PREVALENCE AND PREDICTORS OF HYPERTENSION AMONG URBAN COMMUNITIES IN KWARA STATE

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DEDICATION

This work is dedicated to God Almighty and to my entire Family (My lovely wife, Beatrice Yetunde, and our images; Diekololuwa, Durotoluwa, and Dunsinloluwa), for your constant prayers and patience during the programme.

CERTIFICATION

I certify that this work titled "Prevalence and Anthropometric Risk Factors for Hypertension among Urban dwellers in Kwara State" was carried out by **Dr. Olanrewaju Timothy Olusegun** in the Department of Epidemiology and Medical Statistics, University of Ibadan under my supervision.

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ABSTRACT

Hypertension is a growing public health concern with a rising prevalence and associated clinical outcomes particularly in sub-Saharan Africa. National data on the burden of hypertension in Nigeria is insufficient but available data shows an increasing trend. Determination of the current prevalence of hypertension and its predictors is essential for planning a preventive and therapeutic strategies that would enhance reduction in its overall burden in the general population.

This is a cross-sectional study of adults in eight urban communities in Kwara state between 2006 and 2016. The data was collected using a semi-structured validated interviewer-administered questionnaire. The blood pressure and the anthropometric parameters (body mass index (BMI), waist circumference and hip circumference, and waist-hip ratio), blood sugar and kidney lengths were measured by standard methods. Hypertension is defined as a blood pressure (BP) ≥ 140/90mmHg, taken after 10minutes rest and an average of two measurements recorded 5minutes apart. The data was analyzed by SPSS version 20. The prevalence of hypertension was expressed in percentages. Significant differences between the means were determined by student t-test. The association between hypertension and measured variables were evaluated by spearman correlation, while the predictors were determined by binary logistic regression. The significant level was taken as p value < 0.05.

One thousand five-hundred and six (1506) adults were analyzed out of 1612 participants that participated in the study. The mean of the age was 44 ± 14years, and there was 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 predictors of hypertension were: waist circumference (OR = 1.169, CI = 1.021 – 1.340, P = 0.024), body mass index, (OR = 1.113, CI = 1.059 – 1.170, P = 0.001), and age (OR = 1.052, CI = 1.034 – 1.070, P = 0.001).

In conclusion, the prevalence of hypertension is high in urban population of Kwara State, with similar proportions in men and women but the prevalence increases with age, high body mass index and waist circumference.

Key words: hypertension, high blood pressure, prevalence, urban, Nigeria

Word Count: 379

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CHAPTER ONE

INTRODUCTION

1.1 Background

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 in 2010 (Lim et al, 2012), a major risk factors for premature death, and a main contributor to the rising burden of cardiovascular disease in sub-Saharan Africa, which is projected to double by the year 2030 (Kengne et al, 2012 & Ibrahim et al, 2012). The World Health Organization–International Society of Hypertension (WHO/ISH) defined hypertension as a systolic blood pressure equal to or above 140mmHg and/or diastolic blood pressure equal to or above 90mmHg. The normal adult blood pressure is a systolic blood pressure of 120mmHg and a diastolic blood pressure of 80mmHg (WHO 1999). However, the cardiovascular and overall health benefits of normal blood pressure extend to lower systolic (105mmHg) and lower diastolic (60mmHg) blood pressure values.. 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 (Kearney et al, 2005). 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. Studies have shown that reduction in blood pressure significantly reduced the risk of the commonly associated cardiovascular disease (Lawes et al, 2004).

1.2 Problem Statement

The burden of hypertension is huge worldwide. The global trend of hypertension over four decades showed that the number of adults with hypertension has significantly increased from 594 million in 1975 to 1·13billion in 2015, and the increase occurred largely in the low-income and middle-income countries (NCD Risk Factor Collaboration, 2016). The global age-standardized prevalence of hypertension in 2015 was 24·1% (21·4–27·1) in men and 20·1% (17·8–22·5) in women (NCD Risk Factor Collaboration, 2016). Globally, the number of individuals with hypertension has been projected to increase from 800million in 2000 to 1.5billion by 2030, and by 2025, almost three-quarters of people with hypertension will be living in developing countries (Kearney et al, 2005). In 2010, hypertension accounted for 9.4million deaths and 7% of global disability-adjusted life-years [DALYs] (Lim et al, 2012) thereby rising from the 4th leading risk factor for the global burden of disease in 1990, to number 1 risk factor in 2010 (Bromfield and Muntner, 2013). Data on the prevalence of hypertension in Africa generally and particularly in SSA are sparse (Ezzati et al, 2002 and O'Donnell et al, 2010). A systematic review of available data in the region showed that the age-standardized prevalence of hypertension in Africa increased from 19.1% in 1990 to 30.8% in 2010 (Adeloye and Basquill, 2014). A cross-sectional study in four countries in SSA in 2012 reported an age-standardized prevalence of 25.9% (Guwatudde et al, 2015). In Nigeria the pooled prevalence of hypertension increased from 8.6% from the only study during the period of 1970-1979 to 22.5% in the period of 2000-2011 (Oga et al, 2012). A recent systematic review and meta-analysis estimated the overall prevalence to be 28.9%; 29.5% in men and 25% in women (Adeloye and Basquill, 2015). A more recent semi-urban study in south west Nigeria reported a prevalence of 55%% (Olamoyegun et al 2016). Furthermore, the mortality associated with hypertension in Nigeria is high (Kaufman et al, 1996). These data revealed that the prevalence of hypertension in Nigeria is a rapidly growing trend with associated significant mortality and morbidity that requires reappraisal for planning, policy development, and design of preventive and control strategies.

1.3 Justification

Hypertension has a grave impact on the family, the community, and nation at large. The trend and recent data on hypertension in Nigeria shows increasing prevalence which require adequate estimate for clinical and public health policy, and development of a framework for its control. Hypertension continues to afflict large proportion of Nigeria population and it is the leading cause of cardiovascular disease, stroke and chronic kidney disease. There is no recent national representative data on the burden of hypertension in Nigeria, A recent nationally representative data showed that the prevalence of hypertension has significantly increased (Murthy et al, 2013) which suggest the need for an effective planning of national prevention and intervention programmes. This study will estimate 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 will illuminate demographic structures of hypertension in the state which may be extrapolated to the north-central region of Nigeria. Furthermore, it may elucidate the trend of hypertension which may help in future planning.

