Mediterranean Journal of Pharmacy & Pharmaceutical Sciences
www.medjpps.com

ISSN: 2789-1895 online
ISSN: 2958-3101 print

ORIGINAL RESEARCH article

Educational intervention on knowledge of hypertension and lifestyle/dietary modification among hypertensive patients attending a tertiary health facility in Nigeria

Muslim O. Jamiu [1 *], **Bilkisu B. Maiha** [2], **Nuhu M. Danjuma** [2] and **Abdulganiyu Giwa** [1]

[1] Department of Clinical Pharmacy and Pharmacy Practice, University of Ilorin, Ilorin, Nigeria
[2] Department of Pharmacology and Therapeutics, Ahmadu Bello University, Zaria, Nigeria
[*]Author to whom correspondence should be addressed

Received: 13-12-2023, **Revised:** 04-01-2024, **Accepted:** 09-01-2024, **Published:** 31-03-2024

Copyright© 2024. This open-access article is distributed under the ***Creative Commons Attribution License***, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

HOW TO CITE THIS

Jamiu et al. (2024) Educational intervention on knowledge of hypertension and lifestyle/dietary modification among hypertensive patients attending a tertiary health facility in Nigeria. Mediterr J Pharm Pharm Sci. 4 (1): 1-11. [Article number: 140]. https://doi.org/10.5281/zenodo.10535778

Keywords: Dietary, education, hypertension, knowledge, lifestyle, pharmacist

Abstract: Patients' knowledge of hypertension and treatment has been found to affect health outcomes of hypertension. This study aimed to assess the impact of therapeutic patients' education on knowledge of hypertension and lifestyle/dietary modification among hypertensive patients in Nigeria. The study was conducted among 317 hypertensive patients randomized into controlled and intervention groups (158 vs 159, respectively) between March 2021 and February 2022. Baseline knowledge of the patients was assessed and intervention was provided for the intervention group with a structured educational program at a baseline and six months. Descriptive data were presented with a frequency table in percentage while the chi-square test and univariate logistic regression were used to determine the association between categorical variables. Out of the total 318 patients, 275 completed the study (response rate: 86.8%) with 136 in the control group and 139 in the intervention group. The mean age of the patients was 59.5 (±12.5) and patients >60 years (49.5%) were the most frequent age category. The baseline knowledge score of hypertension was 9.8 (±2.6) and 9.3 (±2.6) on a scale of 16 points in the control group and intervention group, respectively (P=0.060) while at six months 11.9 (±2.3) vs 10.8 (±2.4) (P<0.001) and 12 months 12.6 (±2.5) vs 9.5 (±2.0) (P<0.001), respectively. Knowledge of lifestyle/dietary modification in the control group and intervention group at baseline was 7.0 (±2.1) and 6.6 (±2.0), respectively, while at six months 7.5 (±1.5) vs 9.9 (±1.3) (P<0.001) and at 12 months 7.2 (±1.5) vs 10.4 (±1.2), respectively. Marital status, body mass index, and family history of hypertension were associated with knowledge of hypertension and lifestyle/dietary modification (P<0.001). The educational intervention provided was associated with a significant improvement in knowledge of hypertension and lifestyle/dietary modification. The marital status of the patients, body mass index and family history of hypertension influenced patients' level of knowledge.

ISSN: 2789-1895 online
ISSN: 2958-3101 print

Introduction

Hypertension (HTN) is a leading cause of disability and death in developing and developed countries as a result of its leading role in the development and progression of cardiovascular diseases [1]. It contributes to more than 7.5 million deaths per year of the total 17 million deaths resulting from cardiovascular diseases [2]. It has been found to a pose high economic burden in a developing economy like Nigeria [3]. In a systematic review across Sub-Saharan African countries, the cost of medication accounted for most of the expenditures ranging from 1.70 $ to 97.06 $ from a patient perspective and 0.09 $ to 193.55 $ from a provider perspective per patient per month [4]. Major cost drivers were multi-drug treatment, inpatient or hospital care and having a comorbidity like diabetes mellitus. Despite the availability of multiple effective antihypertensive drugs, control of HPT remains poor [5]. Complications resulting from uncontrolled HTN such as stroke, heart failure and renal failure are associated with high morbidity/mortality and economic loss [6, 7]. HTN is a resource-intensive disease condition and families are often driven into poverty due to lifelong care associated with its management [6]. Patients whose health has deteriorated due to complications from the disease often live with reduced productivity in their routine activities and possible loss of jobs due to illness.

