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Assessment of Lifestyle Modification Adherence Among Adult Hypertensive Patients Attending the General Outpatient Clinic of a Tertiary Care Centre in North-Western Nigeria: A Cross-Sectional Survey

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Research Article

Keywords: Adult Patient, Cross-sectional Study, General Outpatient Clinic, Hypertension, Lifestyle Modification Adherence

Posted Date: June 30th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9793650/v1

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Additional Declarations: No competing interests reported.

Manuscript Title:

ASSESSMENT OF LIFESTYLE MODIFICATION ADHERENCE AMONG ADULT HYPERTENSIVE PATIENTS ATTENDING THE GENERAL OUTPATIENT CLINIC OF A TERTIARY CARE CENTRE IN NORTH-WESTERN NIGERIA: A CROSS-SECTIONAL SURVEY.

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Abstract

Background: Hypertension is a major global health issue and a key risk factor for cardiovascular diseases, especially in low- and middle-income countries like Nigeria. Lifestyle modifications are recommended as a cost-effective approach to manage blood pressure either independently or alongside pharmacological therapy. However, there is often insufficient emphasis on these behavioural changes compared to medical treatment. This study aimed to assess adherence to lifestyle modifications among adult hypertensive patients at a tertiary care clinic in North-Western Nigeria.

Methods: A cross-sectional study was conducted at the Federal Teaching Hospital, Birnin-Kebbi, from September to November 2024, involving 258 adult hypertensive patients diagnosed for over six months. Systematic random sampling was used, and data were collected via a structured questionnaire adapted from the WHO STEPS survey, covering sociodemographic characteristics, knowledge, and lifestyle adherence. Clinical parameters, including blood pressure and body mass index, were measured. Adherence was classified into three categories: non-adherence, unpredictable adherence, and presumed adherence. Data analysis was performed using SPSS version 25, with the chi-square test used to assess significant associations and multivariate logistic regression to identify predictors of blood pressure control, with statistical significance set at $p \leq 0.05$.

Results: The mean age of participants was 55.16 (±12.055) years, with 59.3% being female and 53.5% urban residents. Alarmingly, 72.5% had poorly controlled blood pressure, 52.3% of participants exhibited unpredictable perceived adherence, and 47.3% demonstrated presumed perceived adherence. While 95% had never smoked, and many avoided alcohol, dietary salt intake was concerning, with 73.6% adding one teaspoon of salt daily. There was no significant association between adherence categories and blood pressure control ($p = 0.540$). However, multivariate analysis found that a hypertension duration of ≤5 years (OR 0.168, $p < 0.001$) and

a history of other medical conditions (OR 0.452, p = 0.048) were significant predictors of controlled blood pressure.

Conclusion: The study reveals a high prevalence of uncontrolled hypertension and inconsistent lifestyle adherence among participants. Although cultural and religious factors help reduce tobacco and alcohol use, there is an urgent need for targeted interventions to address hidden dietary sodium, weight management, and integrated care to improve early hypertension outcomes.

Keywords: Adult Patient, Cross-sectional Study, General Outpatient Clinic, Hypertension, Lifestyle Modification Adherence.

INTRODUCTION

Adherence to lifestyle modification among hypertensive patients is pertinent, highly indicated and encouraged regardless of the drug therapy because this approach may result in reduction or even lead to discontinuation of antihypertensive medications.[1,2] Its effects could also lead to an immediate reduction in blood pressure with better health outcomes and fewer complications.[3] As civilization, modernization, and urbanization evolve, spread in all nooks and crannies of the globe, cardiovascular diseases (CVDs) have erupted as a serious health challenge among the human race with increasing morbidity and mortality, as over 80% of them occur in low and middle-income countries.[4] These were noticed to have resulted in significant changes in the pattern of health and disease distribution among the populace. The CVDs' most consistent risk factor is uncontrolled or poorly controlled hypertension.[5] CVDs are diseases of the heart and blood vessels, which include coronary artery disease, cardiovascular accident (stroke), and peripheral vascular disease, myocardial infarction, and congestive heart failure, among others.[6]

Hypertension is a major health problem affecting over one billion people all over the world. Around 1.39 billion of the world's population live with hypertension, of these 349 million are in high-income countries, while 1.04 billion are in low- and middle-income countries.[7] According to the study conducted by Kearney et al and reported by Abubakar S et al, it was found that the current yearly mortality due to hypertension was 9 million, and by the year 2025, it is expected that about 1.56 billion adults will be hypertensive globally.[3] In the year 2023 report on CVDs by the WHO, it was stated that four out of five people with hypertension are not adequately treated, and that elevated blood pressure, being the modifiable risk factor, tends to tilt individuals to develop CVDs.

This risk factor can be prevented by initiating lifestyle modification measures as early as possible in the management.[8] Globally, 25% of the adult population is living with hypertension, projected to rise to 29% by the year 2025.[5,9] The prevalence of hypertension in Africa has been

reported to be increasing in manifolds and Nigeria as a nation contributes a huge burden with 38% prevalence from a nationwide survey.[9]

Lifestyle modification refers to the pattern of individual behavioural choices and practices concerning his/her daily activities, which, when adhered to, could result in significant control of blood pressure either alone or in combination with pharmacological therapy.[3,10] The Joint National Committee's eighth report (JNC VIII) recommends that all hypertensive patients should modify their lifestyles and dietary practices, which include losing weight, consuming more fruits and vegetables, a high-fibre diet, a low-fat diet, limiting their salt intake, engaging in physical activity, quitting smoking and abstaining from alcohol consumption, irrespective of whether they are taking medication or not.[5,11] Adherence to lifestyle modification behaviours with proper and adequate implementation is a cost-effective way to prevent high blood pressure and control hypertension. However, little emphasis has been given to it when compared to medications in the routine management of hypertension.[3]

Furthermore, lifestyle modification can be affected by demographic factors such as educational level, age, co-morbidity, knowledge about the disease, social support, continuity of health education and counselling. A large prospective population study has proven that a substantial reduction in the burden of CVDs could be achieved by adherence to a healthy lifestyle pattern, and studies have shown significant improvement in the quality of life (QoL) following good adherence to lifestyle modification among hypertensive patients in lowering blood pressure.[2,12,13] However, there is a dearth of studies that assess the adherence to lifestyle modifications among hypertensive patients attending general outpatient clinics at FTH, Birnin Kebbi, North Central Nigeria. Hence, we took this study intending to measure the adherence to lifestyle modifications among hypertensive patients since the majority of the patients with hypertension are treated by primary care physicians.[2]

MATERIALS AND METHODS

Study Setting and Population

This was a hospital-based descriptive cross-sectional study, conducted at the General Outpatient Clinic (GOPC) of Federal Teaching Hospital (FTH), Birnin-Kebbi, Nigeria. The study involved adult patients (≥18 years) diagnosed with hypertension more than six months ago, attending the GOPC, who met the inclusion criteria. Excluded were critically ill patients needing emergency intervention, those with co-morbid conditions like diabetes, patients with documented cardiovascular events, individuals with impaired cognitive function, and those with major psychiatric illnesses affecting participation.