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1.4 General Objective

To estimate the prevalence and predictors of hypertension in eight urban communities in Kwara State.

1.5 Specific Objectives

1. To determine the prevalence of hypertension in urban populations in Kwara State

2. To describe the demographic and anthropometric characteristics of patients with hypertension in urban populations in Kwara State

3. To determine the predictors hypertension among the study population

1.6 Study Hypotheses

1. Null hypothesis: There is no identifiable predictors of hypertension among urban populations in Kwara State

2. Alternate hypothesis: Specific demographic and clinical variables predict hypertension among urban populations of Kwara State

CHAPTER TWO

LITERATURE REVIEW

2.0 The Global Prevalence and Burden of Hypertension

Hypertension is a growing public health issue globally, but the impact is more in developing countries and blacks are more prone to its complications (Chobanian et al, 2003 and Rotimi, 1997). Recent data shows that the brunt of the burden has shifted from high-income countries to low- and middle-income countries. Although the global trend in hypertension prevalence in the last four decades shows a decrease, the number of patients has increased remarkably. In a recent pooled analysis of 1479 population-based studies with 19·1 million participants in 2015, the estimated global age-standardized prevalence of hypertension was 24·1% (21·4–27·1) in men and 20·1% (17·8–22·5) in women (NCD Risk Factor Collaboration (NCD-RisC), 2016). While the prevalence had decreased in high income countries, it has remained persistently high in eastern and central Europe, and substantially increased in South Asia and sub-Saharan Africa. The number of adults with hypertension increased from 594 million in 1975 to 1·13 billion in 2015, and the increase occurred largely in low-income and middle-income countries. The increase in the number of persons with hypertension was due to population growth and ageing, while decrease in the prevalence was due to declining age-specific prevalence. The number has further been projected to grow to 1.5billion in 2030, and by 2025, almost three-quarters of people with hypertension will be living in developing countries (Kearney et al, 2005).

The prevalence data of a hypertension are essential for understanding the magnitude of the disease, recognizing individuals who are at risk of associated clinical events, formulating clinical and public health policy for intervention, and for evaluating the effects of the intervention measures (Steyn K, et al, 2005). Hypertension is still a huge burden worldwide. In 2010, it accounted for 9.4million deaths and 7% of global disability-adjusted life-years

[DALYs] (Lim et al, 2012), thereby rising from being the 4th leading risk factor for the global burden of disease in 1990, to number 1 risk factor in 2010 (Bromfield and Muntner, 2013)

2.1. The Prevalence and Burden of hypertension in Africa

Data from Africa and SSA are grossly sparse but accessible studies reported an increasing prevalence which contributes to the increasing cardiovascular disease and other related non-communicable diseases. A systematic review of available data in the region showed that the overall pooled prevalence of hypertension in Africa was 19.7% in 1990, 27.4% in 2000 and 30.8% in 2010; the pooled awareness rate was 16.9%, 29.2% and 33.7% respectively (Adeloye and Basquill, 2015). In the study, over 54.6million people with hypertension were estimated in 1990, 92.3million in 2000, 130.2million in 2010, and a projected increase to 216.8million by 2030; with age-adjusted prevalence of 19.1% (C; 13.9-25.5), 24.3% (CI; 23.3-31.6), 25.9% (CI; 23.5-34.0), and 25.3% (24.3-39.7), respectively. A cross-sectional study of four rural and urban communities in SSA involving 7,568 adults reported the age-standardized prevalence of hypertension of 19.3% (95%CI: 17.3-21.3) in rural Nigeria, 21.4% (19.8-23.0) in rural Kenya, 23.7% (21.3-26.2) in urban Tanzania, and 38.0% (35.9-40.1) in urban Namibia (Hendriks et al, 2012). The control of hypertension in the study ranged from 2.6% in Kenya to 17.8% in Namibia. In another recent cross-sectional study in four countries in SSA, the overall age-standardized prevalence of hypertension among the 1216 participants was 25.9% (Guwatudde et al, 2015). The prevalence was highest among nurses (25.8%), followed by school Teachers (23.2%), peri-urban residents (20.5%) and lowest among rural dwellers (8.7%). Only 50.0 % were aware of their hypertension. The overall age-standardized prevalence of pre-hypertension was 21.0 %, and the factors found to be associated with hypertension were: population growth, older age, higher body mass index, higher fasting plasma glucose level, lower level of education, and tobacco use. The burden of hypertension in Africa and particularly in SSA is heightened by the number of undiagnosed, untreated and controlled individuals. A recent systematic review and met-analysis of 10 414 participants (Ataklte et al, 2015) found that the prevalence of hypertension at mean ages of 30, 40, 50, and 60 years were 16%, 26%, 35%, and 44%, respectively, with a pooled prevalence of 30% (95% CI, 27%–34%). Between 7% and 56% (pooled prevalence: 27%; 95% CI, 23%-31%) were aware of their hypertension, 18% (95% CI, 14%–22%) of those with hypertension were receiving treatment and only 7% (95% CI, 5%-8%) had controlled blood pressure.

2.2. The Prevalence and Burden hypertension in Nigeria

The prevalence of hypertension is persistently rising in Nigeria, and is the leading risk factor for stroke, heart failure, ischemic heart disease and chronic kidney disease (Oga et al, 2006). The national survey of non-communicable disease two decades ago reported hypertension in 4.33million Nigerians aged 15years and above which corresponds to 9.3% of the population based on systolic blood pressure of 160mmHg and diastolic of 90mmHg(National Expert Committee on Non-Communicable Disease, 1997 and Akinkugbe, 2002). The prevalence was slightly higher in the urban than the rural populations. When the WHO-ISH definition of 1999 was applied the prevalence was estimated to be 17-20% (WHO Guidelines Subcommittee, 1999 and Kadiri et al, 1999).