Patient's knowledge of disease conditions like HTN has been known to improve health outcomes. However, this knowledge must be evidence-based and relevant to the patient's needs. Knowledge is one of the components of complex intervention especially in chronic disease states like HTN and diabetes mellitus [8, 9]. While some studies have reported patients' poor knowledge of HTN as consequent to poor blood control [10, 11], some have shown patients good knowledge which has translated to good control of blood pressure [12]. A quite number of patients with non-communicable diseases have very poor knowledge of different components of non-pharmacological therapy. Sabouhi and others [12] have demonstrated that with patients' good level of knowledge about HTN, there was no correlation between the knowledge and good patient' practice that would enhance blood pressure control. With the relatively high level of awareness, knowledge, attitude and practice of HTN, blood pressure control was still poor [12]. A study carried out in Kano, North-Western Nigeria on Knowledge, attitude, and adherence to non-pharmacological therapy among patients with HTN and diabetes mellitus reported that patient self-management education, lifestyle modification which include a healthy diet, regular physical exercise, management of stress and avoidance of tobacco have been shown to improve the outcome of therapy [13]. It has also been demonstrated by Silveira de Castro and others [14] that pharmaceutical care intervention in identifying and resolving drug-related problems improved blood pressure control in patients with uncontrolled HTN. Erah and Chuks-Eboka [15] identified most common components of pharmacists' activities offered were the supply of medication and provision of information on the cost of medication. They found that patients perceived a significantly lower chance of developing medication-related problems when they met with the pharmacists as compared to when they did not. Effective control of blood pressure through health education intervention programs has been shown to decrease the risk of cardiovascular complications especially systolic blood pressure which is more prevalent among the elderly population [16]. The World Health Organization/Europe proposed the concept of Therapeutic Patient Education (TPE) in the prevention of chronic diseases [17]. It is almost impossible to reproduce the education intervention (EI) without a detailed description of the teaching program (number of meetings, duration of the intervention, place, and profession of the teacher and teaching models [18]. Giving appropriate educational intervention to patients is, therefore, a necessary component of care given to patients to improve their knowledge level of their disease condition and also empower them in self-care practices.

ISSN: 2789-1895 online
ISSN: 2958-3101 print

Materials and methods

The study was conducted at the cardiology clinic of the main outpatient department of the hospital among hypertensive patients who were registered with and attended the Cardiology Clinic of the University of Ilorin Teaching Hospital, Ilorin, Nigeria. Eligible patients were hypertensive patients who had been on antihypertensive medication for not less than four weeks and were adults of 18 years and above. 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. The study design was a prospective longitudinal randomized interventional study that was carried out between March 2021 and February 2022. The design was in line with the CONSORT (Consolidated Standards of Reporting Trials) 2010 statement [19]. This study design was chosen because it is less prone to bias and can more easily demonstrate the relationship between causes and effects [20]. The sample size was determined according to recommended standards for sample size calculation in a randomized control study [21]. The design was to assess the effect of the intervention in the treatment group (intervention group) compared to the control group. Online sample size calculator as contained in [21]. The parameter definitions were n=size per group; significance level (α) was set at 5.0% (0.05); expected SD=10.17 mmHg; power (β)=0.9; Ratio of control to intervention=1; Z=1.96; margin=4 and an estimated drop rate 30.0%. The allowable difference in the mean BP was assumed to be zero and a difference in 5.0% (δ) change in systolic blood pressure was assumed to be clinically meaningful [22]. The sample size obtained for each group was 159 making a total of 318 (159x2) participants. There was a drop-out of one participant from the controlled group after recruitment which makes the controlled group become 158.

Eligible patients were identified and recruited for the study continuously on every clinic day. A simple randomization method was used to allocate patients into either a control or intervention group. This method was considered the easiest method of simple randomization but capable of producing reliable results that eliminate bias [23, 24]. Baseline data were collected from each arm of the randomized group where a questionnaire on knowledge of HPT was developed through a literature review on knowledge of HPT, treatment, complication and self-care practices, and knowledge of life and dietary modification and lifestyle/dietary modification administered to the patients in an interviewer-administered manner. After baseline data were collected in the intervention group, it was followed by educational intervention which was self-delivered to the intervention group after baseline assessment and repeated at six months.

