CO-OCCURRENCE OF HYPERTENSION AND TYPE 2 DIABETES AMONG PATIENTS ATTENDING SOME SELECTED HOSPITALS IN UMUAHIA, ABIA STATE

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL,

FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI, IMO STATE, NIGERIA

IN PARTIAL FULFILEMENT OF THE REQUIREMENT

FOR THE AWARD OF MASTER OF PUBLIC HEALTH (MPH) DEGREE

SEPTEMBER, 2016

CERTIFICATION

This thesis study on "Co-Occurrence of Hypertension and Type 2 Diabetes among Patients Attending Some Selected Hospitals in Umuahia, Abia State" written by Chikezie, Onyebuchi Desmond (Reg. No: 20124767528) has been certified as meeting the requirements for Master's Degree projects in Public Health in Post Graduate School, Federal University of Technology, Owerri.

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DEDICATION

This work is dedicated to my parents Nze and Lolo Chikezie

ACKNOWLEDGEMENTS

This study would not have been completed without the assistance of people dear to me. These people deserve my commendation.

My profound gratitude goes to my supervisor, Prof. O. C Abanobi who was very helpful, without his help, this work would not have been possible. He gave me free access to his office any anytime I wanted to see him. To him, I shall forever remain grateful.

I am also indebted to staff of Federal Medical Centre, Umuahia Abia State, especially head of specialist clinic and head of department of chemical pathology for their wonderful contributions towards the success of this work. The head of public health department, Rev. Sr. Prof. E. T Oparaocha and other staff of the department are recognized and thanked as well, because the success of this programme so far is due to their provision of needed facility.

Finally, my gratitude goes to authors whose works helped me in gathering information. To my course mates and friends who in one way or the other assisted me in the course of this work, am grateful.

May God bless you all.

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LIST OF ABBREVIATIONS

DM - Diabetes Mellitus

WHO- World Health Organization

HTN - Hypertension

BP – Blood Pressure

CVD - Cardiovascular Diseases

Et al - And others

HBP - High Blood Pressure

BMI - Body Mass Index

OR - Odd Ratio

CI- Confidence Interval

AS- Addition of Salt

ESF - Eating of Salty Food

EFF - Eating of Fast Food

DMD - Diabetes Mellitus Duration

FHDM- Family History of Diabetes Mellitus

FHHTN- Family History of Hypertension

FHDMHTN-Family History of both Diabetes and Hypertension

ABSTRACT

Diabetes and hypertension are among the commonest diseases in developed countries and the frequency of both conditions are the most common cause of the morbidity and mortality from non- communicable diseases in Africa. This study was designed to determine factors associated with co-occurrence of hypertension and type 2 diabetes among diabetic patients. A comparative, retrospective, survey study was carried out on 240 adult Nigerians suffering type 2 diabetes, who were screened for hypertension, and 140 of them who had hypertension and met the inclusion criteria were compared with 100 non hypertensive diabetic group. Demographic and some factors associated with hypertension were obtained using a pretested, structured and interviewer-administered questionnaire. Out of 240 diabetic patients screened, one hundred and forty (58.3 percent) of them had hypertension. A systematic sampling technique was used to select the subjects from the study population and data obtained were summarized and analyzed using descriptive and logistic regression statistics respectively. Physical inactivity ($P < 0.05$), obesity measured by BMI ($P < 0.05$), Age ($P < 0.05$), diabetes duration ($P < 0.05$), family history of hypertension ($P < 0.05$), and family history of both hypertension and type 2 diabetes ($P < 0.05$) were significantly associated with hypertension. The most significant associated factor of hypertension in diabetic patients was family history of hypertension (OR=3.1(1.774-5.636), $P < 0.05$), followed by family history of both health condition (OR=2.5 (1.309-4.724), $P < 0.05$). Subjects with family history of hypertension were 3.1times more likely to have both disease conditions compared to individual with no family history of hypertension. Subjects with both family history of hypertension and type 2 diabetes were 2.5 times more likely to have both disease condition compared to subjects with no family history of both hypertension and type 2 diabetes. Physical inactivity, obesity measured by BMI, age, family history of hypertension and family history of both hypertension and type 2 diabetes were proximate independent factors associated to comorbidity of hypertension and type 2 diabetes in this group of people. The presence of these factors should therefore provide guide for screening adult Nigerians suffering type 2 diabetes for hypertension in primary care. More of intervention to prevent hypertension among diabetic patients should be a compelling health priority in primary care settings particularly in resource-constrained environment.

Keywords: Hypertension, Type 2 Diabetes, BMI, Family History, Age, Physical Inactivity

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Diabetes mellitus (DM) also known simply as diabetes, is a group of metabolic disorder in which there are high blood sugar levels over a prolonged period (American Diabetes Association, 2004). Diabetes is a chronic condition that arises when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin produced. In another definition, diabetes has been characterized as a chronic metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action or both (Alebiosu, 2003; Kasiam, et al. 2009).

