Prevalence of Hypertension and Relationship with Anthropometric Indices in Urban Dwellers in Kwara State, Nigeria

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ABSTRACT

Background: Hypertension is a growing public health concern with a rising prevalence and associated clinical outcomes particularly in Nigeria. The association of hypertension with anthropometric indices is insufficiently described in Nigeria. **Objectives:** We aim to determine the prevalence of hypertension and its relationship with anthropometric indices. **Materials and Methods**: This is a cross-sectional study of adults in seven urban communities in Kwara state, Nigeria. The study was done during the world kidney days over seven year period (2007-2015). Blood pressure, body mass index, waist circumference and hip circumference were measured. Hypertension was defined as blood pressure ≥ 140/90mmHg. **Results:** One thousand five hundred and six adults were recruited, with mean age of 44 ± 14years, and a female preponderance (55%). The prevalence of hypertension was 30%, (30.2%) in males and (29.8% in females). Hypertension correlates significantly with age (r = 0.416, P = 0.001), BMI (r = 0.301, P = 0.001), hip circumference (r = 0.219, P = 0.001), waist-hip ratio (r = 0.225, P = 0.005), and waist circumference (r = 0.063, P = 0.045). The identified predictors of hypertension were; Waist circumference had about 17% increased risk for hypertension (OR = 1.169, CI = 1.021 – 1.340, P = 0.024), body mass index, 11% (OR = 1.113, CI = 1.059 – 1.170, P = 0.001), and age 5% (OR = 1.052, CI = 1.034 – 1.070, P = 0.001). **Conclusion:** The prevalence of hypertension is high in urban population of Kwara State, and is similar in men and women, but it increases with age, high body mass index and waist circumference.

Keywords: High blood pressure, Hypertension, Nigeria, Prevalence, Urban

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INTRODUCTION

Hypertension imposes significant burden on global health and resources, with the greatest impact on developing countries, especially the sub-Saharan African (SSA). It disproportionately affects populations in low- and middle-income countries who have limited resources and weak health structures. Hypertension is the leading risk factor for mortality and

global burden of disease, and a major risk factors for premature death.[1] Hypertension is a main contributor to the rising burden of cardiovascular disease in sub-Saharan Africa (SSA), which is expected to almost double by the year 2030.[2,3] The World Health Organization–International Society of Hypertension (WHO/ISH) defined hypertension as a systolic blood pressure equal to or above 140 mm Hg and/or diastolic blood pressure equal to or above 90 mm Hg. The normal adult blood pressure is a systolic blood pressure of 120 mm Hg and a diastolic blood pressure of 80 mmHg.[4] However, the cardiovascular and overall health benefits of normal blood pressure extend to lower systolic (105 mm Hg) and lower diastolic blood pressure values (60 mm Hg). Normal blood pressures are vital for the effective function of the heart, brain, kidneys and the general health. Hypertension contributes significantly to the burden of non-communicable diseases such as stroke, heart diseases and chronic kidney disease. The number of individuals with hypertension has been estimated to double between year 2000 and 2030, and the increase was predicted to be highest in SSA.[5] Studies have shown that reduction in blood pressure significantly reduced the risk commonly associated cardiovascular disease.[6] Therefore, designing strategies for prevention and control of hypertension in SSA may be a cost-effective approach to reducing the rising burden and economic impact of cardiovascular disease in the region.

Available data on hypertension in Nigeria shows increasing trend but there is no recent nationally representative data on the burden of hypertension in Nigeria, thereby impairing generalized national prevention and intervention programmes.

In this study, we estimated the current prevalence of hypertension in eight communities in north-central zone of Nigeria thereby providing data for integration to national database on hypertension and for state intervention measures. It revealed demographic structures of people with hypertension in the state which may be extrapolated to the north-central region of Nigeria. Furthermore, it may help in future planning.

MATERIALS AND METHODS

Study Design and setting:

This was a cross-sectional study which was carried out in eight communities in seven of the sixteen local governments areas (LGAs) in the state which are; Adewole in Ilorin West LGA, Oke-Oyi in Ilorin East LGA, Pake in Ilorin South LGA, Afon in Asa LGA, OmuAran in Irepodun LGA, Offa in Oyun LGA, Shao in Moro LGA, and Jebba in Moro LGA.

Study population

We recruited 1612 adults aged≥18years who consented to participate in the study. We excluded individuals who refused consent to participate in the study, and pregnant women.