Statistical analysis: After collecting data at baseline, six months and 12 months, data was entered and analyzed using SPSS version 25. Data were presented in frequency tables and numerical data were analyzed using a Student *t*-test and one-way ANOVA while categorical data were analyzed by using a Chi-square test and univariate logistic regression analysis. P less than 0.05 was considered significant.

Results

In this study, a total of 318 patients were recruited for the study which were randomized into controlled and intervention groups. The patients were analyzed following the completion of the baseline study with 158 in the controlled group and 159 in the intervention group. The number of patients that returned for follow-up at six months was 301 (94.7%, response rate) out of the initial 318 patients at baseline. Seventeen hypertensive patients were lost to follow up with 10 patients in the control group and seven in the intervention group. At 12 months, 275 patients (86.8%, response rate) completed the study with 136 in the control and 139 in the intervention groups. In **Table 1**, the demographic distribution of the patients between the control and the

ISSN: 2789-1895 online
ISSN: 2958-3101 print

intervention groups showed that there is no significant difference in most of the patients' baseline characteristics groups except in the marital status (P=0.033) and family history of HPT (P=0.027).

Table 1: Baseline characteristics of the study population at baseline

Variable	Group n (%) total = 317		MS (±SD)	χ^2/t	*P value*
	Control: 158	Intervention: 159			
Age (years)	58.7 (±13.1)	59.7 (±11.9)	59.5±12.5	-0.72	0.472
Age group					
< 30 years	01 (00.6)	03 (01.9)	04 (01.3)	2.114	0.549
30-45 years	28 (17.6)	22 (13.9)	50 (15.8)		
46-60 years	50 (31.4)	56 (35.4)	106 (33.4)		
> 60 years	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)		
Marital status					
Single	01 (00.6)	04 (02.5)	05 (01.6)	8.72	0.033*
Married	146 (91.8)	130 (82.3)	276 (87.1)		
Divorced/separated	00 (00.0)	04 (02.5)	04 (01.3)		
Widowed	12 (07.5)	20 (12.7)	32 (10.1)		
Family history of hypertension					
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)		
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)		
Body weight mass category (Kg/m^2)					
Underweight: < 18.4	05 (03.1)	05 (03.2)	10 (03.2)	1.126	0.890
Normal weight: 18.5-24.9	53 (33.3)	49 (31.0)	102 (32.2)		
Overweight: 25.0-29.9	50 (31.4)	49 (31.0)	99 (31.2)		
Obesity I: 30.0-34.9	30 (18.9)	37 (23.4)	67 (21.1)		
Obesity II: ≥ 35	21 (13.2)	18 (11.4)	39 (12.3)		

ISSN: 2789-1895 online
ISSN: 2958-3101 print

Knowledge of hypertension among hypertensive patients: In **Table 2**, at baseline (pre-intervention), the scores of knowledges of HPT between the control group and intervention group were found not statistically significant (P>0.05). However, a significantly higher mean score of knowledge of HPT (P<0.001) in the intervention group compared with the control group was observed at six months and 12 months as shown in **Table 2**.

Knowledge scores of lifestyles and dietary modification among the hypertensive patients before and after the intervention: The mean knowledge scores of lifestyles and dietary modification at baseline, six months and 12 months in the control group were 7.0, 7.5 and 7.2, respectively. A highly significant relationship between knowledge of HTN and blood pressure control at six months and 12 months following intervention was observed (P<0.001) (**Table 3**).

Table 2: Knowledge scores of hypertensions among the patients at baseline, 6 and 12 months

Groups	n	MS (±SD)	*t*	*P*	n	MS (±SD)	*t*	*P value*
Baseline (n=317)								
Controlled	126	09.8 (±2.6)	1.887	0.060	132	09.6 (±2.6)	0.764	0.445
Uncontrolled	191	09.3 (±2.6)			185	09.4 (±2.5)		
6 months (n=301)								
Controlled	170	11.9 (±2.3)	4.153	<0.001*		12.1 (±2.2)	5.278	<0.001*
Uncontrolled	131	10.8 (±2.4)	10.7			10.2 (±2.1)		
12 months (n=275)								
Controlled	157	12.6 (±2.5)	10.70	<0.001*	171	12.7 (±2.5)	11.18	<0.001*
Uncontrolled	118	09.5 (±2.0)			104	09.5 (±2.0)		