Diabetes mellitus is a growing public health problem affecting people worldwide both in developing and developed countries, and poses a major socio-economic challenge (Dahiru, Jibo, Hassan & Mande, 2008; Mbanya, Motala, Sobngwi, Assah & Enora, 2010). It is assuming epidemic proportions worldwide (Ogbera, Dada, Adeleye & Jewo, 2010). Each year, over three million deaths worldwide are attributable to diabetes-related causes (American Diabetes Association, 2013). In 2012 and 2013 alone, diabetes resulted in 1.5 to 5.1 million deaths per year, making it the eight leading cause of death worldwide and diabetes overall at least, doubles the risk of death (Vos, et al. 2012). The prevalence of diabetes for all groups worldwide was estimated to be 2.8 percent in 2000 and 4.4 percent in 2030 (Sarah, Gojka, Anders, Hilary & Richard, 2004). The number of people with diabetes is expected to rise to 592 million by 2035(Vos, et al. 2012). Globally, as

of 2013, an estimated 382 million people have diabetes worldwide, with type 2 diabetes making up about 90 percent of the cases (Shi & Hu, 2014). According to Shi and Hu, this is equal to 8.3 percent of the adult's population with equal rates in both women and men. Diabetic population in India, USA, Russian Federation, Brazil, Bangladesh, Egypt and Indonesia are as follows: 61.3, 23.7, 12.6, 12.4, 10.3, 8.4, 7.3 and 7.2 million (International Diabetes Federation, 2011). The most important demographic change to diabetes prevalence across the world appears to be the increase in population of people greater than 65years of age (Sarah, et al. 2004).

Before 1990s, diabetes was considered a rare medical condition in Africa. Epidemiological studies carried out in that decade, however, provided evidence of a trend toward increased incidence and prevalence of type 2 diabetes in African populations (Sobngwi, Mauvais-Jarvis, Vexiau, Mbanya & Gautier, 2001). In Africa and in Nigeria, there are sparse and inadequate information on the prevalence of diabetes mellitus, however, available data suggest that the disease is emerging as a major and most challenging health problem in this region (Mbanya, Boniface & Nagan, 1996).

According to World Health Organization (WHO), there are 1.71 million people living with diabetes in Nigeria and this figure is projected to reach 4.84 million by the year 2030. Prevalence rate estimates of diabetes in Nigeria have been tagged at 2.5 percent compared to its 2.2 percent rate in 2003 (Nwankwo, Nandy & Nwankwo, 2010). Previous documentations have shown that the prevalence of the disease is on a steady increase over the years. Over a decade ago, the prevalence of diabetes mellitus in Nigeria was 2 .2 percent (Akinkugbe & Akinyanju, 1997). Isolated reports from some state of

Nigeria have found prevalence rates to range from 0.9-15 percent (Okeoghene, Chinenye, Onyckwerc & Fasanmade, 2007). In Nigeria, the national prevalence of diabetes mellitus was estimated to be 6.8 percent in adult older than 40 years (Abubakaria & Bhopalb, 2008). A study of the prevalence of diabetes mellitus in Nigeria showed that type 2 diabetes mellitus is the most common type of diabetes mellitus accounting for about 90 percent of cases (Familoni, Olatunde & Raimi, 2008), Sixty two percent of persons with type 2 diabetes mellitus in the northern part of Nigeria were estimated to be hypertensive (Bello-Sani & Anumah, 2009). In 2004, heart disease was noted on 68 percent of diabetes mellitus -related death among people aged 65 years or older (National Institute of Health, 2011). In 1971, a survey in Ibadan put the prevalence at 0.4 percent, in 1989 a similar survey in Lagos metropolis put the prevalence at 1.6 percent, in 1992 another group of researchers recorded the prevalence of 2.2 percent in Lagos Island, and the prevalence recorded was very high, about 7 percent. In Port Harcourt, Rivers State, according to a survey in adult population, the prevalence was 6.8 percent, with the male – female ratio of 1.4:1 (Ebenezer, Osaretin, Anele, Aaron & Seye, 2003). Another survey shows crude prevalence rates of 7.7 and 5.7 percent which were estimated for males and females in Port Harcourt, southern part of Nigeria (Nyenwe, Odia, Thekwaba, Ojule & Babatunde, 2003). Among adults in Jos metropolis, Plateau State; the prevalence of undiscovered diabetes was found to be 3.1 percent in 1994 and 10.3 percent in 2004 (Ebenezer, et al. 2003). In Abia State, south eastern Nigeria, record is unavailable on the present prevalence rate of diabetes at the time of this study, even though the disease is on rampage and has inflicted a lot of pains on the population and the economy of the state.

When one is diabetic, the cells of the body cannot metabolize sugar properly due to a total or relative lack of insulin or due to the cells of the body are not responding properly to the insulin produced. The body then breaks down its own fat, protein, and glycogen to produce sugar resulting in high sugar levels in the blood with excess by products called ketones being produced by the liver (French, 2000). About 60 percent of patients with diabetes are diagnosed with hypertension, making it up to 300 times higher risk of death than people without diabetes (Mathew, Ahmed, Hamid, Abdulla & Batool, 2010). It could be due to the direct toxic effects of hyperglycemia which could lead to cardiovascular diseases. Insulin resistance and hyperglycemia combine to make hypertension more prevalent in the type 2 diabetic patient (Bell, 2009).

Hypertension (HTN) or high blood pressure, sometimes called arterial hypertension, is a chronic medical condition in which the blood pressure in the arteries is elevated on repeated measurement (Carretero & Oparil, 2000). Blood pressure is summarised by two measurements, systolic and diastolic, which depend on whether the heart muscle is contracting (systole) or relaxed between beats (diastole). This equals the maximum and minimum pressure, respectively. There are different definitions of the normal range of blood pressure. Normal blood pressure at rest is within the range of 100–140 mmHg systolic (top reading) and 60–90 mmHg diastolic (bottom reading). High blood pressure is said to be present if it is often at or above 140/90 mmHg on repeated measurement.

