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ORIGINAL ARTICLE

The Impact of Co-Morbidities on the Pattern of Blood Pressure Control in Elderly Hypertensives in Nigeria

L'Impact des Comorbidités sur le Modèle de Contrôle de la Pression Artérielle chez les Personnes Âgées Hypertendues au Nigeria

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ABSTRACT

INTRODUCTION: The elderly hypertensive patients often have increased prevalence of cardiometabolic risk factors and their attendant co-morbidities. The aim of this study was to determine the prevalence of cardiometabolic risk factors and blood pressure control among elderly hypertensive patients, and to determine the influence of modifiable cardiometabolic risk factors on the control of hypertension among elderly hypertensive patients.

SUBJECTS AND METHODS: A case-control comparative and hospital-based study involving a total of 190 consenting elderly (≥65 years), hypertensive patients (subjects) (n=100) and normotensive controls (n=90) was carried out over a period of ten months. Using interviewer-administered questionnaire, biodata and information regarding their lifestyle was obtained. Standard protocols were used to measure blood pressure, weight, height, waist circumference, fasting plasma glucose and fasting lipid profile of the subjects. Body mass index was derived from weight and height.

RESULTS: The mean age of the subjects was 71.5 ± 6.3 years and the controls was 72.3 ± 7.2 years. Forty-eight percent (48%) and 47.8% of the subjects and controls were females (p = 0.651). The level of control of hypertension was poor in over two-thirds (68%) of the elderly hypertensive patients. The prevalence of modifiable cardiometabolic risk factors burden was higher in the hypertensive subjects when compared with the controls. Prevalence of Dyslipidaemia was 76% in the subjects and 51% in the controls (p = 0.004). Prevalence of Diabetes Mellitus was 40% among the subjects and 17.8% in the controls (p = 0.0001); prevalence of Obesity was 24% in the subjects and 4.4% in the controls (p=<0.001); prevalence of excess alcohol intake was 49% in the subjects and 14.4% in the controls (p=<0.001). Prevalence of sedentary life style was high in both the subjects (53%) and controls (50%), p=0.679. Poor blood pressure control was predicted by dyslipidaemia and central obesity.

CONCLUSION: The level of control of hypertension was poor among the elderly and modifiable cardiometabolic risk factors were relatively prevalent. Central obesity and dyslipidaemia were predictive of poor control of hypertension. Addressing these factors may therefore improve blood pressure control. **WAJM 2022; 39(11): 1141–1147.**

Keywords: Blood pressure, Cardiometabolic risk factors, Elderly.

RÉSUMÉ

INTRODUCTION: Les patients hypertendus âgés présentent souvent une prévalence accrue de facteurs de risque cardiométaboliques et de leurs comorbidités. Le but de cette étude était de déterminer la prévalence des facteurs de risque cardiométabolique et le contrôle de la pression artérielle chez les patients hypertendus âgés, et de déterminer l'influence des facteurs de risque cardiométabolique modifiables sur le contrôle de l'hypertension chez les patients hypertendus âgés.

SUJETS ET MÉTHODES: Une étude cas-témoins comparative et hospitalière portant sur un total de 190 patients âgés (e"65 ans) consentants, hypertendus (sujets) (n=100) et témoins normotendus (n=90) a été réalisée sur une période de dix mois. A l'aide d'un questionnaire administré par un enquêteur, des données biographiques et des informations concernant leur mode de vie ont été obtenues. Des protocoles standard ont été utilisés pour mesurer la pression artérielle, le poids, la taille, le tour de taille, la glycémie à jeun et le profil lipidique à jeun des sujets. L'indice de masse corporelle a été calculé à partir du poids et de la taille.

RÉSULTATS: L'âge moyen des sujets était de 71,5±6,3 ans et celui des témoins de 72,3±7,2 ans. Quarante-huit pour cent (48 %) et 47,8 % des sujets et des témoins étaient des femmes (p=0,651). Le niveau de contrôle de l'hypertension était faible chez plus de deux tiers (68 %) des patients hypertendus âgés. La prévalence des facteurs de risque cardiométabolique modifiables était plus élevée chez les sujets hypertendus que chez les témoins. La prévalence de la dyslipidémie était de 76 % chez les sujets, 51 % chez les témoins (p=0,004). La prévalence du diabète sucré était de 40% chez les sujets et de 17,8% chez les témoins (p= 0,0001), la prévalence de l'obésité était de 24% chez les sujets et de 4,4% chez les témoins (p=<0,001), la prévalence de la consommation excessive d'alcool était de 49% chez les sujets et de 14,4% chez les témoins (p=<0,001). La prévalence du style de vie sédentaire était élevée chez les sujets (53%) et les témoins (50%), p=0,679. Un mauvais contrôle de la pression artérielle était prédit par la dyslipidémie et l'obésité centrale. Conclusion : Le niveau de contrôle de l'hypertension était faible chez les personnes âgées et les facteurs de risque cardiométaboliques modifiables étaient relativement prévalents. L'obésité centrale et la dyslipidémie étaient prédictives d'un mauvais contrôle de l'hypertension. La prise en compte de ces facteurs peut donc améliorer le contrôle de la pression artérielle. **WAJM 2022; 39(11): 1141–1147.**

