CARDIOVASCULAR RISK FACTORS AMONG ADULTS IN A SEMI- URBAN COMMUNITY OF KANO STATE, NIGERIA

A DISSERTATION SUBMITTED TO THE NATIONAL POSTGRADUATE MEDICAL COLLEGE OF NIGERIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF FELLOWSHIP OF THE COLLEGE IN INTERNAL MEDICINE (CARDIOLOGY)

BY

DR BALARABE SULAIMAN AMINU

MBBS BUK (2007)

MAY 2018

DECLARATION

It is here by declared that this work is original unless otherwise acknowledged. The work has not been presented to any other College for a Fellowship nor has it been submitted elsewhere for publication.

_____

Dr Balarabe Sulaiman Aminu

CERTIFICATION

SUPERVISORS' CERTIFICATION

We hereby testify that the study reported in this Dissertation was done by the candidate under our supervision. We also supervised the conduct of the study, analysis of the data and writing of the Dissertation.

SUPERVISORS

1. SIGNATURE/DATE: ……..

Professor S.A. Isezuo MBBS (Ib); FMCP; FESC

Professor of Medicine and Consultant Physician/Cardiologist

Usmanu Danfodiyo University Teaching Hospital, Sokoto

2. SIGNATURE/DATE: ….....

Professor M.U. Sani MBBS (ABU); FWACP, FACP, FACC, FRCP

Professor of Medicine and Consultant Physician/Cardiologist

Aminu Kano Teaching Hospital, Kano.

3. SIGNATURE/DATE: ……..

Professor M.M. Borodo MBBS (ABU); FMCP

Professor of Medicine and Consultant Physician/Gastroenterologist

Aminu Kano Teaching Hospital, Kano.

CERTIFICATION

HEAD OF DEPARTMENT'S CERTIFICATION

This is to certify that this study was carried out by Dr Balarabe Sulaiman Aminu of the Department of Medicine, Aminu Kano Teaching Hospital (AKTH) Kano.

Head of Department Signature/Date: ……

Professor A.A. Samaila MBBS (ABU); FWCP.

Professor of Medicine and Consultant Physician/Gastroenterologist.

Aminu Kano Teaching Hospital, Kano.

DEDICATION

This work is dedicated to my parents and my family for their unlimited support and prayers.

ACKNOWLEGDEMENT

I thank Almighty Allah (SWT), who has spared my life and made it possible for me to carry out this project. May Allah shower His blessing onto Prophet Muhammad (SAW) and his family. My profound appreciation goes to Prof. S.A Isezuo, Prof. M.U Sani and Prof. M.M Borodo for their guidance, supervision and encouragement throughout this work.

My gratitude goes to all staff of Medicine Department of AKTH for their encouragement and support during the course of this work. I thankfully acknowledge Prof KM Karaye, Prof. Zubair Iliyasu, Dr MM Yakasai, Dr Aisha Nalado, Dr Rayyan MG, Dr Muktar Gadanya for their critical contributions to this Dissertation. I also thank my colleagues in cardiology unit for their contributions.

I am particularly indebted to my sponsor and employer, Kano State Hospital Services Management Board.

I express my sincere gratitude to my humble parents, my wife Faiza Ahmad and children Fatima, Umar and Saadiya (mamana) and my entire extended family for their support, prayers and patience.

TABLE OF CONTENT

LIST OF ABBREVIATIONS

AKTH – Aminu Kano Teaching Hospital

ATP III – Adult Treatment Panel III

BMI - Body Mass Index

BP - Blood Pressure

CHD - Coronary Heart Disease

CHOL - Cholesterol

CVD - Cardiovascular Disease

CV - Cardiovascular

CRP- C-Reactive Protein

DBP- Diastolic Blood Pressure

DM- Diabetes Mellitus

ECG – Electro Cardiography

HDLc - High Density Lipoprotein cholesterol

HHD - Hypertensive Heart Disease

HTN - Hypertension

IHD - Ischaemic Heart Disease

LDL-c - Low Density Lipoprotein Cholesterol

LGA-Local Government Area

LP(a) - lipoprotein(a)

LVH – Left Ventricular Hypertrophy

mmHg-millimeter of mercury

n- Number of subjects

N – Total number of subjects

NCDs - Non Communicable diseases

PVD - Peripheral Vascular Disease

p- probability value

SBP-Systolic Blood Pressure

SSA- sub Saharan Africa

SD – Standard Deviation

TC - Total Cholesterol

TG – Triglycerides

TOD- Target Organ Damage

US- United States of America

WC – Waist Circumference

WHO- World Health Organization

LIST OF TABLES

ABSTRACT

BACKGROUND: Cardiovascular diseases are the leading causes of mortality and responsible for 16.6million death, representing one third of global death annually. It is projected that there will be a rise in CVD mortality rates in the developing countries because of demographic changes and urbanisation. There are limited community based data on the prevalence of CV risk factors in Northern Nigeria. This study determined the prevalence, determinants and

awareness of modifiable cardiovascular risk factors in a semi urban community of Kano State, Nigeria.

MATERIALS AND METHOD: The study was cross-sectional in design. Four hundred and twenty two (422) subjects resident in a semi urban community were selected using multi-staged sampling technique. The WHO STEP wise approach to surveillance was utilised in screening for cardiovascular risk factors. Data collected was analysed using SPSS version 19.0 (IBM Corp. released 2010).

Results: four hundred and twenty two subjects (199 males and 223 females) with a mean age of 39.4 ± 14.8 (range 18 - 85) years were studied. Prevalence of modifiable cardiovascular risk factors were as follows: hypertension 33.9% (males 29.1%, females 38.1%, p = 0.050), truncal obesity 30.1% (males 13.6%, females 44.8%, p = 0.001), generalised obesity 16.4% (males 13.1%, females 19.3%, p = 0.035), type 2 diabetes mellitus 4.8% (males 4.8%, females 4.7%, p = 0.960), cigarette smoking 2.6% (males 5.5%, females 0.0%, p = 0.001), dyslipidaemia 82.4% (males 80.2%, females 83.5%, p 0.400) and ECG LVH 23.7% (males 8.3%, females 15.4%, p = 0.005). Metabolic syndrome was observed in 12.6% of subjects (males 32.1%, females 67.9%, p = 0.117). On the whole 358 (83.7%) subjects had one or more modifiable CV risk factors.

The most frequently known cardiovascular risk factors to the study population included n cigarette smoking 238 (56.4%), hypertension 209 (49.5%), dyslipidaemia 183 (43.1%), obesity 155 (36.7%) and diabetes mellitus 153 (36.3%). The proportion of subjects who were aware of heart attack and stroke as complications of CV risk factors were significantly higher in males than females.

Apart from cigarette smoking, truncal obesity and ECG LVH, there was no statistically significant gender differences in the prevalence of CV risk factors. Compared to normotensives, the hypertensive subjects did not differ significantly in the prevalence of truncal

obesity [75 (17.8%) vs 52 (12.3%), p = 0.440), generalised obesity [41 (9.7%), vs 28 (6.6%), p = 0.199] and diabetes mellitus [11 (2.8%) vs 8 (2.0%), p = 0.199]. Truncal obesity was significantly more frequent among subjects who were aged more than 60 years (37.3%, p = 0.234), employed (31.8%, p = 0.023), females (44.8%, p = 0.001) and informally educated (37.6%, p = 0.001). Logistic regression analysis identified gender as the only independent predictor of truncal obesity (p = 0.001, OR = 3.850, 95% CI = 1.8 – 8.3).

Conclusions: The study demonstrates high prevalence of cardiovascular risk factors dominated by dyslipidaemia, hypertension and truncal obesity. Female gender was an independent predictor of truncal obesity. The level of awareness of cardiovascular risk factors and their complications was generally low, particularly, in females. Promotion of healthy lifestyle and increased awareness of CV risk factors among the study population are recommended.

CHAPTER ONE

1.0 INTRODUCTION

Cardiovascular diseases remain leading causes of morbidity and mortality worldwide.[1] The 2010 World Health Report estimates that non-communicable diseases (NCDs) are responsible for more than 36 million deaths each year.[1]

Cardiovascular diseases (CVDs) account for most NCD deaths (about 17 million people annually), followed by cancers (7.6 million), respiratory diseases (4.2 million) and diabetes mellitus (1.3 million). The CVD burden afflicts both men and women, with CVD deaths accounting for 34% of all deaths in men and 28% in women in 1998.[2] Nearly 80% of the deaths occur in low and middle income countries (including Nigeria),[2] and more than 9 million deaths attributed to NCDs occur before the age of 60 years.[3] It is projected that between 1990 and 2020, there will be 120% increase in coronary heart disease mortality in women and 137% in men in developing countries compared to 29% in women and 48% in men in developed countries.[4]

Control of infections and nutritional diseases allows most of the population to reach the ages in which CVD manifests. This is the major factor underlying the epidemiological transition from communicable to non-communicable diseases.[4] Omran divided the transition into three basic stages: pestilence and famine, receding pandemics and degenerative and man-made diseases.[5] Olshansky and Ault added a fourth stage, delayed degenerative diseases.[6] A fifth stage, characterised by epidemic of inactivity and obesity, may be emerging in some countries. Although specific country or region enters these stages at different times, the progression from one to another tends to proceed in a predictable manner. [6]

The high burden of CVD in the developing countries are attributable to an increasing incidence of tobacco use, physical inactivity, harmful use of alcohol and unhealthy diets leading to atherosclerotic diseases.[2] There is also a high burden of cardiovascular risk factors especially diabetes mellitus (DM), hypertension (HTN), dyslipidaemia and obesity,[2] which are independently associated with CVD risk and are common among adults in both developed and developing countries.[7,8] Nigeria has witnessed tremendous socio-economic changes and rural-urban migration which has led to the emergence of NCDs including ischaemic heart diseases (IHD).[7] Development of CVDs is promoted by major risk factors such as HTN, dyslipidaemia, DM, smoking as well as adoption of western lifestyle.

The NCD survey done in Nigeria about 21 years ago found high prevalence of traditional CV risk factors.[9] The identification of these major risk factors and the implementation of control strategies, such as community education targeting high risk individuals have contributed to the fall in CVD mortality rates observed in industrialised nations.[8] This study determined the prevalence of cardiovascular risk factors in a semi urban community of Kano State, North-Western part of Nigeria.

1.1 JUSTIFICATION FOR THE STUDY

Cardiovascular diseases remain the major cause of deaths worldwide. Although cardiovascular mortality rates have declined in many high-income countries, over the last two decades it has increased at a fast rate in low and middle-income countries.[9,10] The antecedent of CVD, notably atherosclerosis, begin in early life making primordial and primary preventive strategies necessary from childhood.[11] There is therefore, increased need to prevent atherosclerosis by healthy eating habit, physical exercise and avoidance of cigarette smoking especially in the young age group.[12] The first step towards prevention is the identification of the burden of CVD risk factors in the community. In the NCDs survey done two decades ago, Kano had the highest prevalence of HTN and mean cholesterol levels.[9] Only few small scale community

based studies on CV risk factors have been done since the completion of this survey. The current study determined the prevalence of CVD risk factors in a semi-urban community.

The findings may provide information on the temporal trends of CV risk profile and basis for the development of control and preventive strategies in the study population and Kano State in general.

1.2 RELEVANCE OF THE STUDY

According to World Health report, CVDs account for 9.2% of all death in Africa in 2001. [11] Hospital based studies seem to show that CVDs are now the leading cause of morbidity and mortality in developing countries with rates almost similar to those of developed countries.[14] However, there are limited community based data to support these observations especially in Northern part of Nigeria.

1.3 AIMS AND OBJECTIVES OF THE STUDY

General objective

To determine the prevalence and awareness of modifiable cardiovascular risk factors in a semi-urban community of Kano State, Nigeria.

Specific objectives:

1. To determine the prevalence of modifiable cardiovascular risk factors in the community
2. To determine the level of awareness of the subjects on these risk factors and their complications
3. To identify the socio-demographic determinants of CVD risk factors among the study population

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 BACKGROUND

Cardiovascular diseases (CVDs) cause preventable morbidity and mortality worldwide.[12] It is estimated that NCDs will account for more than three fourth of all death in 2030, and death from CVD will rise to 23.4 million, an approximately 37% increase from 2004 rates.[10] Furthermore, the leading causes of death in the world in 2030 are predicted to be ischaemic heart disease and cerebrovascular disease which are the major components of CVD. CVDs have recently become a leading cause of mortality and morbidity in developing countries, and rates are expected to rise over the next few decades.[13] The prevalence of CVD risk factors is dramatically increasing in low-and middle-income African countries, particularly in urban areas. Other than the national NCDs survey of 1992, studies in Nigeria on CV risk factors are largely hospital based with few community based studies mainly in Southern parts of the country.