Diabetes and hypertension are major risk factors for cardiovascular disease, a leading cause of death in humans (Grossman & Messerli, 1996). Hypertension is an extremely common co-morbidity of diabetes, affecting 20–60 percent of individuals with diabetes

(Mathew, et al. 2010). Many patients with diabetes have hypertension at the time of diagnosis, while others develop hypertension as the duration of the disease lengthens. Conversely a number of patients with systemic hypertension develop diabetes in the course of their disease. The prevalence of hypertension in the diabetic population is 1.5 to 3 times higher than that of non-diabetic age-matched groups (Wingard & Barrett-Conner, 1995). About 60 percent of patients with diabetes are diagnosed with hypertension, carrying up to 300 time's higher risk than people without diabetes (Mathew, et al. 2010). According to Ostergren, Poulter & Sever (2008), approximately 15 percent of hypertensive patients are diabetic and approximately 75 percent of type 2 diabetic patients are hypertensive. In a prospective cohort study that included 12, 550 adults, the development of type 2 diabetes was almost 2.5 times more likely in persons with hypertension than in their normotensive counterparts (Gress, Nieto, Shahar, Wofford & Brancati, 2000). Insulin resistance and hyperglycemia combine to make hypertension more prevalent in the type 2 diabetic patient (Bell, 2009). Sowers and Epstein, (1995) suggests that these two common chronic diseases frequently coexist. The risk of vascular complications in diabetes, microvascular (retinopathy, nephropathy and neuropathy), and macrovascular (coronary artery disease, cerebrovascular disease, and peripheral artery disease) is greatly increased by hypertension (United Kingdom Prospective Diabetic Study Group, 1998). It is of public health importance to effectively control co-morbidity of diabetes and hypertension by changing of lifestyle and eating a healthy diet, which will sustain control of multiple risk factors in patients with hypertension or diabetes. Effective control of the co – morbidity will reduce human suffering and disability.

1.2 STATEMENT OF THE PROBLEM

Many patients with diabetes develop hypertension as the duration of the disease lengthens. Conversely a number of patients with systemic hypertension develop diabetes in the course of the disease. More than 80 percent of patients suffering either hypertension or diabetes are unaware of having both conditions (Siriwat & Wichai 2012). People with coexisting diabetes and hypertension are at increased risk of atherosclerosis, retinopathy, renal failure, non traumatic amputations, and cardiovascular diseases and this is costly in terms of human suffering and national healthcare costs. These conditions not only result in high burden to the patients and family, but also impose a high national health care cost worldwide. Thus, the economic impact of hypertension and diabetes is an enormous burden on society. The main relevance of diabetic complications in a public health perspective is the relationship to human suffering and disability such as reducing human work productivity, reducing quality of life, increased risk of infertility, increase in death rate and the huge socio-economic costs through premature morbidity and mortality (American Diabetes Association, 1998).

Although there is an increasing body of data on diabetes and hypertension but data on coexistence of diabetes and hypertension, and the characteristics of individuals with the coexistence of both conditions have not been clearly identified, therefore making the information of co-occurrence of both conditions limited. Hypertension and diabetes carry an enormous public health burden, making the identification of risk factors and focus on preventive and control measures of these disorders an important strategy. Moreover, knowing risk factors associated with the conditions should be useful for health service

and public health action in term of management and prevention. The data on co-morbidity of hypertension and type 2 diabetes is scanty. To the best of my knowledge, there are hardly any studies providing knowledge on risk factors of co-morbidity of hypertension and type 2 diabetes in diabetic patients in Abia State. It is therefore necessary for one to carry out this study to reduce the prevalence.

1.3 OBJECTIVES OF THE STUDY

1.3.1 General Objective

The main objective of this study was to determine the factors associated to co-occurrence of hypertension and type 2 diabetes among patients attending some selected hospitals in Umuahia, Abia State.

1.3.2 Specific Objectives

Specifically the objectives of the research were to determine the relationship between:

1. Diet and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers.
2. Individual physical inactivity and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers.
3. Obesity as measured by BMI and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers.
4. Age of the subject with time of diagnosis of diabetes and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers.
5. Family history of hypertension and type 2 diabetes and its co-occurrence among diabetes sufferers.

1.4 RESEARCH QUESTIONS

1. What is the relationship between high intake of salty diet and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers?
2. What is the relationship between individual physical inactivity and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers?
3. What is the relationship between obesity as measured by BMI and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers?
4. What is the relationship between individual age with time of diagnosis of diabetes and co-occurrence of hypertension and type 2 diabetes among diabetes sufferers?
5. What is the relationship between family history of hypertension and type 2 diabetes and its co-occurrence among diabetes sufferers.

1.5 RESEARCH HYPOTHESES

H_1: Occurrence of diabetes-hypertension co-morbidity is associated with increasing intake of salty diet.

H_2: Occurrence of diabetes-hypertension co-morbidity is associated with increasing inactivity days.

H_3: Occurrence of diabetes-hypertension co-morbidity is associated with obesity as measured by BMI.

H_4: Occurrence of diabetes-hypertension co-morbidity is associated with increase in subject age and time of diagnosis of diabetes.

H_5: Occurrence of diabetes-hypertension co-morbidity is associated to individual with family history.

