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IMPACT OF KNOWLEDGE AND PRACTICE OF LIFESTYLE/DIETARY MODIFICATION ON QUALITY OF LIFE OF HYPERTENSIVE PATIENTS: A RANDOMISED CONTROLLED STUDY

JAMIU MUSLIM OLAKUNLE*, ABDULAZEEZ IYABODE FATIMA AND GIWA HALIMA BUKOLA
Department of Clinical Pharmacy and Pharmacy Practice, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria

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ABSTRACT

Hypertension (HTN) is a leading cause of disability and death in both developing and developed countries with lifestyle/dietary modification playing a strong role in both prehypertension and hypertensive state. The research was carried out among 317 patients at University of Ilorin Teaching Hospital, Nigeria, who were randomised into control (158) and intervention (159) groups. Intervention was carried out after baseline study and 6 months with evaluation at 6 months and 12 months. A self-developed standardised questionnaire, with a Cronbach's alpha of 0.849, was used to assess patients' knowledge, while quality of life was evaluated using the World Health Organization Quality-of-Life Scale (WHOQOL-BREF) standardised questionnaire. A total of 136 participants in the control group and 139 in the intervention group completed the study. The mean age of the patients was 59.2 ± 12.5 with male = 141 (44.5%) while female = 176 (55.5%). Baseline characteristics were comparable. Following intervention, 6 months and 12 months knowledge difference was significant ($p < 0.001$). A significantly different practice in physical activity ($p < 0.001$) was observed at 6 months while all the four area of practice were significantly different at 12 months. The practice of dietary modification in the intervention group was similarly significantly different in the intervention group at 6 months and 12 months ($p < 0.05$). Significant reduction in alcohol intake ($p < 0.001$), dietary sodium ($p < 0.001$) and increase in physical activity were associated with improved quality of life but, not reduction in sugar intake ($p = 0.325$). Good practice of lifestyle and dietary modification was found to improve quality of life among hypertensive patient.

***Keywords*:** Lifestyle, Dietary modification, Quality of life, Hypertension, Nigeria

*Corresponding author: jamiu.mo@unilorin.edu.ng

INTRODUCTION

Hypertension (HTN) is a leading cause of disability and death in both developing and developed countries as a result of its role in development and progression of cardiovascular diseases (Bromfield and Muntner 2013). HTN contributes more than 7.5 million deaths per year of the total 17 million death resulting from Cardiovascular (CVDs) (Oh and Cho 2020). Despite the availability of multiple effective antihypertensive drugs, control of HTN remains poor (Erejuwa *et al*. 2019). Complications resulting from uncontrolled HTN such as stroke, heart failure and renal failure are associated with high morbidity/mortality and economic loss (Arredondo and Avilés 2014; Carey *et al.* 2018).

Patients practice of lifestyle and dietary modification has been found to improve outcome in cardiovascular diseases. Modifiable risk factors consisting of lifestyle and dietary modification has been found to improve outcome in cardiovascular diseases among patients. One of the modifiable risk factors is obesity, in which the more and individual weighs, the more the needed blood flow to supply oxygen and nutrients to the tissues. Uncontrolled body weight, and high dietary salt intake is when excessive sodium consumption of more than 5 g sodium per day has been shown to produce a significant increase in blood pressure (BP) and has been linked with onset of HTN and its cardiovascular complications. Reduction in sodium intake not only decreases BP levels and HTN incidence which is also associated with a reduction in cardiovascular morbidity and mortality (Grillo *et al*. 2019). More than half of people with high BP also have high cholesterol. Dietary fat is an important modifiable risk factor for HTN. Interventions that reduce total fat intake can effectively lower systolic and diastolic BP (Wang *et al.* 2010). Physical inactivity can have serious implications for people's health. Sedentary lifestyles increase all causes of mortality, double the risk of cardiovascular diseases, diabetes, obesity and increase the risks of colon cancer, high BP, osteoporosis, lipid disorders, depression and anxiety (Gamage and Seneviratne 2021). Physical exercise increases blood flow through all arteries of the body which leads to release of natural hormones and cytokines that relax blood vessels. This in turn lowers BP. Lack of physical activity also increases the risk of being overweight. It has been established that no level of alcohol is safe. It acts probably by activating adrenergic nervous system, causing constriction of blood vessels and simultaneous increase in blood flow and heart rate (Burton and Sheron 2018). High levels of stress can lead to a temporary, but dramatic, increase in BP. A set of behavioural and hormonal responses were induced in individuals with these stressful experiences for adapting to the physical and social environment. High job strain has been associated with increased ambulatory BP at work, at home and during sleep, as well as increased left ventricular mass, consistent with the anticipated effects of sustained BP elevation (Spruill 2010).

High sugar intake, particularly in carbonated soft drinks, may be a key contributor to the epidemic of overweight and obesity as a result of the high added sugar content, the reduced satiety response and the promotion of a positive energy balance by liquid calories relative to isoenergetic solid calories. The mechanism by which a higher intake of sugar sweetened beverages (SSB) increases BP may be complex. Consumption involves stimulation of ventromedial hypothalamus, decrease in Adenin Triphosphase (ATP) which subsequently lead to reduction in Nitrous Oxide Renin Angiotensin System (RAS) and sodium retention increases and eventual hypertensive response (DiNicolantonio *et al*. 2014).

Tobacco or cigarette smoking is the leading preventable cause of disease, disability and death in recent time. Almost one third of chronic heart disease deaths are attributable to smoking and exposure to secondhand smoke. Even low levels of smoking increase risks of

acute myocardial infarction, thus, reducing the number of cigarettes per day does not totally eliminate risk (Chen *et al.* 2010).

Identified risk factors that have been found to be associated with high BP were diabetes, kidney disease and sleep apnoea. Also, exposure to high levels of stress can lead to a temporary increase in BP. High level of physical stress could induce a set of behavioural and hormonal responses in an individual leading to increased circulation of catecholamine (ACC/AHA, 2017).