2.2 CARDIOVASCULAR DISEASE RISK FACTORS

In the developing regions of the world, non-communicable diseases are replacing traditional diseases such as infection, as the leading cause of disability and premature death in adults.[14,15] The reasons given for this include a changing demography characterized by ageing of the population in these regions. Other reasons are westernization and adaptation of western lifestyle patterns. While risk factors were said to be more prevalent among the affluent in most developing countries, recent observations are beginning to show that they are present among the poor.[16 - 19]

Cardiovascular risk factors can be classified as modifiable, non-modifiable and emerging. The non-modifiable risk factors include: age, male gender and family history of premature CVDs, while the modifiable ones include hypertension, diabetes mellitus (DM), cigarette smoking, dyslipidaemia, sedentary life style and obesity. Emerging risk factors include: left ventricular hypertrophy (LVH), hyperinsulinaemia, raised Lipoprotein 'a'{Lp(a)}, C-reactive protein(CRP), Helicobacter-Pylori infection, increased carotid intimal media thickness and homocystein blood levels among others. [9]

2.2.1 HYPERTENSION

Recent review of the global burden of high blood pressure shows that approximately 54% of stroke, 47% of IHD and 25% of other CVDs were attributable to hypertension. This equates to an annual burden of approximately 7.6 million deaths, or 13.5 percent of the total number of annual global deaths, being attributable to high blood pressure.[20] Lawes et al found that more than 80% of the burden of hypertension in 2001 occurred in low and middle income countries.[20]

In China alone, it is estimated that the current age-standardised prevalence rates of HTN was 17.7% which translates to 177 million people, and that approximately 20% of deaths in China are attributable to high blood pressure.[21]

In Sub-Saharan Africa (SSA), hypertension is a predominant driver of CVD, especially stroke and heart failure.[14] The prevalence of HTN is particularly high in urban SSA, with rates ranging between 8 and 25% of adults affected. In South Africa, the 2003 Demographic and Health Survey found that 12.5 % of men and 17.9% of women were hypertensives.[19]

The overall Prevalence of HTN in Nigeria ranges from 8% - 46.4% depending on the study target population, type of measurement and cut off value used for defining HTN.[22] The prevalence is similar in men and women (7.9% - 50.2% vs 3.5% - 68.8%, respectively) and in

the urban (8.1% - 42%) and rural setting (13.5% - 46.4%).[22] The pooled prevalence increased from 8.6% from only study during the period from 1970 - 1979 to 22.5% (2000-2011).[22]

Genetics, excess sodium intake and obesity are among the major underlying risks for HTN. Primary prevention has focused on sodium reduction, increased fruit and vegetable intake, weight reduction, and avoidance of excessive alcohol intake.[23] Finland's experience has potential applications for low and middle income countries where treatment levels remain extremely low and health systems have yet to adapt to managing chronic diseases like hypertension.

2.2.2 DYSLIPIDAEMIA

The Framingham Study first demonstrated the link between hypercholesterolemia and increased risk of CHD in the 1960s. It is demonstrated that the lower levels of high-density lipoprotein (HDL) cholesterol as well as elevated levels of low-density lipoprotein (LDL) cholesterol were associated with increased risk of CVD.[24] Subsequent studies confirmed these results and further established that elevated triglycerides also increase CVD risk. Furthermore, randomized controlled trials have shown that reduction of LDL cholesterol is associated with reduced coronary event.[24] Reductions in LDL cholesterol have also been associated with a lowered incidence of stroke, although the evidence is not as strong as for CHD. In addition, LP (a) is an LDL–like particle that was independently associated with CHD and stroke in a recent comprehensive meta-analysis.

The INTERHEART study confirmed a graded relationship between abnormal lipid levels and risk for CHD in all regions of the world. Abnormal blood lipids were the most important risk factor for myocardial infarction by odds ratio in all global regions.[25] Furthermore, the Global Burden of Disease study estimated that elevated cholesterol was the third leading risk factor for worldwide mortality in general, after hypertension and smoking.

While it is clear that dyslipidemia is one of the leading risk factors for CVD there is significant regional variation in the prevalence of hyperlipidemia. Hypercholesterolemia was found in 22% of subjects enrolled in the Heart of Soweto study of patients with newly diagnosed CVD in South Africa. In Mongolia, the Ministry of Health, in collaboration with WHO performed a steps survey across the country and reported 7% prevalence of hypercholesterolemia.[25] In contrast, a nationally representative population-based study in Iran found the prevalence of hypercholesterolemia to be more than 45%.[25] In accordance with this geographic variability in the prevalence of hypercholesterolemia, the population-attributable risk of dyslipidemia for CHD in the INTERHEART study varied widely by geographic region.[25] Although systematic data specifically regarding Lp(a) and its relationship to CVD among different populations are lacking, Lp(a) levels have been shown to vary among different ethnic groups; Asian Indians for example have higher Lp(a) levels than ethnic Chinese and Caucasian populations. Studies in Africans and African Americans have higher average Lp(a) levels than in Caucasians.[26]

Successful intervention programs in a number of countries have further supported the causal link between dyslipidaemia and CVD by demonstrating that reductions in cholesterol lead to decreased CVD morbidity and mortality. In Finland, a nationwide multispectral program targeted at multiple cardiovascular risk factors decreased population mean serum cholesterol levels as well as CVD mortality between 1972 and 1992. These reductions in cholesterol were largely credited to reductions in saturated fat intake as well as more comprehensive cholesterol monitoring and treatment. Further analysis showed that among men the 13% reduction in cholesterol levels was singlehandedly responsible for a 26 % reduction in CVD mortality. In the Nigerian Non communicable disease survey report of 1997, 0.2% had both hypertension and hypercholesterolemia. The highest prevalence of hypertension and increased cholesterol was recorded in Kano, the second largest Nigerian city.[9] A hospital based study conducted by Karaye et al. in Kano, however reported a rate of 20% among hypertensive on treatments, 4.3%

among treatment-naive and 1.4% in the non hypertensive control.[27] Higher HDL_C values were reported in the hypertensive groups (1.31 ± 0.48mmol/L) when compared with the controls (1.11 ± 0.24mmol/L). A similar trend has also been reported by Okeahialam and colleagues in Jos.[28]

2.2.3 DIABETES MELLITUS

Diabetes Mellitus is becoming increasingly common and is a significant contributor to CVD risk worldwide. Globally, the number of people with DM is expected to rise from 194 million in 2003 to 333 million in 2025.[29, 30] Most of this epidemic is projected to be in developing countries, DM was previously considered a rare medical condition in Africa.[31] However, epidemiological studies carried out in the last decade of the 20th century have provided evidence of global trend towards increase of the prevalence of DM in African population.[31]

CVD is the leading cause of morbidity and mortality in people with Diabetes.[32] People with diabetes have a more than two – fold greater risk of fatal and non fatal CVD compared to non diabetics.[32]

The magnitude of the risk of CVD associated with diabetes is even greater in women and younger individuals. As compared with earlier reports there is an increasing prevalence of DM particularly in urban black people, which is most likely attributable to the increasing prevalence of obesity.[33] Multiple factors contribute to the accelerated atherosclerosis in diabetics, this factors include excess prevalence of traditional risk factors such as obesity, hypertension and dyslipidaemia.

There are also modifications of lipoproteins and other key proteins with glycation and oxidation, increased procoagulation and possibly the state of insulin resistance.[33]

Meticulous control of blood glucose has been conclusively shown to reduce the development of microalbuminuria by 35% in type 1 diabetics.[29] Control of blood pressure with a variety of antihypertensive agents including angiotensin converting enzymes inhibitors, has been shown to delay the progression of albuminuria in both type 1 and type 2 diabetics.[34, 35]

2.2.4 OBESITY

Obesity increases cardiovascular mortality by promoting insulin resistance, hyper insulinaemia, type 2 DM, hypertension and low HDL_C.[36 - 38] It is also associated with increase in serum levels of inflammatory markers such as C- reactive protein and fibrinogen; which have been associated with elevated risk for CVD.[39] Compared with men of normal body weight (BMI < 25kg/m^2), men with BMI of 25 – 29kg/m^2 have been observed to have a 70% greater risk of coronary heart disease (CHD) whereas men with BMI of 29 - 33 kg/m^2 had almost a 3 fold greater risk of CHD.[40] In general, the greater the degree of increase in body weight, the higher the risk of coronary mortality.[41]

Significant positive associations have been reported between BMI and both systolic BP and diastolic BP in studies of African-Americans,[42] Chinese,[43] Africans and Carribeans.[44] Similarly, the non-communicable disease (NCD) Committee in Nigeria reported a strong relationship between increased BMI and hypertension among adult Nigerians.[9] The crude prevalence of hypertension increased progressively as BMI also increased, across all age groups from 15-34 to 55-64 years.[9]

A recent study on pre-hypertensives in Nigeria also showed that BMI increased across the gradient of blood pressure status from normotension through Prehypertension to hypertension.[45] In a study of pattern of blood pressure in adolescents, Mijinyawa et al, observed that both systolic and diastolic pressures increase with increasing BMI in both gender.[46] Similar observations were made by Lawoyin et al, in Ibadan.[18] The mean SBP (mmHg) and

DBP (mmHg) for normal weight, overweight and obese were found to be 120.8 and 74.2, 132.0 and 83.1, and 131.3 and 83.6 respectively.

Weight reduction leads to a reduction in blood pressure in a large proportion of overweight hypertensive individuals and can reduce other CVD risk factors such as DM and dyslipidaemia.[48.- 50]

2.2.5 SMOKING

Cigarette smoking is a leading preventable cause of death in the US. Apart from being a risk factor for CVD, smoking also has significant morbidity and mortality. [51, 52] Smoking is said to be on the decrease in many developed countries but the reverse is the case for many parts of Sub-Saharan Africa.[53] This trend is generally believed to have been caused by rapid urbanization, acculturation and the heavy export of tobacco product to Africa.[53]

The NCD Committee had reported that about 8.9% of Nigerians aged 15 years and above smoke cigarettes. The same study showed that smoking rate was higher in males (15.4%) than females (1.7%).[9] Similar finding was observed by Lawoyin et al, in Ibadan where smoking rates were also higher for men (18.5%) than women (0.0%), and these men had highest risk for obesity and hypertension.[18]

Studies in many African countries have revealed higher prevalence rates of smoking in comparison to data from Nigeria. For example, a community based study in Dar ES Salam, Tanzania among individuals aged 35-64 years revealed a prevalence rate of 22.0% in males and 2.6% in females.[54,55] Another hospital- based prospective study in Yaoundé Cameroun, revealed a prevalence rate of cigarette smoking of 23% among patients aged ≥40years, and these patients had higher incidence of carotid atherosclerosis. Although the exact mechanism by which smoking increases the risk of atherosclerotic diseases are not fully understood, it may

acts as cardiovascular trigger by causing inflammation, impaired endothelial functions, oxidative processes, platelets activation among others.[9]

.

2.3 CARDIOVASCULAR RISK STRATIFICATION

The constellation of cardiovascular disease risk factors markedly increases the absolute risk of cardiovascular events in a geometric fashion, such that when two or more risk factors are present, the total risk is much greater than the sum of their individual contribution.[56] This has led to the emphasis on the need for total CV risk stratification as illustrated in Table A by the European Society of Hypertension / European Society of Cardiology (ESH/ESC) below.[56]

Table A : STRATIFICATION OF ABSOLUTE CVD RISK ACCORDING TO LEVELS OF BLOOD PRESSURE, OTHER RISK FACTORS AND DISEASE HISTORY ADAPTED FROM ESH/ESC HTN GUIDELINES 2013.[56]

Risk factors, organ damage, Disease	Risk stratification by BP (mmHg)			
	SBP 130 – 139 DBP 85 - 89	SBP 140 – 159 DBP 90 – 99	SBP 160 – 179 DBP 100 - 109	SBP ≥180 DBP ≥ 110
No risk factor		Low	Moderate to high	High
1-2 risk factor	Low	Moderate	Moderate to high	High
≥ 3 Risk factors	Low to moderate	Moderate to high	High	High
Organ damage, CKD stage 3 or DM	Moderate to high	High	High	High to very high
Symptomatic CVD,CKD Stage ≥ 4,DM with organ damage/ risk factors	Very high	Very high	Very high	Very high

DM Diabetes Mellitus, CKD Chronic kidney disease, SBP systolic blood pressure, DBP diastolic blood pressure, DM diabetes mellitus, mmHg millimeter of mercury.