1.6 SIGNIFICANCE OF THE STUDY

Every research work seeks to improve knowledge about an existing problem and solution. With the current trend of transition from communicable to non-communicable diseases, it is projected that the later will equal or even exceed the former in developing nations thus culminating in double burden. Findings of this study will be of immense benefit in providing the useful information on how primary health care services should be strengthened with a concerted and multipronged effort to provide promotive, preventive, curative, and rehabilitative measures on persons with comorbidity of type 2 diabetes and hypertension, and persons with only hypertension or diabetes. This will provide a dedicated approach that will emphasizes on primary and secondary preventive practices and sustained control of multiple risk factors in patients with hypertension or diabetes. This study will also help to diagnose people living with diabetes or hypertension or co-occurrence of both illnesses and possible risk factors that can result to co-morbidity of these conditions. Also, the findings of the study will help to control complications of diabetes which has implications on cost reduction by adjusting modifiable risk factors identified to be associated to co-occurrence hypertension and diabetes; and newer fundamental findings of the study will add importantly to our overall knowledge of the cardiovascular complications of diabetes mellitus. For researchers, it will serve as base for further studies.

1.7 SCOPE OF THE STUDY

This study is strictly delimited to diet, physical activity, obesity as measured by BMI, age and family history as the factors associated to occurrence of co- morbidity hypertension

and type 2 diabetes. This study was carried out in Umuahia, Abia State. All information's about the patients were obtained from subjects within the age group of 20years and above. Both male and female patients were considered for both subjects with hypertension-type 2 diabetes comorbidity and those with only type 2 diabetes. The study is limited to find the factors associated to occurrence of co-morbidity of hypertension and type 2 diabetes in diabetic patients.

1.8 DEFINITION OF TERMS

This involves the variables used in this study. The dependent variable; diabetes-hypertension co-morbidity nominally defined as simultaneous or co-existence of diabetes and hypertension in an individual. Operationally, type 2 diabetes or hypertension may give rise to its co-morbidity in an individual. It is defined as rise in blood glucose level due to failure of cell to respond to insulin properly or elevated blood pressure on repeated measurement which resulted to co-occurrence of both conditions in an individual.

Other variables (independent variable) include the following with their conceptual and operational definition

Table 1 Definition of Terms

Concept/Variable	Nominal definition	Operational definition
Salty diet	Whether the patient eats food and drink which have too much salt in them.	Whether the patients put additional salt to their food or always eat from fast food restaurant.
Physical inactivity	Expending less than 1.5kcal/kg/day in leisure physical activities.	Whether the patients engage in any physical activity that makes him sweat, his heart beat rise and spend at least 30min in a week.
Obesity	Accumulation of excessive fat in the body.	Using BMI to determine whether the patient is overweight or obese. BMI > 25-30 kg/m^2 is Overweight and >30kg/m^2 is obese.
Subject age and time of diagnosis of diabetes.	Age of the patient and time length the patient was diagnosed of being diabetic.	Age and time length of diagnosis in years.
Family history	Patient family history of disease.	Whether there has been history of diabetes and hypertension in the patients' family and the degree of relationship.

CHAPTER TWO

LITERATURE REVIEW

2.1 EPIDEMIOLOGY

Hypertension co-existing with diabetes mellitus has received the greatest global attention in the last two decades (Keamey, et al. 2005; Wild, et al, 2004). The co-existence is due to several pathophysiological mechanisms which include increased volume expansion, altered sodium homeostasis, increased peripheral vascular resistance, hyperinsulinemia and lipid abnormalities, with which have been associated with increased risk of cardiovascular disease (Coccheri, 2007; Sowers, 2003).

The presence of hypertension in individual with diabetes increases the mortality 4-5 folds, largely through coronary artery disease and stroke (Sahey & Sahey, 2003). It is now well documented that the association between hypertension and diabetes increases the risk of cardiovascular disease that causes about 85 percent of deaths in diabetic patient (Arrauz- Pacheco, et al. 2002). Therefore acknowledgement of the prevalence of hypertension and blood pressure control in diabetic patient is important for health policy and public health strategy.

The prevalence of hypertension in diabetic patients is more frequent in men than in women before the fifth decade and more frequent in women thereafter (Oster, et al. 1990). The prevalence of these coexistent conditions is higher in blacks compared with whites; both diseases are more common among the socioeconomically disadvantaged (Harris, 1990; Sowers, 1990). In addition to race, age, and sex, greater body mass, longer

duration of diabetes, and the presence of persistent proteinuria are major determinants of elevated blood pressure, especially systolic pressure, in the diabetic population (Haffner, Stern, Hazuda, Mitchell & Patterson, 1990; Harris, 1990; Oster, et al. 1990; Sowers, 1990). Thus, in addition to duration of diabetes, other poorly understood factors likely contribute to the higher prevalence of hypertension in individuals with diabetes mellitus. There is scanty information on the prevalence of co-morbidity of hypertension and type 2 diabetes. The prevalence of hypertension in persons with diabetes is variable worldwide. This could be attributed to differences in race and lifestyle of people living in a place. The number of people living with diabetes currently is 240 million globally and over 7 million in Africa (Wild, et al. 2004). These populations are about a quarter and a third of the corresponding number of hypertension patients in Africa, and the world respectively (Wild, et al. 2004). Approximately 11 million of the 17 million US citizens with type 2 diabetes mellitus also have hypertension (Snow, Weiss & Mottur-Pilson, 2003). Comorbidity of hypertension and type 2 diabetes is the most common cause of morbidity and mortality from non-communicable disease in Africa (Unwin, et al. 2001). Hypertension and diabetes are independent risk factors for microvascular and macrovascular disease. Kumwenda, Harries, Nyrenda & Wirima, (1992) in their report recorded prevalence rate of hypertension among Malawi diabetic patient to be 37 percent while Swar, Lutale & Mclaity, (1990) reported 45 percent among Tanzanian citizens Diabetes mellitus is the most common metabolic disorder in Nigeria and its prevalence has been rising at an alarming rate in the last two decade (Iloh, Ikwudinma & Obiegbu, 2013; Iloh, Ofoedu, Njoku, Amadi & Godswill-Uko, 2012; Ogbu & Neboh, 2009). The