Study procedure

We carried out during the chronic kidney disease awareness and screening activities of the world kidney days programmes (2006, 2009-2014 and 2016) using same protocols. The investigators were members of the Ilorin Renal Study Group (IRSG) which comprises nephrologists (adults and paediatrics), urologists, chemical pathologists, renal histopathologists, hematologists, resident doctors in renal medicine, and renal nurses. They were jointly trained on the protocol for data acquisition. Written consents were obtained from each local government, and verbal consent from each participant and host communities. Theprogramme was funded by the IRSG, University of Ilorin Teaching Hospital., and the local governments. Persons who voluntarily consented to the study were recruited.

We used questionnaire to obtain demographic characteristics and medical history from the participants. The blood pressure was measured using mercury sphygmomanometer with standard cuff (25cmx12cm), on the right arm participants after 5 minute rest in sitting position. We obtained

two measurements and recoded the average. Hypertension was defined based on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC VII). We measured weight with a Seca weighing scale that was placed on a flat, and hard surface and the participants wearing light clothing. We also measured the height by a stadiometer with the participants in erect position without wearing shoes. The body mass index (BMI) was calculated by weight (kg)/height (m^2). We measured waist circumference (WC) at the midpoint between the lower margin of the lowest rib and the top of the iliac crest, with a non-elastic graduated tape, and the hip circumference (HC)at the widest portion of the buttocks. Waist-hip ratio (WHR) was derived by WC (cm) / HC (cm).

Laboratory and Kidney Lengths Evaluation

Blood samples for measurements of random blood sugar and packed cell volume were collected in fluoride oxalate and heparinized bottles respectively and analyzed at the Chemical Pathology Laboratory (for blood sugar), and Hematology Laboratory (for packed cell volume) of University of Ilorin Teaching Hospital. The samples were preserved in ice-packed container between the collection and analysis which were done the same day. The sonologist measured the lengths of both kidneys using a portable ultrasound machine as part of the screening programme formulated by the Ilorin renal study group.

Data Management

The Data obtained were analyzed by Statistical Package for Social Services (SPSS) version 20.0 (SPSS Inc. Chicago, Illinois) and MedCalc software, Ostend Belgium. Mean and standard deviations were computed for numerical variables which are normally-distributed, while median with interquartile ranges were used for continuous variables that are not normally distributed. Categorical variables were summarized by proportions and percentages. Student t-test was used to compare means of numerical variables. The relationship between hypertension and anthropometric indices was determined by spearman correlation and logistic regression methods. A p value of <0.05 was taken as significant.

Ethical considerations

Verbal consent were obtained from the community head and each participant after detailed explanation of the programme, and the procedures involved were delivered in both Yoruba and English languages. Participation was voluntary and participants were free to decline recruitment or withdrawal from further evaluation after commencement without suffering any loss of benefits. A strict confidentiality of each participant was maintained, no name was recorded on the questionnaire, however a study identification number was assigned to each participant to identify those who may require further interventions without breaching confidentiality. The data were kept in a securedcomputer, that is accessible only to the principal investigator.

RESULTS

Baseline characteristics of the study population

Table 1 shows the baseline characteristics of the 1506 participants whose data were analyzed out of the 1612 recruited for the study. There was female preponderance (55%) with male to female ratio of 1:1.2. The mean age was 44 ± 14years, and majority (47.4%) were middle-aged, between 41years and 60years. The mean systolic blood pressure and mean diastolic blood pressure were 128± 24mmHg and 80 ± 14mmHg respectively. The mean body mass index was 26.05 ±5.78Kg/$M^2$and the mean waist hip ratio was 1.00 ± 0.32. The mean blood sugar and packed cell volume were 5.8 ± 1.5mmol/L and 39.0 ± 4.0 %, and the average length of both kidneys was 92.86±8.7cm.

The Prevalence and pattern of hypertension in the study population

Table 2 shows the prevalence and pattern of hypertension and its distribution according to gender. The overall prevalence of hypertension

defined as systolic blood pressure of >/= 140mmHg, and/or diastolic blood pressure of >/= 90mmHg was 30%, with similar prevalence in males (30.2%) and females (29.8%). The prevalence of isolated systolic hypertension was 8.6%, 9% in males and 8.2% in females. Twenty-one percent (21%) of the population have both systolic blood pressure of >/= 140mmHg and diastolic blood pressure of >/= 90mmHg combined.