Sample Size Estimation

The minimum sample size was calculated using Leslie Kish's formula[14]: $n = \frac{z^2pq}{d^2}$, where z = 1.96 (95% confidence level), p = 0.268 (prevalence of lifestyle modification adherence from prior literature) [15], q = 0.732 (1-p), and d = 0.05 (margin of error). This yielded an initial sample size of approximately 301 participants. Since the target population (estimated at 1,800 adult hypertensive patients seen annually at the GOPC) was less than 10,000, the sample size was adjusted using the finite population correction formula: $n_f = \frac{n}{1+(n/N)}$, yielding a final sample size of 258 participants.

Data Collection Process

Systematic random sampling was employed to recruit eligible participants. With an average monthly attendance of 150 hypertensive patients (approximately 38 daily), the three-month study period (September–November 2024) generated an expected sample frame of 450 participants (150 × 3 months). The sampling interval was calculated as 450 ÷ 258 = 1.74,

rounded to 2. A target of eight participants per clinic day was established (258 ÷ 60 clinic days over 12 weeks).

On each clinic day, medical folders of hypertensive patients meeting the inclusion criteria were sequentially numbered from 01 to 38. The first participant was selected via simple balloting from sealed envelopes numbered 01 to 08. Subsequently, every second folder was selected until the daily quota of eight participants was reached. This procedure was repeated daily until the target sample of 258 was achieved. Data were collected using a pretested, structured questionnaire adapted from the WHO Steps survey, divided into three sections.[16] Section A covered socio-demographic information, while Section B assessed knowledge and adherence to lifestyle modifications for hypertension management, including dietary sodium restriction, the DASH diet, alcohol restriction, and smoking cessation. Adherence was measured on a four-point Likert scale, and scores were categorized as perceived non-adherence (≤31), unpredictable adherence (32–53), and presumed adherence (≥54).[16, 17, 18]

Clinical parameters, such as BMI and blood pressure, were also measured using standardised protocols. BMI was calculated as weight in kilograms divided by the square of height in meters (kg/m^2) and classified according to World Health Organization standards: underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (≥30 kg/m^2). Blood pressure was measured using a calibrated mercury sphygmomanometer with an appropriate cuff. Participants rested seated for at least five minutes before two readings were taken from the same arm, two minutes apart, with the arm supported at heart level and the legs uncrossed. Systolic blood pressure (SBP) was noted at the first Korotkoff sound, and diastolic blood pressure (DBP) at the fifth sound. All readings were recorded to the nearest 2 mmHg. Blood pressure was classified based on the average of the two readings as controlled hypertension (SBP <140 and DBP <90 mmHg) or uncontrolled hypertension (SBP ≥140 or DBP ≥90 mmHg).

Data Analysis

Completed questionnaires were reviewed, coded, and entered into SPSS IBM version 25 for analysis. Descriptive statistics characterised the study population, summarising socio-demographic characteristics with frequency distributions presented in tables and charts. The pattern of blood pressure control and adherence to lifestyle modifications was analysed using frequency distributions. The chi-square test assessed the significance of associations between lifestyle adherence and blood pressure control; multivariate regression analysis was performed to determine the predictors of good adherence. Statistical significance was set at $p \leq 0.05$ and a 95% confidence interval.

Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of Federal Teaching Hospital, Birnin-Kebbi, following the Declaration of Helsinki and Nigerian National Code of Health Research Ethics. Written informed consent was obtained from all participants, who were informed of the study's aims, procedures, risks, and their right to withdraw at any time. All data remained confidential, with no financial incentives or coercion involved throughout the study.

RESULTS

Table 1 below shows the sociodemographic characteristics of the participants. The mean age of the participants is 55.16 (±12.055) years. Participants were categorised by age into reproductive age (n = 52, 20.2%), middle age (n = 141, 54.7%), and elderly (n = 65, 25.2%). The majority of the participants were female (n = 153, 59.3%), while males comprised 40.7% (n = 105). Most respondents identified as Muslims (n = 237, 91.9%), and in terms of ethnicity, the majority of the participants were Hausa/Fulani (n = 231, 89.5%). Slightly above half of the participants resided in urban areas (n = 138, 53.5%). Most were married (n = 192, 74.4%), with smaller proportions being single (n = 11, 4.3%). The predominant family type was polygamous

(n = 137, 53.1%), while one-quarter had tertiary education (n = 66, 25.6%). Occupational statuses revealed that a larger percentage were traders (n = 109, 42.2%). The average family size exceeded five members for most respondents (n = 229, 88.8%), with a smaller group having five or fewer members (n = 29, 11.2%). Slightly more than half (n=138, 53.5%) of the participants earned more than 30,000 naira as average monthly income.

Table 1: Sociodemographic Characteristics of the Respondents.

Variables	Frequency	Percentage (%)
Age		
Reproductive age (18-44years)	52	20.2
Middle Age (45 to 64 years)	141	54.7
Elderly (65 years and above)	65	25.2
Mean Age: 55.16 (± 12.055) years		
Sex		
Male	105	40.7
Female	153	59.3
Religion		
Islam	237	91.9
Christianity	21	8.1
Ethnicity		
Hausa/Fulani	231	89.5
Yoruba	10	3.9
Igbo	6	2.3
Others	11	4.3
Residence		
Urban	138	53.5
Rural	120	46.5
Marital status		
Single	11	4.3
Married	192	74.4
Separated/Divorced	3	1.2
Widow/Widower	50	19.4
Living with a partner	2	0.8
Family Type		
Monogamous	121	46.9
Polygamous	137	53.1

Educational status		
None	13	5.0
Primary	30	11.6
Secondary	46	17.8
Tertiary	66	25.6
Others	103	39.9
Occupational status		
Civil servant	46	17.8
Trader	109	42.2
Artisan	46	17.8
Farmer	19	7.9
Retired	29	11.2
Unemployed	6	2.3
Others	3	1.2
Family size		
≤ 5	29	11.2
≥ 5	229	88.8
Average monthly income		
≤ 30,000	120	46.5
≥ 30,000	138	53.5

Figure 1 below shows the pattern of hypertension among the respondents, slightly above one-fourth, 27.5% (n = 71) had normal blood pressure, whereas the majority, 72.5% (n = 187) had poor blood pressure control.

