabetes and hypertension in sub-Saharan Africa: lessons from HIV programmes. *The Lancet*, 2021; *398*(10306): 1111-1113.
14. Birungi, J., Kivuyo, S., Garrib, A., Mugenyi, L., Mutungi, G., Namakoola, I., ... & Jaffar, S. Integrating health services for HIV infection, diabetes and hypertension in sub-Saharan Africa: a cohort study. *BMJ open*, 2021; *11*(11): e053412.
15. Nwovu, A. I., Ifeanyi, O. E., Uzoma, O. G., & Irene, N. O. Evaluation of platelet and prothrombin time in hypertensive patients attending clinic in Federal Teaching Hospital Abakaliki. Open Access Blood Research & Transfusion Journal, Juniper Publishers Inc., 2018; 1(5):93-95.
16. Taban Sadeghi, M., Soroureddin, Z., Nouri-Vaskeh, M., Nazarpoori, P., & Aghayari Sheikh Neshin, S. Association of the mean platelet volume and red cell distribution width with dipper and non-dipper blood pressure in prehypertensive non-smokers. *BMC Research Notes*, 2019; *12*(1): 1-6.
17. Uti, D. E., Igile, G. O., Omang, W. A., Umoru, G. U., Udeozor, P. A., Obeten, U. N., Ogbonna, O. N., Ibiam U. A., Alum, E. U., Ohunene, O. R., Chukwufumnanya, M. J., Oplekwu, R. I. and Obio, W. A. Anti-Diabetic

Potentials of Vernonioside E Saponin; A Biochemical Study. *Natural Volatiles and Essential Oils*, 2021; **8**(4): 14234-14254.

18. Acharya, R. and Chalise, H. Life style of patient before and after diagnosis of hypertension in Kathmandu. *Health*, 2011; **3**: 490-497.
19. Ezeani N.N., Alum E.U., Orji O.U., Edwin N. The Effect of Ethanol Leaf Extract of *Pterocarpus santalinoids* (Ntrukpa) on the Lipid Profile of Alloxan-Induced Diabetic Albino Rats. *International Digital Organization for Scientific Research Journal of Scientific Research*, 2017; **2(2):** 175-189.
20. Ugwu, O. P.C., Alum, E. U., Obeagu, E. I, Okon, M. B., Aja, P. M., Samson, A. O., Amusa, M. O. and Adepoju, A. O. Effect of Ethanol leaf extract of *Chromolaena odorata* on lipid profile of streptozotocin induced diabetic wistar albino rats. *IAA Journal of Biological Sciences*, 2023; **10**(1):109-117.
21. Weber, A., Schiffrin, E. L., White, W. B., Mann, S., Lindholm, L. H., Kenerson, J. G. andCohen, D. L. Clinical practice guidelines for the management of hypertension in the community. *The Journal of Clinical Hypertension*, 2014; 16(1):14- 26.
22. Ejike, D. E., Ambrose, B., Moses, D. A., Karimah, M. R., Iliya, E., Sheu, O. S., & Nganda, P. Determination, knowledge and prevalence of pregnancy-induced hypertension/eclampsia among women of childbearing age at Same District Hospital in Tanzania. *International Journal of Medicine and Medical Sciences*, 2018; 10(2): 19-26.
23. Sairafi, M. A., Alshamali, K. & Al-rashed, A. Effect of physical activity on controlling blood pressure among hypertensive patients from Mishref area of Kuwait. European Journal of General Medicine, 2010; 7(4):377-384 .
24. Wilson, E., Vlack, V., Schievink, P., Doak, B., Shane, S. and Dean, E. Lifestyle Factors in Hypertension Drug Research: Systematic Analysis of Articles in a Leading Cochrane Report. International Journal of Hypertension, 2014; articleID 835716.
25. World Health Organization. A global brief on hypertension: silent killer, global public health crisis: World Health Day 2013. World Health Organization.
26. Adonu, C. C., Ugwu, O. P., Bawa, A., Ossai, E. C., & Nwaka, A. C. Intrinsic blood coagulation studies in patients suffering from both diabetes and hypertension. *Int J Pharm Med Bio Sci*, 2013; *2*(2): 36-45.
