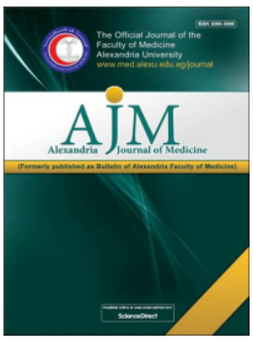

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ARTICLE

Anthropometric, socio-demographic and biochemical risk factors of hypertension in Lagos, Nigeria

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ABSTRACT

Background: Hypertension is a major modifiable risk factor for cardiovascular diseases and all-cause death globally and in Africa. The prevalence of hypertension in Nigeria is 28.9%. In Nigeria, analytical studies to determine risk factors and potential biomarkers of hypertension are lacking. This study was conducted to determine lifestyle, anthropometric, socio-demographic, and biochemical risk factors associated with hypertension in Lagos, Nigeria.

Method: This case–control study was conducted among 410 participants, aged 18–65 years. A well-structured questionnaire was used to collect data from cases and controls. Anthropometric and blood pressure measurements were taken. Blood samples were also collected for biochemical analysis. Logistic regression analysis was used to determine risk factors associated with hypertension. Data obtained were analyzed using SPSS version 25.0. *P*-value less than 0.05 was considered statistically significant.

Result: In total, 205 hypertensive cases and 205 normotensive controls were recruited. The mean ± SD age of the participants was 39.25 ± 11.49 years. Overall, 180 (44%) of participants were female. Logistic regression analysis indicated that obesity (OR = 3.324, 95% CI = 1.693–6.527, *P*= 0.000), family history (OR = 2.861, 95% CI = 1.731–4.729, *P*= 0.000), hypercholesterolemia (OR = 2.940, 95% CI = 1.577–5.480, *P*= 0.001), insufficient fruits and vegetables intake (OR = 0.152, 95% CI = 0.085–0.273, *P*= 0.000), frequent intake of dietary salt (OR = 0.400, 95% CI = 0.198–0.810, *P*= 0.011), and smoking status (OR = 3.709, 95% CI = 1.061–12.964, *P*= 0.040) were significantly associated with hypertension.

Conclusion: Population-based approaches to reduce exposure to hypertension risk factors are required for effective prevention and control of hypertension and cardiovascular diseases in Lagos, Nigeria.

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KEYWORDS
Cardiovascular diseases; Hypertension; Risk factors; Nigeria

1. Introduction

Non-communicable diseases are the leading cause of premature mortality and disability in both developed and developing countries, accounting for 71% (41 million of the total 57 million) of global deaths in 2016 and 80% of disability in 2017 [1,2]. The global health and economic burden of non-communicable diseases is substantial and reports have shown that cardiovascular diseases are the most common non-communicable diseases globally [3,4]. In 2016, about 44% of all non-communicable disease deaths and 31% of all global deaths were due to cardiovascular diseases [1]. According to the World Health Organization (WHO) [4,5], the majority (more than 75%) of cardiovascular disease mortality occur in low- and middle-income countries – this along with an already existing high burden of communicable diseases imposes a double burden of disease on low- and middle-income countries. In Nigeria, non-communicable diseases are estimated to contribute to 29% of total deaths, of which 11% is attributed to cardiovascular diseases [1].

Hypertension has been clearly identified as an important major modifiable risk factor for cardiovascular diseases and all-cause death. Worldwide, almost 10 million deaths in 2015 (4.9 million due to ischemic heart disease and 3.5 million due to stroke) were attributed to hypertension [6]. Hypertension, also known as high blood pressure, is a long-term medical condition in which the blood pressure in the arteries is persistently elevated [7]. There are over 1 billion people with hypertension worldwide and it is estimated that this will rise to 1.5 billion by 2025 [6]. The burden of hypertension in Nigeria is appreciable. The prevalence of hypertension in Nigeria is high and has been put at 28.9% [8].