Another possible risk factor for the development of high BP is the chronic use of non-steroidal anti-inflammatory drugs which could result in worsening of existing HTN or development of new high BP. It can also cause damage to the kidneys, worsening of heart failure, heart attack or stroke (Marcum and Hanlon 2010).

Despite evidence of effectiveness of lifestyle and dietary modification, there is poor knowledge and practice among the patients (Abd El-Hay and El Mezayen 2015). HTN has been known to reduce quality of life (QOL) among patients and poor knowledge and awareness of HTN have been found to be associated with impaired health related quality of life (HRQoL) among patients (Alshammari *et al.* 2021; Adedapo *et al*. 2015). Poor socioeconomic status and presence of illness have been found to negatively affect QOL (Adedapo *et al.* 2015). It has been established that following adherence to antihypertensive medications resulting in improved control of HTN, QOL have been found to improve correspondingly (Souza *et al*. 2016).

Family history of HTN, race, age, gender and genetic predisposition are some of the non-modifiable risk factors for the development of HTN (Ranasinghe *et al.* 2015). For this, there was need to investigate the impact of patient knowledge of HTN and practice of lifestyle and dietary modification on QOL of hypertensive patient.

METHODS

Study Site

The study was carried out at University of Ilorin Teaching Hospital (UITH), Ilorin, Kwara state, Nigeria, located in Oke-Ose in Ilorin East Local Government Area of Kwara state. A tertiary health facility with 450 bed capacity and serves as a referral centre for secondary and private hospitals in the state and beyond especially in the north central geopolitical zone and part of the south-western Nigeria.

Study Design

This study was a prospective longitudinal randomised interventional study which was carried out between March, 2020 and May, 2021 among hypertensive patients attending Cardiology Clinic at UITH. The design was in line with Consolidated Standards of Reporting Trials (CONSORT) 2010 statement (Schulz *et al*. 2010). A total of 317 patients were recruited for the study with 158 and 159 in the control and intervention groups, respectively. Total number of patients available for follow up at 6 months and 12 months in the control group were 149 and 136, respectively while the intervention group had 152 and 139 patients.

DATA COLLECTION

Written informed consent form was read by the patient or read to them by the researcher prior to recruitment/enrollment for the study where the patient consent for voluntary participation was sought and obtained by signing the informed consent form.

Patient's data collection form was designed to collect patient's basic information through case note review, patient interview and measurements. Information on socio-demographics information, health related characteristics like duration of HTN since first diagnosis, presence of comorbid condition and type, BP, body mass index (BMI), history and type of social drug use, adverse drug reaction and current antihypertensive medication use.

Questionnaire on knowledge of lifestyle and dietary modification was designed through literature review (WHO, 2013; Tesema *et al*. 2016; Buda *et al*. 2017) on knowledge areas required of patients about lifestyle and dietary modification. The knowledge areas assessed were knowledge of lifestyle modification, knowledge of dietary modification and knowledge of self-care practices. The response scale for the question items were ordered categorical variables from "excellent", "good", "fair" and "poor". The patient's level of practice of lifestyle and dietary modification was also assessed in the areas of cigarette smoking, alcohol intake, exposure to stressful activity and physical exercise. Dietary components level was dietary salt intake, fruits and vegetable intake, fatty food intake and sugary substance intake. The questionnaire was pre-tested among 30 patients (About 10% of sample size calculated) at Civil Service Hospital, Ilorin, Nigeria. The pretesting was to ensure reliability of the instrument for internal consistency and reproducibility of results.

Reliability of Scale Score

The internal consistency reliability coefficient of the questionnaire was determined using SPSS version 25 and a Cronbach's alpha of 0.849 was obtained which was an indication for reliability of the questionnaire.

Construct Validity

Principal component analysis (PCA) was conducted with direct oblique rotation (Direct Oblimin). The Kaiser-Meyer-Olkin (KMO), which represent a measure of sampling adequacy for the factor analysis had significantly adequate KMO = 0.861. The Bartlett's test for sphericity (χ^2) has a value of 773.93, df = 21, $p < 0.001$. This was an indication for correlations between items for significantly adequate PCA. One question item had eigenvalue greater than 1 (2.5) on Kaiser's criterion. The item was retained because the scree plot showed inflexion that would justify retaining the component questions 15–17 represented question items on knowledge of lifestyle and dietary modification.

Data were transformed to obtain a categorical analysis of the options in the knowledge and practice level of the patient. Patients who were assessed to be "excellent" were given 4 points, those with "good" were given 3 points, those with "fair" were given 2 points while those with "poor" were given 1 point. A maximum of 12 points in knowledge domains represented by three questions, was obtainable while 3 points was the least. A cut-off score for knowledge of lifestyle and dietary modification; a total score of an individual ≤ 7 was said to be low and a total score > 7 was considered to be high knowledge score of lifestyle and dietary modification. Cut-off point was introduced in order to bring patients into categories of high or low knowledge level of lifestyle and dietary modification.

QOL questionnaire used was a World Health Organization (WHO) approved generic instrument for data collection on HRQoL of patients (WHOQOL-BREF) and it has reliably been used in many studies as a generic instrument in the assessment of health related QOL (WHO 1998). The instrument was chosen from among other QOL instruments because of its ability to address most areas of concerns in QOL in chronic disease like HTN although it is a generic instrument. It has been described as a reliable instrument to measure QOL among hypertensive patients as having good internal consistence of Cronbach's alpha of between 0.65–0.88 when used by Ha *et al*. (2014) among hypertensive patients in a rural community in Vietnam, South-East Asia. The instrument is divided into two sections with the first section, containing two item questions on patient's self-reported rating of general QOL and patient's health satisfaction rating. The other section contained 24 question items which were grouped into four domains of QOL consisting of physical, psychological, social and environmental. The four domains of HRQoL as defined by the instrument were determined.

The raw scores for each domain in the WHOQOL-BREF were calculated by adding values of single items. To transform the data so that they were equivalent to those used for the WHOQOL-100, two steps were used; first, scores were converted to a range between 4 and 20. Second, these scores were multiplied by five so that the scores were converted to a scale of 0 to 100, where 100 was the highest health related QOL.