Clinical and laboratory characteristics of participants with and without hypertension

The comparison of the clinical and laboratory characteristics of persons with and without hypertension are shown in figure 3. Those with hypertension are much older (51.6±12years versus 42±13years, P = 0.001), and they have higher body mass index (27.99±6.21Kg/M^2 versus 25.29±5.42Kg/M^2, P = 0.001), waist-hip ratio (1.02±0.38 versus 0.95±0.10, P = 0.001), left renal length (94.0±9.1cm versus 92.1±9.2cm, P = 0.015).

Age and gender distribution of hypertension in the study population

Table 4 shows the distribution of the prevalence of hypertension according the age groups and gender. The pattern shows a progressive increase as age increases from 14.4% in age 18-40years to 50.3% in those at 61year and above. This pattern is similar in men and women.

Prevalence of hypertension according to the categories of Body Mass Index

Table 5 depicts the prevalence of hypertension according the division of body mass index.

Those who are underweight (< 18.5Kg/m^2) had a prevalence of 15.9%, and this increased progressively to 54.9% in those with BMI of 35.0 - 39.9 Kg/m^2. Thirteen (13) individuals out of nineteen (19) who were morbidly obese (>/= 40Kg/m^2) were hypertensive with a prevalence of 68.4%. The trends were similar in men and women.

Correlation of anthropometric indices and other variables with hypertension in the study population

The correlations of anthropometric indices and other variables with high blood pressure are shown in table 6. Age had the strongest correlation (r = 0.416, P = 0.001), followed by body mass index (r = 0.301, P = 0.001), waist-hip ratio (r = 0.225, P = 0.005), and hip circumference (r=0.219, P =0.001). Other variables showed weak correlations with hypertension.

Predictors of hypertension in the study population

The identified predictors of hypertension are shown in table 7. Waist circumference had about 17% increased risk for hypertension (OR = 1.169, CI = 1.021 – 1.340, P = 0.024), body mass index, 11% (OR = 1.113, CI = 1.059 – 1.170, P = 0.001), and age 5% (OR = 1.052, CI = 1.034 – 1.070, P = 0.001).

Table1 |Baseline characteristics of the patients (n = 1506). Characteristics are presented as mean ±SD, and number (%)

Characteristics	mean ±SD, and number (%)
Gender (Male/Female), n(%)	678/828 (45/55)
Age (years)	44 ± 14
18-40	611 (40.6%)
41-50	410(27.2%)
51-60	304(20.2%)
>61	181(12%)
Systolic Blood pressure (mmHg)	128± 24
Diastolic Blood Pressure (mmHg)	80 ± 14
Weight Circumference (m)	77.22 ±37.23
Hip Circumference (m)	78.81 ± 37.53
Weight Hip Ratio	1.00 ± 0.32
Body Mass Index (Kg/M^2)	26.05 ±5.78
Right kidney length (m)	93.02 ± 8.03
Left kidney length (m)	92.70 ± 9.30
Blood sugar (mmol/L)	5.8 ± 1.5
Pack cell volume (%)	39.0 ± 4.0

Table 2| Prevalence and pattern of hypertension according to gender in the study population (number (%))

Blood pressure groups (mmHg)	Total	Male	Female
SBP >/= 140	452 (30.0)	205 (30.2)	247 (29.8)
DBP >/= 90	416 (27.6)	188 (27.7)	228 (27.5)
SBP >/= 140 & DBP >/= 90	323 (21.4)	144 (21.2)	179 (21.6)
SBP >/= 140 & DBP < 90	129 (8.6)	61 (9.0)	68 (8.2)
SBP < 140 & DBP >/= 90	93 (6.2)	44 (6.5)	49 (6.0)

SBP; Systolic blood pressure, DBP; Diastolic blood pressure

Table 3| Comparison of the mean of the clinical and laboratory characteristics of participants with and without hypertension

Characteristics	Persons with hypertension n = 452	Persons without hypertension n = 1054	P value
Age (years)	51.6±12	42±13	0.001
Body mass index (Kg/m^2)	27.99±6.21	25.29±5.42	0.001
Waist-Hip ratio	1.02±0.38	0.95±0.10	0.001
Waist Circumference (cm)	77.21±40	77.08±36	0.957
Hip Circumference (cm)	81.17 ±41.79	77.56±35.47	0.179
Fasting blood sugar (mmol/L)	6.0±2.0	5.7±2.2	0.231
Packed cell volume (%)	39.2±3.8	39.1±4.0	0.703
Right kidney (cm)	93.7±8.3	92.8±7.7	0.167
Left kidney (cm)	94.0±9.1	92.1±9.2	0.015