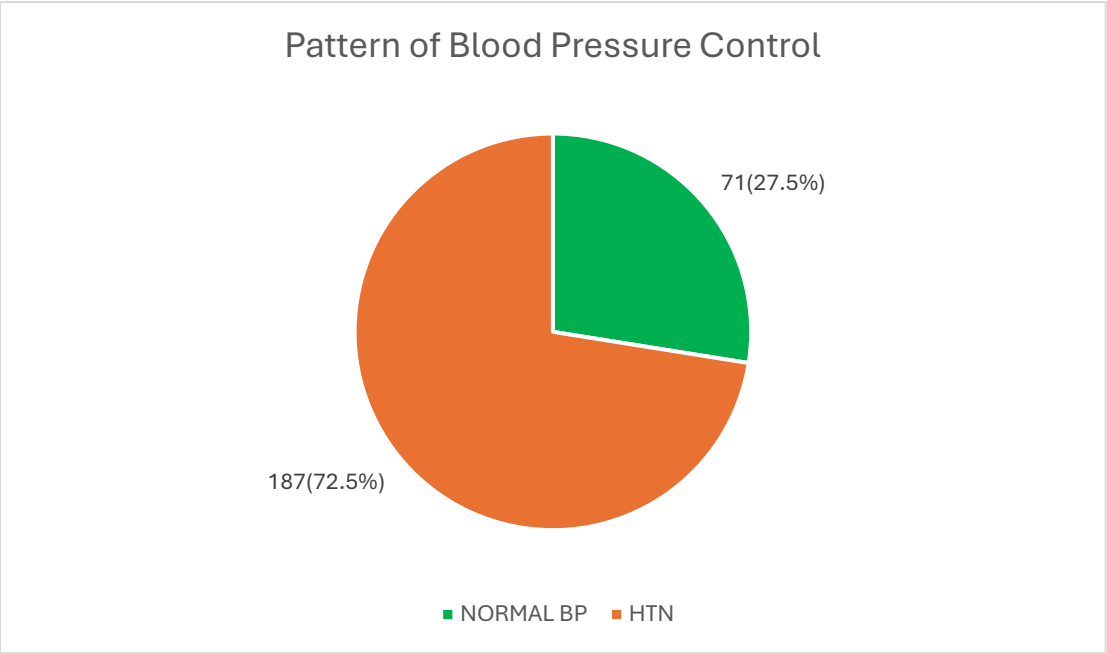


Figure 1 shows the pattern of hypertension among the respondents

Figure 2 shows that the majority of the participants (73.6%) added less than one teaspoon of salt per day to their food, while the others added a larger proportion of salt while cooking. Most (71.7%) did not add salt to their food after cooking, while the other did (Figure 3). Most of the participants (95.0%) never smoked tobacco, while others were either current or former smokers (Figure 4). The majority of them had never consumed alcohol before, while the few others were either current or former consumers (Figure 5). The mean duration of having hypertension was 7.68 (±8.54) years (Figure 6).

Just above half (55.4%) had a family history of hypertension (Figure 7). The majority (76.4%) had no family history of other medical conditions (Figure 8). Approximately three-fifths (59.7%) were regular with clinic attendance, while others were not (Figure 9). The highest proportion of the participants had normal body mass index, while the mean body mass index was 27.56 (±25.70) kg/m^2 (Figure 10).