prevalence of diabetes and hypertension has been reported to be on increase, with a projected rise of 366 million diabetics in 2030 compared to the 171 million in 2000 and a 60 percent rise in people with hypertension by 2025. About 60 percent of Nigerian diabetics are hypertensive (WHO, 2008). Earlier, Osuntokun, (1972) reported a prevalence rate of hypertension in diabetes of 25 percent in Ibadan, Nigeria, while Okesina, Omotoso, Gadzame & Ogunrinola in 1995 reported a prevalence rate of 30 percent in Ilorin, Nigeria. A Study conducted in Jos, Nigeria reported a prevalence rate of 35 percent (Chukwak, Puepet, Okeahialam & Ohwovoriole, 2002). Abdulazeez, et al. 2013, in a study carried out in Ahmadu Bello University Teaching Hospital (ABUTH), Zaria reported a prevalence of 78.33 percent of hypertension among diabetic patient, which 66.33 percent is of type 2 diabetes. Also a study on risk factor of prediabetes in hypertensive patient by Ogbu & Neboh, (2009) in Enugu reported prevalence of 25 percent while a study by Gabriel, Ndubueze & Nnadozie, (2013) in Owerri, South Eastern Nigeria reported 33.1 percent. Other reports elsewhere have been in keeping with high prevalence of hypertension in persons with diabetes (Collato-Mesa, et al. 1999; Donnelly, Molyneaux, Mc Gill, & Yue, 1997).

2.2 ROLE OF HYPERGLYCEMIA IN THE PATHOGENESIS OF HYPERTENSION

Chronic hyperglycemia likely contributes to the genesis of hypertension in diabetic individuals through several mechanisms. One such hypertensive effect engendered by hyperglycemia is that of sodium retention and the increase in exchangeable body sodium that has been observed in diabetic hypertensive individuals (Weidmann & Ferrari, 1991).

Hyperglycemia results in glomerular hyper filtration of glucose, which in turn, stimulates the proximal tubular glucose-sodium ion co transporter. This mechanism is insulin independent. Thus, sodium retention occurs in association with mild-to- moderate hyperglycemia and likely contributes to increase total exchangeable sodium ion and blood pressure elevations in diabetic hypertensive patients.

Chronic hyperglycemia may also contribute to increased vascular rigidity by promoting vascular structural changes. At high concentrations, glucose appears to have a direct toxic effect on endothelial cells, which may result in decreased endothelial-mediated vascular relaxation, increased constriction, promotion of vascular smooth muscle cell hyperplasia, and vascular remodeling. High glucose levels mimicking the diabetic hyperglycemic state have also been shown to induce fibronectin and collagen IV over expression in cultured human vascular endothelial cells (Roy, Sala, Cagliero & Lorenzi, 1990). Enhanced expression of fibronectin and collagen IV may further contribute to endothelial dysfunction. Fibronectin is a protein that has a complex role in cell matrix interactions (Roy, et al. 1990), and its increased expression has been associated with thickened glomerular basement membranes and mesangium (Roy, et al. 1990). Thus, hyperglycemia-induced local synthesis of fibronectin by endothelial cells may contribute directly to endothelial dysfunction as well as indirectly to increases in basement membrane production

2.3 POPULATION AT RISK (American Diabetes Association, 2004)

The growing number of people with co-morbidity of hypertension and type II diabetes and the rapid development of glucose homeostasis dysregulation explains why diabetes

and hypertension is becoming one of the most important public health problems. Therefore, identifying population at risk for hypertension in diabetic patient is of primary importance in order to interrupt its progression and the diabetes-related cardiovascular complications in this group. The population at risk includes.

1. People with family history.
2. Overweight and obsessed persons with BMI >25kg/mm^2 .
3. Pregnant women.

2.4 COEXISTING FACTORS THAT AFFECT THE MEDICAL RISKS OF HYPERTENSION

Coexisting Diabetes and Hypertension (Haffner, et al. 1990)

The presence of hypertension in patients with diabetes markedly enhances development of macrovascular and microvascular disease in these individuals. Both hypertension and diabetes mellitus are major independent risk factors for accelerated atherosclerosis and ischemic heart disease. Coexistence of hypertension and diabetes is also associated with acceleration of diabetic retinopathy. Hypertension also accelerates the development of diabetic nephropathy. Both the onset of microalbuminuria and the progression of renal disease after the onset of proteinuria are accelerated by hypertension.

Hyperinsulinemia and Hypertension

Over the past several years increased attention has been given to the possible role of insulin resistance and hyperinsulinemia in linking obesity, diabetes, and hypertension to increased atherosclerotic vascular risk (Haffner, et al. 1990). Several possible factors may

help explain the epidemiological relation between elevated plasma insulin levels and cardiovascular disease.

Insulin resistance and hyperinsulinemia are closely linked to elevated plasma triglyceride levels, low high density lipoprotein levels, and to a lesser extent, with elevated total and low density lipoprotein-cholesterol levels. Insulin resistance and hyperinsulinemia may also affect atherosclerotic vascular risk by interfering with fibrinolysis (Landin, et al. 1990). A positive correlation exists between plasma insulin levels and those of fibrinogen and plasminogen activator inhibitor (Landin et al., 1990). Insulin stimulates subintimal smooth muscle and fibroblast proliferation in cell culture, increases the uptake and esterification of lipoprotein-cholesterol by smooth muscle cells, and exerts other actions that promote the atherosclerotic process.