Data Collection Process

The data was collected between March 2020 and May 2021. Basic information on the patients were collected from case notes and personal interview with a data collection form after which the questionnaires were administered based on one-on-one contact with the patients in designated office suitable for conducting interview after the patients have seen the consulting physician. Two sets of questionnaires were administered one after the other. A pre-tested, standardised interviewer-administered questionnaire with sections on socio-demographic data, patient knowledge of HTN, treatment, complication, knowledge and practice of lifestyle and dietary modification was used to obtain information from patients. WHOQOL-BREF standardised questionnaire on quality of life was also administered immediately thereafter. Trained research assistants were engaged in the process to assist in areas of patients tracking and coordination with consulting physicians, nurses and records department. The research assistants engaged were two intern pharmacists and two final year pharmacy students who were adequately trained for the purpose of the research.

Pharmaceutical Care Intervention

Pharmaceutical care intervention on patient's education on knowledge lifestyle and dietary modification was done through the use of a developed structured educational material developed through literature (WHO 2013; Tesema *et al*. 2016) which were reviewed and relevant information on lifestyle and dietary modification in hypertensive patients were utilised. Educational intervention on lifestyle and dietary practices was provided to improve the patient level of knowledge and practice of lifestyle and dietary modification. A written form of structured mode of educational intervention, therapeutic patient education was adopted which ensures uniform dissemination of information to patient. Intervention was delivered to patients on practice of lifestyle and dietary modification to improve patients' level of practice of lifestyle and dietary modification through structured educational intervention tool and ensuring adherence to the intervention provided through follow up programme. The patients were of different ethnic and cultural background. The residents people of Ilorin and

environ were indigenous for Yoruba in language and culture but English language is official language of use by the residents as Nigerians and most interaction were based on English language with explanatory language in Yoruba.

The instrument used was a WHOQOL-BREF and it has reliably been used in many studies as a generic instrument in the assessment of health related quality of life (WHOQOL Group 1998). The instrument was chosen from among other QOL instruments because of its ability to address most areas of concerns in QOL in chronic disease like HTN although it is a generic instrument. The instrument is divided into two sections with the first section, containing two item questions on patient's self-reported rating of general QOL and patient's health satisfaction rating. The other section contained 24 question items which were grouped into four domains of QOL consisting of physical, psychological, social and environmental.

Patients' follow up was done using the following method; patients in the control group received the usually provided care/management for HTN according to hospital standards which included hospital visits on appointments, consultations with the patients by the consulting physicians, prescription refill of prescribed medications and routine laboratory tests, review of diagnosis and patient counselling.

Patients in the intervention group received the usual care/management for HTN according to the hospital standards as received by the control group. In addition to this, the patients were provided with pharmacist-delivered education and counselling intervention on knowledge of HTN, knowledge of lifestyle and dietary modification, during the research period. Patients were followed up through phone calls, at least two times before the next clinic visit, interaction during clinic visits and the use of hand bills to serve as reminders for appointments for clinic days and revision of the educational intervention programme provided.

Patient BP measurement were taken with the use of mercury sphygmomanometer during the clinic visit in line with the hospital schedule. BP values obtained were documented in patient's individual case notes. The values were extracted and used for the purpose of the research. The cut-off score for systolic and diastolic BP control was applied according to Whelton et al. (2018) guideline. The cut-off point used to determine whether the patient BP was controlled or not controlled in line with GNC eight recommendation of BP values of $\leq \frac{140}{90}$ mm Hg.

The research assistants were trained on the use of Stadiometer (standard dual weight and height balance) and were regularly supervised by the lead researcher on every task they were assigned. This instrument combine the measurement of weight and height at the same time. This was done and readings were recorded against each patient.

Calculation of BMI in kg/m^2 was done by using the formula:

$$BMI = \frac{w}{h^2}$$

where, w = weight in kg and h = height in m.

Categorisation of BMI into different weight groups was done in accordance with WHO (2010) recommendation. Patients weighing less than 18.5 kg/m^2 were considered underweight, those between 18.5–24.9 kg/m^2 were considered having normal weight, 25–29.9 kg/m^2 were overweight while 30–34.9 kg/m^2 were in obese category 1 and ≥ 35 kg/m^2 were in obesity category 2.

The HRQoL was measured using WHOQOL-BREF. The instrument contained 26 questions. The questionnaire contains four domains of QOL: physical, psychological, social and environment where response options were rated on a similar Likert scale. Questions 3, 4 and 26 were negatively worded and they were reversed before transformation. The raw scores were transformed to a scale of 0–20 and 20–100 before analysis. Questions 1 and 2 were analysed separately to obtain mean score of rating of QOL and life satisfaction on a scale of 100. For the four domains of QOL, mean (SD) was used to describe patients' domain of QOL and overall QOL. Analysis of variance (ANOVA) was used to compare mean scores of the domains. The relationships between knowledge of HTN, knowledge of lifestyle and dietary modification and practice of lifestyle and dietary modification, and QOL was determined using student's *t*-test to test for difference in mean score in QOL in relation knowledge level of the patients.

Data Analysis and Presentation

Completed questionnaires were properly checked and sorted and information obtained were entered into IBM® SPSS, version 25 after defining the variables for each of the variable items. Descriptive data were presented using numbers and percentages in frequency distribution tables and bar charts. Numeric and continuous variables were analysed and presented as mean and standard deviation. Student's *t*-test was used to compare arithmetic means from two group while ANOVA was used to compare means from numerical and continuous variables of more than two groups. Chi square test, univariate and multivariate logistic regression were used to determine association between dependents and outcome variable and p-values < 0.05 were considered to be statistically significant.