This stratification of risk factors for all age groups of patient has a practical value as demonstrated by clinical trials. Individuals in the high risk or very high risk categories do not require only life style changes but prompt BP lowering intervention through drug administration. They may also require non-hypertension related intervention, such as administration of antiplatelet and statins.[57]

FRAMINGHAM RISK SCORE

The Framingham Risk Score (FRS),[58] is a gender specific algorithm used to estimate the 10 year risk of an individual. The FRS was first developed based on data obtained from the Framingham Heart Study, to estimate the 10 year risk of developing coronary Heart disease.[58] In order to assess the 10 year CVD risk, cerebrovascular events, peripheral arterial disease and heart failure were subsequently added as disease out comes for the 2008 FRS, on top of coronary Heart disease.[58,59] It uses the following parameters: Age (in years), total cholesterol (mg/dl), Smoking habit, HDL cholesterol (mg/dl) and systolic blood pressure.

Individuals are classified as low risk, intermediate risk or high risk. Low risk individuals have 10% or less CHD risk at 10 years, with intermediate risk 10-20% and with high risk 20% or more, however it should be remembered that these categories are arbitrary.

CHAPTER THREE

3.0 METHODOLOGY

3.1 BACKGROUND OF THE STUDY AREA

The study was conducted in four wards of Kumbotso Local Government Area (LGA) which is one of the 44 LGA of Kano State, created in 1989. It is located in the Southwestern part of the state, approximately 16Km from the State capital and has an estimated population of 301,8710 people projected from 2006 population census.[9]

The Local Government lies between latitude $11^{0}50^{"}$ and 12^{0} north of the equator and longitude $8^{0}20^{"}$ and $8^{0}40^{"}$ east of the prime meridian. The vegetation of the area is Sudan Savannah, and the hottest months are April and May while the coldest were December and January. The rainy season ranges from May to October. It has an average rainfall of 140mm, with an average of 65 rainy days per annum. Majority of the residents were Hausa and Fulani by tribe, with few other tribes such as Yoruba, Nupe, Igbo, Kanuri, Igala and Ebira. Most of the inhabitants are traders and subsistent farmers. Other occupations in the area include cattle rearing and civil service.

3.2 STUDY DESIGN

The study was descriptive and cross-sectional in design.

3.3 STUDY POPULATION

Adults aged 18 years and above living in the area during the study period.

3.4 INCLUSION AND EXCLUSION CRITERIA

3.4.1 INCLUSION CRITERIA

1. Adults aged 18 years and above

2. Resident in the study area for at least one year

3.4.2 EXCLUSION CRITERIA

1. Visitors to the study area

3.5 SAMPLE SIZE DETERMINATION

The minimum sample size was determined using the Fisher's formula as follows.[60]

$N = Z^2 P Q / D^2$ where

N = Minimum sample size

Z = Standard normal deviate corresponding to 95% confidence interval (i.e. 1.96)

P = Best estimate of CVD risk factor. This was based on the highest prevalent cardiovascular risk factor (truncal obesity, 47.3% =0.47) among apparently healthy adult Nigerians as reported by Sani et al.[14]

Q = (Complementary probability) 1.0 – P (1.0 – 0.47 = 0.53)

D = Absolute precision limit required (5%) 0.05

Thus $N = (1.96^2 (0.47) (0.53) / (0.05)^2$

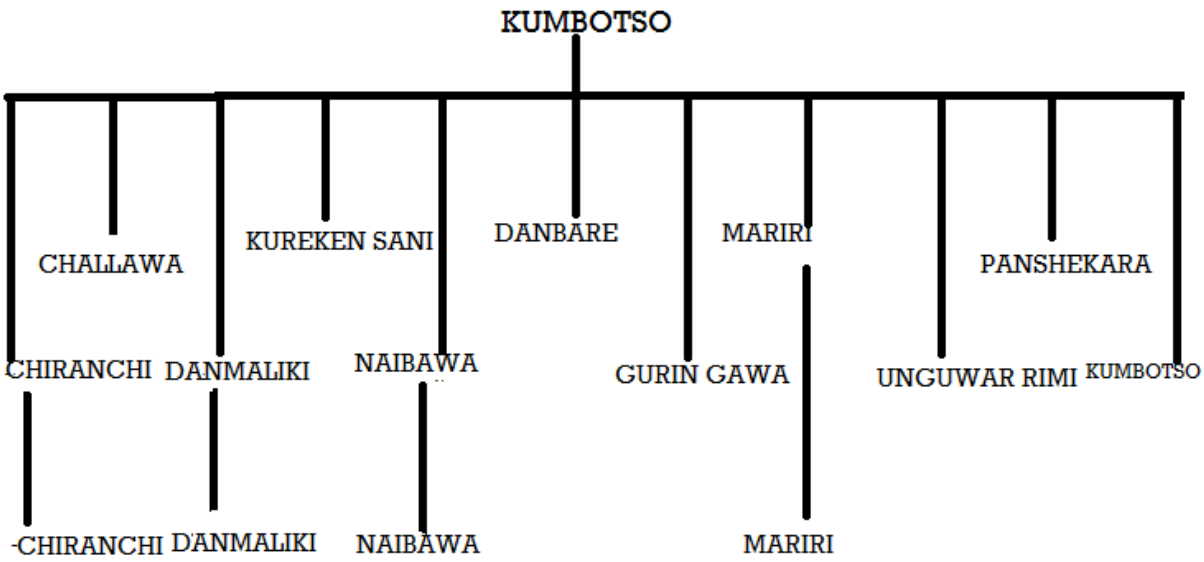
$3.8416 \times 0.1924 / 0.05^2 = 382.3$

Fourty subjects (10% of the calculated sample size) were added to account for non response, giving a sample size of 422.

3.6 SAMPLE TECHNIQUE

A multistage sampling technique was used.

- Four out of eleven wards were selected randomly by balloting.
- A list of all households in the selected wards were made.
- An appropriate number of households in the wards were selected systematically using a sample interval obtained by dividing sampling frame (list of all households in the wards) by the sample size.
- A single respondent 18 years and above was selected in each household.
- The selection of the subjects was determined randomly by balloting.



Flow chart showing the 4 selected wards out of the eleven political wards in the LGA under study.

SN	Selected wards	Total population (2006)	Projected population (2014)	Percentage %	Proportion	Number of people selected from the wards	Number of houses
1	CHIRANCHI	19386	23810	12.60649	0.1260649	56	4767
2	DANMALIKI	53575	65801	34.839123	0.3483912	155	16681
3	NAIBAWA	29040	35667	18.884318	0.1888432	89	9778
4	MARIRI	51777	63593	33.67007	0.3667007	122	4614
	TOTAL	153778	188871	100	1	422	35840

Proportionate allocation based on the 2014 population of the 4 randomly selected wards projected from 2006 census and number of houses.[47]

3.7 STUDY PROTOCOL

Advocacy visits were paid to the Local Government Chairman and Traditional Leaders to obtain permission to carry out the study. Influential members of the community were visited for the same purpose. Permission and cooperation for the study was obtained from the LGA Chairman, District, village and ward heads.

3.8.0 STUDY PROCEDURE

Fifteen research assistants made of medical doctors, medical students, and laboratory scientists, who speaks Hausa/English were trained by the researcher and supervising Consultant assisted in data collection.

The research procedure was based on modification of WHO STEPS Instrument. The WHO STEPS wise approach to surveillance (STEPS) is the WHO recommended surveillance tool for chronic disease risk factors and chronic disease specific morbidity and mortality. STEPS is a

sequential process that involves gathering key information on risk factors with a questionnaire, simple physical measurements and more complex collection of blood sample for biochemical analysis. It covers three different levels or steps for risk factor assessment. They are as follows:

Step 1: Gathering demographic and behavioral information by questionnaire in a household setting.

Step 2: Collecting physical measurement with simple test.

Step 3: Taking blood sample for biochemical measurements.

3.8.1 Key Information

A semi-structured pre-tested interviewer administered questionnaire was used. The socio demographic information of each subject as well as medical history of HTN, DM and history of cigarette smoking were obtained. Smoking 20 cigarettes daily for more than one year was considered significant.

3.8.2 Anthropometric Measurements: The weight was recorded to the nearest gram using Weighing scale on a firm horizontal surface with the patients wearing light clothing without shoe on. Height was measured with a stadiometer with patients standing erect on a flat surface without shoes or cap or head gear. Body Mass Index (BMI) was calculated using the formula: BMI = weight (in kilogram)/ height (in metre^2). Waist circumference was measured with a tape measure at a level midway between the lower rib and iliac crest.

3.8.3 Blood pressure measurement:

This was carried out using standard mercury sphygmomanometer (ACCOSON). After a minimum of 5 minutes rest, blood pressure was measured in both bare arms in sitting position and the arm with the higher BP recording was used for blood pressure measurement. A cuff of appropriate size was wrapped snugly around the arm with the lower margin being about 2.5

cm above the antecubital fossa, and the midline of the bladder over the brachial artery pulsations.

The level of BP on the sphygmomanometer which coincided with the appearance of the first heart sound (Korotkoff phase I) was considered as systolic blood pressure (SBP) while the level of BP recording which coincided with the disappearance of heart sound (Korotkoff phase V) was used as the diastolic blood pressure (DBP). The readings were recorded to the nearest 2mmHg. Three blood pressure measurements were made at 5 minutes interval and the average of the last 2 readings was used as the subject's BP.

3.8.4 Electrocardiography (ECG):

A 12 lead ECG at rest was carried out for those found to have high BP during the study using bionetcardiocare EKG – 2000 machine. The ECGs were interpreted by the Investigator under the guidance of the supervising Consultants.

3.8.5 Fasting Plasma Glucose:

Two millilitre of blood was taken from the subjects, and transferred to fluoride oxalate bottle, separated in to serum before being analysed. The analysis was done using glucose oxidase method in AKTH Chemical Pathology Laboratory.

3.8.6 Fasting Lipid Profile:

Four millilitre of blood was taken from the subjects transferred in to lithium heparin bottle, then separated in to serum before being analysed, analysis was by CHOD-PAP enzymatic colorimetric method in AKTH Chemical Pathology Laboratory.

3.9.0 DEFINITION OF TERMS

3.9.1 Hypertension: This was taken as positive history of hypertension, use of anti-

hypertensive drugs or systolic blood pressure equal to or greater 140 mmHg and or diastolic blood pressure ≥ 90 mmHg[16,17]

3.9.2 Diabetes Mellitus

This was defined as fasting plasma glucose ≥ 7.0 mmols/L (≥126 mg/ dl) or 2 hour plasma glucose of ≥11.1mmol/l (≥200mg/dl).[35]

3.9.3 Hyperlipidaemia

Hyperlipidaemia was defined using the NCEP ATP III guidelines. Total cholesterol was considered to be high if it is >200mg/dl (>5.17mmol/l). Low Density Lipoprotein cholesterol (LDLc) was considered to be raised if it is >130mg/dl (>3.20mmol/l) and HDL was considered to be low in men if it is < 40mg/dl (<1.03mmol/l) and in women if <50mg/dl (1.29mmol/l). Triglyceride was considered high if it is >150mg/dl (>1.7mmol/l)[62]

3.9.4 (a) Truncal Obesity:

This was defined based on waist circumference of ≥102 cm in men or ≥ 88 cm in women.[62]

(b) Generalized obesity:

This was defined based on BMI of ≥ 30 kg/m.^{2} [62]

3.9.5 Cigarette Smoking:

This was classified in to :

(a) Never Smoker- adults who have never smoked cigarette or who have smoked fewer than 100 cigarette in their entire lifetime.

(b) Former smoker-Adults who have smoked at least 100 cigarettes in their life time, but say they currently do not smoked.

(c) Nonsmoker-adults who currently do not smoke cigarettes, including both former smoker and never smokers.

(d) Current smoker-Adults who have smoked 100 cigarette in their lifetime and currently smoke cigarettes everyday (daily) or some days.

3.9.6 Metabolic syndrome: Metabolic syndrome was defined using ATP III criteria as follows: Diabetes mellitus = glucose abnormalities of >6.1mmols/L (FBS), HTN=BP > 130/80mmHg, truncal obesity = WC > 102cm in males and >88cm in females, raised triglyceride = >1.7mmols/L and low HDLc = <1.0mmols/L. Any respondent with three or more of the above risk factors is diagnosed to have metabolic syndrome.[62]

3.9 Data analysis

The questionnaire was manually checked for accuracy and completeness. All data collected were entered and analyzed using IBM Corp. Released 2010, IBM SPSS statistics for windows, version 19.0. Armonk, NY: IBM Corp. Quantitative variables were summarised as means and standard deviations. Qualitative variables were expressed as ratios and percentages. Chi-squared test was used to compare proportions, while Student t-test was used to compare means of continuous variables for significant differences. Logistic regression analysis was used to identify significant predictors adjusting for confounders.

A p- value of < 0.05 was considered as statistically significant.