Thus, the hyperinsulinemia existing in disorders of carbohydrate tolerance, such as that in hypertension associated with type 2 diabetes mellitus and obesity, could accelerate atherosclerosis both directly and secondarily by promoting hypertension.

Obesity and Hypertension

Obesity appears to be an important factor linking hypertension to impaired carbohydrate metabolism (Julius, et al. 1990). The relation between obesity and hypertension is often apparent in childhood (Julius, et al. 1990). The fact that blood pressure rises in concert with body weight and increased adiposity, even at an early age, suggests that obesity is an important factor in the development of hypertension. Fat distribution appears to be important because central or android obesity is much more strongly linked to insulin

resistance and type 2 diabetes, hypertension, and dyslipidemia than is peripheral or gynecoid obesity.

Lifestyle Changes and Hypertension

A sedentary lifestyle also appears to be associated with both diabetes mellitus and hypertension (Paffenbarger, Wing, Hyde and Jung, 1983; Flack and Sowers, 1991). For example, men who do not engage in regular aerobic exercise are at increased risk for the development of hypertension.

Insulin sensitivity improves in obese individuals who accomplish a significant increase in maximal oxygen consumption during physical training, even when only minor changes in body weight and fat composition occur. It has been suggested therefore, that physical training exerts at least a portion of its favorable effect on blood pressure via improved insulin sensitivity (Flack and Sowers, 1991).Thus, it is clear that obesity and a sedentary lifestyle are likely important contributors to high blood pressure in type II diabetic individuals

2.5 FACTORS ASSOCIATED TO OCCURRENCE OF CO-MORBIDITY OF HYPERTENSION AND TYPE 2 DIABETES

There are many factors associated with high blood pressure in diabetic patient. Some of this factors which can't be adjusted is known as non modifiable factors. This includes among others, increased age, gender, family history, and race/ethnicity etc. Others are modifiable factor which is based on one's lifestyle. This includes among others, being diabetic, physical inactivity, smoking, pregnancy, diet, overweight/obesity and high alcohol intake.

Non Modifiable

Age

An increase in blood pressure (BP) has always been taken as an inevitable consequence of ageing in industrialized societies, leading to hypertension in a high proportion of elderly subjects. However, the characterization and definition of what constitutes hypertension in the elderly has changed over the years. Older adults are at greater risk for high blood pressure. The risk of high blood pressure increases as one age (Franklin, 1999). Though early middle age, or about age 45 years, high blood pressure is more common in men. Women are more likely to develop high blood pressure after age 65 (Franklin, et al. 1997).

The risk of type 2 diabetes increases as one gets older, especially after age 45. That's probably because people tend to exercise less, lose muscle mass and gain weight as they age. Data obtained during the Framingham heart study, which followed patients for 30 years, agreed that systolic blood pressure (SBP) shows a continuous increase between the ages of 30 and 84 years or over. Diastolic blood pressure (DBP), however, has a varying pattern with ageing, increasing until the fifth decade and slowly decreasing from the age of 60 to at least 84 years of age. This leads to a steep rise in pulse pressure (PP) with ageing (Franklin, 1999). The increase in blood pressure with age is mostly associated with structural changes in the arteries and especially with large artery stiffness (Elisabete, 2007). This also goes in agreement with the work of Akhuemokhan, et al. (2008); Fayzeh, Erika, Hashem & Kamel, (2008) and Haydeh & sara Dorari (2013) which finds out that hypertension in diabetics increases as one gets older .

In diabetes type 2, hypertension is more common in women than in men (Williams, 2003). Trials have shown that lowering blood pressure reduces major cardiovascular events in those with diabetes (Curb, et al.1996; United Kingdom Prospective Diabetes Study Group, 1998) for cardiovascular and renal protection. People with diabetes require good blood pressure control and so most patients with diabetes and hypertension require combination therapy to achieve targets (Mancia & Grassi, 2002; Zanchetti & Ruilope, 2002).

The increase in blood pressure with age is most likely due to complex and varied factors molded and influenced by the individual environment and lifestyle. A few studies have showed a difference in the age-related rise in blood pressure with gender (Martins, Nelson, Pan, Tareen & Norris, 2001; Staessen, Ginocchio, Thijs & Fagard, 1997). The Framingham heart study showed a higher prevalence in elderly women than in elderly men (Franklin et al., 1997). This may be because elderly hypertensive women have stiffer large arteries, greater central wave reflection and consequently a higher pause pressure than elderly men. It is known that younger women have less stiff arteries compared with men of similar age (Smulyan, Asmar, Rudnicki, London & Safar, 2001; Waddell, Dart, Gatzka, Cameron & Kingwell, 2001). The increased arterial stiffness occurs after the menopause and could explain the rapid acceleration of cerebrovascular and cardiovascular events in elderly women. However, these rates always remain lower than in elderly men (Barrett-Connor & Bush, 1991). A study of over 600 subjects with a mean age of 71 found decreased systemic arterial compliance (lower functional compliance), a higher augmentation index (greater central wave reflection) and increased pulse pressure

in women independent of other variables. This was true even though mean arterial pressure was slightly higher in men (Berry, et al. 2004).

Gender

Women over 65 are more likely to have higher blood pressure, and men under age 45 are more likely to have high blood pressure than women (Jane, 2001). Recent studies using the technique of 24-hour ambulatory blood pressure monitoring have shown that blood pressure is higher in men than in women at similar ages. After menopause, however, blood pressure increases in women to levels even higher than in men (Jane, 2001). Also studies by Abbas, (2012) and Hyaydeh & sara Dorari (2013) shows higher prevalence of hypertension in diabetic women when compared to age matched men.