Mots clés: Pression artérielle, Facteurs de risque cardiométabolique, Personnes âgées.

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INTRODUCTION

Cardiovascular disease is a major cause of morbidity and mortality especially in the elderly. According to the 2012 WHO report, an estimated 17.3 million people died from cardiovascular diseases in 2008, representing 30% of global deaths[1]. Cardiovascular diseases were responsible for 48% of deaths from non-communicable diseases.[2] It is projected that by 2030, almost 25 million people will likely die from cardiovascular diseases; mainly from heart diseases and stroke.[2] These are projected to remain the leading causes of death with disproportionate involvement of low and middle income countries where over 80% of cardiovascular disease deaths occur, and almost equally in both sexes. In Nigeria, a case-fatality rate of 42.9% was reported in a five-year review of hypertension-related admissions.[3]

The trend of non-communicable diseases (NCDs) in sub-Saharan Africa (SSA) reveals an increasing prevalence such that the region is currently described as battling with high burdens of communicable and non-communicable diseases.[4] In SSA, cardiovascular diseases were responsible for about 25% of all deaths and about 44% of deaths attributable to NCDs.[4]

The increase in the burden of NCDs is thought to be due to two key factors namely: decreasing mortality from infectious diseases which has resulted in increased longevity resulting in many people living up to middle age and older where hypertension and non-communicable diseases begin to manifest. Also there is increased urbanization which is often associated with changes in lifestyle comprising preference for unhealthy diets, physical inactivity, smoking, obesity and increased alcohol consumption.[4,5]

According to Odili *et al*,[6] hypertension in Nigeria is characterized by variable prevalence rates depending on the population studied and the geopolitical zones. The study showed a prevalence of 6.8% for those less than 30 years and 63.0% for those aged 70 years and above. The prevalence also varied according to regions in the country; North Central 20.9%, North West 26.85, North East 27.5%, South West 42.1%, South South 44.6% and South East 52.8%. The study also reported poor blood pressure control among those who were on treatment. The variation in the prevalence hypertension across the regions was also reported in a systematic review and meta-analysis by Adeloye, *et al.*[7] Arodiwe, *et al*,[3] observed that most of the complications which included: acute hypertensive crises such as cerebrovascular accidents, hypertensive encephalopathy, and acute renal failure, congestive cardiac failure, and chronic renal failure were often mostly avoidable.

The proportion of people aged 65 years and older in the United States of America is projected to increase from 12.4% of the population in 2000 to 19.6% in 2030. The global trend is similar, with the worldwide population of people older than 65 years projected to increase to 12% in 2030 and about 20% of the population in 2050. The increase will be greatest in underdeveloped nations.[8] The development of cardiovascular disease is promoted by major risk factors such as: hypertension, dyslipidaemia, diabetes mellitus, obesity, sedentary lifestyle, and smoking.[9] Hypertension has been described as the commonest illness in elderly people and is the leading cause of death in both men and women aged 65 years and above.[10] Cardiovascular disease risk factors burden was shown to be high among rural-dwelling elderly subjects in South Eastern Nigeria.[3]

It is important to draw the attention of Clinicians to the impact of these largely modifiable risk factors on achieving a better blood pressure control and thus improving the quality of life of our elderly patients. Risk factors identification and implementation of control strategies are especially important in developing countries like Nigeria where finance and healthcare manpower are grossly inadequate. Targeting blood pressure control by focusing on behavioural risk factors may contribute to achieving better control with less financial involvement, hence the incorporation of evaluation of risk factors in this study. The aim of this study therefore was to determine the level of blood pressure control, and the prevalence and influence of modifiable behavioural cardiometabolic risk factors on the control of hypertension among elderly patients.