3.10 Ethical Approval:

Ethical clearance for the study was obtained from AKTH Ethics Committee. Permission and cooperation for the study was obtained from the LGA Chairman, District, Village and Ward heads. Informed consent was obtained from each subject (see Appendix II). The HELSINKI declaration on investigation on human subjects was respected.[63]

CHAPTER FOUR

4.0. RESULTS

4.1.0 Response rate

Of the 450 subjectsts that were recruited, 422 completed the study giving a response rate of 93.8%. Laboratory evaluations was refused by 48 (11.4%) subjects.

4.1.1 Socio-demographic characteristics

The socio-demographic characteristics of the respondents are presented in Table 1.0. Of the 422 subjects who completed the study, 199 (47.2%) were males and 223 (52.8%) were females. The age ranged from 18 to 85 years (mean 39.4 ± 14.8 years). Majority (71.1%) of the respondents were married and Hausa/Fulani by tribe (95.7%). Over half (52.1%) of the participants had at least primary education, 47.9% had no formal education, a third (36.6%) were traders and less than a quarter (14.5%) were civil servants.

4.2.0 Prevalence of modifiable cardiovascular risk factors

Table 2 shows the prevalence of modifiable CV risk factors.

4.2.1 Hypertension

One hundred and forty three (33.9%) subjects had hypertension. This consisted of 54 (37.8%) known and 89 (62.2%) newly diagnosed hypertensives. Only 15 (27.8%) of the known hypertensives were taking antihypertensive treatment.

Table 1: Socio-demographic characteristics of the respondents

Characteristics	Frequency N = (422) N (%)
Age (years)	
< 60	371(87.9)
≥60	51 (12.1)
Gender	
Male	199 (47.2)
Marital status	
Single	87 (20.6)
Married	300 (71.1)
Widowed	15 (3.8)
Divorced	20 (4.5)
Tribes	
Hausa/Fulani	404 (95.7)
Yoruba	7 (1.7)
Igbo	0 (0.0)
Others	11 (2.6)
Educational status	
Primary	53 (12.6)
Secondary	92 (21.8)
Tertiary	75 (17.8)
Quranic	202 (47.9)
Occupational status	
Civil servants	61 (14.5)
Housewives	167 (39.5)
Traders	153 (36.6)
Unemployed	41 (9.7)

4.2.2 Diabetes mellitus

Nineteen subjects had type 2 DM, giving a prevalence rate of 4.8%. Of these, 12 (63.2%) were known diabetics and had suboptimal glycaemic control despite being on treatment. Seven (36.8%) were newly diagnosed type 2 DM patients.

4.2.3 Obesity

Sixty nine (16.4%) subjects were obese (BMI: $\geq$30kg/m^2), while 199 (47.2%) were overweight (BMI: 25-29.9kg/m^2). Twenty seven (13.6%) males and 100 (44.8%) females had truncal obesity defined as Waist Circumference of more than 102cm and 88cm, respectively. The overall prevalence of truncal obesity was 30.1%.

4.2.4 Cigarette Smoking

Cigarette smoking was observed in 11(2.6%) subjects. They were all young males and mostly single (unmarried).

4.2.5 Dyslipidaemia

One hundred and twenty five (31.3%), 80 (20.1%), 96 (24.1%), and 207 (51.9%) subjects had hypertriglyceridaemia, hypercholesterolaemia, raised LDLc and low HDLc, respectively.

4.2.6 Left ventricular hypertrophy (LVH)

Ninety four (23.7%) respondents had ECG evidence of LVH by Sokolow and Lyon criteria. Twenty nine (7.3%), 2 (0.5%), and 30 (7.6%) were hypertensive, diabetic and obese (truncal obesity), respectively.

4.2.7 Metabolic syndrome

Fifty three (12.6%) respondents had metabolic syndrome defined using ATP III criteria. Majority 36 (67.9%) were females and 35 (66.0%) had hypertension. Only 1 (2.0%) had diabetes mellitus.

On the whole, 358 (83.7%) out of 422 subjects that were studied had one or more modifiable CV risk factors, with the three leading risk factors being dyslipidaemia 331 (82.9%), HTN 143 (33.9%) and truncal obesity 127 (30.1%).

Compared to normotensives, the hypertensives subjects did not differ significantly in the prevalence of truncal obesity [75 (17.8%) VS 52 (12.3%), p = 0.440], generalized obesity [41 (9.7%) VS 28 (6.6%), p = 0.199] and diabetes mellitus [11 (2.8%) VS 8 (2.0%), p = 0.199]. Compared to subjects with normal lipid status, those with dyslipidaemia had significantly higher prevalence of type 2 DM [12 (3.0%) VS 7 (1.8%), p = 0.030].

Table 2: Prevalence of modifiable cardiovascular risk factors by gender

	Frequency			
Characteristics	**Males**	**Females**	**Total**	**p value**
	N = 199	**N = 223**	**N = 422**	
	N (%)	**N (%)**	**N (%)**	
Hypertension	58 (29.1)	85 (38.1)	143 (33.9)	0.050
Diabetes mellitus	9 (4.8)	10 (4.7)	19 (4.8)	0.960
Hypercholesterolaemia	32 (8.0)	48 (12.0)	80 (20.1)	0.170
Raised LDL	47 (11.8)	49 (12.3)	96 (24.1)	0.720
Hypertriglyceridaemia	53 (13.3)	72 (18.0)	125 (31.3)	0.180
Low HDLc	102 (49.3)	105 (50.7)	207 (51.9)	0.320
Dyslipidaemia	131(39.6)	200 (60.4)	331 (82.9)	0.039
Cigarette smoking	11(5.5)	0 (0.0)	11 (2.6)	<0.001
BMI $\geq$30kg/m^2	26 (13.1)	43 (19.3)	69 (16.4)	0.035
Truncal obesity	27 (13.6)	100 (44.8)	127 (30.1)	<0.001
ECG LVH	33 (8.3)	61 (15.4)	94 (23.7)	0.005

BMI Body mass index, HDLc High Density Lipoprotein cholesterol, LDL Low Density Lipoprotein, CV cardiovascular, N total number of subjects. LVH Left Ventricular Hypertrophy.

4.3.0 Modifiable CV risk factors and influence of sociodemographic characteristics

The influence of sociodemographic characteristics of the respondents on the prevalence of modifiable CV risk factors are shown in Table 2 - 11. Apart from cigarette smoking, truncal obesity and ECG LVH, there was no statistically significant gender differences in the prevalence of cardiovascular risk factors. (Table 2).

Hypertension was significantly more frequent among subjects who had informal than formal education (42.3% VS 20.6%, $p < 0.001$) and those living in Danmaliki compared to other wards ($p < 0.001$). (Table 3).

Truncal obesity was significantly more frequent among subjects who were aged more than 60 years (37.3%, $p = 0.234$), employed (31.8%, $p = 0.023$), females (44.8%, $p = 0.001$) and informally educated (37.6%, $p = 0.001$). (Table 4). However, logistic regression analysis identified gender as the only independent predictor of truncal obesity ($p = 0.001$, OR = 3.850, 95% CI = 1.8 – 8.3). (Table 5).

The prevalence of obesity by BMI was significantly higher among subjects who were employed 67 (17.4%, $p = 0.04$) and those who had informal education 53 (20.8%, $p = 0.002$). (Table 6). However, DM, dyslipidaemia and ECG LVH were not related to socio-demographic characteristics. (Tables 7, 8 and 9)

4.4.0 Cardiovascular risk factors and influence of sociodemographic characteristic

Table 3: Comparison of sociodemographic characteristics of subjects with and without hypertension.

Characteristics	Frequency			
	HTN – VE N= 279 N (%)	HTN + VE N = 143 N (%)	Total N= 422	p value
Age group				
< 60 years	254 (68.5)	117 (31.5)	371	
≥ 60 years	25 (49.0)	23 (51.0)	48	0.086
Occupational status				
Employed	251(65.9)	130 (34.1)	381	
Unemployed	28 (68.3)	13 (31.7)	41	0.760
Marital status				
Married	191 (63.7)	109 (36.3)	300	
Unmarried	88 (72.1)	34 (27.9)	122	0.960
Gender				
Male	141 (70.9)	58 (29.1)	199	
Female	138 (61.9)	85 (38.1)	223	0.052
Educational status				
Formal	132 (79.4)	35 (20.6)	167	
Informal	147 (57.7)	108 (42.3)	255	0.001
Ward				
Danmaliki	79 (51.3)	75 (48.7)	154	
Mariri	95 (76.0)	30 (24.0)	125	
Naibawa	59 (67.5)	29 (32.5)	88	0.001
Chiranci	46 (83.6)	9 (16.4)	55	

HTN; hypertension, -VE; hypertension absent, +VE; Hypertension present

Table 4: Comparison of socio-demographic characteristics of subjects with and without truncal obesity.

Characteristics	Frequency			p value
	Non obese N = 295 N (%)	Obese N = 127 N (%)	Total N= 422	
Age group				
<60 years	263(70.9)	108 (29.1)	371	
≥ 60 years	32 (62.7)	19 (37.3)	51	0.234
Occupational status				
Employed	260 (68.2)	121(31.8)	381	
Unemployed	35 (85.4)	6 (14.6)	41	0.023
Marital status				
Married	197 (65.7)	103 (34.3)	300	
Unmarried	98 (80.3)	24 (19.7)	122	0.003
Gender				
Male	172 (86.4)	27 (13.6)	199	
Female	123 (55.2)	100 (44.8)	223	0.001
Ward				
Danmaliki	98 (63.6)	56 (36.4)	154	
Mariri	93 (74.4)	32 (25.6)	125	
Naibawa	71 (80.7)	17 (19.3)	88	0.009
Chiranchi	33 (60.0)	22 (40.0)	55	
Educational status				
Formal	136(81.4)	31 (18.6)	167	
Informal	159(62.4)	96 (37.6)	255	0.001

WC; waist circumference

Table 5: Socio-demographic determinants of obesity by waist circumference

Sociodemographic Characteristics	P value	Odd Ratio	95% confidence Interval
Age group	0.722	1.183	0.468 – 2.990
Occupational status	0.562	1.346	0.493 – 3.672
Gender	<0.001	3.850	1.796 – 8.253
Educational status	0.286	1.337	0.784 – 2.279
Address	0.635	1.257	0.489 – 3.229
Marital status	0.118	1.586	0.890 – 2.827

Table 6: Comparison of sociodemographic characteristics of subjects with and without Obesity using BMI.

Characteristics	Frequency			p value
	Non obese N = 353 N (%)	Obese N = 69 N (%)	Total N= 422	
Age group				
< 60 years	310 (87.6)	61 (12.4)	371	
≥ 60 years	43 (84.3)	8 (15.7)	51	0.891
Occupational status				
Employed	318 (82.6)	67 (17.4)	385	
Unemployed	39 (95.1)	2 (4.9)	41	0.040
Marital status				
Married	249 (83.0)	51 (17.0)	300	
Unmarried	104 (85.2)	18 (14.8)	122	0.570
Gender				
Males	173 (86.9)	26 (13.1)	199	
Females	180 (80.7)	43 (19.3)	223	0.090
Ward				
Danmaliki	125 (80.5)	29 (19.5)	154	
Mariri	109 (87.2)	16 (12.8)	125	
Naibawa	74 (84.1)	14 (15.9)	88	0.570
Chiranchi	45 (81.8)	10 (18.2)	55	
Educational status				
Formal	151 (90.4)	16 (9.6)	167	0.002
Informal	202 (79.2)	53 (20.8)	255	

BMI; Body mass Index.

Table 7: Comparison of sociodemographic characteristics of subjects with and without diabetes mellitus.

Characteristics	Frequency			p value
	DM – VE N = 380 N (%)	DM + VE N = 19 N (%)	Total N= 422	
Age group				
< 60 years	332 (94.9)	18 (5.1)	350	
≥ 60 years	48 (98.0)	1 (2.0)	49	0.340
Occupational status				
Employed	345 (95.0)	18 (5.0)	363	
Unemployed	35 (97.2)	1(2.8)	36	0.380
Marital status				
Married	277 (96.2)	11 (3.8)	288	
Unmarried	103 (92.8)	8 (7.2)	111	0.154
Gender				
Males	178 (95.2)	9 (4.8)	187	
Females	202 (95.3)	10 (4.7)	212	0.960
Educational status				
Formal	148 (97.7)	10 (2.3)	158	
Informal	232 (92.5)	9 (7.5)	241	0.460
Ward				
Danmaliki	136 (92.5)	11 (7.5)	147	
Mariri	116 (97.5)	3 (2.5)	119	0.210
Naibawa	81 (95.2)	4 (4.7)	85	
Chiranchi	47 (97.9)	1 (2.1)	48	

DM; Diabetes mellitus, -VE; Diabetes mellitus absent,+VE; Diabetes mellitus present.

Table 8: Comparison of sociodemographic characteristics of the subjects with and without dyslipidaemia.