* Significant difference in the level of knowledge between the control and intervention group by χ^2 is the Chi-square test

Table 3: Knowledge scores of lifestyles and dietary modification among the patients at baseline, 6 and 12 months

Parameters	n (%)	MS (±SD)	t-test	*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)	-15.29	<0.001*
Intervention	152 (50.5)	9.9 (±1.3)		
12 months (N=275)				
Control	136 (49.5)	7.2 (±1.5)	-18.3	<0.001*
Intervention	139 (50.5)	10.4 (±1.2)		

* Significant difference in knowledge scores between control and intervention groups

Relationship between patients' socio-demographic characteristics and knowledge of hypertension, and lifestyle/ dietary modifications: In **Table 4**, when the relationship between socio-demographic characteristics of the patients and knowledge of HPT was assessed, patients' marital status was observed to be the only demographic variable significantly associated with the knowledge of HPT (P=0.017). The highest mean score of knowledge

ISSN: 2789-1895 online
ISSN: 2958-3101 print

in marital status was found among the divorced/separated individuals. Almost all the patients' health-related characteristics were not significantly associated with knowledge of HPT except the body mass index of the patients (P<0.001). When the relationship between socio-demographic characteristics of the patients and knowledge of lifestyle/dietary modifications was assessed, only family history and body mass index showed a highly significant relationship with a P=0.01 and P<0.001, respectively (**Table 4**).

Relationships between patients' characteristics and knowledge of lifestyle and dietary modifications: As shown in **Table 5**, there was no significant difference (P>0.05) in patients' knowledge scores of lifestyles and dietary modifications in most of the assessed patients' socio-demographic characteristics (P>0.05).

Table 4: Relationship between socio-demographic characteristics and knowledge of hypertension among the study population

Variables	n (%)	MS (±SD)	*F/t*	*P*
Age group				
< 30.0	02 (7.0)	14.5 (±0.7)	2.351	0.073
31.0-45.0	89 (17.1)	11.2 (±2.8)		
46.0-60.0	47 (32.4)	11.9 (±2.7)		
> 60.0	137 (49.8)	11.2 (±2.7)		
Gender				
Male	122 (44.4)	11.3 (±2.6)	-0.593	0.554
Female	153 (55.6)	11.5 (±2.7)		
Educational Qualification				
Non-formal	44 (16.0)	11.4 (±3.0)	0.096	0.962
Primary	35 (12.7)	11.7 (±2.5)		
Secondary	61 (22.2)	11.3 (±2.7)		
Tertiary	135 (49.1)	11.5 (±2.8)		
Occupational status				
Unemployed	45 (16.4)	11.0 (±3.1)	0.574	0.633
Self-employed	118 (42.9)	11.5 (±2.7)		
Civil servant	69 (25.1)	11.7 (±2.8)		
Retiree	43 (15.6)	11.3 (±2.6)		
Marital status				
Single	03 (1.1)	12.3 (±3.8)	4.112	0.017*
Married	243(88.4)	11.4 (±2.8)		
Divorced/separated	15 (5.5)	12.5 (±2.0)		
Widowed	14 (5.1)	11.5 (±2.7)		
Level of income**				
Low (<30,00 Naira/month)	166 (60.4)	11.5 (±2.7)	0.065	0.948
High (≥30, 000 Naira /month)	109 (39.6)	11.5 (±2.8)		
Body weight category (Kg/m^2)				
Normal weight, 18.5-24.9	112 (40.7)	12.6 (±2.6)	16.4	<0.001*
Overweight, 25.0-29.9	117 (42.5)	11.1 (±2.7)		
Obesity I, 30.0-34.9	36 (13.1)	9.6 (±2.0)		
Obesity II, ≥ 35.0	10 (3.6)	9.5 (±2.1)		

* Significant difference in knowledge scores of hypertension, *F*=ANOVA; ** Based on national minimum wage, n = 275

ISSN: 2789-1895 online
ISSN: 2958-3101 print

Table 5: Socio-demographic characteristics and knowledge scores of lifestyles and dietary modifications