27. Nnatuanya, I. N., Obeagu, E. I., Nnatuanya, C. I. C., Ogar, O. A., & Stephen, E. C. Evaluation of alpha one anti-trypsin and haptoglobin in hypertensive patients in Elele. *Transl Biomed*, 2017; *8*(4): 131.
28. Teckman, J., Rosenthal, P., Hawthorne, K., Spino, C., Bass, L. M., Murray, K. F., ... & Ye, W. Longitudinal outcomes in young patients with alpha-1-antitrypsin deficiency with native liver reveal that neonatal cholestasis is a poor predictor of future portal hypertension. *The Journal of pediatrics*, 2020; 227: 81-86.
29. Shneider, B. L., Goodrich, N. P., Ye, W., Sawyers, C., Molleston, J. P., Merion, R. M., ... & Childhood Liver Disease Research Network (ChiLDReN). Nonfasted liver stiffness correlates with liver disease parameters and portal hypertension in pediatric cholestatic liver disease. *Hepatology Communications*, 2020; 4(11): 1694-1707.
30. Mada, S. B., Ugwu, C. P., Abarshi, M. M., and Saliu, M. A. Renin-inhibitory bioactive peptides with antihypertensive property: a review. *FUDMA JOURNAL OF SCIENCES*, 2020; 4(2): 478-489.
31. Mfinanga, S. G., Nyirenda, M. J., Mutungi, G., Mghamba, J., Maongezi, S., Musinguzi, J., ... & Jaffar, S. Integrating HIV, diabetes and hypertension services in Africa: study protocol for a cluster randomised trial in Tanzania and Uganda. *BMJ open*, 2021; 11(10): e047979.
32. Eshkoor, S. A., Hamid, T. A., Shahar, S., Ng, C. K. and Mun, C. Y. Factors Affecting Hypertension among the Malaysian Elderly. *Journal of Cardiovascular Development and Disease*, 2016; 3(1): 8.
33. Joubert J, Bradshaw D. Population ageing and health challenges in South Africa. In: Steyn K, Fourie J, Temple N, editors. Chronic diseases of lifestyle in South Africa: 1995-2005. Cape Town: South African Medical Research Council; 2006. p. 204-19.
34. Babiker FA, Elkhalifa LA, Moukhyer ME. Awareness of hypertension and factors associated with uncontrolled hypertension in Sudanese adults. Cardiovasc J Afr. 2013;24(6):208-12.
35. Mungreiphy, N., Kapoor, S. & Sinha, R. Association between BMI, blood pressure, and age: Study among Tangkhul Naga tribal males of Northeast India. *J. Anthropol.*, 2011:2011.
36. Joyner M. J., Wallin B. G., Charkoudian N. Sex differences and blood pressure regulation in humans. *Exp. Physiol.*, 2016; 101: 349–355.
37. Duman, S. Rational approaches to the treatment of hypertension: diet. Kidney international supplements, 2013; 3(4): 343–345.
38. Stephen O. Crawford and others, Association of Lactate With Blood Pressure Before and After Rapid Weight Loss, *American Journal of Hypertension*, 2008; 21(12):1337–1342.
39. Hankinson, L., Daviglus, M., Bouchard, C., Carnethon, M., Lewis, C., Schreiner, P., Liu K. and Sidney S. Maintaining a high physical activity level over 20 years and weight gain. Journal of the American Medical Association, 2010; 2(304): 2603-2610.
40. Abid, R. Association of low physical activity with high body mass index in both genders. *Khyber Medical University Journal*, 2014; 6(3).
41. Sanusi, R.A., et al. An assessment of dietary diversity in six Nigerian states. Afr. J. Biomed. Res., 2010; 13(3):

161-167.
42. Morales-Suárez-Varela M, Ruso Julve C, Llopis González A. Comparative Study of Lifestyle: Eating Habits, Sedentary Lifestyle and Anthropometric Development in Spanish 5- To 15-yr-Olds. Iran J Public Health. 2015; 44(4):486-94.
43. Alum, E. U., Ibiam, U. A., Ugwuja, E. I., Aja, P. M., Igwenyi, I. O., Offor, C. E., Orji, O. U., Aloke, C., Ezeani, N. N., Ugwu, O. P. C. and Egwu, C. O. Antioxidant Effect of *Buchholzia coriacea* Ethanol Leaf Extract and Fractions on Freund's Adjuvant-induced Arthritis in Albino Rats: A Comparative Study. *Slovenian Veterinary Research* 2022; 59 (1): 31–45.