Hypertension has been called the "silent killer" as it is often asymptomatic and many hypertensive people go undiagnosed and untreated until adverse outcomes become serious [5,9]. Studies indicate that the growing epidemic of hypertension and resulting cardiovascular diseases can be controlled by early detection and by reducing exposure to hypertension risk factors. Various risk factors such as obesity, advancing age, unhealthy diet, physical inactivity,

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smoking, dyslipidemia, diabetes, and family history have been implicated in the pathogenesis of hypertension [5,6,10–12]. Interventions targeted toward high-risk groups and the most important risk factors are critical for effective management and prevention of hypertension; such interventions require data or information from population-specific studies. Several studies have been carried out to determine the factors that predispose to hypertension in various populations with conflicting results [10,13,14]. There is a paucity of available current data for hypertension risk factors in Nigeria. Therefore, this study aimed to determine lifestyle, anthropometric, socio-demographic, and biochemical risk factors associated with hypertension in Lagos, Nigeria.

2. Patients and methods

2.1. Study design

This was a hospital-based case–control study conducted between January 2018 and December 2018.

2.2. Ethical approval

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Health Research Ethics Committee of the College of Medicine, University of Lagos, Lagos, Nigeria. All participants provided the written informed consent.

2.3. Sample population and selection criteria

A total of 410 adult participants (205 newly diagnosed hypertensive cases and 205 controls) aged from 18 to 65 years were included in the study. Hypertensive cases that obeyed the formulated criteria by JNC 7 (The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure) [15], that is, subjects with systolic BP readings consistently ≥140 mmHg and diastolic BP readings consistently ≥90 mmHg, were recruited from the hypertension clinics and General Out-Patient clinics of Lagos University Teaching Hospital and the Medical Centre, University of Lagos, Akoka, Lagos. Individuals whose blood pressure were consistently below 120/90 mmHg formed the normotensive control group. Controls were randomly selected from hospital workers, university students, university staff, and volunteers. Blood pressure measurement was done at least 3 times at not less than 2 different visits. People that were pregnant, below 18 years, and who did not give their consent were excluded from the present study.

2.4. Sample size determination

The minimum sample size of 175 per group was estimated using the formula for comparing two proportions considering both alpha and beta errors [16].

$$n = (Z_{\alpha} + Z_{\beta})^2 Pq/d^2$$

Z_{α} = Standard normal deviate at α probability. (i.e. α = 5% = 1.96)

Z_{β} = Standard normal deviate at β probability. (i.e. β = 80% = 0.84)

P = Prevalence of hypertension = 28.9% = 0.289 [8]

2.5. Data collection

A well-structured questionnaire, adapted from the World Health Organization STEPwise surveillance (WHO STEPS) questionnaire, was administered to each of the participants to obtain information on socio-demographics (age, sex, marital status, ethnicity, employment status, education level, and religion), lifestyle (physical activity, alcohol consumption, smoking status, dietary salt intake, and fruits and vegetables consumption), and family history of hypertension. All questionnaires were verified for completed information and participant with completed data had their blood pressure and anthropometric parameters measured. Blood samples were also collected from participants.

Participants who had consumed alcoholic beverages in the previous 12-month period were referred to as current drinkers. Nondrinkers or lifetime abstainers had never consumed alcohol while past drinkers had previously consumed alcohol but had not done so in the previous 12-month period before the survey [17].

Participants who smoked in the last 30 days were referred to as current smokers. Nonsmokers had never smoked any cigarette while past smokers had stopped smoking more than one month before the survey. Fruit and vegetable intake was considered insufficient if consumption was less than five servings per day [18,19].

Insufficient physical activity or physical inactivity was defined as engaging in less than 150 minutes of moderate-intensity physical activity per week, or equivalent, as recommended by WHO [19].