Variables	n (%)	MS (±SD)	*F/t*	*P*
Age group				
<30.0	02 (07.0)	11.0 (±0.0)	1.915	0.127
31.0-45.0	47 (17.1)	8.9 (±2.1)		
46.0-60.0	89 (32.4)	9.1 (±2.1)		
>60.0	137 (49.8)	8.6 (±2.1)		
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	03 (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
High (≥30, 000 Naira / Month)	109 (39.6)	8.9 (±2.1)		

F=ANOVA, * Significant difference in the mean scores of knowledges of lifestyle and dietary modifications
** Based on national minimum wage

Discussion

This study was conducted to explore the effect of pharmacist intervention on patients' knowledge of HPT and knowledge of lifestyle/dietary modification. The socio-demographic characteristics of the patients at baseline showed a homogenous distribution of most of the patients' characteristics in the control group and intervention group were not different. The mean age of the participants was 59.4 (±13.1). In similar studies carried out in Baltimore, Maryland, USA on knowledge of HPT and lifestyle practices among hypertensive patients by Abu et al. [25], the mean age of the participants was 59.5 (±12.4) years while Adedapo et al. [26] in a study carried out among hypertensive patients at University College Hospital, Ibadan, Nigeria, it was found 57.1 (±11.0) year. The reason for a similar age bracket with studies could be the fact that HPT is more common in adults and its trend increases with an increase in age [27]. Higher mean age has also been found in other studies as seen in a study carried out at a Sri Lankan hospital by Ralapanawa et al. [11] where the mean age of 64.5 years was obtained. Studies by Demisse et al. [28] from Ethiopia and Odili et al. [29] from Delta State, Nigeria have identified increasing age as an associated factor with increased incidence of HPT. The most occurring age group

ISSN: 2789-1895 online
ISSN: 2958-3101 print

in this study was >60 years. The high occurrence of HPT among female patients in this study compared to their male counterparts could be attributed to possible family and job pressure since the majority of the participants were married and also self-employed. Meeting ends need may be a difficult task which might expose them to stressful environmental risk factors for HPT [30, 31].

Patients' knowledge of HPT between the control group and intervention group was not different at the beginning of the study. Higher scores of knowledges which were significantly different in the intervention group at six months and 12 months might be a result of the education received by the intervention group. However, the magnitude of the difference in the level of knowledge of HPT also showed that the level of knowledge in the control group and the intervention group at baseline was found to be comparable because there was no significant difference in the knowledge level of the patients. A significantly higher level of knowledge level of HPT in the intervention group compared with the control group at six months and 12 months following the intervention could be attributed to the intervention provided. It was also observed that the patients in the control group showed improvement in their level of knowledge from baseline to six months. However, the observed improvement could be attributed to general counseling and education usually provided by other healthcare providers although the intervention group showed a significantly higher knowledge level than the control. Nevertheless, there was a slight reduction in knowledge level from 79.2% to 64.0% from six months to 12 months. This could be due to a lack of consistency in the routine counselling and/or difficulty in attending the counseling session regularly among the patients in the control group. In a similar interventional study carried out in Spain by Ho and his colleagues [32] a lower level of knowledge was achieved following intervention (50.0%). This value was far below the baseline knowledge level in this study. The high baseline level of knowledge of HPT could be attributed to effectiveness in the general counseling and educational programs the health care providers administer to hypertensive patients. The patients' knowledge increase found in the current study demonstrated the possible positive impact of the educational intervention which increased by about two times the baseline value within six months of the study. A significant relationship found between knowledge of HPT and blood pressure control demonstrated the significance of knowledge in disease management. Knowledge imparted to patients was capable of empowering patients to make meaningful contributions to their disease state management [33]. In a similar study in Ekiti South-Western Nigeria, patients' knowledge improvement was found to be associated with good blood pressure control [34]. There was also a significant increase in patients' level of knowledge of lifestyle and dietary modification following intervention from baseline to six months (48.0%-94.6%). The observed difference was higher than what was obtained by Bogale et al. [35] in Harar, Eastern Ethiopia, with an average knowledge of 83.9%. Significant differences in the relationship between patients' family history of HPT and knowledge of lifestyle and dietary modification could be a result of interaction between the patients and family members in sharing knowledge and experience. Body mass index 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 63.0% of individuals who are overweight or obese would be willing to participate in weight loss programs [36]. This implied that there could be raised consciousness among the patients in this recent study with about two-thirds of overweight and obese patients showing interest in what would help them in losing weight.