Emerging data however revealed that the prevalence hasincreasedremarkably. In a retrospective review of published data on hypertension over five decades (1950-2011) in Nigeria, The overall prevalence of hypertension in Nigeria was 8%-46.4% depending on the target population and the defining figures for hypertension. The prevalence was similar in men and women (7.9%-50.2% versus 3.5%-68.8%, respectively) and in the urban (8.1%-42.0%) and rural settings (13.5%-46.4%). The pooled prevalence increased from 8.6% from the single study during the period from 1970-1979 to 22.5% (2000-2011). The awareness, treatment and control rates of hypertension were reported to be generally low and this was associated with high burden of hypertension related clinical outcomes(Oga et al, 2012). A recent systematic review and meta-analysis of hypertension in Nigeria by Adeloye et al reported the overall prevalence of 28.9% with 29.5% in men, and 25% in women (Adeloye et al, 2015); the prevalence in urban and rural dwellers were 30.6% and 26.4% respectively, and the number of people with hypertension was projected to increase from 20.8million in 2010 to 39.1million in 2030. In a recent nationally representative data of 13504 Nigerians aged 40years and above, the prevalence of hypertension was 44.9% [95% CI: 43.5–46.3%], and the independent risk factors identified were increasing age, gender, urban residence and body mass index (Murthy et al, 2013). In the rural and urban populations of Abia State in the south-East zone of Nigeria, the prevalence of systolic hypertension was 31% (33.5% in men and 30.5% in women), and diastolic hypertension was 22.5% (23.4% in men and 25.4% in women) (Oga et al, 2013).

The prevalence of hypertension in Nigeria is increasing at alarming rate. A more recent semi-urban study in south west Nigeria reported a much higher prevalence of 55%% (Olamoyegun, 2016). In this study of seven hundred and fifty participants,the mean age wassignificantly high (61.7 ± 18.2 years). The prevalence of hypertension was 55.5%. Stage 2 hypertension was commoner (54.1%) than stage 1 hypertension (45.9%). Those with both systolic and diastolic hypertension was 47.6%, while isolated systolic hypertension and isolated diastolic hypertension were 43.6% and 8.9%, respectively. In another recent study of urban slum residents in Enugu, South-eastern Nigeria, the prevalence of hypertension was 52.5% (95% CI: 48.9–56.0); 55.4% (95% CI: 49.5–61.3) in males and 50.8% (95% CI: 46.4–55.1) in females (P=0.23). (Ezeala-Adikaibe et al, 2016). Hypertension increased with age and peaked at 45–54 years in females, and ≥55 years in males. Approximately 40.1% were aware of their hypertension and 28.8% of those that are aware had normal blood pressure. In regression analysis, systolic blood pressure (R^2 =0.192) and diastolic blood pressure (R^2 =0.129) increased with age and body mass index. With increasing prevalence of hypertension in Nigeria, the mortality associated with it is high (Kaufman et al, 1996). These figures shows that the prevalence of hypertension is rapidly rising in Nigeria and is associated significant mortality and morbidity, which demands a strategic policy on prevention and control in order to reduce the clinical outcomes.

2.3 The Risk factors for hypertension

Some specific risk factors for hypertension have been described extensively while others still being evaluated. The identified risk factors suggest why some people are at increased risk of developing hypertension compared with others. Generally, these risk factors may be non-modifiable (age, genetics, family history, ethnicity, black race, low birth weight)or modifiable (overweight and obesity, excess abdominal fat, excess salt intake, low potassium intake, unhealthy diet, sedentary occupation, reduced physical activity, psychological stress, urban living, smoking), and may be related to other bio-social factors (such as hypertriglyceridemia, hyperuricaemia, high gross national product per head, increased arterial stiffness, systemic proinflammatory state, undernutrition in childhood, sleep deprivation, and drugs such non-steroidal anti-inflammatory drugs) which are largely modifiable (Ibrahim et al, 2012). The mostly recognized clusters of risk factors are genetics, environmental influence, racial differences, behavioural changes or a consequence of disease condition. The influence of environmental and lifestyle factors appears to be stronger than genetically determined differences in the prevalence of hypertension across ethnic groups and races. For example, high blood pressure is more common in Africans than Caucasians (Harding et al, 2006). In addition, the differences in the prevalence of hypertension between the populations of Africans and European descent was found to be significantly reduced when corrected for socio-economic status (Agyemang et al, 2009), which shows a robust interaction between environmental and genetic factors or a stronger influence of environment than genetics on the occurrence of hypertension. Few of the important risk factors are described below.

2.3.1 Genetics, race, and environmental factors

The genetic contribution to hypertension is still being actively studied. Genetic factors appear to play an important part in salt sensitivity which is common in black individuals. Many single gene mutations facilitates salt retention through a deficiency in the handling of sodium by the kidneys (Sanders, 2009), but those linked with blood pressure are yet to be determined. The role of genetics is enhanced by the occurrence of other factors such as obesity or increase in weight, high salt intake, psychosocial stress, excess alcohol consumption and other lifestyle changes (Saunders, 1991). Black skin colour is another factor recognized to be associated with high blood pressure in some people, Burt and his colleagues had reported that the prevalence of high blood pressure is two times greater in black people than in white people (Burt et al, 1995). However, in another study, a non-linear relation between skin pigmentation and blood pressure was documented in Egyptian women (Mosley et al, 2000). Furthermore, a much earlier study had reported no association between skin colour and the incidence of hypertension after controlling for environmental factors such as education and other indices of social class. (Keil et al, 1981). Skin colour is related to environmental elements that influence the occurrence and effects of blood pressure, such as education, poverty, access to healthcare, body mass, and sodium and potassium excretion (Williams, 1992) .

2.3.2 Excess salt intake

There is a strong evidence linking salt intake to the incidence of hypertension, and these evidences are greater than those for other lifestyle risk factors (He et al, 2009). Many studies have confirmed that emigration from societies that consume low-salt to those that consume high salt diets is associated with an increase in blood pressure (He et al, 1991 and Poulter et al, 1990). Salt consumption varies widely worldwide and it's measured by urinary excretion of sodium. A study by Brown and colleagues (Brown et al, 2009) on urinary sodium excretion rate in many countries revealed that the lowest mean urinary sodium excretion rates were reported in Ghana and in rural and urban Cameroon; while the highest excretion rates were in north China. Daily salt intake was as high as 18 g per person in Turkey (Erdem et al, 2010), and 8·5 g per person in an urban Indian dwellers; and these was associated with the risk of hypertension (Radhika et al, 2007). Many factors such as genetics, age, body mass, related diseases, and ethnicity influence the response of blood pressure to sodium intake (Sanders, 2009). The sources of diets that contains sodium differ in developing countries compared with the developed countries. 65. Salt added to meal while cooking and those in sauces and seasonings are the main sources of sodium in the die of Africans and Asian populations, while in North America and Europe, majority of salt intake is from processed and restaurant foods. Bread is an important source of sodium in diets and is consumed widely. The control of salt intake can be feasible if targeted at an industrial production companies but this might be difficult in Africa because majority of bread are produced by many small private companies which make the control measures difficult to execute.