Characteristics	Frequency			
	Normal	Dyslipidaemia	Total	p value
	N = 72	N = 327	N= 422	
	N (%)	N (%)		
Age group				
< 60 years	65 (18.6)	285 (81.4)	350	0.465
≥ 60 years	7 (14.3)	42 (85.7)	49	
Occupational status				
Employed	67 (18.5)	295 (81.5)	362	
Unemployed	5 (13.5)	32 (86.5)	37	0.450
Marital status				
Married	54 (18.8)	233 (81.2)	287	
Unmarried	18 (16.1)	94 (83.9)	112	0.314
Gender				
Males	37 (19.8)	150 (80.2)	187	
Females	35 (16.5)	177 (83.5)	212	0.400
Educational status				
Formal	30 (19.1)	127 (80.9)	157	
Informal	42 (17.4)	200 (82.6)	242	0.660
Ward				
Danmaliki	29 (19.7)	118 (80.3)	147	
Mariri	19 (16.0)	100 (84.0)	119	
Naibawa	15 (17.7)	70 (82.3)	85	0.650
Chiranchi	9 (18.6)	39 (81.4)	48	

Table 9: Comparison of sociodemographic characteristics of subjects with and without left ventricular hypertrophy

Characteristics	Frequency			p value
	LVH - VE N = 303 N (%)	LVH + VE N = 94 N (%)	Total N = 422	
Age group				
< 60 years	262 (75.3)	86(24.7)	348	
≥ 60 years	41 (83.7)	8 (16.3)	49	0.196
Occupational status				
Employed	277 (76.9)	83 (23.1)	360	
Unemployed	26 (70.3)	11 (29.7)	37	0.236
Marital status				
Married	217 (75.9)	68 (24.1)	286	
Unmarried	86 (76.8)	26 (23.2)	112	0.502
Gender				
Males	154 (82.3)	33 (17.6)	187	
Females	149 (71.0)	61 (29.0)	210	0.405
Educational status				
Formal	122 (77.7)	35 (22.3)	157	
Informal	181 (75.4)	59 (24.6)	240	0.344
Ward				
Danmaliki	103 (71.0)	42 (29.0)	145	
Mariri	100 (84.0)	19 (16.0)	119	0.092
Naibawa	65 (76.5)	20 (23.5)	85	
Chiranchi	35 (72.9)	13 (27.1)	48	

LVH Left Ventricular Hypertrophy, -VE LVH absent,+VE;Diabetes LVH present.

4.4.0 Awareness of cardiovascular risk factors and their complications:

The most frequently known cardiovascular risk factors to the study population included cigarette smoking 238 (56.4%), hypertension 209 (49.5%), dyslipidaemia 183 (43.1%), obesity 155 (36.7%) and diabetes mellitus 153 (36.3%). (Table 10). The proportions of subjects who were aware of CV risk factors, stroke and heart attack as their complications were significantly higher in males than females (Table 11 and 12).

Table 10 : Awareness of modifiable cardiovascular risk factors according to gender

		Frequency		
CV risk factor	**Males N = 199 N (%)**	**Females N= 223 N (%)**	**Total N=422 N (%)**	**p value**
Hypertension	131(65.8)	78(35.0)	209 (49.5)	<0.001
Diabetes mellitus	93 (46.7)	60 (26.9)	153(36.3)	<0.001
Cigarette Smoking	147 (73.9)	91 (40.8)	238(56.4)	<0.001
Obesity	92 (46.2)	63 (28.3)	155 (36.7)	<0.001
Lipid abn.	110 (55.3)	73 (32.7)	183 (43.1)	<0.001

n – number of subjects, CV cardiovascular, N total number of subjects, abn. Abnormality

Table 11: Comparison of awareness of stroke as a complication of modifiable cardiovascular risk factors according to gender.

CV cardiovascular, HTN Hypertension, DM Diabetes Mellitus, CHOL Cholesterol, abn. abnormalities.

		Frequency		
CV risk factors	**Male**	**Female**	**Total**	**P value**
	N = 199	**N = 223**	**N = 422**	
	N(%)	**N (%)**	**N (%)**	
HTN and Stroke	91(45.7)	61(27.4)	152 (36.0)	0.001
DM and Stroke	80 (40.2)	55 (24.7)	135 (32.0)	0.001
Smoking and Stroke	76 (38.2)	49 (22.0)	125 (29.6)	0.001
Lipid abn. and Stroke	66 (33.2)	48 (21.5)	114 (27.0)	0.001
Obesity and Stroke	74 (37.2)	50 (22.4)	125 (29.6)	0.001

Table 12: Comparison of awareness of heart attack as a complication of modifiable cardiovascular risk factors according to gender.

CV cardiovascular, HTN Hypertension, DM Diabetes Mellitus, CHOL Cholesterol, abn.

	Frequency			
CV risk factors	**Male**	**Female**	**Total**	**P value**
	N = 199	**N = 223**	**N = 422**	
	N (%)	**N (%)**	**N (%)**	
HTN and Heart attack	93(46.7)	60(26.9)	152 (36.0)	0.001
DM and Heart attack	80 (40.2)	55 (24.7)	135 (32.0)	0.001
Smoking and Heart attack	75 (37.7)	50 (22.4)	125 (29.6)	0.001
Lipid abn. and Heart attack	66 (33.2)	48 (21.5)	114 (27.0)	0.001
Obesity and Heart attack	80 (40.2)	50 (22.4)	130 (29.8)	0.001

abnormalities.

CHAPTER FIVE

5.0 DISCUSSION

This study determined among others, the prevalence of modifiable cardiovascular risk factors and their sociodemographic determinants in a semi urban community of Kano State, Northwestern Nigeria. The study demonstrated high prevalence of traditional cardiovascular risk factors and gender related differences in the level of awareness of these factors.

5.1.0 Prevalence of cardiovascular risk factors

5.1.1 Hypertension

The prevalence of HTN in this study (33.9%.) is higher than 11.2% reported by the Non Communicable Disease Survey in Nigeria and some other studies in Southern Nigeria using cut off point of 160/90mmHg.[9,18,81] It is however higher than the results of community based studies by Hendricks et al [80] in Kwara state (20.8%) and Isezuo et al [45] in Sokoto (24.8%) that utilized the cut-off point of 140/90mmHg. But comparable to reported values of 30% by Ekwunife et al [66] in an urban community of Nsukka, and 35% by Ulasi et al [73] in a semi urban community (Emene-Nike) both in Southeastern Nigeria, as well as those by other workers in various parts of Nigeria.[64,65,72] It is also similar with the findings from some African nations including Eriteria (31.7%),[80] Ethiopia (35.2%),[80] Benin (36.7%),[80] and Mali (34.7%).[80] Furthermore, the figure is similar to 32.4% reported among non-hispanic Blacks in the US [124] and 30% in England.[114]

A recent study among urban adults aged over 40 years, recruited during a national survey on blindness in Nigeria showed a higher prevalence of hypertension (44.9%).[83] In addition to being urban, this is an older study population when compared with subjects in the present study (mean age = 55.9 ± 12.4 vs 39.4 ± 14.8 years).[83] The observed higher prevalence of hypertension in Southern part of Nigeria may be related to higher literacy rate and access to health facilities.

The prevalence of HTN in this study was higher in females than males, though the difference did not attain statistical significance. This is in contrast to most other findings on the prevalence of hypertension according to gender in Africa.[14,85] However, few African countries had higher prevalence of HTN in women than men: Algeria (31.6% vs 25.7%), Bostwana (37.0% vs 28.8%) [84] and Mali (25.8% vs 16.6%).[84]

5.1.2 Diabetes Mellitus

The prevalence of type 2 DM (4.8%) in the current study is similar to values ranging from 3.6% to 4.4% reported from Southeastern Nigeria.[85,86,103] It is however higher than the rates of 2.0% in Zaria, Northwestern Nigeria [117] and 1.5 - 2.8% reported by some other workers in Nigeria.[9,67,68,106] It is lower than 7.0% and 9.5% reported from Maiduguri, Northeastern Nigeria and Sokoto, Northwestern Nigeria, respectively.[69,104] In Malawi and Ethiopia, East Africa, type 2 DM was observed in 2.0% of the populations,[107] while higher values ranging from 6.7% to 10.7% have been reported from America and Europe.[118] The female preponderance in the prevalence of DM in this study is consistent with the findings of Ohwovoriole et al [77] in Lagos, Southwestern Nigeria and Ekpenyoung et al [78] in Uyo, Southeastern Nigeria. However, some surveys reported higher rates in males.[69,79] Intra and inter population differences in the prevalence rates of type 2 DM may be linked to differences in age and level of affluent life styles.

5.1.3 Obesity:

Truncal obesity was observed in 30.1% of the study population. This is higher than values of 10.3% and 20.1% observed in Benue state and Abuja (Northcentral) Nigeria respectively,[87,118] as well as 14.5% reported in Maiduguri, Northeastern Nigeria.[88] It is however, lower than 4.4% reported among University Staff in Ogbomoso,[106] but comparable to observations by Sani et al [14] in Katsina, Northwestern Nigeria.

In the present study, generalised obesity (BMI ≥ 30Kg/m^2) was observed in 16.4% of the respondents. This is comparable to 15.9% and 14.7% reported from Northeastern and Southwestern Nigeria, respectively,[76,88] but higher than 2.6% reported in rural Fulani community of Kano State, Northwestern Nigeria [70] and 4.0% in Benue State, Northcentral Nigeria.[87] It is lower than reported values of 21.3% in urban Katsina, Northwestern Nigeria[14] and 41.3% from Southeastern Nigeria.[73] Differences in the prevalence of obesity in Nigeria, like type 2 diabetes is probably due to varying degree of adoption of western or affluent life styles.

5.1.5 Cigarette Smoking

In the survey of CV risk factors conducted by the Expert Committee on NCD in Nigeria in 1990, 8.9% of the study population were cigarette smokers. Reports from studies involving semi urban communities in the Southeastern Nigeria (Ulasi et al)[73] and Southsouth Nigeria (Suleiman et al)[74] showed prevalence rates of 18.9% and 14.9%, respectively. These values as well as those from South Africa (20.6%) and some European countries are higher than 2.8% observed in the current study. The observed prevalence rates of smoking in the current study is however higher than rates ranging from 1.7% to 2.3% reported in some rural communities in Nigeria.[70,75,76] The higher prevalence in Southeast and Southsouth parts of Nigeria could be due to differences in cultural acceptability of public smoking or increased availability.

5.1.6. Dyslipidaemia

The overall prevalence of dyslipidemia in this study was 82.9% with low HDLc (51.9%) and hypertriglyceridaemia (31.3%) being the most frequent subtypes. These findings are comparable to those from other studies in Nigeria.[14,70,93] They are however higher than 60.3% reported among elderly in the US.[108]

Elevated total cholesterol was observed in 20.1% of the study population. This is in concordance with 20.8% reported by Isezuo et al[92] in Sokoto, Northwestern Nigeria and 23% by Odenigbo et al [93] in Asaba, Southsouth Nigeria. However, it is lower than 43.5% reported by Agaba et al,[94] 55.2% by Idogun et al,[95] 60.4% by Agboola et al,[96] 62.5% by Ojji et al [97] and other studies from various parts of Nigeria.[14,98,99] Lower prevalence rates of hypercholesterolaemia ranging from 2.4% to 11.1% have been reported in other Nigerian studies.[91,97,103]

In the current study the prevalence of low HDLc was 51.9%. This is in agreement with values ranging from 45.8% to 55.0% observed by other workers in various parts of Nigeria.[14,97,98,100,103] It is however higher than 43.1% and 37.6% observed by Oladapo et al [76] and Iloh et al,[100] respectively. A low HDLc prevalence rate of 6.3% was observed in rural Limpopo province in South Africa.[107]

High LDLc was observed in 24.1%, of the study population which is comparable with 25.7% reported by Sani et al[14] in Katsina, Northwestern Nigeria and 23.3% reported by Akintunde[91] in Osogbo Southwestern Nigeria. However, it is lower than observed values of 60.9% in Asaba[93] Delta State, Southsouth Nigeria, 74.0% in Lagos[98] Southwestern Nigeria and 48.1% among University staff in Ogbomoso, Southwestern Nigeria.[106]

Hypertriglyceridemia was observed in 31.1% of subjects. This is higher than reported values of 25.5% from Benin, Southsouth Nigeria and other researchers in various parts of Nigeria.[14,95-98] It is however consistent with 30.0% recorded in the United State of America[101] and 30.4% reported from Turkey, but lower than values of 46.0%, 42.5% and 83.1% in Iran[125] and Austrea[126] respectively. The higher prevalence of dyslipidaemia in Europe and USA could be due to affluence associated with high income, resulting in increased intake of fasts foods and sugary products.