Most patients' socio-demographic characteristics did not show their influence on patients' knowledge of HPT. The positive relationship between the patient's marital status and body mass index was, however, evident. A similar study in Babylon Province also identified marital status's influence on knowledge of HPT [37] while the study of Chen et al. [38] has only identified body mass index as a strong risk factor for HPT but no association

ISSN: 2789-1895 online
ISSN: 2958-3101 print

has been found with patients' knowledge of HPT or lifestyle modification [38]. Reasons for divorce/separation having a significantly higher knowledge score than others could be as a result of their possibility of having available time to attend their clinic appointments more regularly than others. The relationship of body mass index with knowledge could be attributed to patients' attitudes in seeking ways to control their weight which could expose them to some areas of knowledge about their health. As observed in this study, patients with overweight and obese at baseline were 64.0%, hence differences in their characteristics could impact the result.

Conclusion: The patient's knowledge of hypertension and lifestyle/dietary modification improved tremendously following pharmaceutical care intervention in terms of patient education. Marital status, body mass index and family history of hypertension were significantly associated with improved knowledge of hypertension and, lifestyle/dietary modification.

References

1. Bromfield S, Muntner P (2013) High blood pressure: the leading global burden of disease risk factor and the need for worldwide prevention programs. Current Hypertension Reports. 15 (3): 134-136. doi: 10.1007/s11906-013-0340-9
2. World Health Organization (2022) Non-communicable diseases progress monitor. Global Report. Pages 233. ISBN: 9789240047761.
3. Ganiyu KA, Suleiman IS (2014) Economic burden of drug therapy in hypertension management in a private teaching hospital in Nigeria. British Journal of Pharmaceutical Research. 4 (1): 70-78. doi: 10.9734/BJPR/2014/3983
4. Gnugesser E, Chwila C, Brenner S, Deckert A, Dambach P, Steinert JI, Bärnighausen T, Horstick O, Antia K, Louis VR (2022) The economic burden of treating uncomplicated hypertension in Sub-Saharan Africa: a systematic literature review. BMC Public Health. 22: 1507. doi: 10.1186/s12889-022-13877-4
5. Arredondo A, Aviles R (2014) Hypertension and its effects on the economy of the health system for patients and society: suggestions for developing countries. American Journal of Hypertension. 27 (4): 635-636. doi: 10.1093/ajh/hpu010
6. Erejuwa OO, Gan SH, Romani AM, Kamal MA, Nammi S (2019) Non-pharmacologic interventions in prevention and treatment of hypertension. International Journal of Hypertension. 1-2. doi: 10.1155/ 2019/670981
7. Carey RM, Muntner P, Bosworth HB, Whelton PK (2018) Prevention and control of hypertension: JACC health promotion series. Journal of the American College of Cardiology. 72 (11): 1278-1293. doi: 10.1016/j.jacc.2018.07.008
8. Mühlhauser I, Lenz M (2008) Does patient knowledge improve treatment outcome? German Journal for Evidence and Quality in Health Care. 102 (4): 223-230. doi: 10.1016/j.zefq.2008.04.002
9. El-hamali GJ, Sherif FM (2017) Public health education in pre-diabetes and diabetes control. JOJ Public Health. 2 (4): 1-3. doi: 10.19080/JOJPH.2017.02.555594
10. Almas A, Godil SS, Lalani S, Samani ZA, Khan AH (2012) Good knowledge about hypertension is linked to better control of hypertension; A multicentre cross-sectional study in Karachi, Pakistan. BioMed Centre Research Notes. 5 (579): 1-8. doi: 10.1186/1756-0500-5-579
11. Ralapanawa U, Bopeththa K, Wickramasurendra N, Tennakoon S (2020) Hypertension knowledge, attitude, and practice in adult hypertensive patients at a tertiary care hospital in Sri Lanka. International Journal of Hypertension. 2020: 1-6. ID 4642704. doi: 10.1155/2020/4642704
12. Sabouhi F, Babaee S, Naji H, Zadeh AH (2011) Knowledge, awareness, attitudes and practice about hypertension in hypertensive patients referring to public health care centers in Khoor & Biabanak. Iranian Journal of Nursing and Midwifery Research. 16 (1): 34-40. PMID: 22039377. PMCID: PMC3203297.
13. Abubakar S, Muhammad LU, Ahmed A, Idris F (2017) Knowledge, attitude, and adherence to non-pharmacological therapy among patients with hypertension and diabetes attending the hypertension and diabetes clinics at Tertiary Hospitals in Kano, Nigeria. Sahel Medical Journal. 20 (3): 102-108. doi: 10.4103/1118-8561.223170