2.3.3 Obesity

In both developed and developing countries, studies have shown that there is a consistent and strong association between blood pressure, body mass index and abdominal adiposity (Forman et al, 2009). In the Nurses' Health Study II (Doll et al, 2002), body mass index was the dominant predictor of hypertension. Studies in china women reported that the risk of incident hypertension was associated with body mass index, salt intake, low physical activities and advanced age (Sun et al, 2010). The increase in obesity will contribute significantly to the rising number of individuals with hypertension worldwide if control measures are not instituted.

2.3.4 Effect of Urbanization

Migration from rural to urban is associated with changes in social status, and lifestyles such as consumption of processed foods that contains high salts, and fats. The changes in diet contribute to increase in bodyweight and obesity, which is an independent risk factor for hypertension. Thus urbanization is associated with increase in blood pressure and prevalence of hypertension (Poulter et al, and BeLue et al, 2009). Studies in Cameroon, reported that urbanization is associated with high body mass index, fasting blood sugar, and blood pressure (Sobngwi et al, 2004). South African urban dwellers are more hypertensive that their rural counterpart (Steyn et al, 2008). Furthermore, BeLue et al also showed that body mass index which is a strong determinant of hypertension is associated with urbanization (BeLue et al, 2009).

2.4. The relationship between Anthropometric indices and hypertension

Several studies in developed and developing countries have reported the association of the indices of anthropometric measurements and incidence or prevalence of hypertension. In the United States, Data from the National Health and Nutrition Examination Survey (2009-2010 NHANES) reported that body mass index and waist circumference were significant predictors of hypertension in the overall population, and that gender-specific models showed that body mass index played an important role in the risk of hypertension among males, but waist circumference in females (Roka et al, 2015). In a Chinese study of 169,871 men and women aged 40years and above, progressive increase in body mass index increased the effects of systolic or diastolic blood pressure on the risk of cardiovascular disease (Wang et al, 2010). Similarly in India, a study of 1120 urban dwellers of Gujarat city, there was a strong association between body mass index and hypertension (Verma et al, 2013). A recent trend analysis of impact of overweight and obesity defined by body mass index in Japan indicated that from 1980 to 2010, the odds ratios for hypertension, comparing overweight and obesity with normal weight (BMI =18.5-24.9 kg m^2)), increased from 1.94 (95% Confidence Intervals: 1.64-2.28) to 2.82 (CI, 2.07-3.83) in men, and from 2.37 (CI, 2.05-2.73) to 3.48 (CI, 2.57-4.72) in women (Nagai et al, 2015). The association was observed mainly in participants who are overweight, because only 3% of the population were obese.

In a study of the association between body mass index and blood pressure across three populations in Africa and Asia, Tesfaye et al (Tesfaye et al, 2007) found that the mean blood pressure increased with increasing BMI. The risk of hypertension was higher among population groups with overweight and obesity (BMI>/=25 kg/m2)); odds ratio (95% confidence interval); 2.47 (1.42, 4.29) in Ethiopia, 2.67 (1.75, 4.08) in Vietnam and 7.64 (3.88, 15.0) in Indonesia. BMI was significantly and positively correlated with both SBP and DBP in all the three populations ($r = 0.23 - 0.27$, $P<0.01$). In a similar study of 18,702 African resident in Africa, Caribbean, United States and United Kingdom, Cappuccio et al found a positive relationship between body mass index and both systolic and diastolic blood pressure, but the effect of BMI on blood pressure levels diminishes as BMI increases which suggests a complex interplay between excess body weight, adiposity, energy expenditure and blood pressure (Cappuccio et al, 2008). In a cross-sectional study of four rural and urban communities in SSA (Nigeria, Kenya, Tanzania and Namibia) involving 7,568 adults, BMI independently predicted blood pressure level in all the study populations (Hendriks et al, 2012). Furthermore, a South African study on the association of waist and hip circumferences with hypertension in young adults showed that waist circumference correlated significantly with blood pressure in females and not males.

In Nigeria, a study of 335 urban and 332 rural dwellers in Abuja reported that waist circumference and abdominal height were predictors of systolic blood pressure in rural and urban men respectively (Adediran et al, 2013). Also in a study of 231 staff of a tertiary hospital in Yenagoa reported that body mass index, waist circumference (WC) and waist hip ratio had significant association with hypertension but only older age and waist circumference predicted hypertension (Egbi et al, 2015). In a study of 13504 nationally representative population of Nigerians showed that body mass index was an independent predictor of hypertension (Murthy et al, 2013). Furthermore, a recent study of 482 adults (aged 16-40years) reported that there is weak positive correlation between waist hip ratio and diastolic blood pressure (diastolic BP: $r = 0.122$, $p = 0.008$) in both sexes (Onuoha et al, 2016).

CHAPTER THREE

METHODOLOGY

3.1 Study Design

This was a cross-sectional study.

3.2 Study Area

The study 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, Omu Aran in Irepodun LGA, Offa in Oyun LGA, Share in Moro LGA, and Jebba in Moro LGA. Inhabitants of Kwara State are mainly Yorubas, other tribes which include, Nupe, Baruba, Fulani and Igbo also constitutes significant proportion of the population. The people are mainly farmers, traders, artisans, private employees and civil servants. Kwara state was created in May 27, 1967 with the headquarters in Ilorin, and has a population of 2,591,555 (2005 estimate.). It currently grouped among North-central of the six geopolitical zones in the country, and it's bordered by the neighbouring states of Oyo, Osun and Ekiti (South-West), Kogi (South-East), Niger (North), and Niger Republic in the West. Kwara State has a Federal University, a State University, a private University, a Federal Polytechnic, a State Polytechnic, a State College of Education, and a recently approved additional private University.