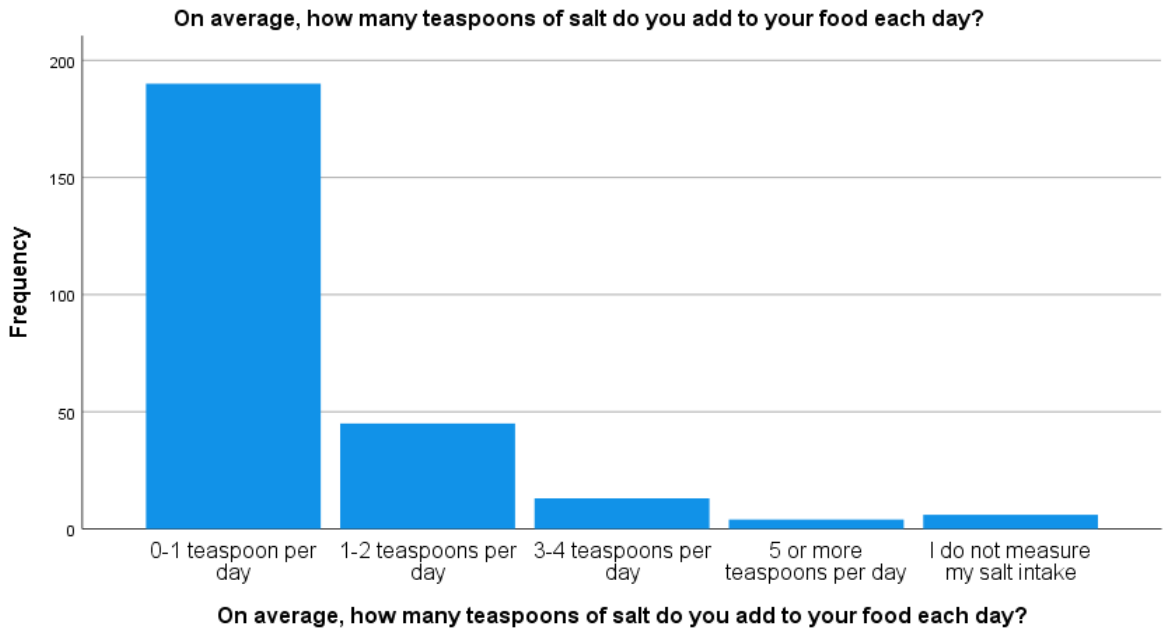


Figure 2: Quantity of salt intake

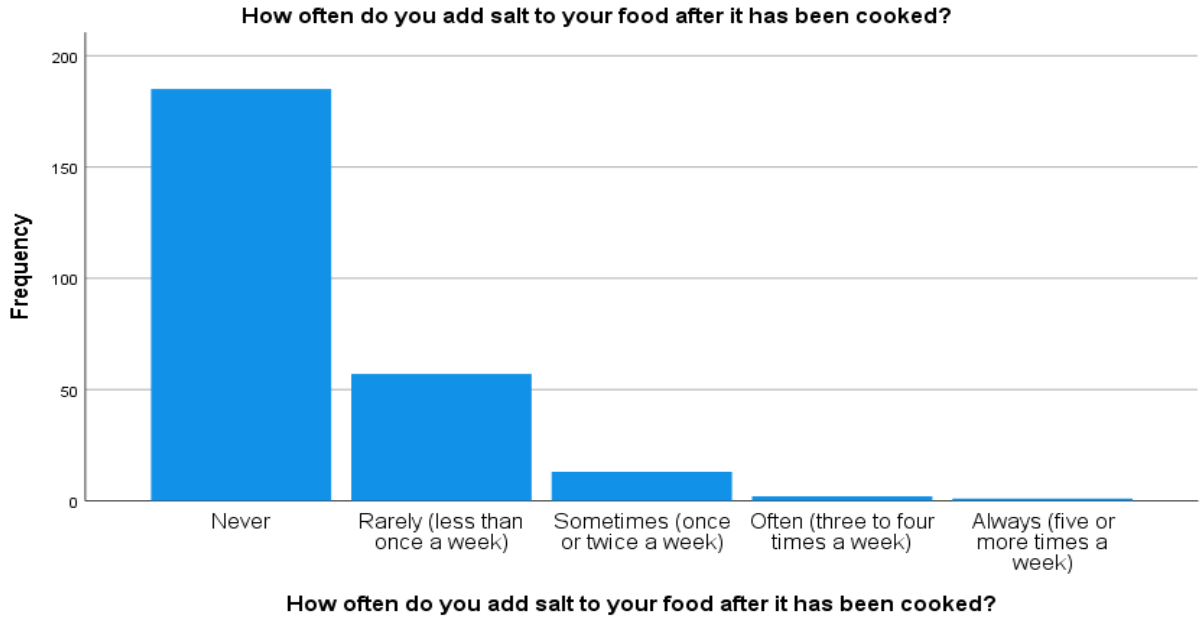


Figure 3: Frequency of salt intake

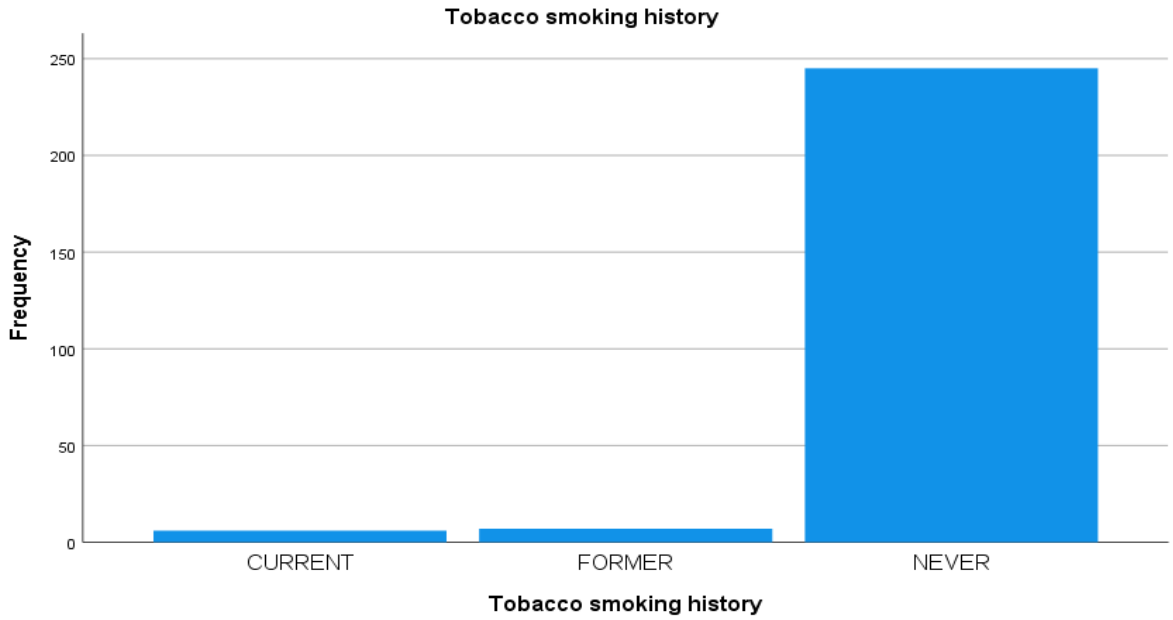


Figure 4: History of tobacco smoking

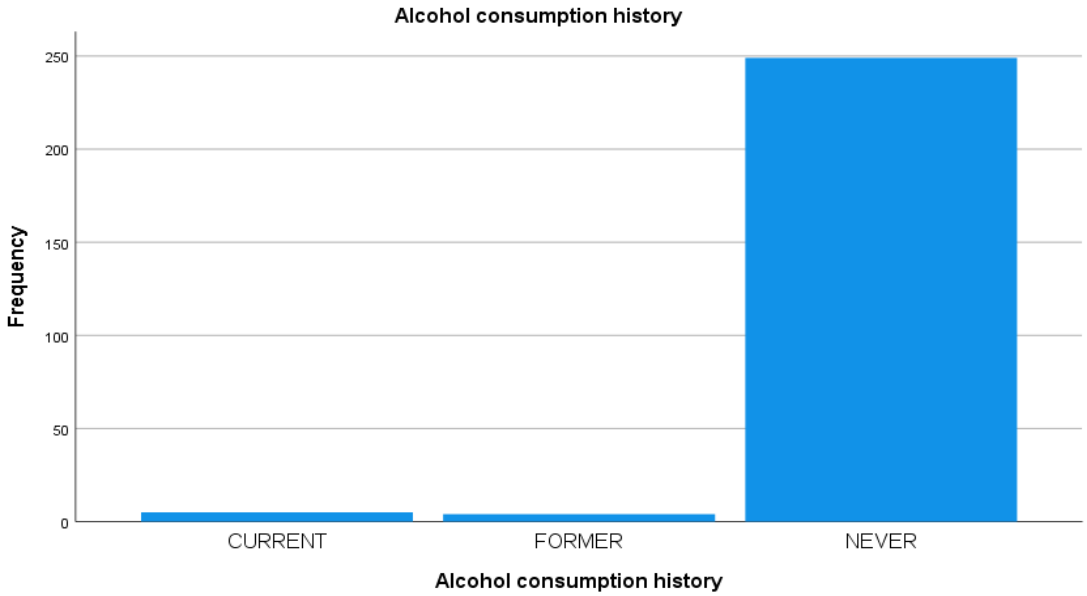


Figure 5: History of alcohol consumption

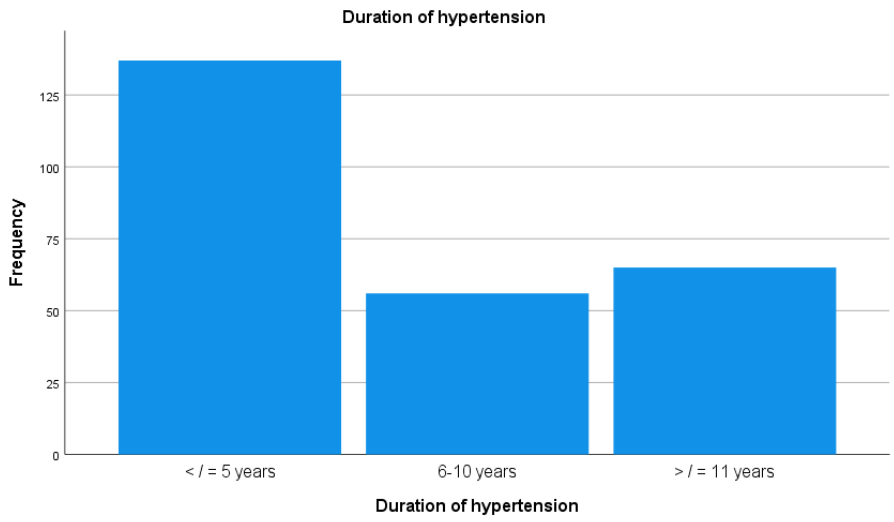


Figure 6: Duration of Hypertension

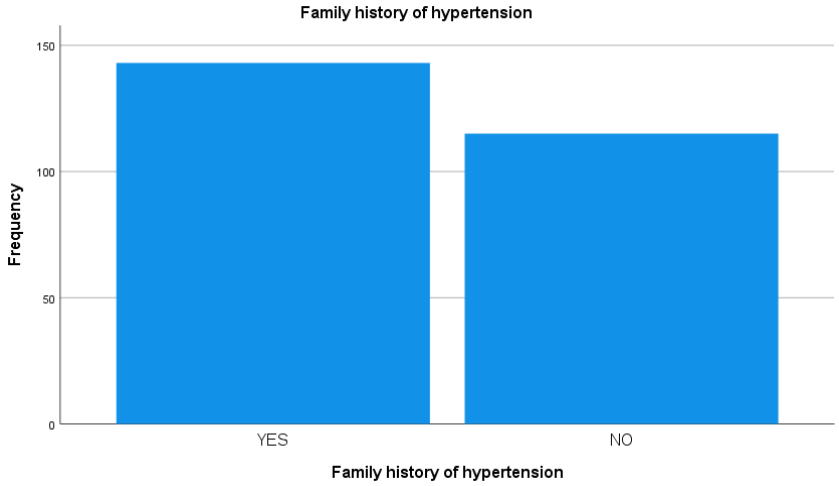


Figure 7: Family history of Hypertension.