Dietary salt consumption was evaluated by asking about the frequency of adding salt or salty sauce to food during preparation/cooking, or before or while eating; and/or frequency of consuming high-salt processed foods. Participants who frequently (always or often) added salt or salty sauce to food during preparation/cooking, or before or while eating; and/or consumed high-salt processed foods were considered to be at risk. Frequency of dietary salt intake was categorized as “always” or “often,” “sometimes” and “rare” or “never” [19].

2.6. Blood pressure measurement

Blood pressure was recorded after participants had relaxed for at least 5 min. Measurements were taken with the subject being in the seated position using an automated blood pressure monitor (Omron HEM-5001, Kyoto, Japan) placed on the subject's left arm. Measurement was done three times with at least a -10 minute interval between each measurement, and the average reading was recorded. Hypertension was defined as systolic blood pressure of equal to or greater than 140 mm Hg and/or diastolic blood pressure equal to or greater than 90 mm Hg [15].

2.7. Anthropometric measurement

Body weight was measured using an automated scale. Portable Height Rod Stadiometers were used for body height to the nearest centimeters. The subject stood straight, with feet placed together and flat on the ground. Body Mass Index was calculated as body weight divided by height squared (kg/m^2). Obesity was defined as BMI ≥ 30 kg/m^2 [20].

2.8. Biochemical determinations

Biochemical investigations were carried out using blood samples collected after an 8–12 h fast. Fasting blood sugar and total cholesterol levels were measured enzymatically using Cobas c311 analyzer (Roche Diagnostics). Patients were said to have diabetes if their fasting blood glucose level ≥7 mmol/L (126 mg/dL) [21]. Hypercholesterolemia was defined as total cholesterol levels >5.17 mmol/L [22].

3. Data analysis

The data were analyzed using IBM Statistical Package for the Social Sciences (SPSS) software 25. Descriptive statistics were performed and data were presented as frequency (N) and percentage (%). Continuous data were presented as mean and standard deviation. Chi-square test was used to compare proportions between groups. Logistic regression analysis was used to determine the association between variables and hypertension. The *P*-value of <0.05 was considered significant.

4. Results

4.1. Characteristics of study participants

The study comprised 410 adults: 205 newly diagnosed hypertensive cases and 205 normotensive controls. The mean ± SD age of the participants was 39.25 ± 11.49 years. Table 1 shows the characteristics of cases and controls. The sex distribution of participants was 180 (44%) female and 230 (56%) male. Age and sex distribution did not vary significantly ($P = 0.06$ and $P = 1.000$, respectively) between cases and controls. Predominate of the study population were married 252 (61%), people of the Yoruba tribe 275 (67%), and nonsmokers 372 (91%). Most of the participants ate sufficient fruits and vegetables 285 (70%), and were not diabetic 391 (95%) or obese 330 (80%).

Differences in smoking status ($P= 0.002$), alcohol consumption ($P = 0.001$) and employment status ($P= 0.002$) of cases and controls were significantly different. Fruits and vegetables consumption ($P= 0.000$), dietary salt intake ($P = 0.000$) and family history of hypertension ($P = 0.001$) varied significantly between cases and control. Obesity and hypercholesterolemia rates were found to be significantly higher in cases than in controls ($P= 0.000$ and $P= 0.000$, respectively).

4.2. Association of risk factors and hypertension

Univariable and multivariable logistic regression analyses were used to explore the factors associated with hypertension prevalence. Table 2 shows that, of all demographic and socio-economic factors, only employment status (OR = 0.454, 95% CI 0.273–0.753, $P= 0.002$) was significantly associated with hypertension.

As depicted in Table 3, current smokers (OR = 2.558, 95% CI 1.037–6.307, $P= 0.035$) were significantly more likely to be hypertensive compared with those who were not current smokers. More so, amount of fruits and vegetables intake (OR = 0.156, 95% CI 0.095–0.255, $P= 0.000$), and frequency of dietary salt intake (OR = 0.318, 95% CI 0.182–0.556, $P= 0.000$) were found to be significantly associated with hypertension. Family history (OR = 2.121, 95% CI 1.429–3.146, $P= 0.001$), obesity (OR = 3.048, 95% CI 1.793–5.180, $P= 0.000$), diabetes (OR = 2.932, 95% CI 1.036–8.287, $P= 0.034$), and hypercholesterolemia (OR = 3.574, 95% CI 2.147–5.948, $P= 0.000$) significantly increased the odds of disease in hypertension cases compared to controls.