3.3 Study population

Adults age 18years and above who are resident in the eight stated communities

3.3.1 Inclusion criteria

All adults 18years and above who willingly consented to participate in the study

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3.3.2 Exclusion criteria

i. Adults aged 18years and above who refused consent to participate in the study

ii. Individuals less than 18years

iii. Pregnant women

3.4 Sample size calculation

The sample size was arrived at using the following formula[88]:

$$n = \frac{z^2 pq}{d^2}$$

Where

n = The desired sample size (where population >10,000)

z = Standard normal deviation, usually set at 1.96 or 2 which corresponds to 95% confidence level

p = The proportion in the target population estimated to have a particular characteristics, i.e. best estimate of the population prevalence.

q = 1-p = 0.9, for a prevalence of 39.5% [Murthy et al, 2015]

d = degree of accuracy desired, usually set at ± 0.05

thus,

$$n = \frac{(1.96)^2 \times 0.395 \times 0.605}{0.05 \times 0.05}$$

$$n = 368$$

However, 1612 adults participated in the study

3.5Sampling technique

The studies were carried out during the chronic disease awareness and screening activities of the world kidney days programmes (2006, 2009-2014 and 2016) using same protocols. This programme was carried out by the Ilorin Renal Study Group (IRSG) which comprises the Nephrologists (including the investigator as a key personnel), Pediatric Nephrologists, Urologists, Chemical pathologists, Renal Histopathologists, Hematologists, Resident doctors in renal medicine, and Renal Nurses. They were jointly trained on the standard protocol for data acquisition from the participants. Advance team of the IRSG was sent to the communities to meet the head and his cabinet to discuss the detail of the program in terms of the purpose, the benefit and the procedures with any potential risk involved such as the pain of a needle prick when taking blood samples. Verbal consents were thereafter obtained from the community head who then mobilized the community for the screening programme, and venues were provided for the activities. The local government authorities were equally informed formally, who also provided logistic, refreshments, some funds, and also participated in the activities. The programme was supported by the University of Ilorin Teaching Hospital. A lecture on the details of the programme was reiterated to the participants in Yoruba and English and those who voluntarily consented to participate in the screening were recruited.

3.6Study Instruments

- Pre-tested questionnaire
- Accouson mercury sphygmomanometer
- Littman stethoscope
- Portable weighing (SECA) scale
- Standiometer
- Inelastic tape
- Tube racks

- Disposable gloves
- Needle and syringes
- Fluoride oxalate and heparinized bottles
- Methylated Spirit
- Cotton wools

3.7 Data Collection

A detailed questionnaire (appendix II) was used to document the socio-demographic, clinical laboratory, and kidney parameters of the participants. They were administered by the investigator and other trained members of the IRSG. Information from each participants were kept in strict confidentiality

3.7.1 Clinical data collection

Medical history was obtained from each participants such as history of cigarette smoking, alcohol ingestion and drug use. Significant ingestion of alcohol is defined as more than four (4) units (32g or one big bottle (750ml) of beer) per day for men and more than two (2) units per day for women[80]. Past medical history and family history were also obtained. Weight was measured using the portable SECA weighing scale placed on flat hard surface with the subjects wearing light clothing and height measured with subjects standing without shoes. Body mass index was calculated from height and weight using the following formula[89]:

$$BMI = Weight\ (kg)/Height\ (m^2)$$

The waist circumference (cm) was measured with a non-elastic tape at a horizontally position midpoint between the costal margin and the iliac crest along the mid-axillary crest on an uncovered abdomen in an enclosed but illuminated room. The hip circumference (cm) was measured with same tape at a horizontal positioned at the widest point around the greater trochanter. The waist-to-hip ratio was obtained by dividing the waist circumference by the hip circumference. A value >0.9 in women and >1.0 in men is considered abnormal.

The blood pressure was measured by the investigator and other trained personnel using mercury sphygmomanometers with standard cuff (25cm x 12cm) and a Littman stethoscope. The participants were in sitting position and the BP was measured on the right arm after 5 minutes of rest. Korotkoff phases I and V were taken as systolic and diastolic blood pressure respectively. Two measurements were taken at least 5minutes apart and the value of the mean was used. The mean arterial pressure (MAP) was calculated from the formula. 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).

MAP (mmHg) = DBP + (1/3 x PP)

3.7.2Laboratory and kidney lengthsdata collection

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 sinologist measured the lengths of both kidneys using a portable ultrasound machine as part of the screening programme formulated by the Ilorin renal study group.

3.8 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 Pearson or spearman correlation and logistic regression methods. A p value of <0.05 was taken as significant.

A detailed questionnaire (appendix II) was used to document the socio-demographic and clinical parameters of the participants. They were administered by the investigator and other trained members of the IRSG. Information from each participants were kept in strict confidentiality. 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 Pearson or spearman correlation and logistic regression methods. A p value of <0.05 was taken as significant.

3.9 Ethical considerations

Verbal and written consents (Appendix I) were obtained from the community head and each participants after detailed explanation of the programme, and the procedures involved were delivered in both Yoruba and English languages. Approval for the study was also obtained from the ethical Review Committee of University of Ilorin Teaching Hospital. 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 names was recorded on the questionnaire, however a study identification number was assigned to each participants to identify those who may require further interventions without breaching confidentiality. The data were kept in a secure computer and accessible only to the principal investigator.

CHAPTER FOUR

RESULTS

4.1 Baseline characteristics of the study population

Table 4.1 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.

Table 4.1 |Baseline characteristics of the patients (n = 1506).

Characteristics	number (%), mean ±SD, or median (range)
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(59-109)
Hip Circumference (m)	78.81(56-116)
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

SD; standard deviation

4.2. The Prevalence and pattern of hypertension in the study population

Table 4.2 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 prevalences 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.

Table 4.2| 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

4.3. Comparison of the clinical and laboratory characteristics of male and female participants with hypertension

The differences in the mean values of the clinical and laboratory variables between the male and females who are hypertensive are shown in table 4.3. Women had significantly higher body mass index (30.3±6.7Kg/m^2) than men (26.2±4.7Kg/m^2),P=0.001; while men had higher packed cell volume (41.3±3.1%) than women (37.4±3.6%), P=0.001. there was no significant differences in the age, systolic and diastolic blood pressures, the waist and hip circumferences, the kidney lengths, and the blood sugar.

Table 4.3|Comparison of the mean of the clinical and laboratory characteristics of male and female participants with hypertension. n = 452

Characteristics	Male	Female	P value
Age (years)	52±13	50±10	0.205
Systolic BP (mmHg)	158±16	160±18	0.327
Diastolic BP (mmHg)	98±10	98±95	0.442
Body mass index (Kg/m^2)	26.2±4.7	30.3±6.7	**0.001**
Right Kidney (cm)	95.0±8.9	93.1±8.7	0.181
Left Kidney (cm)	96.1±8.4	93.6±9.5	0.104
Waist Circumference (cm)	74.5(52-91)	78.5(44-114)	0.449
Hip Circumference (cm)	79.1(58-101)	82.8(53-101)	.511
Waist-Hip ratio	0.94±0.08	0.95±0.11	0.578
Random blood sugar (mmol/L)	6.2±2.3	6.1±2.3	0.964
Packed cell volume (%)	41.3±3.1	37.4 ±3.6	**0.001**

BP; blood pressure

4.4. 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 table 4.4. 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).