SUBJECTS AND METHODS

The study was a cross-sectional, comparative and hospital-based study which was carried out over a period of ten months. Subjects were divided into two groups: groups A and B. Group A consisted of elderly (age $\geq$ 65 years) hypertensive patients who were recruited consecutively from the Medical Outpatient Clinic, General Outpatient Clinic, Accident and Emergency unit, and medical wards of the University of Nigeria Teaching Hospital. Hypertensive subjects included newly diagnosed, known hypertensive patients of the hospital and those who were on treatment for hypertension. Group B consisted of non-hypertensive elderly (age $\geq$ 65 years) subjects who served as controls.

Inclusion Criteria

Participants with hypertension and those on treatment for hypertension who gave informed consent. Elderly individuals without hypertension.

Exclusion Criteria

Subjects who did not give consent, hypertensives in heart failure, those with acute stroke, those on treatment for chronic kidney disease and those on steroids or who had features suggestive of Cushing's syndrome were excluded.

Sample Size

Sample size of 90 was calculated using the formula for calculation of a sample size in a cross-sectional study.[11] as follows: $n = \pi (1-\pi)/e2$; where n = the desired sample size or minimum sample size, e = required size of standard error usually taken as 0.05 which corresponds to 95% confidence level, = the proportion (prevalence) in the target population estimated to have a particular characteristic (27.8%).[12] However, a sample size of 100 for the test group (hypertensives) was used to take care of attrition (10% of sample size) while 90 participants were recruited as controls (non-hypertensives) making a total of 190 participants.

Study Protocols

The tool for data collection was a pre-tested, structured and an interviewer-administered questionnaire. Information

sought in the questionnaire included age, sex, marital status, educational level, occupation, relevant family and social history, history of hypertension, diabetes mellitus, tobacco use, alcohol consumption and physical inactivity.

The study was explained to patients who met the inclusion criteria for the study. After the administration of the questionnaire, a general physical examination was carried out on each participant. Height (h) was measured in centimetres but converted to metres thereafter (to the nearest 0.1m) using either a movable or wall-mounted stadiometer. Each subject was politely requested to remove footwear or headgear during the measurement. Weight (wt) was measured in kilogram to the nearest 0.5kg using a weighing scale with patient wearing light outdoor clothing and no shoes. Both height and weight were measured without the subject's privacy being compromised. Body mass index (BMI) in Kg/m^2 was derived by dividing the weight (wt) in kilograms by the square of patient's height (h^2) in metre (wt/h^2).

The participants' blood pressures were measured using a standard mercury sphygmomanometer on the left arm after 5-minute rest using a cuff of appropriate size with the subject in sitting position. The first and fifth phases of Korotkoff sounds were used to determine the systolic blood pressure (SBP) and diastolic blood pressures (DBP), respectively. Two measurements were taken at least five minutes' interval and the mean of two measurements regarded as the subject's blood pressure. Waist circumference was measured using a non-stretchable measuring tape with the umbilicus as the landmark.

All subjects and controls had blood glucose estimation done with the aid of a glucometer using capillary blood. Lipid profile was carried out in all subjects and controls. The observation of a fast (which they were asked earlier to observe) was ascertained from each participant. Five millilitres of venous blood was drawn from the antecubital vein aseptically from each participant while in a fasting state. The blood was placed in a plain bottle and transported to the chemical pathology laboratory for processing and storage until analysis within 48 hours of collection. Measurement of total cholesterol (TC), high density lipoprotein cholesterol (HDL-C) and triglyceride (TG) were done by enzymatic method, while the value of low density lipoprotein cholesterol (LDL-C) was obtained from the Friedewald formula: TC "[HDL cholesterol + (TGs ÷ 5)].[13]

Definition of Risk Factors

The definition of risk factors used in this study are summarized below:
Hypertension: SBP ≥140mmHg and/or DBP ≥90mmHg and/or history of use of antihypertensive medication and /or self-volunteered history of hypertension[14].
Overweight: BMI = 25 – 29.9 Kg/m2.[15]
Generalized obesity: BMI ≥30 Kg/m2,[15]
Central Obesity: Waist circumference ≥88cm (females) and ≥102cm (males).[15]
Diabetes Mellitus: FBG ≥126mg/dl or self-volunteered history of use oral glucose lowering agents or insulin.[16]