Multivariable logistic regression analysis indicated that, obesity (OR = 3.324, 95% CI = 1.693–6.527, $P= 0.000$), family history (OR = 2.861, 95% CI = 1.731–4.729, $P= 0.000$), hypercholesterolemia (OR = 2.940, 95% CI = 1.577–5.480, $P= 0.001$), insufficient fruits and vegetables intake (OR = 0.152, 95% CI = 0.085–0.273, $P= 0.000$), frequent intake of dietary salt (OR = 0.400, 95% CI = 0.198–0.810, $P= 0.011$), employment status (OR = 0.242, 95% CI 0.115–0.510, $P= 0.000$) and smoking status (OR = 3.709, 95% CI = 1.061–12.964, $P= 0.040$) were significantly associated with hypertension (Table 4).

5. Discussion

This case–control study demonstrated that participants who were current smokers had an elevated risk of developing hypertension compared with those who

Table 1. Characteristics of study participants by blood pressure status.

Characteristics	Normotensive N (%)	Hypertensive N (%)	Total N (%)	*P*-value
Age group (years)				0.06
<40	109 (53)	90 (44)	199 (49)	
≥40	96 (47)	115 (56)	211 (51)	
Sex				1.000
Female	90 (44)	90 (44)	180 (44)	
Male	115 (56)	115 (56)	230 (56)	
Marital status				0.387
Single/Never married	61 (30)	53 (26)	114 (28)	
Married	118 (58)	134 (65)	252 (61)	
Separated	16 (8)	11 (5)	27 (7)	
Widowed	10 (4)	7 (4)	17 (4)	
Tribe				0.492
Igbo	36 (18)	33 (16)	69 (17)	
Yoruba	140 (68)	135 (66)	275 (67)	
Hausa	6 (3)	4 (2)	10 (2)	
Others	23 (11)	33 (16)	56 (14)	
Level of education				0.257
No formal education	7 (3)	7 (3)	14 (3)	
Primary	9 (5)	6 (3)	15 (4)	
Secondary	25 (12)	39 (19)	64 (16)	
Tertiary	164 (80)	153 (75)	317 (77)	
Employment status				**0.002**
Unemployed	28 (14)	53 (26)	81 (20)	
Employed	177 (86)	152 (74)	329 (80)	
Religious affiliation				0.450
Christianity	153 (75)	163 (79)	316 (77)	
Islam	44 (21)	34 (17)	78 (19)	
Others	8 (4)	8 (4)	16 (4)	
Physical activity				0.056
<150 minutes	56 (27)	74 (36)	130 (32)	
≥150 minutes	149 (73)	131 (64)	280 (68)	
Smoking status				**0.002**
Current smoker	7 (3)	17 (8)	24 (6)	
Past smoker	2 (1)	12 (6)	14 (3)	
Nonsmoker	196 (96)	176 (86)	372 (91)	
Alcohol consumption				**0.001**
Current drinker	27 (13)	41 (20)	68 (17)	
Past drinker	29 (14)	50 (24)	79 (19)	
Nondrinker	149 (73)	114 (56)	263 (64)	
Fruits and vegetables (servings/day)				**0.000**
≥5	179 (87)	106 (52)	285 (70)	
2–4	6 (3)	24 (12)	30 (7)	
≤1	20 (10)	75 (36)	95 (23)	
Dietary salt intake				**0.000**
Always/Often	20 (10)	52 (25)	72 (18)	
Sometimes	135 (66)	136 (66)	271 (66)	
Rarely/Never	50 (24)	17 (9)	67 (16)	
Family history				**0.001**
Yes	79 (39)	117 (57)	196 (48)	
No	84 (41)	54 (26)	138 (34)	
Don't know	42 (20)	34 (17)	76 (18)	
Obesity				**0.000**
No	182 (89)	148 (72)	330 (80)	
Yes	23 (11)	57 (28)	80 (20)	
Diabetes				**0.034**
No	200 (98)	191 (93)	391 (95)	
Yes	5 (2)	14 (7)	19 (5)	
Hypercholesterolemia				**0.000**
No	180 (88)	137 (67)	317 (77)	
Yes	25 (12)	68 (33)	93 (23)	