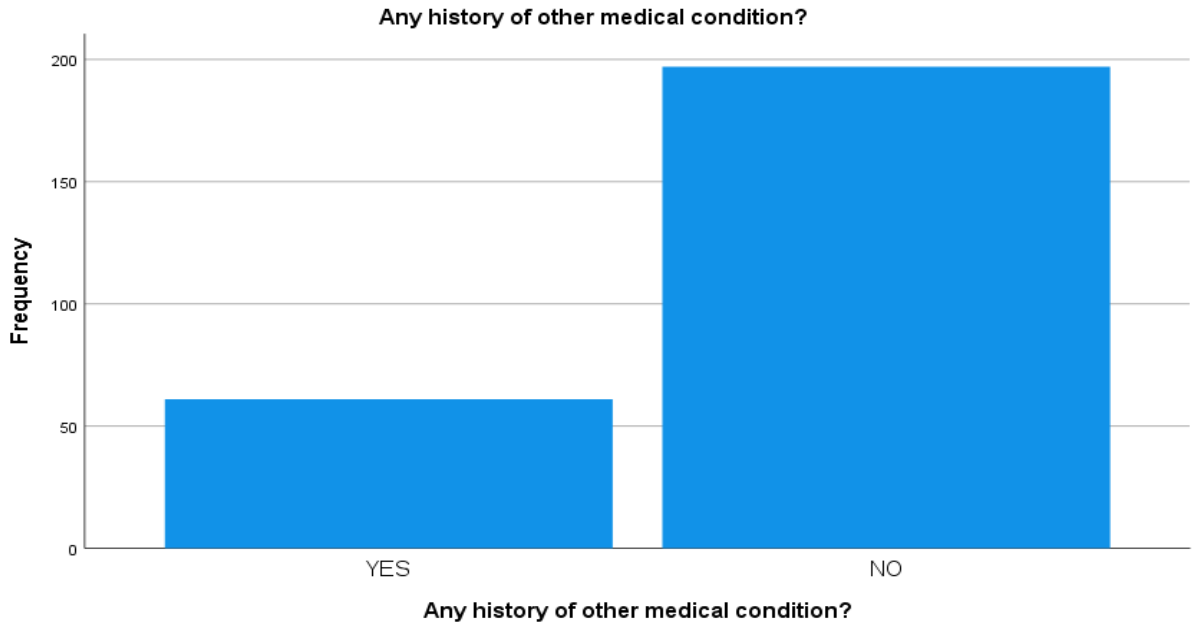


Figure 8: Co-morbidities.

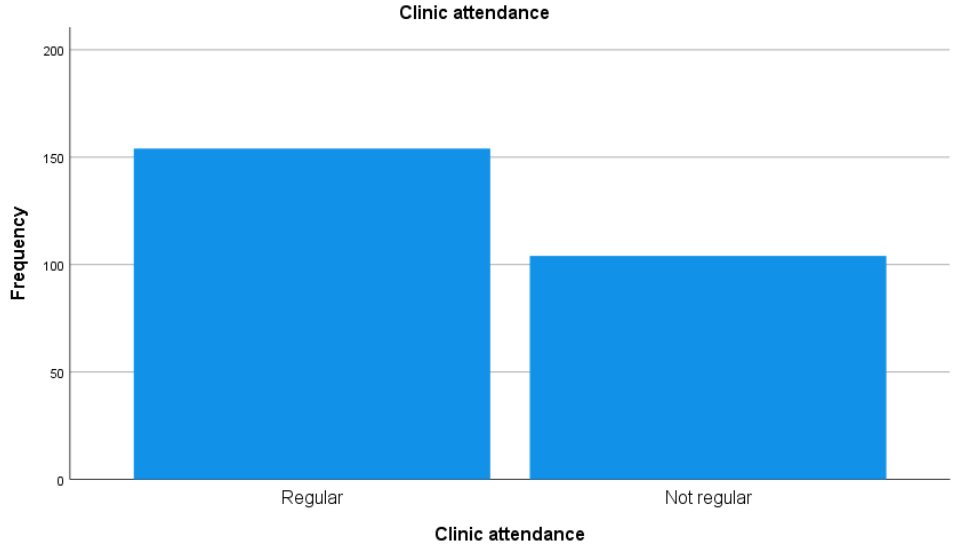


Figure 9: Frequency of clinic attendance among the participants.

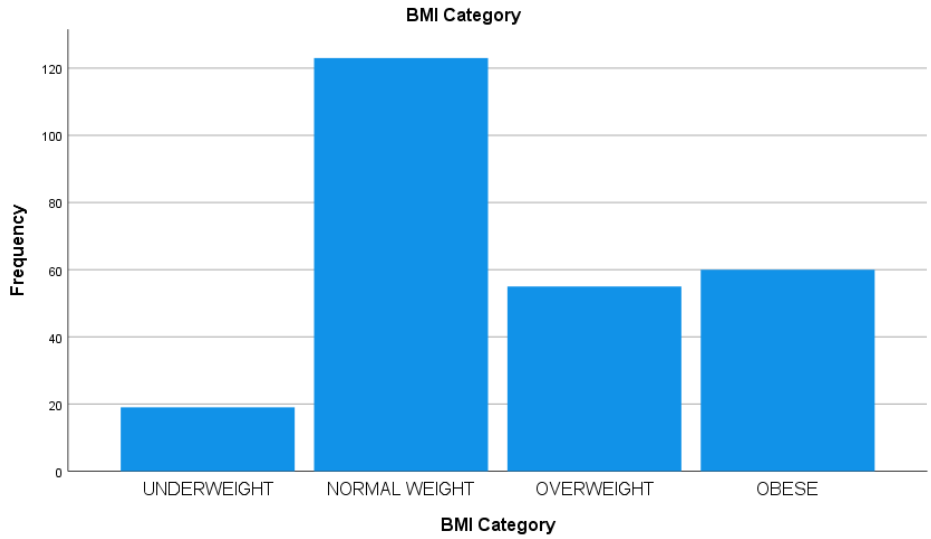


Figure 10 shows the BMI pattern of the participants

Table 3 below shows the respondents' knowledge and practices related to dietary salt intake and usage. Regarding daily salt added to food, most respondents reported adding 0–1 teaspoon of salt per day (73.6%, *n* = 190), with smaller proportions reporting 1–2 teaspoons (17.4%, *n* = 45), 3–4 teaspoons (5.0%, *n* = 13), or five or more teaspoons (1.6%, *n* = 4). A small number (2.3%, *n* = 6) stated that they do not measure their salt intake. For the added salt to food after cooking, the majority of respondents never add salt to their food after cooking (71.7%, *n* = 185), while a small minority reported adding salt sometimes (5.0%, *n* = 13).