5.1.7. Metabolic syndrome

The prevalence of metabolic syndrome (12.6%) in this study is comparable to 10.0% and 12.1% reported in rural communities in Southeastern and Southwestern parts of Nigeria respectively [73,120] and 15.3% reported from Ghana.[90]

It is however, lower than values ranging from 17.8% to 66.7% observed by other workers in various parts of Nigeria,[14,73,121-123] and 31% reported by Ker et al [82] among corporate executives in South Africa. The observed difference could possibly be as a result of the fact that cooperate executives were already at increased risk for metabolic syndrome because of the sedentary nature of their job.

5.2.0 Awareness of CVD risk factors

5.2.1 Hypertension

The level of awareness of hypertension as a CVD risk factor in this study (49.5%) is higher than values ranging from 8.0% to 39.3% reported from various parts of Nigeria,[70,76,99,105] but comparable with 50.5% reported by Awosan et al[104] among teachers in Sokoto and 55.2% among Chinese adults.[111] It is however, lower than 59.0% reported among Bankers in Sokoto,[104] 84.5% among secondary school teachers in Oyo,[127] 59.1% among elderly men in the US,[108] and 84% among American-Indian smokers.[110]

5.2.2 Diabetes mellitus

About 36.3% of the study population were aware of diabetes mellitus as a CVD risk factor. This is comparable with 31.4% reported by Awosan et al[104] among secondary school teachers in Sokoto, Northwestern Nigeria. However, it is lower than 42.9%, 69.0%, 75.0% and 78.0% reported among bankers in Sokoto,[104] American-Indian smokers,[110] Canada[112] and CARMELA study in urban latin America,[113] respectively.

5.2.3 Smoking

The level of awareness of smoking as a CVD risk factor (56.4%) is in agreement with 52.4% reported from a study in Nigeria.[104] It is however lower than 92% reported from India,[109] 88% from the US,[110] and 70% from Sweden.[115]

5.2.4 Dyslipidaemia

In spite of the high prevalence of dyslipidaemia in the current study, only 43.1% were aware of it as a CVD risk factor. This level of awareness is similar to 44.8% reported from a study in Nigeria,[104] and 45% reported from Canada.[112] It is however, lower than 51% observed in Sweden,[115] 52% in US,[116] and 98% in India.[109] It is higher than 33.9% reported among Chinese adults with diabetes mellitus,[111] 34% among subject in the US[116] and 12.8% among diabetic patients in China.[115]

5.2.5 Obesity

About 36.7% of subjects were aware of obesity as a CVD risk factor in the present study. This is lower than reported values of 47.6% from a study in Nigeria,[104] 62% from Sweden,[115] 91% from US,[110] 90 to 100% among American-indian patients.[109,110]

The awareness level of CVD risk factors is generally low in the current study. Differences in the literacy level, varying access to health care facilities and availability of information technology might explain the differences in the level of awareness of CV risk factors in different populations. Furthermore, the observed gender differences in the awareness of CVD risk factors in the current study could be because male subjects had more formal education and higher literacy level than their female counterparts. Additionally there is cultural restriction of females in the study population.

5.3.0 Socio-demographic determinants of modifiable CVD risk factors among the study population

This study shows that the level of education and ward location within the community influenced frequencies of hypertension and truncal obesity. The observed difference in the prevalence of HTN according to ward location might be as a result of the fact that the study subjects in the affected ward (Danmaliki) were older. Higher prevalence of truncal obesity among females compared to males has been observed in previous studies from Katsina, Ogbomoso in Nigeria as well as in Spain and South Asian populations.[14,69,89,119]

The reason for the high prevalence of truncal obesity among women in the current study might be due to cultural restriction of women to domestic work among Hausa and Fulani tribes that largely constituted the study population. Truncal obesity predisposes to increased CV morbidity and mortality. Intra-abdominal adipocytes are active and liberate free fatty acids directly into the circulation where they are metabolised in the liver and produce metabolites responsible for premature atherosclerosis and endothelial dysfunctions culminating in metabolic disorders such as type 2 diabetes mellitus. The frequencies of diabetes mellitus, dyslipidaemia and generalised obesity were not related to the investigated sociodemographic factors.

The high prevalence of major CV risk factors and concomitant low level of awareness of these conditions and their complications constitute a potential for rapid rise in the incidence of CV events including ischaemic heart disease that has hitherto being a relative rarity in Nigeria.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

1. The study demonstrates high prevalence of cardiovascular risk factors dominated by hypertension, truncal obesity and dyslipidemia in the study population.

2. The awareness of cardiovascular risk factors and their complications were low particularly, in females.

3. Female gender was an independent predictor of truncal obesity.

RECOMMENDATIONS

1. Screening for CVD risk factors including HTN, DM, Obesity and Dyslipidemia should be incorporated in to the primary health care services which should be accessible in the rural communities of Nigeria.

2. There is need to promote healthy lifestyle measures and increased awareness of cardiovascular risk factors in the population using print and electronic media.

3. Routine measurement of waist circumference in clinical care is recommended as a key step in initiating the prevention, control and management of obesity among patients.

4. There is need for an updated national survey of CVD risk factors in Nigeria.

LIMITATIONS OF THE STUDY

1. Newer CVD risk factors including C- reactive protein, microalbuminuria, homocysteinaemia and coagulation factors (fibrinogen, factor vii), were not determined because of financial constraint.

2. It would have been appropriate to calculate systemic coronary risk evaluation (SCORE), though this largely is based on Caucasian populations.

REFERENCES

1. The World Health Report. Making a Difference. Geneva: World Health Organization 1999.

2. The World Health Report. Making a Difference. Geneva: World Health Organization 2010.

3. Popkin BM. The nutrition transition and its health implication in lower income countries. J Nutr. 1998; 1: 5-21.

4. Yusuf S, Reddy S, Ounpuu S. Global burden of cardiovascular diseases part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization. Circulation 2001; 104: 2746-2753.

5. Omran AR. The epidemiological transition, theory of the epidemiology of population change. Milbank M Fund 1971; 49: 509- 5186.

6. Machiel J Gaziano. Global burden of cardiovascular disease. Peter Libby, Robert O Bonow, Douglas L Mann, Braunwald Heart Disease, A textbook of cardiovascular medicine 8th edition, Saunders Elsevier Philadelphia 2008; 1 - 4

7. Falase AO, Oladapo OO, Kanu EO. Relatively low incidence of myocardial infarction in Nigerians. Trop. Card. 2001; 27: 45 - 47

8. Ford ES, Ajani UA, Croft JB, Critchley JA, Labarthe DR et al. Explaining the decrease in US deaths from coronary disease,1980-2000. N Engl. J. Med. 2007; 23: 2388 - 2398

9. Non–Communicable Diseases (NCD) in Nigeria. Final Report of a National Survey. Federal Ministry of Health National Expert Committee on NCD, 1993.

10. Global atlas on cardiovascular disease prevention & control World Health Organisation in collaboration with World Heart Federation and World stroke organization Geneva 2011. (Accessed May 2013)

11. McGill HC, McMahan CA, Gidding SS. "Preventing heart disease in the 21st century: implications of the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study." Circulation 2008; 117: 1216 - 1227

12. Vanhecke TE, Miller WM, Franklin BA, Weber JE, McCullough PA. "Awareness, knowledge, and perception of heart disease among adolescents." Eur J Cardiovas Rehabil. 2006; 13: 718–723.

13. Alan D Lopez, Christopher JL Murray, Colin D, Majid Ezzati, Dean T Jamison. Global and regional burden of Diseases and risk factors, systematic analysis of population health data. Lancet 2006; 367: 1747-1757.

14. Sani MU, Kolawale WH, Bashir OY, Maaruf Gbadamosi, Omolara V Johnson et al. Prevalence of modifiable cardiovascular risk factors in apparently healthy adults in Nigeria. BMC research notes. 2010; 3: 1756 - 1763

15. Liska HA, Mainous AG, King DE, Arch GM, Dane EK et al. Prehypertension and cardiovascular mortality. Ann Fam Med. 2005; 3: 294 – 299.

16. Kshirsagar AV, Carpenter M, Bang H, Wyatt SB, Colindres RE. Blood Pressure usually considered normal is associated with an elevated risk of cardiovascular disease. Ann J Med. 2006; 1992: 133 – 141.

17. Dodi SRA. Emergence of cardiovascular disease in developing countries. Int J Cardiol.1988; 75: 56 - 64.

18. Lawoyin TO, Asuzu MC, Kaufman j, Rotimi C, Owoaje E et al. Prevalence of cardiovascular risk factors in an African urban inner city community. WAJM. 2002; 21: 208 – 211.

19. Barnighausen T, Welz T, Hosegood V, Batzing-Feigenbaum J, Tanser F et al. Hiding in the shadows of the HIV epidemic: Obesity and hypertension in a rural population with very high HIV prevalence in South Africa. J Human Hypertens. 2008; 22: 236–239.

20. Thomas A Gaziano. Cardiovascular disease in the developing world and its cost effective management. Circulation 2005; 112: 3547 - 3553

21. Yu-Quan Ma, Wen-hua Mei, PingYin, Xiao-Hui Yang, Sana Kiani et al. Prevalence of hypertension in Chinese cities: A meta analysis of published studies. Plosone J. 2013; 8: 5830 - 5842

22. Okechukwu S Ogah, Ikechi Okpechi, Innocent Chukwuonye, Joshua O. Akinyemi, Basden JC Onwubere et al. Blood pressure, prevalence of hypertension related complications in Nigeria, Africa. WJC 2012;4(12):327-340

23. Surveillance and population based prevention of chronic diseases and health promotion World Health Organisation Geneva Switzerland www.who.int/chp/steps (accessed April 2013)

24. Barker DJ, Martyn CN, Osmond C, Hales CN, Fall CH. Growth in utero and serum cholesterol concentrations in adult life. BMJ. 1993; 307: 1524–1527

25. Yusuf S, Hawken S, Ounpuu S, Dans T, Avenzum A et al. INTERHEART study Investigators. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case control study. Lancet. 2004; 364: 937-952

26. Anand SS, Enas EA, Pogue J, Haffner S, Pearson T et al. Elevated lipoprotein(a) levels in South Asians in North America. Metabolism. 1998; 47: 182–184

27. Karaye KM, Okeahialam BN, Wali SS. Plasma lipids in Nigerians with systemic arterial hypertension. J Clin Lipidol. 2008; 2: 274 - 287.

28. Okeahialam BN, Osunkwo A, Isichei CO. Atherogenic burden of hypertensive, diabetic and hypertensive – diabetic patients seen in Jos. J Med Trop. 2003; 5: 5550 – 5559.

29. The Diabetes Control and Complication Trial (DCCT) research group: effect of intensive therapy on the development and progression of nephropathy in DCCT. Kidney Int. 1995; 47: 1903-1920

30. International Diabetes Federation home page. http://www.eatlas.idf.org/prevalence (accessed 26th June 2013)

31. UK Prospective Diabetes Study group: High blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. BMJ. 1998; 317: 703-713

32. Aboderin I, Kalache A, Ben-Shlomo Y, Lynch JW, Yajnik CS, Kuh D et al. Life course perspectives on coronary heart disease, stroke and diabetes: Key issues and implications for policy and research. Geneva: World Health Organization; 2002.

33. Mooradian A.D. Cardiovascular disease in type 2 diabetes mellitus current management guidelines. Arch Intern Med. 2003; 163: 33-34

34. Stiveling EM, Hillege HL, Bakkae SJ, Hillege HL, Burgerhof JG et al. C-reactive protein and microalbuminuria differs in their association with ugors domains of vascular disease. Atherosclerosis 2004; 172: 107-114

35. World Health Organisation: definition, diagnosis and classification of diabetes mellitus and its complication; report of WHO Consultation part I; Geneva, World Health Organisation, 1999.

36. FX Pi – Sunyer. Medical hazards of obesity. Ann Intern Med. 1993; 119: 655 – 660.

37. Caballero B. A nutrition paradox—underweight and obesity in developing countries. N Engl J Med. 2005; 352: 1514–1516

38. Gregg EW, Cheng YJ, Cadwell BL. Secular trends in cardiovascular disease risk factors according to body mass index in US adults. J Intern Med. 2005; 293: 1868 – 1874.

39. Rosengren A, Euskasson H, Hanson PO, Welin L, Johansson S. Obesity and trends in cardiovascular risk factors over 40 years in Swedish men aged 50. AMJ. 2009; 181: 127 – 129.