Wiinber and colleagues studied 352 normotensive (for age) Danish men and women, aged 20 to 79 years, and found that blood pressure increased with aging in both men and women, but that men had higher 24-hour mean blood pressure, by approximately 6 to 10 mm Hg, than did women, until the age of 70 to 79 years, when blood pressure was similar for men and women (Wiinber, et al. 1995). Khoury and colleagues performed ambulatory blood pressure monitoring on 131 men and women, aged 50 to 60 years, and found that men had higher blood pressure than did women (Khoury, Yarows, O'Brien & Sowers, 1992). In addition, the Third National Health and Nutrition Evaluation Survey (NHANES III) showed that, in general, men had higher blood pressure than women through middle age (Burl, et al. 1995). Furthermore, the incidence of uncontrolled hypertension is also greater in men than in women (Anastos, et al. 1995).

The mechanisms responsible for the gender differences in blood pressure control are not clear; there is significant evidence that androgens, such as testosterone, play an important role in gender-associated differences in blood pressure regulation. For example, studies using ambulatory blood pressure monitoring techniques in children have shown that with increasing age, blood pressure increases in both boys and girls. However, after the onset of puberty, boys have higher blood pressure than do age-matched girls (Bachmann, Horacek, Leowsky & Hirche, 1987; Bachmann, Horacek, Leowsky & Hirche, 1994). At ages 13 to 15 years, systolic blood pressure was approximately 4 mm Hg higher in boys than girls, and at ages 16 to 18 years, boys had higher systolic blood pressures than girls by 10 to 14 mm Hg.

The blood pressure in postpubescent boys also does not dip as low at night as in girls (Bachmann, et al. 1987; Bachmann, et al. 1994). A reduction in nocturnal dipping is recognized as a hallmark of early dysfunction in blood pressure regulation (Bachmann, et al. 1987; Bachmann, et al. 1994). These data clearly show that in adolescence and puberty, when androgen levels are increasing, blood pressure is higher in boys than in girls. On the other hand, increases in androgens in humans and animals increase blood pressure. Women with polycystic ovary syndrome or adrenal virilizing tumors, which are characterized by elevated testosterone levels, experience hypertension (Mattson, Hamberger, Samsioe & Silfverstolpe, 1995; Soranno, et al. 1999; Talbott, et al. 1995). Since, men and male rats have higher blood pressures than female; it is possible that female hormones may play a role in protecting females from developing higher blood pressures. Interestingly, the blood pressure does not increase during the transitional phase

from perimenopause to menopause (Luoto, et al. 2000) but rather the increase in blood pressure after menopause takes an average of 5 to 20 years to develop (Burl, et al. 1995), suggesting that lack of female hormones may not be the only contributing factor for the elevated blood pressure.

Race

Hypertension is one of the leading causes of death attributed to cardiovascular diseases, and the prevalence varies across racial/ethnic groups, with African Americans being disproportionately affected (Holmes, Hossain, Ward & Opara, 2012). High blood pressure is particularly common among blacks, often developing at an earlier age than it does in whites (Holmes, et al. 2012). Serious complications, such as stroke, heart attack and kidney failure, also are more common in blacks. A study shows that 60 to 69 years of age, non-Hispanic black and Hispanic women developed higher blood pressure than men of similar ethnic background (Burl, et al. 1995). However, the mechanisms responsible for the hypertension in these populations are complicated by comorbid conditions of obesity and type 2 diabetes, both of which lead to increases in blood pressure (Burl, et al. 1995). In the non-Hispanic white population, in which the incidence of obesity and type 2 diabetes with aging is not as high, blood pressure also increased after the average age of menopause (51.4 years). Therefore, by 60 to 69 years of age, non-Hispanic white women had blood pressure similar to that of men, and by 70 to 79 years of age, this population of women had higher blood pressure than did men (Burl, et al. 1995).

The etiology of hypertension is multifactorial and incidence, prevalence and mortality vary by race/ethnicity (Kressin, Orner, Manze, Glickman & Berlowitz, 2010; Mellor & Milyo, 2002; Ong, Cheung, Man, Lau & Lam, 2007). A study also showed that the age-adjusted prevalence of hypertension by race, in the year 2003-2004, among the United States residents of age 20 years or older was 39.1 percent non-Hispanic Black, 28.5 percent non-Hispanic White, and 27.8 percent Hispanic, while age-unadjusted prevalence rate was 34.4, 30.3 and 16.9 percent for three racial groups, respectively (Currie & Stabile, 2015). However, it is not fully understood whether the observed variance is due to race or other factors associated with race or hypertensive risk factors per se.

Explanatory factors for racial/ethnic differences in hypertension include racial/ethnic differences in family income, education and insurance status. Because there are racial/ethnic differences in the distribution of the postulated risk factors in hypertension, these factors may very well explain the ethnic/racial variations in hypertension prevalence in our population.

Family History

The risk of becoming hypertensive for an individual with a family history of hypertension has been estimated to be up to four times higher than average (Corvol, Jeunemaitrie, Charru & Soubrier, 1992; Williams, et al. 1993). Between 40 and 49 years of age, individuals with a positive family history of hypertension have four times greater risk for developing high blood pressure than persons with a negative family history (Stamler, Stamler, Riedlinger, Algera & Roberts, 1979). Although most agree that there is a strong association between elevated blood pressures and positive family history for

hypertension. The mechanisms underlying this association are complex and poor understood.