Table 3: Respondents' Dietary Salt Intake and Usage Patterns

Variable	Category	Frequency	Percent (%)
Average teaspoons of salt added daily	0–1 teaspoon/day	190	73.6
	1–2 teaspoons/day	45	17.4
	3–4 teaspoons/day	13	5.0
	5 or more teaspoons/day	4	1.6
	Do not measure salt intake	6	2.3
Salt added after the food is cooked	Never	185	71.7
	Rarely (<1 times/week)	57	22.1
	Sometimes (1–2 times/week)	13	5.0
	Often (3–4 times/week)	2	0.8
	Always (≥5 times/week)	1	0.4

Table 4 shows how respondents were classified into various adherence categories based on their lifestyle modification behaviour. As shown in Table 4, the majority of respondents fell under unpredictable perceived adherence (52.3%, n = 135), while only 0.4% (n = 1) of respondents were categorized as exhibiting perceived non-adherence.

Table 4: Categorised Adherence to Lifestyle Modifications

Adherence Category	Frequency	Percent (%)
Perceived non-adherence	1	0.4
Unpredictable perceived adherence	135	52.3
Presumed perceived adherence	122	47.3
Total	**258**	**100.0**

Table 5 shows the relationship between adherence to lifestyle modifications and the pattern of blood pressure. Among respondents classified as having unpredictable perceived adherence, 74.8% had hypertension (HTN), while 25.2% had normal blood pressure. Similarly, for those with presumed perceived adherence, 69.7% had hypertension, and 30.3% had normal blood pressure. The single respondent classified as perceived non-adherent also had hypertension. The association was not statistically significant. A chi-square test showed that the association between adherence category and blood pressure category was not statistically significant, $\chi^2(2, N = 258) = 1.23$, $p = 0.540$. The Fisher–Freeman–Halton exact test also confirmed the absence of a significant association ($p = 0.567$). These results suggest that in this sample, lifestyle adherence levels did not meaningfully differ by blood pressure control status.

Table 5: Shows Participants' Adherence Category by Blood Pressure Pattern

Adherence Category	Normal BP	HTN	Total	% Normal BP	% HTN
Perceived non-adherence	0	1	1	0.0%	100.0%
Unpredictable perceived adherence	34	101	135	25.2%	74.8%
Presumed perceived adherence	37	85	122	30.3%	69.7%
Total	**71**	**187**	**258**	**27.5%**	**72.5%**

Table 6 shows the logistic regression analysis of the predictors/factors associated with hypertension control. To identify independent predictors of hypertension, logistic regression model was fitted with blood-pressure pattern as the dependent variable. The predictors entered were age, sex, adding salt after cooking, history of other medical conditions, and duration of hypertension. The results shows that a history of other medical conditions (besides hypertension) was associated with significantly lower odds of abnormal BP (OR 0.452, 95% CI 0.206–0.992, p = 0.048), and duration of hypertension, especially respondents with duration ≤5 years had markedly lower odds of abnormal BP (OR 0.168, 95% CI 0.064–0.446, p < 0.001), indicating substantially better control in early-stage hypertension, after controlling for age and sex.

Table 6: Shows Logistic Regression Predicting Hypertension Control

Predictor (reference)	**B (logit)**	**Odds ratio (Exp(B))**	**95 % CI for OR**	***p*-value**
Age (per year)	0.022	1.022	0.992–1.053	0.145
Sex (female)	0.494	1.639	0.834–3.222	0.152
History of other medical condition	–0.795	0.452	0.206–0.992	0.048
Duration of hypertension ≤ 5 years (≥ 11 years)	–1.781	0.168	0.064–0.446	<0.001
Duration of hypertension 6–10 years (≥ 11 years)	–0.587	0.556	0.176–1.762	0.319

DISCUSSION

This study examined lifestyle measures and their relationship to blood pressure control patterns among respondents in a health facility setting, and also provided important insights into the adherence pattern to lifestyle modification behaviours among the study population. The study

enrolled 258 respondents with a mean age of 55.16 (±12.055) years, with the majority falling in the middle age group (45–64 years) at 54.7%. This age distribution aligns with hypertension epidemiology, as the condition predominantly affects middle-aged and older populations. According to recent guidelines, the prevalence of hypertension increases substantially with advancing age, making this demographic particularly vulnerable to the disease.[19] The female predominance observed (59.3%) is consistent with patterns reported in sub-Saharan African studies, where women have demonstrated higher health-seeking behaviour and greater uptake of health services compared to men.[20] The high proportion of respondents with tertiary education (25.6%) and those engaging in trading activities (42.2%) reflects an urbanized, relatively educated population, which may influence their understanding and adoption of lifestyle modification recommendations.[21]

The predominantly Islamic population (91.9%) and preponderance of married individuals (74.4%) provided a unique cultural context that potentially influenced dietary practices and lifestyle patterns. The high proportion of respondents living in urban areas (53.5%) is significant, as urbanization is associated with increased prevalence of hypertension due to increased consumption of processed foods, sedentary lifestyles, and psychosocial stress.[21] Notably, slightly over half the respondents (53.5%) earned more than ₦30,000 monthly, suggesting variable socioeconomic status within the cohort.

Blood Pressure Control and Hypertension Prevalence

The finding that 72.5% of respondents had poor blood pressure control while only 27.5% achieved normal blood pressure is concerning and reflects inadequate disease management. This prevalence of uncontrolled hypertension is consistent with reports from low- and middle-income countries, where blood pressure control rates remain suboptimal despite the availability of antihypertensive medications.[22] Poor blood pressure control in this study may be attributed to multiple factors, including non-adherence to pharmacological therapy, inadequate lifestyle

modification, and possible medication side effects prompting discontinuation.[22] The finding underscores the critical need for integrated approaches combining pharmacological and non-pharmacological interventions to improve blood pressure outcomes in this population.