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Table 4.4| 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(48-100)	77.08(44-99)	0.957
Hip Circumference (cm)	81.17(56-110)	77.56(52-102)	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

4.5 Age and gender distribution of hypertension in the study population

Table 4.5 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.

Table 4.5|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)

4.6. Prevalence of hypertension according to the categories of Body Mass Index

Table 4.6 depicts the prevalences 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 hypertension with a prevalence of 68.4%. The trends were similar in men and women.

Table 4.6| 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

4.7. 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 4.7. 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.

Table 4.7| Correlation of anthropometric indices and other variables with blood pressure in the study population

Variables	correlation coefficient (r)	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

4.8. Predictors of hypertension in the study population

The identified predictors of hypertension are shown in table 4.8. 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).

Table 4.8| 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

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Body mass index	1.113	1.059 – 1.170	0.001
Age (years)	1.052	1.034 – 1.070	0.001

CHAPTER FIVE
DISCUSSION

5.1. Demographic characteristic of the participants

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 lout 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 by Ezeala-Adikaibe et al, 2016 in the study in Enugu in south eastern part of the country. 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 by Olamoyegun et al, 2016 in a study carried out in a semi-urban populations in Ekiti State in the South western Nigeria. 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. 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 positive health seeking habits and respond to health screening better than men. Much higher figures were documented by both studies by Ezeala-Adikaibe et al (64.7%) and Olamoyegun et al (73%). 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 by Ezeala-Adikaibe et al.

5.2 Prevalence of hypertension in urban population of Kwara State

The overall prevalence of hypertension defined as systolic blood pressure of >/= 140mmHg, and/or diastolic blood pressure of >/= 90mmHg was 30%, with comparable prevalences 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, 2015; 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 Oga et al, 3013 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 f Kwara State (Hendriks et al, 2012). The prevalence is lower than 44.9% (95% CI: 43.5–46.3%) reported by Murthy et al, 2013 in a national survey, 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 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, 2016 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 (Ezeala-Adikaibe et al, 2016), 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

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5.3 Age and sex distribution of hypertension in the study population

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 by similar studies by Olamoyegun et al, 2016 and Ezeala-Adikaibe et al, 2016. The prevalence and trends are similar in men and women.

5.4 Relationship of anthropometric indices with hypertension in the study population

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), Wang et al, 2010 (China), Verma et al, 2013 (India), Nagai et al, 3015 (Japan), Tesfaye et al, 2007 (Asia and Africa), Cappuccio et al, 2008 (Africa including Nigeria and Africa in Diaspora), Hendriks et al, 2012 (Sub-Saharan Africa including Nigeria), Ezeala-Adikaibeet al, 2016 (Nigeria) 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, such as; Adediran et al, 2013; Egbi et al, 2015; and Onuoha et al, 2016.

5.5 Predictors of hypertension in the study population

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. The reduced risk for age compared with BMI and waist circumference remains to be determined.

5.6 Conclusions

The prevalence of hypertension is high in urban population of Kwara State, 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.

5.7. Recommendations

1. Public awareness on the rising prevalence of hypertension in Nigeria and the risk factors
2. The need to fund a national study on hypertension to determine the patterns and associated factors in different populations in Nigeria
3. Recognition of increase in weight and abdominal obesity in particular as modifiable predictors of hypertension among urban dwellers, and thus the need for lifestyle changes to control them.

REFERENCES

Adediran, O.S., Adebayo, P.B., & Akintunde, A.A. (2013). Anthropometric differencesmongnatives of Abuja living in urban and rural communities: correlations with other cardiovascular risk factors.BMC Res Notes. 27;6:123.

Adeloye, D., & Basquill, C. (2014). Estimating the prevalence and awareness rates of hypertension in Africa: a systematic analysis, PLoS One 9(8): e104300.

Adeloye, D., Basquill, C., Aderemi, A.V., Thompson, J.Y., & Obi, F.A. (2015). An estimate of the prevalence of hypertension in Nigeria: a systematic reviewand meta-analysis. J Hypertens. 33(2):230-42.

Agyemang, C., Addo, J., Bhopal, R., Aikins Ade, G., & Stronks, K.(2009) Cardiovascular disease, diabetes and established risk factors among populations of sub-Saharan African descent in Europe: a literature review. Global Health; 5: 7.

Akinkugbe, O.O. (2002). Current epidemiology of hypertension in Nigeria. Archives of Ibadan Medicine 1(1) :3-5.

Ataklte, F., Erqou, S., Kaptoge, S., Taye, B., Echouffo-Tcheugui, J.B., & Kengne, A.P. 2015), Burden of undiagnosed hypertension in sub-saharan Africa: a systematic review and meta-analysis. Hypertension. 2015 Feb;65(2):291-8.

BeLue, R., Okoror, T.A., &Iwelunmor, J,, et al (2009). An overview of cardiovascular risk factor burden in sub-Saharan African countries: a socio-cultural perspective. Global Health 22: 5–10.

Bromfield, S., & Muntner, p. (2013). High Blood Pressure: The Leading Global Burden of Disease Risk Factor and the Need for Worldwide Prevention Programs Curr Hypertens Rep . 15(3): 134–136.

Brown, I.J., Tzoulaki, I., Candeias, V., & Elliott, P. (2009). Salt intakes around the world: implications for public health. Int J Epidemiol 38: 791–813.

Burt,V.L., Whelton, P., & Roccella, E.J., et al (1995). Prevalence of hypertension in the USadult population. Results from the Third National Health and Nutrition Examination Survey, 1988–1991. Hypertension 25: 305–13.

Cappuccio, F.P., Kerry, S.M., Adeyemo, A., Luke, A., Amoah, A.G., & Bovet, P., et al. (2008). Body size and blood pressure: an analysis of Africans and the African diaspora. Epidemiology. 19(1):38-46.

Chobanian, A.V., Bakris, G.L., Black, H.R., et al (2003). Seventh Report of theJoint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure. Hypertension 2003;42:1206-1252.