40. Ghannem H, Hadj FA. Prevalence of cardiovascular risk factors in the urban population of Soussa in Tunisia. J Pub Health Med. 1997; 19: 1372 -1378

41 Jousilahti P, Tuomilehti J, Vartiainen E, Pekka P, Errki V. Body weight, cardiovascular risk factors and coronary mortality. Circulation. 1996; 93: 1372-1378

42. Croft JB, Strongatz DS, Keenan NL, James SA, Malarcher AM et al. The independent effects of obesity and body fat distribution on blood pressure in black adults. Int J Relat Metab Disord. 1993; 17: 390 –397

43. Folsom AR, Raox LY. Body mass, fat distribution and cardiovascular disease risk factors in a lean population of South China. J Clin Epidemiol. 1994; 47: 173-18

44. Kaufman JS, Asuzu MC, Forest T, Jacob M, Rainford W. The Relationship between BMI and BP in Lean Population. Hypertens. 1997; 30: 1511 –1520

45 Isezuo SA, Sabir AA, Ohwovorilole AE, Fasanmade OA. Prevalence, associated factors and relationship between prehypertension and hypertension: a study of two ethnic African populations in Northern Nigeria. J Hypertens. 2010; 1 – 7.

46 Mijinyawa MS, Abdu A, Habib AG. Pattern of Blood Pressure in Adolescents. SMJ. 2009; 12: 159 -164.

47 National Population Commission list of Nigerian States by population. Federal Republic of Nigeria census 2006

48 Trials of Hypertension Prevention Collaboration Research Group. Effects of weight loss and sodium reduction on blood pressure and hypertension incidence on overweight people with high-normal blood pressure. Arch Intern Med. 1997; 159: 657 – 669.

49 Tuomilehto J, Lindstorm J, Erickson JG. Prevention of type 2 DM by changes in life style among subjects with impaired glucose tolerance. N Engl J Med. 2001; 344: 1343 – 1350

50 Stefanick ML, Mackey S. Effects of diet and exercise in men and postmenopausal women with low levels HDL-Cholesterol and high level of LDL- Cholesterol. N Engl J Med. 1998; 337: 12 – 20.

51 Akinkugbe OO. Epidemiology of cardiovascular disease in developing countries. J Hypertens. 1990; 8: S233 – S238

52. Anoop S, Ronald K, Barbara EK Klein. The association among smoking, heavy drinking and Chronic Kidney Disease. Am. J. Epidemol.2006; 164(3):263 – 271.

53. Taylor SA. Tobacco and economic growth in developing nation. Business in the contemporary world. Winter. 1989; 204: 55 – 70.

54. Bovet P, Ross AG, Gervasoni JP, Mashambo Makambi, Deo M Mtasiwa et al. Distribution of blood pressure, body mass index and smoking habits in the urban population of Dares Salam, Tanzania, and associations with socioeconomic status. Int J Epidemiol. 2003; 31: 240 - 247.

55. Puddey IB, Beilin LJ. Alcohol, hypertension and the cardiovascular system: a critical appraisal. Addiction Biol. 1997; 2: 159 – 170

56. Guidelines Committee. 2013 European Society of Hypertension/European Society of Cardiology guidelines for the management of arterial hypertension. J Hypertens. 2013; 21:S1011 – 1053.

57. P.W. Wilson, D. Agostino, D Levy, M.B Albert, H. Silbershatz. Prediction of coronary heart disease using risk factors categories. Circulation 1998; 97: 1837-1847

58. D. Agostino, RS Vasan, MJ Pencina, PA Wolf, M Cobain et al. General cardiovascular risk profile for use in primary care: the Framingham Heart Study. Circulation 2008; 117: 744-753.

59. Olatunbosun ST, Kaufman JS, Cooper RS, Bella A. Hypertension in black population: prevalence and biosocial determinants of high blood pressure in a group of urban Nigerians. J Hum Hypertens. 2000; 14: 249 – 257.

60. Yamane T. Statistics, an introductory analysis, 2nd edition. New York: Harper and Row 1967; 40 – 51.

61. KM Karaye, AA. Akintunde. Insight in to heart failure with preserved ejection fraction among admitted Nigerian patients. Int J Cardio. 2013; 170: e30 - e39

62. National Cholesterol Education Program. Third report of the expert panel on the detection, evaluation and treatment of high blood cholesterol in adults (Adult Treatment Panel III) National Heart Lung and Blood Institute, National Institute of Health. NIH Publication. 2002; 2: 3163 - 3184.

63. World Medical Association Declaration of Helsinki, Ethical Principles for Medical Research involving Human Subject. J Post Grad Med. 2002; 48: 206 – 208

64. Kannel WB. Blood pressure as a cardiovascular risk factor: Prevention and treatment. JAMA. 1996; 275: 1571-1576

65. Odugbemi TO, Onajole AT, Osibogun AO. Prevalence of cardiovascular risk factors amongst traders in an urban market in Lagos, Nigeria. Niger Postgrad Med J. 2012; 19: 1-675

66. Ekwunife OI, Udeogaranya PO, Nwatu IL. Prevalence, awareness, treatment and control of hypertension in a Nigerian population. Health. 2010; **7**: 731-735

67. Kadiri S, Salako BL: Cardiovascular risk factors in middle aged Nigerians. East Afr Med J. 1997; 74: 303-306.

68. Okesina AB, Oparinde DP, Akindoyin KA, Erasmus RT. Prevalence of some risk factors of coronary heart disease in a rural Nigerian population. East Afr Med J. 1999; 76: 212-216.

69. ID Gezawa, FH Puepet, BM Mubi, Haliru I, AE Uloko et al. Socio demographic and anthropometric risk factors for type 2 diabetes in Maiduguri, North-Eastern Nigeria. SMJ. 2015; 18: S1-S7

70. Karaye KM, Yakasai MM, Abdullahi U, Hamza M, Dalhat M et al. Hypertension and other cardiovascular risk factors in a semi-nomadic Fulani population in Kano, Nigeria, Nig J of cardiol. 2015; 190: 1-5

71. Steven van de Vijver, Hilda Akinyi, Samuel Oti, Ademola Olajide. Status report on hypertension in Africa-consultative review for the 6th session of the African Union Conference of Ministers of Health on NCDs. Pan Afri Med J. 2013; 16: 38 - 44

72. Rufus A Adedoyin, Chidozie E. Mbada, Michael O Balogun, Tanimola Martins. Prevalence and pattern of hypertension in a semi-urban community in Nigeria. Eur J Prev Cardiol. 2008; 15: 683- 687.

73. Ulasi I I, Ijoma CK, Onodugo OD. A community-based study of hypertension and cardio-meatabolic syndrome in semi-urban community and rural community in Nigeria. BMC Health Serv Res. 2010; 10: 71-80

74. Suleiman IA, Amogu EO, Ganiyu KA. Prevalence and control of hypertension in a Niger Delta semi urban community, Nigeria. Pharmacy practice. 2011; 11: 24-30

75. Okaehialam BN. cardiovascular epidemiological transition in a rural habitat of Nigeria: the case of Mangu local government area. WAJM. 2004; 31: 14-18.

76. Oladapo OO, Salako L, Sodiq O, Shoyinka A, Adedapo K et al. Prevalence of cardio metabolic risk factors among rural Yoruba Southwestern Nigeria: a population-based survey. Cardiovasc J Afri. 2010; 21: 26-31.

77. Ohwovoriole AE, Kuti JA, Kabiawu SIO. Casual blood glucose levels and prevalence of diabetes mellitus in Lagos metropolis Nigeria. Diabetes Res Clin Prac. 1988; 4: 153‑158.

78. Ekpenyong CE, Akpan UP, Ibu JO, Nyabuk DE. Gender and age specific prevalence and associated risk factors of type 2 diabetes in Uyo metropolis, Southeastern Nigeria. Diabetes Res Clin Practice. 2012; 41: 17‑25.

79. Puepet FH. Prevalence of diabetes and associated risk factors in Jos Nigeria. FMCP dissertation. National Postgraduate Medical College of Nigeria. May 1996

80. Hendriks ME, Wit FW, Roos MT, Brewster LM, Akande TM et al. Hypertension in sub-Saharan Africa: cross-sectional surveys in four rural and urban communities. PLoS One. 2012; 7: 326 - 338

81. Onwuchekwa AC, Mezie-Okoye MM, Babatunde S. Prevalence of hypertension in Kegbara-Dere, a rural community in the Niger Delta region Nigeria. Ethn Dis. 2012; 22: 340-346

82. Ker JA, Rheeder P, Tonder RV. Frequency of metabolic syndrome in screened South African corporate executive. Cardiovasc J South Afr. 2007; 18: 30 – 33

83. Murthy GV, Fox S, Sivasubramaniam S, Gilbert CE, Mahdi AM, Imam AU et al. Nigeria National blindness and visual impairment study group. Prevalence and risk factors for

hypertension and association with ethnicity in Nigeria: Results from a national survey. Cardiovasc J Afr. 2013; 24: 344-350

84. Damasceno A, Bruijnzeels MA, Silva-Matos, A Prista, Diogo D et al. Hypertension prevalence, awareness, treatment and control in Mozambique: urban/rural gap during epidemiological transition. Hypertension. 2009; 54: 77-83

85. Ejim EC, Onwubere BJ, Okafor CI, Emehel A, Ulasi II et al. Prevalence of cardiovascular risk factors in middle aged and elderly population of a Nigerian rural community. Niger J Med. 2013; 22: 286-289

86. Okpechi IG, Chukwuonye I I, Tiffin N, Madukwe OO, Onyeonoro UU et al. Blood pressure gradient and cardiovascular risk factors in urban and rural populations in Abia State Southeastern Nigeria using WHO STEP wise approach. Plos one.; 8: 734- 738

87. Adediran O Sola, Adeniyi O Steven, Jimoh A Kayode, Alao O Olayinka. Under weight, over weight and obesity in Adults Nigerians leaving in rural and urban communities of Benue state. Ann Afri Med. 2011, 10: 139-143

88. Gezawa ID, Musa BM, Mijinyawa MS, Talle MA, Uloko A et al. Prevalence of hypertension and its relationship with indices of obesity in Maiduguri North Eastern Nigeria. Niger J Basic Clin Sci. 2014; 11: 67-61

89. I.O Amole, A. Adediran, O.T. Awotunde, O.A Duradola, B.O. Oyelade. The prevalence of Obesity in Ogbomoso Southwestern Nigeria. Res J Health Sci. 2014; 2: 98-102

90. Mawuli Gyakobo, Albert GB Amoah, Deanne Martey-marbell, Rachel C Snow. Prevalence of metabolic syndrome in a rural community in Ghana. BMC Endocr Disord. 2012; 12: 1472 - 1479

91. Akintunde AA, Ayodele EO, Akinwusi OP, Opadiji JO. Dyslipidaemia among newly diagnosed hypertensives: pattern and clinical correlates. J Natl Med Assoc. 2010; 102: 403 - 407

92. Isezuo SA, Badung SL, Omotosho AB. Comparative analysis of lipid profiles among patient with type 2 diabetes mellitus, hypertension and concurrent type 2 diabetes mellitus. A view of metabolic syndrome. J Natl Med Assoc. 2003; 95: 328- 334

93. Odenigbo CU, Odenigbo UM, Oguejiofor OC, Okonkwo UC, Oguanobi NI. Prevalence of dyslipidaemia in elderly subjects in Asaba, Southsouth Nigeria. J Indian Acad Geriatr. 2010; 6: 160- 164

94. Agaba IE, Anteyi EA, Puepet FH, Omodu PA, Idoko JA. The clinical pattern of diabetic nephropathy in type 2 diabetes mellitus in Northcentral Nigeria. J Med Tropics. 2002; 4: 101 - 115

95. Idogun ES, Unuigbe EI, Ogunro PS, Ainola OT, Famodu AA. Assessment of serum lipids in Nigerians with type 2 diabetes mellitus complications. Pak J Med Sci. 2007; 23: 708 -712

96. Agboola-Abu CF, Onabolu A. plasma lipid level in patient attending Igbininedion hospital and Medical Research Centre, Okada, Edo state, Nigeria. Nig Med J. 2000; 38: 1-5

97. Ojji DB, Ajayi SO, Mamven MH, Antherton J. Prevalence of dyslipidaemia in normoglycemic subjects with newly diagnosed high blood pressure in Abuja Nigeria. J Clin Lipid. 2009; 3: 51- 6

98. Oguejiofor OC, Onwukwe CH, Odenigbo CU. Dyslipidaemia in Nigeria: prevalence and pattern. Ann Afr Med. 2012; 11: 197-202

99. Omuemu VO, Okoeji OH, Omeemu CE. Awareness of high blood pressure status, treatment and control in a rural community in Edo State. Niger J Clin Pract. 2007; 10: 208-212

100. Iloh GUP, Ofoedu JN, Amadi AN. The magnitude of atherogenic dyslipidemia among geriatric Nigerians with systemic hypertension in a rural hospital in eastern Nigeria. Niger J Med 2012; 2: 320-325.