RESULTS

Socio-demographic Characteristics of The Study Population

The total number of patients that were enrolled for the study was 318 which was randomised into control and intervention groups. A patient's data from control group was removed from the analysis due to incomplete information provided and the patient was dropped from the study. A total of 158 patients (49.8%) were assigned to the control group, while 159 patients (50.2%) were assigned to the intervention group. The mean age of the patients was 59.2 ± 12.5 years (control group, 58.7 ± 13.1; intervention group 59.7 ± 11.9 (p = 0.472). Patients who were ≥ 60 years were 157(49.5%) and those with tertiary level of education were 158 (49.8%). The number of patients who were married were 276 (87.1%) and there was a significant difference in this distribution between the control and the intervention group (p = 0.033). The health related characteristics of the patients showed that the baseline characteristics of the patients in the control and intervention groups were not significant different in most of their distribution in the distribution was found in patients' marital status distribution except in the patients' family history of HTN (p = 0.027) and presence of adverse drug reaction (p = 0.024). Patients with HTN comorbidities were 142 (44.8%) and 128 (40.4%) of the patients engaged in the use of herbal drug. There was no significant deference in the distributions of these characteristics between the control and the intervention group (p > 0.05) (see Table 1).

Table 1: Socio-demographic characteristics of the study population at baseline.

Variable	Group N (%)		Total N (%)	X^2/t	*p*
	Control *n* (%)	Intervention *n* (%)			
Age (years)	58.7 ± 13.1	59.7 ± 11.9	59.5 ±12.5	–0.72	0.472
Age group (years)					
< 30	1(0.6)	3 (1.9)	4 (1.3)	2.114	0.549
30–45	28 (17.6)	22 (13.9)	50 (15.8)		
46–60	50 (31.4)	56 (35.4)	106 (33.4)		
> 60	80 (50.3)	77 (48.7)	157 (49.5)		
Gender					
Male	72 (45.3)	69 (43.7)	141 (44.5)	0.083	0.773
Female	87 (54.7)	89 (56.3)	176 (55.5)		
Educational qualification					
Non-formal	20 (12.6)	31 (19.6)	51 (16.1)	4.116	0.249
Primary	18 (11.3)	22 (13.9)	40 (12.6)		
Secondary	38 (23.9)	30 (19.0)	68 (21.5)		
Tertiary	83 (52.2)	75 (47.5)	158 (49.8)		
Occupational status					
Unemployed	26 (16.4)	20 (12.7)	46 (14.5)	2.577	0.462
Self-employed	56 (35.2)	68 (43.0)	124 (39.1)		
Civil servant	42 (26.4)	35 (22.2)	77 (24.3)		
Retiree	35 (22.0)	35 (32.0)	70 (22.1)		
Family history of HTN					
Yes	69 (43.4)	73 (46.2)	142 (44.8)	7.241	0.027*
No	54 (34.0)	34 (21.5)	88 (27.8)		
Not sure	36 (22.6)	51 (32.3)	87 (27.4)		
Duration of years since diagnosis					
< 1	13 (8.2)	17 (10.8)	30 (9.5)	2.277	0.517
1–10	107 (67.3)	104 (65.8)	211 (66.6)		
11–20	23 (14.5)	27 (17.1)	50 (15.8)		
> 20	16 (10.1)	10 (6.3)	26 (8.2)		
Presence of comorbid condition					
Present	67 (42.1)	75 (47.5)	142 (44.8)	0.910	0.340
Absent	92 (57.9)	83 (52.5)	175 (55.2)		
Presence of adverse drug reaction					
Present	33 (20.7)	52 (32.9)	85 (26.5)	7.483	0.024*
Absent	126 (79.2)	106 (67.1)	232 (73.2)		

Note: *p* = significance level < 0.05; *Significant difference; N = 317 (Control 158; Intervention 159).

Knowledge scores of lifestyle and dietary modification among the study population before and after the intervention

From 317 that completed the baseline study, only 301 were able to complete follow up study after 6 months (149 in the control group and 152 in the intervention group). At the end of the second follow up study in 12 months, only 275 (136 in the control group and 139 in the intervention group) completed the study. The reduction in the number of patients to this magnitude from 317 to 275 (13.3%) could be attributed partly to the COVID-19 which occurred in the earlier part of the study. The mean knowledge scores of lifestyle and dietary modification at baseline, 6 months and 12 months in the control group were 7.0, 7.5 and 7.2, respectively. Significant relationship between knowledge of HTN and BP control at 6 months and 12 months following intervention ($p < 0.001$) (see Table 2).

Table 2: Knowledge scores of lifestyle and dietary modification among the study population at baseline, 6 months and 12 months.

Parameters	*n* (%)	MS ± SD	*t*	*p*
Baseline (N = 317)				
Control	159 (50.2)	7.0 ± 2.1	1.823	0.069
Intervention	158 (49.8)	6.6 ± 2.0		
6 Months (N = 301)				
Control	149 (49.5)	7.5 ± 1.5	–15.290	< 0.001*
Intervention	152 (50.5)	9.9 ± 1.3		
12 Months (N = 275)				
Control	136 (49.5)	7.2 ± 1.5	–18.300	< 0.001*
Intervention	139 (50.5)	10.4 ± 1.2		

Note: p = significance level < 0.05; *significant difference in knowledge scores between Control and Intervention groups; t = student's t-test.; MS = mean score; SD = standard deviation; N = number of patients.

Relationships between patient's characteristics and knowledge of lifestyle and dietary modification

There was no significant difference ($p > 0.05$) in patients' knowledge score of lifestyle and dietary modification in most of the assessed patients' socio-demographic characteristics ($p > 0.05$). Patients' family history of HTN and BMI were significantly associated with knowledge of HTN ($p = 0.010$ and $p < 0.001$, respectively) (see Table 3).

Table 3: Relationship between patient characteristics and knowledge scores of lifestyle and dietary modification among the study population.