Doll, S., Paccaud, F., Bovet, P., Burnier, M., & Wietlisbach, V (2002). Body mass index, abdominal adiposity and blood pressure: consistency of their association across developing and developed countries. Int J Obes Relat Metab Disord 26: 48–57.

Egbi, O.G., Rotifa, S., &Jumbo, J. (2015). Prevalence of hypertension and its correlatesamong employees of a tertiary hospital in Yenagoa, Nigeria.Ann Afr Med. 14(1):8-17.

Erdem, Y., Arici, M., & Altun, B., et al (2010). The relationship between hypertension and salt intake in Turkish population: SALTURK study. Blood Press 19: 13–18.

Ezeala-Adikaibe, B.A., Orjioke, C., Ekenze, O.S., Ijoma, U., Onodugo, O., & Okudo G., et al (2016). Population-based prevalence of high blood pressure among adults in an urban slum in Enugu, South East Nigeria.J Hum Hypertens. 30(4):285-91.

Ezzati, M., Lopez, A.D., Rodgers, A., Vander Hoorn, S., &Murray, C.J. (2002).Selected major risk factors and global and regional burden of disease. Lancet 360:1347–1360

Forman, J.P., Stampfer, M.J., & Curhan, G.C. (2009). Diet and lifestyle risk factors associated with incident hypertension in women. JAMA 302: 401–11.

Guwatudde, D., Nankya-Mutyoba, J., Kalyesubula, R., Laurence, C., Adebamowo,C., &Ajayi, I.(2015).The burden of hypertension in sub-Saharan Africa: a four-country cross sectional study.BMC Public Health5;15:1211.

Harding, S., Maynard, M., Cruickshank, J.K., & Gray, L.(2006). Anthropometry and blood pressure differences in black Caribbean, African, South Asian and white adolescents: the MRC DASH study. J Hypertens 24: 1507–14.

He, F.J., & MacGregor, G.A. (2009). A comprehensive review on salt and health and current experience of worldwide salt reduction programmes. J Hum Hypertens 23: 363–84.

He, J., Klag, M.J., & Whelton, P.K., et al.(1991). Migration, blood pressure pattern, and hypertension: the Yi Migrant Study. Am J Epidemiol 1991; 134: 1085–101.

Hendriks, M.E., Wit, F.W., Roos, M.T., Brewster, L.M., Akande, T.M., et al. Hypertension in sub-Saharan Africa: cross-sectional surveys in four rural and urban communities. PLoS One. 2012;7(3):e32638.

Ibrahim, M.M., & Damasceno, A. (2012). Hypertension in developing countries. Lancet 380:611–619.

Kadiri, S., Walker, O., Salako, B.L., & Akinkugbe, O.O.(1999). Blood pressure, hypertension and correlates in urbanized workers in Ibadan, Nigeria-Arevist. *J Hum Hypertens* 1999;13:23-27.

Kaufman, J.S., Rotimi, C.N., & Brieger, W.R. et al (1996). The mortality risk associated with hypertension: preliminary results of a prospective study inrural Nigeria. J Hum Hypertens 10:461-464.

Kearney, P.P., Whelton, M., Reynolds, K., Muntner, p., Whelton, P.K., & He, J. (2005). Global burden of hypertension: analysis of worldwide data. Lancet 365: 217–23.

Guwatudde, D., Nankya-Mutyoba, J., Kalyesubula, R., Laurence, C., Adebamowo,C., &Ajayi, I.(2015).The burden of hypertension in sub-Saharan Africa: a four-country cross sectional study.BMC Public Health5;15:1211.

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Kearney, P.P., Whelton, M., Reynolds, K., Muntner, p., Whelton, P.K., & He, J. (2005). Global burden of hypertension: analysis of worldwide data. Lancet 365: 217–23.

Keil, J.E., Sandifer, S.H., Loadholt, C.B., & Boyle, E Jr. (1981). Skin color and education effects on blood pressure. Am J Public Health 71: 532–34.

Kengne, A.P., Ntyintyane, L.M., & Mayosi, B.M.(2012). A systematic overview of pro-spective cohort studies of cardiovascular disease in sub-Saharan Africa. Cardiovasc J Afr. 23:103–112.

Lawes, C.M., Vander Hoorn, S., Law, M.R., Elliott, P., MacMahon, S., & Rodgers, A.(2004). High blood pressure, Comparative Quantification of Health Risks: Globaland Regional Burden of Disease Attributable to Selected Major Risk Factors, World Health Organization, Vol Geneva 2004, pp. 281–390.

Lim, S.S., Vos, T., Flaxman, A.D., Danaei, G., Shibuya, K., & Adair-Rohani, H., et al. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380:2224–2260.

Mosley, J.D., Appel, L.J., Ashour, Z., Coresh, J., Whelton, P.K., & Ibrahim, M.M.. (2000). Relationship between skin color and blood pressure in Egyptian adults: results from the national hypertension project. Hypertension 36: 296–302.

Murthy, G.V., Fox, S., Sivasubramaniam, S., Gilbert, C.E., Mahdi, A.M., &Imam, A.U., et al. (2013). Prevalence and risk factors for hypertension and association with ethnicity in Nigeria: results from a national survey.Cardiovasc J Afr.24(9-10):344-350

Nagai, M., Ohkubo, T., Murakami, Y., Takashima, N., Kadota, A., & Miyagawa, N. (2015). Secular trends of the impact of overweight and obesity on hypertension in Japan, 1980-2010.Hypertens Res.38(11):790-795.

National Expert Committee on Non-Communicable Disease (1997). Non- communicable disease in Nigeria-final report of a national survey. Fed Min Health Social Service. Lagos. 1997.

NCD Risk Factor Collaboration (NCD-RisC) (2016). Lancet Published Online November 15, 2016 http://dx.doi.org/10.1016/ S0140-6736(16)31919-5

O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, et al. (2010). Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. Lancet 376:112–123.

Ogah, O.S. (2006). Hypertension in Sub-Saharan African popula- tions: the burden of hypertension in Nigeria. Ethn Dis 16: 765

Ogah, O.S., Madukwe, O.O., Chukwuonye, I.I., Onyeonoro, U.U., Ukegbu, A.U., &Akhimien, M.O., et al.(2013) Prevalence and determinants of hypertension in Abia State Nigeria: results from the Abia State Non-Communicable Diseases and Cardiovascular Risk Factors Survey. Ethn Dis. 23(2):161-7.