Impaired fasting blood glucose: Moderate hyperglycaemia during the fasting state of ≥110mg/dl but < 126mg/dl.[16]
Dyslipidaemia: High TC: >5.2 mmol/l, *Low HDL:* <1.2 mmol/l (females) or <1.0 mmol/l (males), High LDL: >3.4mmol/l, *High triglyceride:* >1.7mmoll).[17]
Tobacco use: Any habitual use of the tobacco plant leaf and its products.[18]
Physical inactivity: Using self-reported recall by patients; failure to participate in a minimum of 150 minutes of moderate exercise or 75 minutes of a more rigorous regimen per week.[19]
Excess alcohol consumption: >14 units/week (females) or >21 units/week (males).[20]
Poor blood pressure control: A systolic blood pressure of ≥140mmHg and/or diastolic blood pressure ≥90mmHg for a patient who is taking antihypertensive medication.[21]

Data Analysis

The data obtained from this study were analysed using the Statistical Package for the Social Sciences (SPSS) software, version 20 (SPSS Chicago Inc., IL, USA). Descriptive statistics were used to compute proportion and percentages for categorical variables, means and standard deviations for numerical variables. Chi-squared test was used to test the association between categorical variables while student's t-test was used to test for differences in means for continuous variables. Significant risk factors were subjected to multiple logistic regression analysis. Level of statistical significance fixed at a p-value of <0.05.

Ethics Approval

Ethics approval for the study was obtained from the Health Research Ethics Committee (HREC) of UNTH Enugu. Informed written consent was obtained from each participant before being recruited into the study.

RESULTS

General Characteristics of the Subjects

A total of 190 individuals comprising 100 (52.6%) hypertensive subjects and 90 (47.4%) normotensive controls matched by sex and age were recruited for the study (Table 1). The subjects were made up of 52 (52.0%) males and 48 (48.0%) females while the control group was made up of 47 (52.2%) males and 43 (47.8%) females. Generally, the two subgroups of participants were similar in all the socio-demographic parameters (Table 1). The age of the individuals ranged from 65 years to 94 years. There was no significant difference in the mean age of subjects (71.5±6.3 years) and controls (72.3±7.2 years) (p =0.651).

The group consisted mainly of farmers and retirees with less than 50% of the subjects in both groups acquiring some form of education. Non-formal education was commoner among the control subjects, but the differences in the distribution of educational levels by groups of subjects were not significant (Table 1).

Risk Factors for Cardiovascular Disease

The mean values of the cardiovascular risk factors among the subjects (Table 2) were broadly grouped into clinical and laboratory parameters. These parameters showed statistically significant higher mean values among the subjects. Of all the clinical parameters, it was only the height of the individuals that showed no significant difference. For the laboratory parameters, only

Table 1: Socio-demographic Parameters of the Participants

Parameter	Subjects N (%)	Controls N (%)	P value*
Sex			
Male	52 (52.0)	47 (52.2)	0.976
Female	48 (48.0)	43 (47.8)	
Total	**100(100)**	**90 (100)**	
Educational Level			
None	53 (53.0)	55 (61.1)	0.252
Primary	25 (25.0)	25 (27.8)	
Secondary	10 (10.0)	4 (4.4)	
Tertiary	12 (12.0)	6 (6.7)	
Total	**100 (100)**	**90 (100)**	
Age Range			
65 – 69	46 (46)	44 (49)	0.828
70 – 74	27 (27)	23 (26)	
75 – 79	17 (17)	12 (13)	
80 – 84	4 (4)	5 (6)	
85 – 89	4 (4)	2 (2)	
90 – 94	2 (2)	4 (4)	
Total	**100 (100)**	**90 (100)**	
Occupation			
Contractor	4 (4.0)	2 (2.2)	0.516
Farmer	42 (42.0)	45 (50.0)	
Retirees	37 (37.0)	24 (26.7)	
Trading	15 (15.0)	16 (17.8)	
Artisan	2 (2.0)	3 (3.3)	
Total	**100 (100)**	**90 (100)**	
Marital Status			
Married	89 (89.0)	77 (85.6)	0.475
Widow/ widower	11 (11.0)	13 (14.4)	
Total	**100 (11.0)**	**90 (100)**	