Variables	*n* (%)	MS ± SD	F/t	*p*
Age group				
< 30	2 (7.0)	11.0 ± 0.0	1.915	0.127
31–45	47 (17.1)	8.9 ± 2.1		
46–60	89 (32.4)	9.1 ± 2.1		
> 60	137 (49.8)	8.6 ± 2.1		

(*continued on next page*)

Table 3: (*Continued*)

Variables	*n* (%)	MS ± SD	F/t	*p*
Gender				
Male	122 (44.4)	8.7 ± 2.2	–0.638	0.524
Female	153 (55.6)	8.9 ± 2.1		
Educational qualification				
Non-formal	44 (16.0)	8.8 ± 2.2	0.217	0.885
Primary	35 (12.7)	8.7 ± 1.9		
Secondary	61 (22.2)	8.7 ± 2.0		
Tertiary	135 (49.1)	8.9 ± 2.1		
Occupational status				
Unemployed	45 (16.4)	8.2 ± 2.3	1.700	0.167
Self-employed	118 (42.9)	8.9 ± 2.1		
Civil servant	69 (25.1)	9.2 ± 2.0		
Retiree	43 (15.6)	8.8 ± 2.1		
Marital status				
Single	3 (1.1)	9.3 ± 2.9	1.135	0.335
Married	243(88.4)	8.7 ± 2.1		
Divorced/separated	15 (5.5)	9.7 ± 1.6		
Widowed	14 (5.1)	9.1 ± 1.4		
Level of income**				
Low (Less than 30,00 Naira/Month)	166 (60.4)	8.8 ± 2.2	–0.327	0.744
Family history of hypertension				
Yes	126 (45.8)	9.2 ± 2.0	4.671	0.010*
No	79 (28.7)	8.3 ±2.2		
Not sure	70 (25.5)	8.8 ±2.2		
Duration since diagnosis (years)				
< 1	24 (8.7)	9.3 ± 2.0	0.866	0.459
1–10	185 (67.3)	8.9 ± 2.1		
11–20	43 (15.6)	8.6 ± 2.3		
> 20	23 (8.4)	8.5 ± 2.2		
Presence of comorbid condition				
Present	125 (45.5)	8.8 ± 2.1	–0.036	0.971
Absent	150 (54.5)	8.8 ± 2.2		
Presence of adverse drug reaction				

(*Continued on next page*)

Table 3: (*Continued*)

Variables	*n* (%)	MS ± SD	F/t	*p*
Present	73 (26.5)	9.2 ± 2.1	1.648	0.101
Absent	202 (73.5)	8.7 ± 2.1		
BMI (kg/m^2)				
Normal weight (18.5–24.9)	112 (40.7)	9.6 ± 2.0	14.43	< 0.001*
Overweight (25–29.9)	117 (42.5)	8.7 ± 2.0		
Obesity 1 (30–34.9)	36 (13.1)	7.4 ± 1.8		
Obesity 2 (≥ 35)	10 (3.6)	7.3 ± 1.6		

Note: F = ANOVA; p = significance level < 0.05; *Significant difference in the mean scores of knowledge of lifestyle and dietary modification; **Income based on national minimum wage of 30,000 Naira/month.

Practice of Lifestyle and Dietary Modification

Assessment of body weight and BMI changes among the study population

The mean body weight and BMI at the beginning of the study were 77.3 ± 19.9 kg and 28.9 ± 7.5 kg/m^2, respectively in the control group and the intervention group values were 78.3 kg ± 20.6 kg and 28.9 ± 7.5 kg/m^2 with *p*-value of 0.670 and 0.184 for body weight and BMI difference, respectively. At 6 months the body weight and BMI values in the control group were these were found to be 75.5 ± 14.1 kg and 28.4 ± 5.9 kg/m^2 and the intervention group values were 72.4 ± 15.6 and 26.5 ± 4. At 12 months post-intervention, the body weight and BMI values were 75.5 ± 10.9 kg and 28.3 ± 4.3 kg/m^2 in the control group while the intervention the body weight were 70.1 ± 9.4 kg and BMI of 25.2 ± 2.3 kg/m^2 with a significant difference of *p*-value of 0.001 between the control and intervention groups in both cases.

Patients' practice of lifestyle modification was not significantly different between control and intervention group at baseline. At 6 months, only the practice of physical activity was significantly higher in the intervention group compared to the control group ($p < 0.001$). All the domains of practice were significantly different in the intervention group compared to control group at 12 months ($p < 0.001$). Pre-intervention, there was no significant difference in the practice of dietary modification between control and intervention groups. Following, all aspects of dietary modification practices were significantly different both at 6 months and 12 months ($p < 0.005$) except in the practice of intake of fatty ($p = 0.091$) and sugar and sugary substance intake ($p = 0.0990$) (see Table 4).

Overall and domains quality of life rating among hypertensive patients

There was no statistical difference overall QOL and domains at baseline between the control and intervention groups ($p > 0.05$). The least mean score was in the physical domain quality of life and highest in the environment. Post-intervention, there was a statistical difference between the control and intervention groups in the overall quality of life and domains at 6 months and 12 months ($p < 0.05$) with environment domain having the best QOL at the end of the study (see Table 5).

Table 4: Practice of lifestyle and dietary modification among the study population before and after intervention.

	Baseline				6 Months				12 Months			
Practice domain of lifestyle modification	**CTG N (%) (158)**	**ITG. N (%) (159)**	**χ^2**	***p***	**CTG N (%) (149)**	**ITG N (%) (152)**	**χ^2**	***p***	**CTG N (%) (136)**	**ITG N (%) (139)**	**χ^2**	***p***
Cigarette smoking												
Non-smoker**	143 (90.5)	142 (89.3)	0.125	0.723	132 (88.6)	137 (90.1)	0.665	0.541	118 (86.8)	131 (94.2)	4.493	0.034*
Current smoker	15 (9.5)	17 (10.7)			17 (11.4)	15 (9.9)			18 (13.2)	8 (5.8)		
Intake of alcohol												
No**	133 (84.2)	138 (85.5)	0.114	0.736	126 (84.6)	132 (86.8)	0.319	0.575	112 (82.8)	128 (92.1)	5.863	0.015*
Yes	25 (15.8)	23 (14.5)			23 (15.4)	20 (13.2)			24 (17.6)	11 (7.9)		
Stressful condition												
Rarely**	88 (52.4)	80 (47.6)	0.821	0.663	32 (23.5)	40 (28.8)	1.108	0.574	7 (4.7)	34 (22.4)	21.475	< 0.001*
Occasional	58 (48.3)	62 (51.7)			81 (59.6)	75 (54.0)			116 (77.9)	103 (67.8)		
Daily /Always	13 (44.8)	16 (55.2)			23 (16.9)	24 (17.3)			26 (17.4)	15 (9.9)		
Physical activities												
Rarely	60 (38.0)	79 (56.4)	4.702	0.095	35 (25.7)	91 (66.9)	49.10	< 0.001*	56 (37.6)	17 (12.5)	88.65	< 0.001*
Occasional	85 (56.3)	66 (43.7)			91 (66.9)	72 (51.8)			87 (58.4)	54 (35.5)		
Daily**	13 (50.0)	13 (50.0)			10 (7.4)	57 (41.0)			6 (4.0)	79 (52.0)		
Dietary sodium intake												
High	44 (27.7)	54 (34.2)	1.570	0.210	64 (47.1)	11 (7.9)	53.107	< 0.001*	25 (16.8)	13 (8.6)	4.616	0.032*
Low**	115 (72.3)	104 (65.8)			72 (52.9)	128 (92.1)			124 (83.2)	139 (91.4)		