ISSN: 2789-1895 online
ISSN: 2958-3101 print

14. Silveira de Castro M, Fuchs FD, Santos MC, Maximiliano P, Gus M, Moreira LB, Ferreira MB (2006) Pharmaceutical care program for patients with uncontrolled hypertension report of a double-blind clinical trial with ambulatory blood pressure monitoring. American Journal of Hypertension. 19 (5): 528-533. doi: 10.1016/j.amjhyper.2005.11.009
15. Erah PO, Chuks-Eboka NA (2008) Patients' perception of the benefits of pharmaceutical care services in the management of hypertension in a tertiary health care facility in Benin City. Tropical Journal of Pharmaceutical Research. 7 (1): 897-905. doi: 10.4314/tjpr.v7i1.14674
16. Iyer AS, Ahmed MI, Filippatos GS, Ekundayo OJ, Aban IB, Love TE, Nanda NC, Bakris GL, Fonarow GC, Aronow WS, Ahmed A (2010) Uncontrolled hypertension and increased risk for incident heart failure in older adults with hypertension: findings from a propensity-matched prospective population study. Journal of American Society of Hypertension. 5 (1): 22-31. doi: 10.1016/j.jash.2010.02.002
17. Ozoemena EL, Iweama CN, Agbaje OS, Umoke PCI, Ene OC, Ofili PC, Agu BN, Orisa PU, Agu M, Anthony E (2017) Diabetes, hypertension, and cardiovascular disease: clinical insights and vascular mechanisms. Canadian Journal of Cardiology. 34 (5): 575-584. doi: 10.1016/j.cjca.2017.12.005
18. Ozoemena EL, Iweama CN, Agbaje OS (2019) Effects of a health education intervention on hypertension-related knowledge, prevention and self-care practices in Nigerian retirees: a quasi-experimental study. Archives of Public Health. 77: 23. doi: 10.1186/s13690-019-0349-x
19. Schulz KF, Altman DG, Moher D. CONSORT Group (2010) CONSORT 2010 Statement: updated guidelines for reporting parallel group randomized trials. British Medical Journal. 340: c332. doi: 10.1136/bmj.c332
20. Thiese MS (2014) Observational and interventional study design types; an overview. Biochemia Medica. 24 (2): 199-210. doi: 10.11613/BM.2014.022
21. Zhong B (2009) How to calculate sample size in randomized controlled trial? Journal of Thoracic Disease. 1 (1): 51-54. PMID: 22263004. PMCID: PMC3256489.
22. Wang X, Ji X (2020) Sample size estimation in clinical research from randomized controlled trials to observational studies. Chest. 158 (1S): S12-S20. doi: 10.1016/j.chest.2020.03.010
23. Dickinson HO, Mason JM, Nicolson DJ, Campbell F, Beyer FR, Cook JV, Williams B, Ford GA (2006) Lifestyle interventions to reduce raised blood pressure: a systematic review of randomized controlled trials. Journal of Hypertension. 24 (2): 215-233. doi: 10.1097/01.hjh.0000199800.72563.26
24. Kim HL, Kim HM, Kwon CH (2020) Blood pressure levels and cardiovascular risk according to age in patients with diabetes mellitus: a nationwide population-based cohort study. Cardiovascular Diabetology. 19: 181. doi: 10.1186/s12933-020-01156-8
25. Abu H, Aboumatar H, Carson KA, Goldberg R, Cooper LA (2018) Hypertension knowledge, heart healthy lifestyle practices and medication adherence among adults with hypertension. European Journal for Person Centered Healthcare. 6 (1): 108-114. doi: 10.5750/ejpch.v6i1.1416
26. Adedapo AD, Akunne OO, Adedokun BO (2015) Comparative assessment of determinants of health-related quality of life in hypertensive patients and normal population in south-west Nigeria. International Journal of Clinical Pharmacology and Therapeutics. 53 (3): 265-271. doi: 10.5414/CP202257
27. China PEACE Collaborative Group (2021) Association of age and blood pressure among 3.3 million adults: insights from China PEACE million persons' project. Journal of Hypertension. 39 (6): 1143-1154. doi: 10.1097/HJH.0000000000002793
28. Demisse AG, Greffie ES, Abebe SM, Bulti AB, Alemu S, Abebe B, Mesfin N (2017) High burden of hypertension across the age groups among residents of Gondar city in Ethiopia: a population based cross sectional study. BioMed Central Public Health. 17 (1): 647. doi: 10.1186/s12889-017-4646-4
29. Odili AN, Chori BS, Danladi B, Nwakile PC, Okoye IC, Abdullah U (2017) Prevalence, awareness, treatment and control of hypertension in Nigeria: Data from a Nationwide Survey 2017. Global Heart. 15 (1): 47. doi: 10.5334/gh.848
30. Spruill T M (2010) Chronic psychosocial stress and hypertension. Current hypertension reports. 12 (1): 10-16. doi: 10.1007/s11906-009-0084-8
31. Barbini N, Speziale M, Squadroni R (2017) Occupational risk factors for arterial hypertension in workers of high-speed railway line in Italy. Archives of Clinical Hypertension. 3 (1): 1-4. doi: 10.17352/ach.000011
32. World Health Organization (2019) Delivering quality health services: a global imperative for universal health coverage. Geneva: World Health Organization, Organization for Economic Co-operation and Development, and the World Bank; 2018. License: CC BY-NC-SA 3.0 IGO. ISBN: 9789241513906.