* *Chi square analysis*

Table 2: Mean values of Cardiovascular Risk Factors

Parameter	Mean ± SD		p-value*
	Subjects (n=100)	Controls (n = 90)	
Clinical Parameters			
SBP(mmHg)	146.70 ± 20.6	118.67 ± 8.6	<0.0001*
DBP (mmHg)	84.70 ± 10.09	71.67 ± 7.82	<0.0001*
Weight (kg)	69.10 ± 15.56	56.72 ± 9.94	<0.0001*
Height (meters)	1.62 ± 0.08	1.61 ± 0.05	0.309
BMI (kg/m2)	26.05 ± 5.2	22.94 ± 3.3	<0.0001*
WC (cm)	96.44 ± 14.2	83.2 ± 9.3	<0.0001*
Laboratory Parameters			
FBG (mmol/l)	6.8 ± 3.3	5.3 ± 1.0	<0.0001*
TC (mmol/l)	4.98 ± 0.84	4.72 ± 0.65	0.0855
HDL (mmol/l)	0.98 ± 0.25	1.05 ± 0.19	0.0555
LDL (mmol/l)	3.32 ± 0.84	3.30 ± 0.68	0.303
TG (mmol/l)	1.15 ± 0.50	0.99 ± 0.29	0.027

SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; WC, Waist Circumference; BMI, Body Mass Index; FBG, Fasting Blood Glucose; TC, Total Cholesterol; HDL, High Density Lipoprotein; LDL, Low Density Lipoprotein; TG, Triglyeride.
** P value is statistically significant.*

fasting blood glucose and triglycerides attained statistical significance. Fasting glycaemia and dyslipidaemia were particularly higher in the subjects (Table 2).

Characteristics of cardio-metabolic risk factors among the participants

Cardiovascular risk factors were more prevalent among subjects (Table 3). These risk factors included diabetes mellitus, generalized obesity, gender-specific central obesity, excess consumption of alcohol, use of tobacco, and dyslipidaemia. Dyslipidaemia was significantly commoner among the subjects, mainly due to those with hypertriglyceridaemia. The commonest forms of dyslipidaemia in descending order were hyperglyceridaemia, low HDL, high LDL and then total hyper-cholesterolaemia. Indices of physical activity revealed a high level of sedentary living. Twelve (12%) of subjects used tobacco in the form of snuff (smokeless tobacco) while only 1% smoked cigarettes.

The blood pressure control was very poor among the subjects as 68% of them had poor blood pressure control. Multiple logistic regression analysis showed that dyslipidaemia (OR 2.56, CI 1.19–5.53, p = 0.017) and central obesity (OR 7.63, CI 2.34–24.9, p = 0.001) were the only independent risk factors predictive of poor blood pressure control (Table 4).

DISCUSSION

Cardiovascular disease is a common condition in the elderly and is a leading cause of death in both men and women older than 65 years.[21] This study showed a low level of blood pressure control and a high prevalence of cardiovascular risk factors among the subjects. The high prevalence of poorly controlled blood pressure in over two-thirds (68%) of the subjects in this study is an indicator that more effort is needed to bring the blood pressures of our elderly hypertensive patients under control. Blood pressure control rate in this study (32%) fell within the range reported by some other studies in Ido Ekiti (34.4% to 45.3%),[22] and other parts of Nigeria as reported from the systematic review and meta-analysis by

Table 3: Distribution of Behavioural Risk Factors in the Participants

Parameter	Hypertensive Subjects n (%)	Normotensive Controls n (%)	P-value
Poor blood pressure control	68 (68)	n.a	–
Diabetes mellitus	40 (40)	16 (17.8)	0.0001*
Generalized Obesity	24 (24)	4 (4.4)	<0.001*
Overweight	23 (23)	12 (13.3)	0.086
Central obesity	45 (45)	8 (8.9)	<0.001*
Excess alcohol consumption	49 (49)	13 (14.4)	<0.001*
Tobacco Use	13 (13)	–	n.a
Sedentary lifestyle	53 (53)	45 (50)	0.679
Inadequate exercise	20 (20)	16 (17.8)	0.696
Dyslipidaemia	76 (76)	46 (51.0)	0.0004*
High TC	32 (32)	26 (28.2)	0.753
Low HDL	49(49)	38 (42.2)	0.349
High LDL	46 (46)	34 (37.8)	0.253
High triglyceride	14 (14)	4 (4.4)	0.025

DM, Diabetes Mellitus; *WC, Waist Circumference; BMI, Body Mass Index; TC, Total Cholesterol; HDL, High Density Lipoprotein; LDL, Low Density Lipoprotein;* n.a, not applicable.
** P value is statistically significant.*

Table 4: Multiple Logistic Regression Analysis to Determine Independent Cardiometabolic Risk Factors Predictive of poor Blood Pressure Control