(*Continued on next page*)

Table 4: (*Continued*)

	Baseline				6 Months				12 Months			
Practice domain of lifestyle modification	**CTG N (%) (158)**	**ITG. N (%) (159)**	**χ^2**	***p***	**CTG N (%) (149)**	**ITG N (%) (152)**	**χ^2**	***p***	**CTG N (%) (136)**	**ITG N (%) (139)**	**χ^2**	***p***
Fruits and vegetables												
High**	83 (52.2)	51 (32.2)	1.891	0.102	86 (63.2)	127 (91.4)	31.153	< 0.001*	76 (51.0)	118 (77.6)	23.28	< 0.001*
Low	76 (47.8)	107 (67.7)			50 (36.8)	12 (8.6)			73 (49.0)	34 (22.4)		
Fatty food intake												
High**	90 (54.1)	105 (66.0)	2.757	0.097	53 (39.0)	34 (24.5)	6.692	0.010*	61 (40.9)	48 (31.6)	2.854	0.091
Low	68 (43.0)	54 (34.0)			83 (61.0)	105 (75.5)			88 (59.1)	104 (68.4)		
Sugar and sugary substance												
High	92 (58.2)	102 (64.2)	1.171	0.279	56 (41.2)	24 (17.3)	19.052	< 0.001*	48 (32.2)	50 (32.0)	0.016	0.900
Low**	66 (41.8)	57 (35.8)			80 (58.8)	115 (82.7)			101 (67.8)	102 (57.1)		

Note: CTG = control group; ITG = intervention group; χ^2 = Chi square; *p* = Significance level at < 0.05; *Significant difference; **Acceptable practice.

Table 5: Quality of life of hypertensive out-patients attending cardiology clinic of UITH, Ilorin, Nigeria, pre-intervention and post-intervention.

	Baseline				6 Months				12 Months			
Domains of Quality of life	**CTG (n = 158) MS ± SD**	**ITG (n = 159) MS ± SD**	***t***	***p***	**CTG (n = 148) MS ± SD**	**ITG (n = 152) MS ± SD**	***t***	***p***	**CTG (n = 136) MS ± SD**	**ITG (n = 139) MS ± SD**	***t***	***p***
Overall QOL	58.1 (9.3)	59.5 ± 9.4	–1.280	0.201	61.4 ± 9.1	75.2 ± 8.4	–3.69	< 0.001	65.1 ± 6.2	80.6 ± 8.9	–6.787	< 0.001
Physical	55.1 (11.1)	55.8 ± 11.8	–0.522	0.602	59.3 ± 10.5	73.3 ± 11.0	–2.05	< 0.001	62.1 ± 9.8	78.6 ± 10.7	–13.25	< 0.001
Psychological	58.8 (10.4)	61.1 ± 10.2	–1.962	0.051	60.5 ± 10.7	74.8 ± 9.6	–2.23	< 0.001	64.6 ± 8.4	80.3 ± 10.7	–0.524;	< 0.001
Social	56.4 (14.7)	58.8 ± 15.0	–1.437	0.152	61.8 ± 12.6	74.2 ± 9.6	–8.27	< 0.001	66.7 ± 10.8	78.7 ± 13.4	–8.252	< 0.001
Environment	62.2 (11.2)	62.2 ± 11.3	0.021	0.983	65.1 ± 10.7	78.6 ± 9.6	–11.51	< 0.001	67.1 ± 9.8	84.8 ± 9.7	–15.081	< 0.001

Note: *p* = significance level at < 0.05; *Significant difference.

Relationship between patients' characteristics and QOL of hypertensive patients

The relationship between socio-demographic characteristics of the patients and QOL was assessed. There was significant difference between age and quality of life ($p = 0.014$). Using student's *t*-test or ANOVA, there was no relationship between socio-demographics of the patients and overall QOL. A significant difference was however observed in the association between BMI and QOL ($p < 0.001$).

Table 6: Relationship between socio-demographic characteristics of the patients and mean scores of overall HRQoL among the study population post-intervention

Variables	n (%)	Overall QOL MS ± SD	*F*	*p*
Age group				
< 30	2 (7.0)	87.6 ± 2.3	3.622	0.014*
31–45	47 (17.1)	70.5 ± 10.0		
46–60	89 (32.4)	75.2 ± 11.3		
> 60	137 (49.8)	72.1 ± 10.7		
Gender				
Male	122 (44.4)	72.6 ± 19.3	–0.465	0.542
Female	153 (55.6)	73.2 ± 11.3		
Educational qualification				
Non-formal	44 (16.0)	72.7 ± 11.4	0.022	0.996
Primary	35 (12.7)	73.3 ± 11.4		
Secondary	61 (22.2)	72.9 ± 1.8		
Tertiary	135 (49.1)	73.0 ± 10.3		
Occupational status				
Unemployed	45 (16.4)	70.9 ± 10.9	0.618	0.604
Self-employed	118 (42.9)	73.5 ± 11.1		
Civil servant	69 (25.1)	73.6 ± 10.6		
Retiree	43 (15.6)	72.6 ± 10.9		
Marital status				
Single	3 (1.1)	82.4 ± 9.1	1.057	0.368
Married	243 (88.4)	72.7 ± 10.9		
Divorced/separated	15 (5.5)	75.3 ± 9.3		
Widowed	14 (5.1)	71.8 ± 12.2		
Family history of hypertension				
Yes	126 (45.8)	73.8 ± 11.4	0.754	0.471
No	79 (28.7)	71.9 ± 10.0		
Not sure	70 (25.5)	72.7 ± 11.0		