Table 4: Age and gender distributions of hypertension in the study population (number (%)

Age (years)	Total	Male	Female
18-40	88/611(14.4)	34/244(13.9)	54/361(14.9)
41-50	136/410(33.2)	56/188(29.8)	80/222 (36)
51-60	137/304 (45)	61/134(45.5)	76/170 (44.7)
>61	91/181(50.3)	53/105(50.5)	38/76(50)

Table 5| Distributions of hypertension according to BMI categories in the study population (number (%))

BMI categories (Kg/m^2)	Total	Male	Female
< 18.5	**7/44 (15.9)**	**4/24 (16.7)**	**3/20 (15)**
18.5 – 24.9	**111/493 (22.5)**	**70/259 (27)**	**41/234 (17.5)**
25.0 – 29.9	**89/306 (29.1)**	**46/132 (34.8)**	**43/173 (24.9)**
30.0 – 34.9	**65/161 (40.4)**	**21/39 (53.8)**	**44/122 (36.1)**
35.0 - 39.9	**28/51 (54.9)**	**3/8 (37.5)**	**25/43 (58.1)**
>/= 40	**13/19 (68.4)**	**1/1 (100)**	**12/18 (66.7)**

BMI; body mass index

Table 6| Correlation of anthropometric indices and other variables with blood pressure in the study population

Variables	correlation coefficient ®	P value
Age (years)	0.416	0.001
Waist circumference (cm)	0.063	0.045
Hip circumference (cm)	0. 219	0.001
Body mass index (Kg/M^2)	0. 301	0.001
Waist-hip ratio	0.225	0.005
Right kidney (cm)	0.108	0.006
Left Kidney (cm)	0.162	0.001

Table 7| Binary Logistic regression showing predictors of hypertension in the study Population

Predictors	Odd Ratio (OR)	Confidence Interval (CI)	P value
Waist Circumference (cm)	1.169	1.021 – 1.340	0.024
Body mass index	1.113	1.059 – 1.170	0.001
Age (years)	1.052	1.034 – 1.070	0.001

DISCUSSION

The study reports the result of a cross-sectional study of one thousand, five hundred and six urban dwellers in eight communities spread across seven out of the sixteen local government areas in Kwara State in the North-Central zone of the country. The mean age of 44 ± 14years of the participants is similar to 43.9 (42.8 – 45) years reported in Enugu in South Eastern part of the country.[7] Both studies evaluated the general populations of urban dwellers using cross-sectional design. The mean age in this study is however significantly lower than the 61 ± 18.2years documented in a study carried out in a semi-urban populations in Ekiti State in the South western Nigeria[8]. The reason for this wide difference require further study since both studies were population based although semi-urban dwellers instead of urban residents were studied by Olamoyegun et al.[8] However, the populations were randomly selected which largely reduced the possibility of a bias in the recruitment of the participants. The significantly higher mean age of the Ekiti study may suggest improved survival which requires further studies. In our study, females constitute 55% of the participants. Generally, women are known to have positive health seeking habits and respond to health screening better than men. Much higher figures were documented in both studies by Ezeala-Adikaibe et al (64.7%)[7] and Olamoyegun et al (73%)[8]. Furthermore, the mean body mass index of 26.05 ±5.78Kg/m2 found in this study is similar to that of the women (26.6 (25.7–26.7) kg/m^2) but higher than the men (23.7 (23.2–24.2) kg/m^2) in the study in South East.

The overall prevalence of hypertension defined as systolic blood pressure of >/= 140mmHg, and/or diastolic blood pressure of >/= 90mmHg was 30%, with comparable prevalence in males (30.2%) and females (29.8%). The figure is comparable to the prevalence of 30.6% in urban population reported by Adeloye et al[9], and is also comparable to 29.5% reported in men and 25% in women. The figure is also similar to 31% (33.5% in men and 30.5% in women) reported by Ogah et al[10], in Abia state in South Eastern Nigeria. The prevalence is however