44. Alum, E. U., Oyika, M. T., Ugwu, O. P. C., Aja, P. M., Obeagu, E. I., Egwu, C. O. and Okon, M. B. Comparative analysis of mineral constituents of ethanol leaf and seed extracts of *Datura stramonium*. *IDOSR JOURNAL OF APPLIED SCIENCES*, 2023; 8(1):143-151.
45. Reyhani P, Azabdaftari F, Ebrahimi-Mamagani M, Asghari-Jafarabadi M, Shokrvash B. The Predictors of High Dietary Salt Intake among Hypertensive Patients in Iran. Int J Hypertens. 2020; 2020:6748696.
46. Mehrabani, S., Mohammadifard, N., Mehrabani, S., Sadeghi, M., Sajjadi, F., Maghroun, M. & Safavi, S. M. The Effect of Nutrition Consultation on Dietary Diversity Score of Cardiac Patients Referred to Cardiac Rehabilitation Research Center Isfahan Cardiovascular Research Institute during 2008–2013. International Journal of preventive medicine, 2016; 7.
47. Mishra, V., Arnold, F., Semenov, G., Hong, R. and Mukuria, A. Epidemiology of obesity and hypertension and related risk factors in Uzbekistan. European Journalof clinical nutrition, 2006; 60: 1355.
48. Achieng, L., & Ogola, E. Adequacy of blood pressure control and level of adherence with antihypertensive therapy at Kenyatta National Hospital: abstract. 2008.
49. Shook, R. P. Obesity and energy balance: What is the role of physical activity? Expert Rev Endocrinol Metab. 2016;11(6):511-520.
50. Han T.S., Correa E., Lean M.E.J., Lee D.M., O'Neill T.W., Bartfai G., Forti G., Giwercman A., Kula K., Pendleton N., et al. Changes in prevalence of obesity and high waist circumference over four years across European regions: The European male ageing study (EMAS) *Endocrine*. 2017; 55:456–469.
51. OU Orji, UA Ibiam, PM Aja, P Ugwu, AJ Uraku, C Aloke, OD Obasi, BU Nwali (2016). Evaluation of the phytochemical and nutritional profiles of Cnidoscolus aconitifolius leaf collected in Abakaliki South East Nigeria. World Journal of Medical Sciences,13(3): 213-217.
52. Ugwu Okechukwu P.C., Nwodo, Okwesili F.C., Joshua, Parker E., Odo, Christian E. and Ossai Emmanuel C. (2023).
Effect of Ethanol Leaf Extract of Moringa oleifera on Lipid profile of malaria infected mice. Research Journal of Pharmaceutical, Biological and Chemical Sciences,4(1): 1324-1332.
53. Nwali B. U., GI Egesimba, PCO Ugwu and ME Ogbanshi (2015). Assessment of the nutritional value of wild and farmed Clarias gariepinus. Int. J. Curr. Microbiol. App. Sci, 4(1): 179-182.
54. Offor CE, PC Ugwu Okechukwu, U Alum Esther (2015). Determination of ascorbic acid contents of fruits and vegetables, Int. J. Pharm. Med. Sci,5: 1-3.
55. Enechi OC, H Ikenna Oluka, PC Okechukwu Ugwu (2014). Acute toxicity, lipid peroxidation and ameliorative properties of *Alstonia boonei* ethanol leaf extract on the kidney markers of alloxan induced diabetic rats. African journal of biotechnology,13(5): 678-682.
56. ANADUAKA, Emeka Godwin *, EGBA, Simeon Ikechukwu , UGWU, Jecintha Uchenna , APEH Victor Onukwube and UGWU Okechukwu Paul-Chima (2014).Effects of dietary tyrosine on serum cholesterol fractions in rats African Journal of Biochemistry Research 8(5): 95-100.

Nasasira Nauce (2023).Physical Activity, Dietary Practices, and Nutrition Status of Hypertensive Patients Attending Rugazi Health Centre IV in Rubirizi District, South Western Uganda. EURASIAN EXPERIMENT JOURNAL OF SCIENTIFIC AND APPLIED RESEARCH 4(1):96-105