101. Toth PP, Potter D, Ming EE. Prevalence of lipid abnormalities in the United State. The national and nutrition examination survey 2003-2006. J Clin Lipidol. 2012; 6: 325-330

102. Cihangir Erem, Arif Hacihasanoglu, Orhan Deger, Mostafa Kocak, Topbas K. Prevalence of dyslipidemia and associated risk factors among Turkish adults. Endocrine. 2008; 34: 36-51

103. Ogah OS, Madukwe OO, Onyeonoro UU, Onyeonoro UU, Ukegbu AU et al. Cardiovascular risk factors and non-communicable diseases in Abia State, Nigeria: report of a community based survey. Int. J Med Biomed Res. 2013; 2: 57- 68

104. Awosan K.J, Ibrahim M.T.O, Sabir A.A, Ejimodu P. Awareness and prevalence of risk factors of coronory heart disease among teachers and bankers in Sokoto Nigeria. J Med Sci. 2013; 4: 337-342

105. Ulasi I I, Ijoma CK, Onwubere BJ, Arodiwe E, Onodugo O et al. High prevalence and low awareness of hypertension in a market population in Enugu, Nigeria. Int J Hypertens. 2011; 211: 869 - 875

106. Akintunde AA, Salawu AA, Opadijo OG. Prevalence of traditional cardiovascular risk factors among staff of Ladoke Akintola University of Technology, Ogbomoso, Nigeria. Niger J Clin Pract. 2014; 17: 750-755.

107. SCKM Motaung, DG Sengwayo, MM. Moraba. Prevalence of obesity and dyslipidemia in rural black community in Limpopo province. Med Techn SA. 2012; 26: 43 – 4132

108. Mc Donald M, Hertz RP, Unger AN, Lustic MB. Prevalence awareness and management of hypertension dyslipidemia and diabetes among United State adults aged 65 and older. J Gerontol Biol Sci. 2009; 64: 256-63

109. Chinju George, G. Andhuva. A population - based study on awareness of Cardiovascular Disease Risk Factors, IJPP. 2014; 2: 23-25

110. Schweigman Kurt, Thomas K. Weity, Ying Zhang. Cardiovascular disease risk factor awareness in American Indian communities: the strong heart study. Ethn Dis. 2006; 16: 647-652

111. Wang Tienge, YU XU, Min Xu. Awareness treatment and control of cardio metabolic disorders in Chinese adults with diabetes: a national representative population study. 2015; 14: 1-10

112. Jacobien C, Verhave N, Stephan Troyanov, Frederic Mongeau, Verhave J. et al. Prevalence awareness and management of CKD and cardiovascular risk factors in publicly funded health care. CJASN. 2014; 9: 4713-4719

113. Silva Honorio, Rafael Hernandez-Hernendez, Raul Vinueza, Manuel Valesco, Carlos Pablo et al. Cardiovascular risk awareness, treatment and control in urban latin America. AJT. 2010; 17: 159-166

114. Michel Joffrey, Emanuela Falaschetti, Cathleen Gillespie, Norm Campbell. Hypertension prevalence, awareness, treatment and control national surveys from England, USA and Canada and correlation with stroke and ischemic heart disease mortality: a cross sectional study. BMJ. 2013; 3: 3423- 3430.

115. Leif R. Erhardt. Managing cardiovascular risk: reality VS perception. Eur Heart J. 2007; 7: L11-L15

116. Wadwa R. Paul, Gregory L. Kenney. Awareness and treatment of dyslipidemia in young adults with type 1 Diabetes. Diabetes Care 2005; 28: 1051-1056

117. Dahiru T, Jibo A, Hassan AA, Mande AT. Prevalence of diabetes in a semi-urban community in Northern Nigeria. Niger J Med. 2008; 17: 414- 418

118. Oguejiofor O, Odenigbo C, Onwukwe C. Diabetes in Nigeria: impact, challenge and future directions. Endocrinol Metab Synd. 2014; 3: 1041 – 1048

119. Olatunbosun ST, Kaufman JS, Cooper RS, Bella AF. Hypertension in a black population: Prevalence and biosocial determinants of high blood pressure in a group of urban Nigerians. J Hum Hypertens. 2000; 14: 489- 496

120. Adegoke OA, Adedoyin RA, Balogun MO, Adebayo RA, Basiriyu LA et al. Prevalence of metabolic syndrome in rural community of Nigeria. Metab Syndr Relat Disord. 2010; 8: 59

121. Osuji CU, Nzerem BA, Dioka CE, Onwubuya EI. Metabolic syndrome in a newly diagnosed type 2 diabetes using NCEP-ATP III, the Nnewi experience. Niger J Clin Pract. 2012; 15: 475 - 480

122. Awosan KJ, Ibrahim MTO, Ariseyi SA, Ejimadu SP, Erhiano EE et al. prevalence of metabolic syndrome and its components among civil servants in a metropolitan city in Northern Nigeria. Glo Adv Res J Med Sci. 2013; 2: 238 – 246

123. Akintunde AA, Ayodele OE, Akinwusi PO, Opadijo GO. Metabolic syndrome: Comparison of occurrence using three definitions in hypertensive patients. Clin. Med Res. 2011; 9: 26 – 31

124. Burt VL, Whelton P, Rocella EJ, Brown C, Cutler JA et al. Prevalence of hypertension in the US adult population. Results from the Third National Health and Nutrition Examination Survey. 1988-1991. Hypertension. 1995; 25: 305- 310

125. Tabatabae Malazy Ozra, Qorbani Mostafa, Sambat T, Sharifi T, Larijiani B et al. Prevalence of dyslipidemia in Iran. A systematic review and meta analysis study. Int J Prev Med. 2014; 5: 373-9

126. Drexel Heinz, Chazelle Francois, Fauer Chriastene, Dominik Lautsch, Anselm K Gitt. Persistent dyslipidemia in Austrian patient treated with statins for secondary prevention of atherosclerotic events results of the dyslipidemia international study. Wiener Klinische Wochenschrift. 2011; 123: 611- 617.

127. Familoni IF, Familoni OB. Determinants and perception of cardiovascular risk factors among secondary school teachers in Oyo state, Nigeria. Afr J Med Sci. 2011; 40: 339-43.

APPENDIX I

QUESTIONNAIRE DESIGN

A. PERSONAL DATA

1. Serial no:_____ .

Initials:_____

3. Age (years):_____ 4.Occupation:

_____

5. Sex: Male [ ] Female [ ]

6. Tribe: _____ Hausa /Fulani [ ] Yoruba [ ] Igbo [ ] others_____

7. Marital status: Single [ ] Married [ ] Divorced[ ] widowed[ ]

8.Address:

_____

9. Level of education: a) primary….. b) secondary……C) tertiary…… d) others specify_____

B. CLINICAL HISTORY

1. History of Hypertension? Yes [ ] No [ ]

If yes: a. For how long? _____ b. Are you on treatment?: Yes [ ] No[ ]

If yes, what drugs?_____

2. History of Diabetes Mellitus: Yes [ ] No[]

If yes: a. For how long_____ b. Are you on treatment?: Yes [ ] No [ ]

If yes, what drugs_____

3. Family history of Hypertension: Yes [ ] No[ ]

3. Family history of diabetes Yes [ ] No[ ]

4. History of Cigarettes smoking? Yes [ ] No [ ] Have stopped [ ]

If yes: a. for how long?_____ b. How many sticks/day?_____

5. History of Alcohol intake? Yes [ ] No [ ] Have stopped[ ]

If yes: a. For how long?_____ b. How much (gm)/week?_____

6. Family history of Hypertension: Yes [ ] No [ ]

7. Family history of Diabetes: Yes [ ] No [ ]

8. Family history of stroke: Yes [ ] No [ ]

9. Family history of Heart attack Yes [ ] No [ ]

9. Have you ever measured your serum lipids: Yes [ ] No [ ]

If yes, was it normal: yes [ ], No [ ], Can't remember [ ]

10. Are you aware that high lipids in the blood are dangerous to your health: Yes [ ] No [ ], if yes, what can it lead to……

11.Are you aware that Diabetes mellitus is dangerous to your health: Yes [ ] No [ ], if yes, what can it lead to……

12. Are you aware that HTN is dangerous to your health: Yes [ ] No [ ], if yes, what can it lead to……

13 Are you aware that smoking is dangerous to your health: Yes [ ] No [ ], if yes, what can it lead to……

.14 Are you aware that obesity is dangerous to your health: Yes [ ] No [ ], if yes, what can it lead to……

15. Are you aware that Diabetes can leads to stroke Yes: [] No [ ]

16 Are you aware that Diabetes can leads to heart attack Yes: [] No [ ]

12. Are you aware that obesity can cause stroke and heart attack: Yes [ ] No [ ]

13. Are you aware that obesity can cause stroke and Heart attack: Yes [ ] No [ ]

14 Are you aware that Cigarette smoking can lead to stroke and heart attack? Yes [ ] No [ ]

15 Are you aware that hypertension can lead to stroke and heart attack yes [ ] No [ ]

C. CLINICAL XAMINATION

1. Weight(kg)_____ 2. Height (cm)_____

3. BMI(kg/m^2_____

4. Waistcircumference_(cm)_____

5. Waist/hip ratio_____

6. PR(bpm)…….

7.BP(mmHg) SBP……DBP……..

D.ECG: Rate (bpm)……..rhythm …….. QRS axis……LAE…… RAE……. LVH (by sokolow and Lyon)……..Other findings…….

E. BIOCHEMICAL MEASUREMENTS

1. Fasting plasma glucose (mmols/l):-_____-
2. Fasting plasma lipids (mmols/l) : Total chol……..HDL……..LDL……..TG……..

APPENDIX II

WHO STEPS INSTRUMENT

The WHO STEP wise approach to surveillance (STEPS) is the WHO recommended surveillance tool for chronic diseases risk factors and chronic disease-specific morbidity and mortality. It provides an entry point for low and middle income countries to get started on chronic diseases surveillance activities. It is also designed to help countries build and strengthen their capacity to conduct surveillance.

STEPS are a sequential process. It starts with gathering key information on risk factors with a questionnaire, then to simple physical measurements and then to more complex collection of blood samples for biochemical analysis.

STEPS emphasizes that small amount of good quality data are more valuable than large amount of poor data. It is based on the following two key premises:

• Collection of standardized data, and

• Flexibility for use in a variety of country situations and settings.

STEPS use a representative sample of the study population. This allows for results to be generalized to the population.

The STEPS tool used to collect data and measure chronic disease risk factors is called the STEPS Instrument.

The STEPS Instrument covers three different levels or 'Steps' of risk factor assessment: Step 1, Step 2 and Step 3 as follows: STEP 1: Gathering demographic and behavioral information by questionnaire in a household setting. To obtain core data on socio-demographic information, history of hypertension, diabetes, tobacco and alcohol use, and physical activity.

STEP 2: Collecting physical measurements with simple tests in a household setting.

To build on the core data in Step 1 and determine the proportion of adults that is overweight/obese, and has raised blood pressure.

STEP 3 Taking blood samples for biochemical measurement. To measure prevalence of diabetes and abnormal blood lipids. Only recommended for well-resourced settings.

Within each Step, there are three levels of data collection- the core, expanded and optional levels These depend on what can realistically be accomplished (financially, logistically and in terms of human and clinical resources) in each country setting.

APPENDIX III

CONSENT FORM

MY name is Dr Balarabe Sulaiman Aminu, a resident doctor from Department of Internal Medicine Aminu Kano Teaching Hospital. I am conducting a study with the aim of identifying risk factors for Cardiovascular Diseases among adults in Danmaliki, Naibawa, Chiranchi and Mariri wards of Kumbotso LGA of Kano state.

I will be grateful if you can participate in the project as a subject.

All that is required of you as a participant is to answer some few questions. I will then examined you, then take your blood for blood lipids and glucose for analysis . If you agree to participate, kindly sign in the space provided below.

Those found to have risk factors for CVD will be appropriately referred to specialist for further evaluations and treatment.

Name of subject……..

sign/thumbprint_____

Date:_____

Name of researcher: _____

signature_____

Date_____

Witness_____Date_____

APPENDIX IV

ETHICAL CONSIDERATION

Ethical clearance was obtained from the ethical committee of AKTH before commencement of the study.

The provision of the Helsinki declaration will be respected. A written permission will be obtained from the Chairman of Kumbotso Local Government through the Primary Health Care Coordinator.

Informed consent was obtained from subjects.

1. All data collected from participants will be kept secret.

2. Participants were duly informed in a language they adequately understand.

3. Benefits shall include diagnosis of diabetes mellitus, hypertension, obesity, hyperlipidaemia and other risk factors of CVD. Treatment will be recommended.

4. The study shall in no way be used to the detriment of the participants.

5. Taking part in the study is voluntary. Participants have the liberty to refuse to participate in the study without any negative consequences.