ISSN: 2789-1895 online
ISSN: 2958-3101 print

33. Ho TM, Estrada D, Agudo J, Arias P, Capillas R, Gibert E, Salvadó A (2016) Assessing the impact of educational intervention in patients with hypertension. Journal of Renal Care. 42 (4): 205-211. doi: 10.1111/jorc.12165
34. Deji-Dada OO, Aina FO, Soloman OA, Omosanya OE, Shabi MO (2019) The impact of knowledge of hypertension on blood pressure control among the elderly hypertensive attending a primary health care facility in Ekiti, South-Western Nigeria. Nigerian Journal of Family Practice. 10 (2**)**: 39-47. doi: Nil.
35. Bogale S, Mishore KM, Tola A, Mekuria AN, Ayele Y (2020) Knowledge, attitude and practice of lifestyle modification recommended for hypertension management and the associated factors among adult hypertensive patients in Harar, Eastern Ethiopia. SAGE Open Medicine. 8: 1-9. doi: 10.1177/2050312120953291
36. Cole AM, Keppel GA, Andrilla HA, Cox CM, Baldwin LM, WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho), Region practice and research network (WPRN) patient preferences for weight loss in primary care development group, and the WPRN practice champions (2016) Primary care patients' willingness to participate in comprehensive weight loss programs: from the WWAMI region practice and research network. Journal of the American Board of Family Medicine. 29 (5): 572-580. doi: 10.3122/jabfm.2016.05.160039
37. Mahdi HA, Al-Humairi AK (2022) Assessment of knowledge about hypertension among hypertensive patients in Babylon Province. Medical Journal of Babylon. 19: 31-36. doi: 10.4103/MJBL.MJBL_73_21
38. Chen H, Zhang R, Zheng Q, Yan X, Wu S, Chen Y (2018) Impact of body mass index on long-term blood pressure variability: a cross-sectional study in a cohort of Chinese adults. BMC Public Health. 18: 1193. doi: 10.1186/s12889-018-6083-4

Acknowledgments: The cooperation of the entire physicians, nurses and other members of staff of the Cardiology unit of the University of Ilorin. Teaching Hospitals are highly appreciated for their cooperation in providing. The research assistants who worked with me throughout the field-work are highly acknowledged for their efforts.
Author contribution: All authors contributed significantly to the proposal, data collection data analysis and script development and review.
Conflict of interest: The authors declare the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Ethical issues: Including plagiarism, informed consent, data fabrication or falsification, and double publication or submission were completely observed by the authors.
Data availability statement: The raw data that support the findings of this article are available from the corresponding author upon reasonable request.
Author declarations: The authors confirm that all relevant ethical guidelines have been followed and any necessary IRB and/or ethics committee approvals have been obtained.