(*Continued on next page*)

Table 6: (*Continued*)

Variables	n (%)	Overall QOL MS ± SD	*F*	*p*
Duration since diagnosis (years)				
< 1	24 (8.7)	74.5 ± 11.5	1.046	0.373
1–10	185 (67.3)	73.3 ± 10.6		
11–20	43 (15.6)	72.5 ± 12.7		
> 20	23 (8.4)	69.4 ± 8.7		
Presence of comorbid condition				
Present	125 (45.5)	73.2 ± 11.0	0.400	0.689
Absent	150 (54.5)	72.7 ± 10.9		
Adverse drug reaction				
Present	73 (26.5)	73.4 ± 10.5	0.384	0.701
Absent	202 (73.5)	72.8 ± 11.1		
Body weight category				
Normal weight (18.5–24.9)	112 (40.7)	77.5 ± 9.9	19.44	< 0.001*
Overweight (25–29.9)	117 (42.5)	72.0 ± 10.5		
Obesity 1 (30–34.9)	36 (13.1)	64.3 ± 8.5		
Obesity 2 (≥ 35)	10 (3.6)	64.6 ± 7.1		

Note: *F* = ANOVA; *p* = significance level < 0.05; *Significant difference in overall quality of life; **According to National Minimum Wage; N = 275.

DISCUSSION

This study was conducted to explore the effect of pharmacist's intervention on patients' knowledge of HTN, knowledge of lifestyle, dietary modification and practice of lifestyle and dietary modification and its' impact on their BP control and QOL. The socio-demographic characteristics of the patients at baseline showed a homogenous distribution of most of the patients' characteristics in both control and intervention groups were not significantly different. The mean age of the participants was 59.4 ± 13.1. In a similar institutional based study carried out in Baltimore, Maryland, USA on knowledge of HTN and lifestyle practices among hypertensive patients by Abu *et al.* (2018), the mean age of the participants was 59.5 ± 12.4 years while Adedapo *et al*. (2015) in a study carried out among hypertensive patients at University College Hospital, Ibadan, Nigeria it was found to be 57.1 ± 11 year. The results, particularly the number of participants reduced from 317 completed the study at the baseline, with only 301 and 275 completing first and second follow up could be attributed to the COVID-19 pandemic which was more pronounced in the early part of the study. There were few weeks of shut down between March 2020 and July 2020, improved activities, especially in scheduled hospital functions gradually began to restore. The COVID-19 pandemic similarly affected the processes of routine comprehensive care for disease management in other parts of the world. The physical face-to-face consultations had been halted due to government restriction, greater instilled fear and focus shifted toward COVID care (Fekadu *et al.* 2021)

Knowledge of lifestyle and dietary modification which was found to improve from baseline without significant difference between the control and intervention group but with a significant difference after the intervention between control and intervention group. The intervention group having a significantly higher knowledge score than the control group was an indication of the effectiveness.

There was a significant increase in patients' level of knowledge of lifestyle and dietary modification (48% to 94.6%) which was higher than what was obtained in Bogale *et al*. (2020) in Harar, Eastern Ethiopia, with average knowledge of 83.9%, where patients' family history of HTN and BMI were associated with good level of knowledge. Significant difference in the relationship between patients' family history of HTN and knowledge of lifestyle and dietary modification could be as a result of interaction between the patients and family members in sharing knowledge and experience. BMI which was found to be associated with knowledge of lifestyle and dietary modification might be related to the fact that it has been reported in a study carried out in the USA that 63% of individuals who are overweight or obese would be willing to participate in weight loss programmes (Cole *et al*. 2016). Which implies that there could be raised consciousness among the patients in this recent study with about two-third overweight and obese patients to show interest in what would help them in losing weight.

Patients' practice of lifestyle and dietary modification was found to be effective in reducing mean body weight and BMI. According to (Alexander *et al*. 2019) weight loss of up to 10 kg can lower BP by as much as 5–20 mmHg in a patient whose weight is more than 10% of ideal body weight. Such a level of difference achieved cold be attributed to the effectiveness of a structured intervention rather than traditional or regular counselling that patient receive.

The practice of lifestyle modification among the patients at the beginning of the study were at a similar level of comparison as there was no significant difference in the practice between the control and the intervention group. Patients level of physical activity was significantly higher in the intervention group at 6 months whereas others practice domains did not. This implies that changes in patients' lifestyle modification in physical activity was earlier achieved than others. Probably, this could be the reason why significantly changes observed in body weight and BMI were associated with BP control. Different from lifestyle modification practice, patients' practice of dietary modification produced a significant difference at 6 months which was also sustained at 12 months with intervention group having a significantly higher level of practice compared to control group. This showed that it was possible to achieve patients' adherence to dietary modification in a shorter period than lifestyle modification.

Relationship between practice of lifestyle and dietary modification showed that physical activity had significant relationship with BP control. This was consistent in agreement with Alsairafi *et al*. (2010) in a study carried out in Kuwait which demonstrated inverse relationship between physical activity and systolic blood pressure (increased physical activity was associated with reduction in BP). Although there was a reduction in the level of cigarette smoking as well as intake of alcohol in this study, the reduction was not associated with BP control ($p > 0.05$). This was similar to Roerecke *et al*. (2017) but Xin *et al*. (2001) observed a dose dependent relationship between alcohol and systolic BP. When lifestyle changes in alcohol consumption is desired, it should be done with consistency because it has been reported that up to 40% and it could be possible for 20% to stop alcohol (Thompson, 2020). This study achieved a reduction in alcohol intake from initial 15.8% to a final 7.9% which was about 50% reduction.