Ogah, O.S., Okpechi, I., Chukwuonye, I.I., Akinyemi, J.O., Onwubere, B.J., & Falase, A.O., et al. (2012). Blood pressure, prevalence of hypertension and hypertension related complications in Nigerian Africans: A review. World J Cardiol. 26;4(12):327-40.

Olamoyegun, M.A., Oluyombo, R., Iwuala, S.O., & Asaolu. S.O. (2016). Epidemiology and patterns of hypertension in semi-urban communities, south-western Nigeria. Cardiovasc J Afr. 11;27:1-5.

Onuoha, F.M., Ebirim, C.C., &Ajonuma, B.C., et al. (2016). Correlation between central obesity and blood pressure in an adult Nigerian population. Journal of Insulin Resistance. 1(1), a16. http://dx.doi. org/10.4102/jir.v1i1.16.

Poulter, N.R., Khaw, K.T., & Hopwood, B.E., et al. (1990). The Kenyan Luo migrationstudy: observations on the initiation of a rise in blood pressure. BMJ 300: 967–72.

Radhika, G., Sathya, R.M., Sudha, V., Ganesan, A., Mohan, V. (2007). Dietary salt intake and hypertension in an urban south Indian population— [CURES-53]. J Assoc Physicians India 55: 405–11.

Roka, R., Michimi, A., &Mac, G.(2015). Associations Between Hypertension and Body Mass Index and Waist Circumference in U.S. Adults: A Comparative Analysis by Gender.High Blood Press Cardiovasc Prev. 22(3):265-73.

Rotimi CN (1997). Hypertension in Blacks. Am J Hypentens 10:804-812.Sanders, P.W. (2009). Dietary salt intake, salt sensitivity, and cardiovascular health. Hypertension 53: 442–45.

Saunders, E. (1991). Hypertension in African-Americans. Circulation 83: 1465–67Sobngwi, E., Mbanya, J.C., &Unwin, N.C., et al (2004). Exposure over the life course to anurban environment and its relation with obesity, diabetes, and hypertension in rural and urban Cameroon. Int J Epidemiol 33: 769–76.

Steyn, K., Bradshaw, D., Norman, R., &Laubscher, R (2008). Determinants and treatment of hypertension in South Africans: the fi rst demographic and health survey. S Afr Med J 98: 376–80.

Steyn, K., Sliwa, K., Hawken, S., Commerford, P., Onen, C., et al. (2005). Risk factors associated with myocardial infarction in Africa: the INTERHEART Africa study. Circulation 112:3554–3561.

Sun, Z., Zheng, L., & Detrano, R, et al (2010). Risk of progression to hypertension in a rural Chinese women population with prehypertension and normal blood pressure. Am J Hypertens 23: 627–32.

Tesfaye, F., Nawi, N.G., Van Minh, H., Byass, P., Berhane, Y., & Bonita, R. (2007). Association between body mass index and blood pressure across three populations in Africa and Asia. J Hum Hypertens. 21(1):28-37.

Verma, A., Patel, P., Patel, J. R.,&Chaudhary, H (2013). Relation of BMI & hypertension in natives of Gujarat. GCSMC J Med Sci Vol (II) No (I).

Roka, R., Michimi, A., &Mac, G.(2015). Associations Between Hypertension and Body Mass Index and Waist Circumference in U.S. Adults: A Comparative Analysis by Gender.High Blood Press Cardiovasc Prev. 22(3):265-73.

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Verma, A., Patel, P., Patel, J. R.,&Chaudhary, H (2013). Relation of BMI & hypertension in natives of Gujarat. GCSMC J Med Sci Vol (II) No (I).

Wang, H.1., Cao, J., Li, J., Chen, J., Wu, X., Duan, X., &Huang, J. (2010).Blood pressure, body mass index and risk of cardiovascular disease in Chinese men and women.BMC Public Health;10:189.

WHO Guidelines Subcommittee (1999). 1999 World Health Organization-International Society of Hypertension Guidelines for the Management of Hypertension. *J Hypertens* 151-183.

Williams, D.R. (1992). Black-white differences in blood pressure: the role of social factors. Ethn Dis 1992; 2: 126-41.

APPENDIX I

CONSENT FORM

Research study- PREVALENCE AND PREDICTORS OF HYPERTENSION AMONG URBAN COMMUNITIES IN KWARA STATE

I ....of ....

....Hereby consent to participate in the study with the above topic.

Dr. .... has explained the nature of the study with its benefits and risks to me. I understand that the topic is to be carried out solely for the purpose of medical research and I am willing to act as a volunteer for that purpose. I recognize that the result of the study may be of significant benefit to mankind.

Date..

[signed]..

....[witness to the patient's signature].

I confirm that I have explained to you the purpose and nature of the study and the risks involved, including the fact that any my refusal to participate will not in any way affect your normal care by me or any member of the institution. All information obtained in this study is strictly confidential. Your responses will be identified by a study code number. Your name will not be used in this study. If any information is published, there will not be any information which would identify you as a participant. I know the consequences of any false declaration on this or any other form.

Date .... (signed) ....

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APPENDIX II

PREVALENCE AND PREDICTORS OF HYPERTENSION AMONG URBAN COMMUNITIES IN KWARA STATE

QUESTIONNAIRE

Section A: Biodata

Name.................................... Age ....

Sex ....Occupation ....

Mobile phone number 1: ....

Mobile phone number 2: ....

Section B: Medical History

Hypertension ☐ Diabetes mellitus ☐ Sickle cell ☐

Renal disease ☐ Facial swelling ☐ Leg swelling ☐

Haematuria ☐ None ☐

Antihypertensive ☐ algesic ☐ pe.........................

Local concoction ☐

Hypertension ☐ Diabetes ☐ None ☐

Alcohol ☐ Smoking ☐ None ☐

Section C: Clinical Examination

* Weight (kg)...........................
* Height(m)...........................
* Body mass index (Kg/m^2)....................................
* Waist Circumference (cm) ....
* Hip Circumference (cm) ....
* Waist/Hip ratio ....
* Blood pressure (mmHg): 1st reading =2nd reading =

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* Blood pressure (mmHg): 1st reading =2nd reading =

Average =

Section D: Laboratory Investigations

- Fasting blood glucose (mmol/L) …………………………………………………..
- PCV (%) ……………………………………………..
- Urine protein (+)……………………………………..
- Urine Blood (+)……………………………………

Section E: Kidney Ultrasonigraphy

Right kidney length (cm)………………………………

Left kidney length (cm) ……………………………..

Average =

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