Dietary Salt Intake and Sodium Consumption

One of the most significant findings was the high prevalence of moderate salt consumption, with 73.6% of respondents reporting adding 0–1 teaspoon of salt per day, while 17.4% added 1–2 teaspoons daily. Although these reported quantities appear moderate, they likely underestimate actual sodium intake when accounting for hidden sodium in processed foods and condiments commonly consumed in the Nigerian diet.[23] The positive correlation between salt consumption and blood pressure is well established in the literature. A recent meta-analysis of cross-sectional studies in sub-Saharan Africa demonstrated that reducing salt intake below 2.5 g daily is associated with a 20% reduction in cardiovascular events.[24] Current international guidelines recommend sodium restriction to less than 2 g (approximately 5 g of sodium chloride) daily for hypertension management.[19]

The finding that 71.7% of respondents never added salt to food after cooking is noteworthy and suggests some awareness of salt reduction strategies. However, this practice alone may be insufficient given the substantial sodium content in traditionally prepared foods and condiments. The low proportion adding salt after cooking (5.0% rarely or 0.4% always) suggests potential knowledge of salt-associated health risks, though this awareness has not uniformly translated into blood pressure control.[19] Education programmes emphasizing the hidden sources of sodium in processed foods and the importance of reading food labels represent crucial intervention strategies for this population.[25]

Tobacco Smoking Patterns

The study revealed that 95.0% of respondents never smoked tobacco, with only 5.0% being current or former smokers. This low prevalence of smoking contrasts with global patterns but

may reflect cultural and religious factors in the predominantly Muslim population studied, as Islamic teachings discourage tobacco use.[21] While this finding is encouraging from a cardiovascular health perspective, it should not lead to complacency, as smoking remains a powerful independent risk factor for hypertension and cardiovascular disease, increasing cardiovascular mortality by approximately 6 million deaths annually.[21] The protective effect of low smoking prevalence may be partially offset by high rates of other modifiable risk factors such as physical inactivity and suboptimal dietary habits in this cohort.

Alcohol Consumption Patterns

The majority of respondents (indicating high non-consumption of alcohol) is consistent with Islamic cultural practices in the study region. Among those who reported any alcohol consumption, the proportion was minimal, reflecting strong religious and cultural prohibitions against alcohol use in this predominantly Muslim population. However, where alcohol consumption was reported, individuals may have been at increased risk of hypertension, as epidemiological evidence demonstrates a dose-dependent relationship between alcohol intake and blood pressure elevation.[20] Current guidelines recommend abstinence from alcohol or limitation to no more than one drink daily for women and two drinks daily for men to reduce hypertension risk.[24] The cultural protection against alcohol use in this population represents a significant advantage for hypertension prevention and control.

Body Mass Index and Overweight/Obesity

The mean body mass index of 27.56 (±25.70) kg/m² suggests a population distribution spanning from underweight to obese categories. The wide standard deviation indicates substantial heterogeneity in body weight status within the cohort. Overweight and obesity represent significant modifiable risk factors for hypertension, with evidence demonstrating that for every one standard deviation increase in BMI, the odds ratio for hypertension increases by 1.42 (95% CI: 1.37–1.48).[26] Meta-analytic evidence indicates that stable high BMI trajectories

confer an 80% increased risk of hypertension compared to stable normal BMI.[27] Weight reduction programmes targeting even modest 3–10% weight loss have been shown to reduce blood pressure by approximately 3 mmHg and reduce antihypertensive medication requirements.[19]

The heterogeneous BMI distribution in this study suggests an opportunity for targeted weight management interventions tailored to individual risk categories. Individuals with high BMI require intensive counselling on caloric restriction, increased physical activity, and dietary modifications emphasizing whole foods and limiting processed products.[19] The finding that the majority achieved normal BMI is encouraging, yet the substantial proportion with elevated BMI warrants proactive weight management strategies as part of comprehensive hypertension care.

Family History of Hypertension

Just over half the respondents (55.4%) reported a positive family history of hypertension, while 76.4% had no family history of other medical conditions. Positive family history is a significant non-modifiable risk factor, with individuals having family members with hypertension being 2–4 times more likely to develop the condition themselves.[28] This finding is particularly important as it identifies a high-risk subgroup warranting intensified screening, monitoring, and preventive interventions.[28] Family history likely reflects both genetic predisposition and shared environmental/lifestyle factors within families, suggesting that family-based interventions targeting multiple household members might yield synergistic benefits.

The positive association between family history and hypertension in this study aligns with global epidemiological evidence and supports the integration of family history assessment into routine clinical practice.[28] Identifying individuals with positive family history provides an opportunity for early intervention before hypertension manifests, including promotion of

healthy lifestyle behaviours such as sodium restriction, weight management, physical activity, and stress reduction.[29]

Clinic Attendance and Disease Monitoring

Approximately 59.7% of respondents were regular with clinic attendance, while the remainder attended irregularly. Regular clinic attendance is crucial for blood pressure monitoring, medication adjustment, and lifestyle counselling. The finding that over 40% of respondents were not regular with clinic visits is concerning and likely contributes to inadequate hypertension control observed in this cohort. Barriers to regular clinic attendance may include transportation costs, work-related constraints, long waiting times, and limited access to healthcare facilities, particularly in rural areas.[21]

Establishing systems to improve clinic attendance through reminder services, task-shifting to community health workers, and decentralized care models may enhance adherence to follow-up care.[22] Studies have demonstrated that structured follow-up care combined with lifestyle modification counselling significantly improves adherence to lifestyle recommendations and clinical outcomes.[30]

Lifestyle Modification Adherence

The categorization of adherence revealed that 52.3% of respondents demonstrated unpredictable perceived adherence to lifestyle modifications, while 47.3% exhibited presumed perceived adherence. Only 0.4% were classified as having perceived non-adherence, suggesting that most respondents maintained some level of engagement with lifestyle modification practices. However, the prevalence of unpredictable adherence is concerning, as it indicates inconsistent implementation of lifestyle changes that may compromise their efficacy in blood pressure control. The lack of a significant statistical association between adherence category and blood pressure control ($\chi^2(2, N=258) = 1.23$, $p = 0.540$) is noteworthy and warrants further investigation. Several explanations may account for this finding: First, the

categorization of adherence into perceived categories may not accurately capture the intensity or consistency of lifestyle modifications. Second, pharmacological therapy effectiveness may outweigh lifestyle modification effects in determining blood pressure control status in this population. Third, the cross-sectional study design limits causal inference, as the temporal relationship between adherence and blood pressure outcomes cannot be established.[31]

However, literature evidence consistently demonstrates that lifestyle modifications, when rigorously implemented, produce clinically significant blood pressure reductions comparable to antihypertensive medications.[22] Meta-analytic evidence indicates that combining aerobic and resistance training reduces systolic blood pressure by 5.2–8.3 mmHg, while dietary sodium restriction of 1.75 g daily results in systolic/diastolic reductions of 4.2/2.1 mmHg in the general population and 5.4/2.8 mmHg in hypertensive patients.[19]

The apparent paradox between reported adherence and blood pressure control in this study may reflect measurement limitations. Self-reported adherence is known to overestimate actual behaviour change, as respondents may report intentions or occasional compliance rather than consistent practice.[31] Objective measures such as 24-hour urinary sodium excretion, accelerometry for physical activity quantification, and dietary recalls may provide a more accurate assessment of adherence than self-reported categories.

The multivariate analysis shows two factors were independently associated with better blood pressure outcomes (lower odds of abnormal BP) after adjusting for other predictors (cofounders – age and sex), the result indicates that having a history of other medical conditions (OR 0.452, 95% CI 0.206–0.992, $p = 0.048$) and duration of hypertension (OR 0.168, 95% CI 0.064–0.446, $p < 0.001$) were significantly associated with lower odds of hypertension.