Reduction in salt intake was associated with good BP control as there was a significant difference in patients' practice of dietary salt reduction and BP control. This is

consistent with literature review study carried out by Grillo *et al*. (2019) where reduction in intake of dietary salt was associated with reduction in BP other cardiovascular events. However, possibility of increased risk of CVD morbidity and mortality at extremes of low salt intake has been scientifically proven (He *et al.* 1999). High intake of fruits and vegetables has been demonstrated to improve micronutrients, water and fibres which provide modest benefits that compliment other measures in HTN management (Borgi *et al.* 2016). In a study carried out in Deleware, USA by Mansoori *et al*. (2019), a decrease of 2.3 teaspoons of added sugar was found to result in 8.4 mmHg drop in systolic BP and a 3.7 mmHg drop in diastolic BP. This study found a significant association between patients' reduction of sugar and BP control. The negative impact of high sugar intake with its' attendant risk on HTN has been established (DiNicolantonio *et al*. 2014). High sugar intake can increase insulin levels which can make blood vessels less flexible and renal water and sodium retention (Johnson *et al.* 2009; Dansinger 2020).

HTN has been associated with a reduced QOL (Trevisol *et al*. 2012). In a comparative assessment of QOL between hypertensive and normotensive individuals carried out by Adedapo *et al*. (2015) in Ibadan South-Western Nigeria, hypertensive patients were found to have a lower overall QOL (63.6 ± 5.9) compared with normotensive patients (67.4 ± 9.8). The mean overall QOL obtained in that study was higher than baseline value obtained from this study (58.9 ± 9.3) indicating a comparatively higher QOL among patients in that study. The lowest QOL domain was in the physical health similar to Adedapo *et al*. (2015) but in the contrary social health domain was with highest mean QOL as against environment health in this study. Ibadan is more a developed city with better infrastructural development which could be responsible for a higher social domain of QOL compared to Ilorin. Ha *et al.* (2014) in a study among hypertensive rural patients in Vietnam had lower QOL mean score (56.9 ± 7.8) and highest QOL domain score at in the environment domain in as found in this while the least was in psychological health. Physical domain which was lowest in this study could result from presence of factors that could lead to a reduced QOL in the physical domain. One hundred and two (102) patients experienced some hindrance which could prevent them from performing physical activity in which pain and pain related conditions were the most commonly experienced hindrance. In a study carried out in Brazil by Gusmão *et al*. (2009), physical domain was found to be significantly higher than other domains of QOL which was more pronounced in uncomplicated HTN. Significantly higher overall mean QOL in the intervention group post-intervention might be associated with the effectiveness of the intervention provided.

Significant relationship between knowledge of lifestyle and dietary modification and QOL has also been found in the studies of Jafari *et al*. (2016) carried out in Isfahan, Iran, Azar *et al*. (2020) in Karaj city of Iran. This study achieved a significantly improved quality of life with patients' improved knowledge of lifestyle and dietary modification.

Reduction in cigarette smoking was not found to be associated with patients' quality of life in this study. The number of patients that were smokers at the beginning of the study were 32 (10.1%) which was reduced to 26 (9.5%) after the study. This little difference could not produce a reasonable change in QOL. Goldenberg *et al*. (2014) in a review study concluded that there were associated reduced quality of life with cigarette smoking among patients while Rezaei *et al.* (2017) in a population survey in Western Iran assessed the impact of smoking on QOL and found that smoking was significantly associated with reduced HRQoL among the study population and worse among nicotine dependent smokers. Lack of significant difference in this study may probably results of low number of smokers in the study population. Alcohol intake was found to have a significant relationship with patients QOL. This finding was similar to a study in India (Daeppen *et al.* 2013) and Switzerland (Olickal *et al*. 2021) where alcohol intake had significant relationship with patients' QOL and

impact on QOL is determined by the pattern and extent of consumption. Increased level of exposure to stress has been found to affect QOL. Any measure that reduces exposure to stress would have positive impact on QOL of patients. Reduction in daily exposure to stress from 55.2% of the patients to 9.9% had significant impact on patients' QOL. This study has found physical activity as an important component of lifestyle modification that improves hypertensive patients' QOL. The significant relationship between increase in physical activity and QOL might be from significant difference in patients' level of practice of physical activity in the intervention group compared with control group at 6 months of the study. A similar result has been reported in Xiao *et al*. (2019), where significant association was found between physical exercise and QOL. BMI was found to be significantly associated with patients' overall QOL. Patients with normal weight (18.5–24.9 kg/m^2) had significantly increased QOL compared to other categories while the least scores were found among the obese patients. Improved QOL associated with reduced BMI could be related improved physical activity. People who engage in regular physical activity could achieve a healthy body weight/BMI which could translate into improved QOL. Bhandari *et al*. (2016), in a study in Nepal found direct relationship between BMI and QOL which is a rare result when compare with available data. Significant reduction in patients' practice of dietary salt intake was associated with increased QOL. A reduction in number of patient who restricted salt intake from 65.8% to 91.4% was associated with improved QOL. Perceived self-efficacy, social acceptability and family structure were also some of the identified factors influencing patients' adherence to dietary salt restriction in a study carried out in Nepal (Ghimire *et al*. 2018). However, in the present study, there was no relationship between intake of sugar and quality of life among this patient

CONCLUSION

Knowledge of lifestyle and dietary modification was comparably different between the control and intervention group in a two phase interventional study on knowledge and practice of lifestyle/dietary modification. Significant level of practice of lifestyle/dietary was associated with improved QOL among hypertensive patients. Practice domains associated with improved QOL were physical activity, reduction in alcohol intake and practice of good dietary habits.

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Ethical consideration

Ethical approval for the study was obtained from the University of Ilorin Teaching Hospital Ethical committee (UITH-ERC) with reference number ERC/PAN/2020/02/0002.

Conflict of interest

The authors declare no conflict of interest in carrying out this research work.

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