Parameter	Odds Ratio (OR)	95% C.I	Z-Statistic	p-value
Dyslipidaemia	2.56	1.19 – 5.5394	2.3970	0.017*
Central obesity	7.63	2.34 – 24.9	3.3688	0.001*
Alcohol use	1.78	0.00 – 1.01	0.0430	0.9657
Diabetes Mellitus	1.32	0.63 – 2.77	0.7372	0.4610
Sedentary lifestyle	1.26	0.6 – 2.68	0.6117	0.5408
Smoking	0.96	0.25 – 3.72	–0.0631	0.9497
Constant	–	–	–0.0463	0.9631

** P value is statistically significant*

Adeloye *et al*[7] and a recent nation-wide survey by Odili *et al.,* (12.4%)[6]. Generally, these studies show a variable but low prevalence of good blood pressure control. Similarly, poor rate of blood pressure control has been reported from across Africa and around the globe. Low high blood pressure detection and treatment as well as poor adherence with antihypertensive drugs were the major factors responsible for poor rate of blood pressure control among people with hypertension.[23–28]

The benefits of attaining acceptable blood pressure control goal is expected to positively impact on the overall health-related quality of life of the subjects. The 40% reduction in stroke and at least 25% reduction in myocardial infarction among subjects with good blood pressure control are clear evidences that the gains associated with treatment and control of hypertension cannot be over-emphasized.[29] The high prevalence of poor blood pressure control among the subjects has grave implications considering both the number of people exposed to poor cardiovascular outcomes and the rising prevalence of hypertension. Hypertension was the most common risk factor identified with elderly age (>60 years) as a significant predictor of stroke mortality in Africa including Nigeria.[30] Hypertension is also a known risk factor for the development of ischaemic heart disease, chronic kidney disease, peripheral artery disease and dementia[31.] Thus, concerted efforts are needed to improve these poor outcomes in our aging populations.

Factors contributing to poor blood pressure control are complex. Subjects' awareness of their hypertensive status may contribute significantly to poor outcome of blood pressure control as this could be an indirect assessment of their overall knowledge on hypertension and its management. Awareness has been shown to be low in Nigeria,[32] though a recent national survey by Odili, *et al* showed improvement in the level of awareness of hypertension.[6] There is poor adherence to antihypertensive medication in Nigeria.[33] Drug-related factors that may influence adherence to medication include: the long duration of use of antihypertensive medications and too many antihypertensive medications. Poor adherence could also be attributed to side effects of the drugs, cost of medications, and preference to herbal medication.[33] Non adherence could also be attributed to forgetfulness, and it may be rewarding to institute mechanisms that will remind these patients of their medications like use of buddy or companion reminder.[33] Other possible factors may include poor knowledge, attitudes, beliefs, and socio-cultural practices, affordability of medications and issues related to substandard drugs even among those who are aware of their hypertensive status.[34]

This study showed that obesity and dyslipidaemia were the only modifiable risk factors found to significantly predict poor blood pressure control. This was similar to the findings by Xu *et al.,* in China and Chopra *et al.,* where truncal obesity and dyslipidaemia were associated with poor blood pressure control.[35,36] The linkage between these risk factors and hypertension is still thought to be insulin resistance, though the relationship has not been well delineated because of its multifactorial associations. The possible link between hypertension and insulin resistance is thought to be from abnormalities in vasodilation and blood flow.[37] Insulin resistance which results in hyper-insulinemia plays a critical role in the genesis of hypertension through various mechanisms. These include increased sodium reabsorption in the kidney

tubules, activation of the sympathetic nervous system and alteration in vascular resistance through increased calcium concentration in smooth muscle cell.[38] Reduced tissue insulin is a common feature of metabolic syndrome.[39] Addressing insulin resistance by strongly emphasizing and teaching lifestyle modifications may also contribute significantly to controlling hypertension.

Education and counselling are key tools that can change the poor picture of blood pressure control in Nigeria, having been found to improve blood pressure control.[40] Addressing other co-morbid cardiovascular risk factors/conditions will also contribute to improved control. These risk factors were quite common among our subjects.

CONCLUSION

This study demonstrated low level of blood pressure control and high prevalence of modifiable cardiovascular risk factors in our elderly hypertensive patients, thus calling for a scaling up of efforts towards improving these parameters. This is expected to impact positively on the quality of life of the ageing population in developing nations which are faced by several other health challenges.

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Conflict of Interest

The authors declare no conflict of interest.

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