Categorical data were presented as frequency and percentage and compared to each other using Chi-square analysis. All bold numbers are significant at $p < 0.05$.

were not. Obesity, family history of hypertension, and hypercholesterolemia were also found to be associated with hypertension, while sufficient fruits and vegetables intake, and infrequent intake of dietary salt were found to be protective against hypertension.

Despite the reported adverse effects of smoking on blood pressure, epidemiological studies have shown inconsistent results. While recent cross-sectional studies reported similar findings from our study of an association between smoking and hypertension [23,24], in a study conducted by Jayawardana *et al.* [14], smoking was not significantly associated with hypertension. In addition, some studies have reported lower blood pressure (BP) levels among smokers [25], and increases in blood pressure (BP) after smoking cessation [26]. Jayawardana *et al.* [14] also found no

Table 2. Association of socio-demographic factors and hypertension.

Characteristics	Normotensive N (%)	Hypertensive N (%)	Total N (%)	Odds Ratio (95% CI)	*P*-value
Age group (years)					0.060
<40	109 (53)	90 (44)	199 (49)	1	
≥40	96 (47)	115 (56)	211 (51)	1.451 (0.983–2.141)	
Sex					1.000
Female	90 (44)	90 (44)	180 (44)	1	
Male	115 (56)	115 (56)	230 (56)	1.000 (0.677–1.477)	
Marital status					0.104
Single/Never married/Separated/Widowed	87 (42)	71 (35)	158 (39)	1	
Married	118 (58)	134 (65)	252 (61)	1.392 (0.933–2.075)	
Tribe					0.599
Igbo/Hausa/Others	65 (32)	70 (34)	135 (33)	1	
Yoruba	140 (68)	135 (66)	275 (67)	0.895 (0.593–1.352)	
Level of education					0.563
No formal education/Primary	16 (8)	13 (6)	29 (7)	1	
Secondary/Tertiary	189 (92)	192 (94)	381 (93)	1.250 (0.585–2.671)	
Employment status					**0.002**
Unemployed	28 (14)	53 (26)	81 (20)	1	
Employed	177 (86)	152 (74)	329 (80)	0.454 (0.273–0.753)	
Religious affiliation					0.240
Islam/Others	52 (25)	42 (21)	94 (23)	1	
Christianity	153 (75)	163 (79)	316 (77)	1.319 (0.830–2.095)	

All bold numbers are significant at $P < 0.05$.

Table 3. Association of anthropometry, lifestyle, biochemical parameters, and family history of study participants with hypertension.