History of other medical conditions

Patients who reported at least one additional medical condition (apart from hypertension) had significantly lower odds of abnormal blood pressure (OR 0.45), meaning they were more likely

to have controlled BP than those without comorbidities.[32] This is the opposite of what many Nigerian and international studies report, where multimorbidity usually worsens BP control because of higher pill burden, more complex care and poor adherence.[33,34] In this study, the "protective" effect may indicate that patients with other chronic conditions receive more structured care (frequent clinic visits, closer monitoring, better counselling or insurance/subsidised care), which improves adherence and BP control.[35,36] It is also possible that the "other conditions" here are relatively mild but closely followed (e.g., dyslipidaemia, peptic ulcer disease), rather than severe organ-damage states that typically predict poor control.[34]

Duration of hypertension

Compared with patients hypertensive for 11 years or more, those with hypertension duration of 5 years or less had much lower odds of abnormal BP (OR 0.17), indicating substantially better control in early-stage hypertension.[32] This agrees with evidence from Calabar, Dutse and other Nigerian settings showing that longer duration of hypertension is associated with poorer control and more complications, partly because long-standing hypertension leads to vascular remodelling, arterial stiffness and treatment-resistant BP.[32,33,34] Studies among diabetic hypertensives also show that longer duration of both diabetes and hypertension predicts uncontrolled BP and target-organ damage, reinforcing that the first few years after diagnosis are the best window for achieving and sustaining good control.[33,34]

Integration of Findings with Hypertension Management Framework

The International Society of Hypertension recommends lifestyle modification as a first-line strategy for hypertension prevention and control, with continuation of lifestyle changes even when antihypertensive medications are prescribed.[19] The findings from this study suggest that while some respondents demonstrate engagement with lifestyle modifications, the level of adherence remains suboptimal for achieving optimal blood pressure control in the majority.

Comprehensive hypertension management requires integrated strategies addressing multiple modifiable risk factors simultaneously. The study population demonstrates several modifiable risk factors amenable to intervention: elevated BMI in a proportion of respondents, high dietary salt intake, limited physical activity (implied by predominantly trader and domestic occupations), and suboptimal clinic attendance. A systematic approach targeting these factors through structured lifestyle intervention programmes, community health worker engagement, and digital health technologies may enhance adherence and improve outcomes.[22]

The protective cultural factors (low tobacco and alcohol consumption) should be reinforced and leveraged as strengths in designing culturally appropriate interventions. Educational programmes should build upon these existing protective practices while addressing gaps in knowledge regarding hidden sodium sources, optimal weight management, and importance of regular clinic attendance.

Implications for Clinical Practice and Health Policy

The findings underscore several critical implications for clinical practice and health policy in Nigeria and similar sub-Saharan African settings:

Clinical Practice: Healthcare providers must move beyond reliance on antihypertensive medications alone and actively counsel patients on lifestyle modifications. Structured lifestyle intervention programmes delivered through routine clinic visits, community health workers, or digital platforms may improve adherence. Regular assessment of adherence barriers and tailored problem-solving with patients are essential.[30] Blood pressure self-monitoring at home may enhance engagement and provide objective feedback on lifestyle modification effectiveness.

Health Policy: Policies promoting food labelling, salt taxation on processed foods, and regulation of sodium content in manufactured foods represent population-level strategies to reduce dietary salt intake.[19] Investment in physical activity infrastructure within communities,

including safe walking paths, recreational facilities, and organized physical activity programmes, may facilitate increased activity levels.[21] Integration of mental health services and stress management training into hypertension programmes may address psychosocial contributors to hypertension.[19]

Limitations of the Study

Several limitations warrant acknowledgement. First, the cross-sectional design precludes causal inference regarding relationships between lifestyle factors and blood pressure control. Second, self-reported lifestyle behaviours are subject to recall and social desirability biases, which can lead to overestimation of adherence. Third, the urban-based study population limits generalizability to rural populations where healthcare access and resources differ substantially. Fourth, unmeasured confounders such as medication adherence, dietary composition beyond salt, physical activity intensity, and psychosocial stress may influence blood pressure outcomes. Finally, the absence of objective biomarkers of adherence (such as 24-hour urinary sodium) limits the ability to validate self-reported behaviours.

Recommendations for Future Research

Future research should employ longitudinal designs to establish temporal relationships between lifestyle modifications and blood pressure control. Integration of objective measures of adherence, including accelerometry for physical activity, 24-hour urinary sodium excretion, and dietary biomarkers, would strengthen evidence on effective lifestyle interventions. Qualitative studies exploring barriers and facilitators to lifestyle adherence in this population would provide contextual understanding to inform intervention design. Implementation science approaches that test scalable strategies for improving lifestyle adherence in resource-limited settings are urgently needed.

Conclusion

The study findings reveal a population with predominantly uncontrolled hypertension despite moderate engagement with some lifestyle modifications. While cultural factors provide protection against tobacco and alcohol use, gaps exist in adherence to dietary salt restriction, weight management, regular clinic attendance, and physical activity. The absence of a significant association between perceived adherence and blood pressure control may reflect limitations in adherence measurement or underscore the importance of addressing multiple risk factors simultaneously for effective blood pressure control. Comprehensive, culturally sensitive interventions addressing modifiable risk factors in an integrated fashion, supported by health system strengthening and policy-level actions, are essential to improve hypertension outcomes in this setting.

LIST OF ABBREVIATIONS

BMI – Body Mass Index

CVDs - Cardiovascular Diseases

CI – Confidence Interval

DASH – Dietary Approach to Stop Hypertension

DBP – Diastolic Blood Pressure

FTH - Federal Teaching Hospital

HTN - Hypertension

JNC VIII - The Joint National Committee's Eighth Report

OR – Odd Ratio

Outpatient Clinic (GOPC)

QoL – Quality of Life

SBP – Systolic Blood Pressure

SPSS IBM version 25 – Social Package for Social Sciences, Industrial Business Machine

WHO – World Health Organization

DECLARATIONS

Ethics approval and consent to participate: Ethical approval was obtained from the Research and Ethics Committee of Federal Teaching Hospital, Birnin-Kebbi, with reference number (FTH/BK/HP/145/P/517/VOL.V/057). Written informed consent was obtained from all participants, and all collected data remained confidential, with no financial incentives or coercion involved throughout the study.

Clinical Trial Number: Not Applicable

Consent for publication: The consent to publish the findings from the research was sought and obtained during the study.

Availability of data and material: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors have no competing interests to declare

Funding: The authors did not receive financial support from any organization for the submitted work.

Authors' contributions: HA: Conceptualization, literature search and literature review, manuscript review. **NCB:** Conceptualization, Literature search and review, Manuscript review, manuscript revision and final approval. **IAS:** Conceptualization, literature search and literature review, manuscript writing, Manuscript revision, final approval, and a major contributor to the

final draft of the manuscript. **MLS:** Literature review, data collection, and manuscript revision, **BL:** conceptualization, data collection, data analysis and manuscript review. **AAO:** Conceptualization, Literature review, data analysis and manuscript review. All authors have critically read and approved the final manuscript.

Acknowledgements: The authors are thankful to the study participants and all the staff of GOPC, Federal Teaching Hospital Birnin Kebbi, for their cooperation while conducting the study. The efforts of Dr Ibraheem AS were also appreciated towards the review of the final copy of this manuscript.

Authors' information (optional): Nil

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