significantly higher than 19.3% (17-21.3%) reported from similar studies in rural populations in Kwara State.[11] The prevalence is lower than 44.9% (95% CI: 43.5–46.3%) reported by Murthy et al in a another survey[12], this remarkable difference may be due to the difference in the age of the participants. While we recruited adults 18years and above (mean age of 44 ± 14years), Murthy et al.[12], recruited individuals above 40 years (mean age of 59.9± 12years). Also, the prevalence is much higher in the semi-urban study by Olamoyegun et al[8], who reported 55%. This again might be due to the much higher (older) mean age of the participants compared with the younger age of participants in our study. Age has been a consistent risk factor for hypertension and the prevalence increases in response to increased age. Physiological changes associated with old age and the consequent hemodynamic alterations such as arterial stiffness, loss of vascular elasticity and arteriolosclerosis explain the generally recognized high blood pressure in older age groups. The prevalence of hypertension in the urban slum residents in Enugu, was 52.5%; 55.4% in males and 50.8% in females, although both studies were similar in terms of the study area (urban) and the age of the participants. The role of lifestyles, ethnicity and genetics may contribute to this significant difference in the hypertension prevalence between the two regions. A National data is urgently required to properly characterize hypertension and to estimate its burden in Nigeria which would facilitate the development of strategies for its control in Nigeria population. We found the prevalence of combined systolic and diastolic hypertension to be 21.4%, isolated systolic hypertension 5.6%, and isolated diastolic hypertension, 6.2%; the corresponding figures in the study by Olamoyegun et al were 47.6%, 43.65, and 8.9%[8]. Isolated systolic hypertension is more common in older age.

There is a progressive increase in the prevalence of hypertension as age increases which again reiterates a well-known fact. The prevalence in participants younger than 40 years is 14.4% and 45% in those older than 50years which is similar to the findings reported in other studies by Olamoyegun et al,[8] and Ezeala-Adikaibe et al [7]. The prevalence and trends are similar in men and women.

In this study, we found an increase in the prevalence of hypertension as body mass index (BMI) increases. At BMI of < 18.5Kg/m^2, the prevalence was 15.9%, and about 55% in those with BMI 35 Kg/m^2 and above. The trend shows that men has higher prevalence of hypertension than women in each group of BMI except those in 35.0 - 39.9Kg/m^2 but the number of individuals in this group is small to make a reasonable deductions.Further analysis shows that BMI has significant correlation with high blood pressure (r = 0.301, P = 0.001). Several studies in different populations that reported an association of hypertension with increased BMI include, Roka et al, 2015 (United States) [13],, Wang et al, 2010 (China), [14], Verma et al, 2013 (India) [15], Nagai et al, 2015 (Japan) [16], Tesfaye et al, 2007 (Asia and Africa) [17], Cappuccino et al, 2008 (Africa including Nigeria and Africa in Diaspora) [18], Hendriks et al, 2012 (Sub-Saharan Africa including Nigeria)[11], Ezeala-Adikaibe al, 2016 (Nigeria)[7]among others. Other anthropometric indices also have significant correlations with high blood pressure; waist-hip ratio (r = 0.225, P = 0.005), Hip circumference (r = 0.219, P = 0.001), and waist circumference (r = 0.063, P = 0.045). Many studies in Nigeria have equally documented a positive association between these anthropometric indices and hypertension. [19-21]

Binary logistic regression methods revealed that the predictors of hypertension were; waist circumference (17% increased risk), body mass index, 11%, and age 5%. The findings reemphasize significant contributions of increase in weight and metabolic changes to the development and or perpetuation of hypertension. [19-20] The reduced risk for age compared with BMI and waist circumference requires further studies.

The strength of this study is the coverage and the sample size. We studied 1506 individuals in eight

communities in eight different local government areas in Kwara State over a 7-year period. This is one of the largest study of hypertension in the North-Central Zone of the country. The limitation of the study is that the study was done as screening programme during the world kidney days, with voluntary participation of the individuals. A better sampling techniques such as systematic random sampling would have provided a more generalizable results.

CONCLUSION

The prevalence of hypertension is high in urban population of Kwara State, Nigeria and is significantly higher than the prevalence in the rural populations. The prevalence is high in similar proportions in men and women but it increases with age, high body mass index and waist circumference.

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Author contributions

TOO, AA, and AP conceptualize d and designed the study. TOO, AA, AP, MOB, OTA, SAK, SAB, AC, AAJ, SAD and OO contributed to implementation of the project. TOO analyzed the data. All authors were involved in the writing and revision of the manuscript. The authors read, approved the final manuscript and agree to be accountable for all aspects of the work.

Data availability

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

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Conflict of interest:

The authors declare no conflict of interest in the conduct and publication of this work.

Ethical approval:

The study was approved by the Institutional Ethics Committee

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