Characteristics	Normotensive N (%)	Hypertensive N (%)	Total N (%)	Odds Ratio (95% CI)	*P*-value
Physical activity					0.056
<150 minutes	56 (27)	74 (36)	130 (32)	1	
≥150 minutes	149 (73)	131 (64)	280 (68)	0.665 (0.438–1.012)	
Current smoker					**0.035**
No	198 (97)	188 (92)	386 (94)	1	
Yes	7 (3)	17 (8)	24 (6)	2.558 (1.037–6.307)	
Current alcohol drinker					0.063
No	178 (87)	164 (80)	342 (83)	1	
Yes	27 (13)	41 (20)	68 (17)	1.648 (0.970–2.800)	
Sufficient fruits and vegetables consumption					**0.000**
No	26 (13)	99 (48)	125 (30)	1	
Yes	179 (87)	106 (52)	285 (70)	0.156 (0.095–0.255)	
Dietary salt intake					**0.000**
Always/Often	20 (10)	52 (25)	72 (18)	1	
Sometimes/Rarely/Never	185 (90)	153 (75)	338 (82)	0.318 (0.182–0.556)	
Family history					**0.001**
No/Don't know	126 (61)	88 (43)	214 (52)	1	
Yes	79 (39)	117 (57)	196 (48)	2.121 (1.429–3.146)	
Obesity					**0.000**
No	182 (89)	148 (72)	330 (80)	1	
Yes	23 (11)	57 (28)	80 (20)	3.048 (1.793–5.180)	
Diabetes					**0.034**
No	200 (98)	191 (93)	391 (95)	1	
Yes	5 (2)	14 (7)	19 (5)	2.932 (1.036–8.287)	
Hypercholesterolemia					**0.000**
No	180 (88)	137 (67)	317 (77)	1	
Yes	25 (12)	68 (33)	93 (23)	3.574 (2.147–5.948)	

All bold numbers are significant at $P < 0.05$.

relation between alcohol consumption and hypertension as was observed in the present study. Some investigators suggest that increased risk for hypertension is dependent on the type and duration of exposure to cigarette smoke and alcohol [27,28]. Although the direct relation of smoking and alcohol consumption with hypertension is less well defined, smoking and harmful use of alcohol are still considered major risk factors for hypertension worldwide [5,6]. Smoking and chronic alcohol consumption are reported to cause sympathetic activation, increased oxidative stress, and endothelial dysfunction – processes known to be important in the pathophysiology of hypertension [29,30].

In this study, diet was assessed by the amount of fruits and vegetables consumption, and salty food intake, while nutritional status was determined by body mass index, fasting blood sugar levels, and total cholesterol levels. This study found that the prevalence of sufficient fruits and vegetables consumption was significantly lower in cases compared to controls. Insufficient consumption of fruits and vegetables was also found to be significantly associated with having hypertension. A vast majority of studies including recent meta-analyses by Schwingshackl *et al.* have

Table 4. Multivariable logistic regression analysis of potential risk factors for hypertension.

Characteristics	Adjusted Odds Ratio (95% CI)	*P*-value
Age group (years)		0.157
<40	1	
≥40	1.528 (0.849–2.751)	
Sex		0.729
Female	1	
Male	0.911 (0.536–1.546)	
Marital status		0.115
Single/Never married/Separated/Widowed	1	
Married	1.659 (0.884–3.113)	
Tribe		0.289
Igbo/Hausa/Others	1	
Yoruba	1.333 (0.784–2.266)	
Level of education		0.264
No formal education/Primary	1	
Secondary/Tertiary	1.931 (0.608–6.132)	
Employment status		**0.000**
Unemployed	1	
Employed	0.242 (0.115–0.510)	
Religious affiliation		0.268
Islam/Others	1	
Christianity	1.410 (0.768–2.589)	
Physical activity		0.678
<150 minutes	1	
≥150 minutes	1.1219 (0.653–1.926)	
Current smoker		**0.040**
No	1	
Yes	3.709 (1.061–12.964)	
Current alcohol drinker		0.318
No	1	
Yes	0.675 (0.313–1.459)	
Sufficient fruits and vegetables consumption		**0.000**
No	1	
Yes	0.152 (0.085–0.273)	
Dietary salt intake		**0.011**
Always/Often	1	
Sometimes/Rarely/Never	0.400 (0.198–0.810)	
Family history		**0.000**
No/Don't know	1	
Yes	2.861 (1.731–4.729)	
Obesity		**0.000**
No	1	
Yes	3.324 (1.693–6.527)	
Diabetes		0.304
No	1	
Yes	2.006 (0.531–7.569)	
Hypercholesterolemia		**0.001**
No	1	
Yes	2.940 (1.577–5.480)	

All bold numbers are significant at $P < 0.05$.

shown that a healthy diet consisting of sufficient fruits and vegetables plays a crucial role in hypertension prevention [12,31]. Fruits and vegetables contain nutrients such as minerals and vitamins, and phytochemicals which have antioxidant and anti-inflammatory effects. Antioxidants have been shown to have beneficial effects on endothelial function – a major determinant of hypertension [31].

The linear relationship of the amount of sodium salt intake and salt sensitivity with blood pressure levels has been elucidated, and previous studies have shown significant decreases in blood pressure with lower salt intake [11]. Studies have suggested that the salt-induced elevation of blood pressure is primarily due to blunted activity of the renin–angiotensin – aldosterone system and renal sympathetic nervous system and that salt sensitivity is common among blacks [11]. Findings from this study indicate that frequent dietary salt intake was more prevalent among cases than controls, and that frequent dietary salt intake was significantly associated with hypertension. Researchers have noted that Lagos residents consume processed and restaurant foods regularly [32], and that most processed and restaurant foods contain high amounts of salt [33,34]. The World Health Organization recommends a reduction in salt intake to less than 5 g/day (sodium 2 g/day)

Multiple lines of evidence have shown that obesity and hypercholesterolemia are important modifiable risk factors for hypertension [5,6,12,35]. Obesity and hypercholesterolemia are largely determined by diet and physical activity, and fundamentally caused by an imbalance between calories consumed and calories expended [12,35]. Several studies have stressed the negative impact of physical inactivity and poor nutrition on blood pressure [12,13,36]. Hypercholesterolemia is associated with atherosclerosis which causes endothelial dysfunction and vascular issues, that lead to the development of hypertension while obesity

is associated with activation of the renin–angiotensin–aldosterone system and sympathetic nervous system, which contribute to the development of hypertension [35]. Poor lifestyle choices including excessive intake of dense energy food such as fats, sugars and salt, low intake of fruits and vegetables, and an inadequate amount of regular physical activity cause hypercholesterolemia and raised body mass index in the obese. Increased urbanization, industrialization, and westernization including changes in types of occupation and forms of transport have been blamed for the demographic transition which has encouraged poor lifestyle choices in low- and middle-income countries [5,37].

That hypertension runs in the family is well documented [13,38]. The heritability of blood pressure estimated from family and twin studies is approximately 30–50%, varying widely from population to population [39]. Family history of hypertension was significantly associated with a greater likelihood of developing hypertension in the present study. A Framingham Heart Study by Niiranen *et al.* revealed that offsprings of hypertensive parents and grandparents are at a greater risk of hypertension than the general population and that early (onset before 55 years) rather than late-onset of hypertension in first- and second-degree parents is a stronger predictor of the risk of elevated blood pressure values in offspring [38]. Though the role of genetic factors in the development of hypertension has been highlighted, results from findings indicate that healthy lifestyle choices can mitigate genetic risk [12].

Some potential limitations in our study design should be considered. Firstly, the study was carried out only in two hospital environments in Lagos, Nigeria, so it may not be a representative of the general population of Nigeria. Secondly, the ascertainment of risk factors was dependent on self-reports. It is difficult to exclude the possibility of bias in self-reporting. Finally, a lack of information on lifestyle factors, such as waist/hip circumference, income, and stress, limited further interpretation of the data.

6. Conclusion

Frequent dietary salt intake, insufficient consumption of fruits and vegetables, hypercholesterolemia, being obese and a current smoker, and having a family history of hypertension were identified as significant risk factors for hypertension in the study population. Therefore, adopting a healthier lifestyle, such as smoking cessation and reducing excess body weight through healthier eating habits and increased levels of aerobic physical activity, will likely result in a reduced number of hypertensive persons in the study population.

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Notes on contributors

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