Blood pressure is affected by variety of factors including genetic and environmental influences (Corvol, et al. 1992), long-term exposure to stressors (Cobb & Rose, 1973) and personality characteristic (Ditto, 1986; Groer, Thomas, Droppleman & Younger, 1994). Although stress and environmental influences alone are most likely not sufficient causal factors for development of hypertension. Lawler, Lacy, Armstead & Lawler, (1988) suggest that family history and environmental stress may combine to increase the risk of developing hypertension. It is unclear, however, when in the life span the effects of the increased risk of positive family history are manifested.

Modifiable Factor

Drinking Alcohol

Alcoholic have been part of human culture for thousands of years and cross nearly every political and demographic boundary. Despite this long history, the interaction between alcohol and human health is still poorly understood. This confusion is particularly true with regard to blood pressure, as multiple studies have debated the association between alcohol intake and the development or management of hypertension. Having more than two drinks per day can cause hypertension, probably by activating your adrenergic nervous system, causing constriction of blood vessels and simultaneous increase in blood flow and heart rate.

However, a meta-analysis of 15 randomized controlled trials in which alcohol reduction was the only intervention between active and control groups found that alcoholic

beverage reduction lowered systolic and diastolic blood pressure, with a dose-response relationship (Xin, et al. 2001). Additionally, an older, randomized controlled crossover trial found that after an alcohol-reduction-induced drop in blood pressure, the resumption of baseline alcohol intake increased blood pressure back to pre-study levels (Puddey, Beilin, Vandongen, Rouse & Rogers, 1985). Taken together, these two studies implicate alcoholic consumption as a reversible cause of blood pressure elevation. This effect correlates with many large studies that have consistently found that persons reporting usual daily intake of three drinks or more have a higher than average blood pressure.

The association between chronic high-dose alcohol intake and blood pressure elevation has been shown in genders, multiple racial and ethnic groups, disparate international populations, and across all adult age groups (Klatsky & Gunderson, 2008). However, the association between hypertension and light-to-moderate drinking–up to two drinks per day for men and one drink per day for women–is more complicated (Klatsky, Friedman & Armstrong, 1985). This gender discrepancy was also seen in a study of 28, 848 women followed prospectively in the Women's health study and 13, 455 men from the Physicians' health study for an average of 10.9 and 21.8 years, respectively. This large study showed that light-to-moderate drinking was associated with reduced hypertension risk in women and increased hypertension risk in men (Sesso, Cook, Buring, Manson & Gaziano, 2008). Racial considerations further complicate the light-drinking-hypertension picture.

Relative to abstinence, black men consuming low-to-moderate amounts of alcohol appear to have a higher risk of hypertension compared to black women or Caucasians of either

gender (Fuchs, Chambless, Whelton, Nieto & Heiss, 2001). On the other hand, a 20-year follow-up study of young adults revealed no association between baseline alcohol consumption and incident hypertension, except among European-American women, in whom any current alcohol consumption was associated with lower incident hypertension risk (Halanych, et al. 2010). There is mounting evidence from both clinical and epidemiologic studies that alcohol consumption, especially at higher levels, is associated with elevations in blood pressure (BP), both systolic and diastolic, although the elevation in systolic BP is generally of greater magnitude.

Previous studies have varied greatly in their assessment of both alcohol consumption and blood pressure, and in their assessment of potential confounding factors that might be involved in this association. A consistent finding has been that drinkers at the highest levels of alcohol consumption show an increase in blood pressure (Klatsky, Friedman, Siegelaub & Gerard, 1977). Other studies have shown an increase in liver function abnormalities in hypertensive patients, presumably due to increased alcohol intake (Ramsey, 1977).

Being Overweight or Obese

The relevance of both hypertension and obesity, as important public health challenges, is increasing worldwide (Krzysztof, 2006). This epidemic of obesity and obesity-related hypertension is paralleled by an alarming increase in the incidence of diabetes mellitus and chronic kidney disease. Excess body weight is the sixth most important risk factor contributing to the overall burden of disease worldwide (Haslam & James, 2005). More than 1 billion adults and 10 percent of children are now classified as overweight or obese

(Haslam & James, 2005). Obesity have been consistently associated with hypertension and increased cardiovascular risk.

Based on population studies, risk estimates indicate that at least two-thirds of the prevalence of hypertension can be directly attributed to obesity (Krause, Winston, Fletcher & Grundy, 1998). This also agrees with the work of Akhuemokhan, et al. (2008); Essien, Peter, Udoh, Ekott & Odigwe, (2007); Fayzeh, et al. (2008) which founds out that increase in BMI ($\geq 25 kg/m^2$) in type 2 diabetic patients can lead to hypertension in them. The precise mechanisms linking obesity to hypertension and increased cardiovascular risk are not fully understood. However, neuroendocrine mechanisms and, most recently, factors derived from adipose are thought to play a major role (Engeli & Sharma, 2000; Wiecek, Kokot, Chudek & Adamczak, 2002).

Obesity might lead to hypertension and cardiovascular disease by activating the renin–angiotensin–aldosterone system, by increasing sympathetic activity, by promoting insulin resistance and leptin resistance, by increased procoagulatory activity, by endothelial dysfunction and by increasing more blood flow one need to supply oxygen and nutrients to tissues. As the volume of blood circulating through blood vessels increases, so does the pressure inside the arteries.

Further mechanisms include increased renal sodium reabsorption, causing a shift to the right of the pressure–natriuresis relationship and resulting in volume expansion (Wofford & Hall, 2004). Obesity-related hypertension is commonly associated with further elements of the metabolic syndrome, such as insulin resistance and glucose intolerance. In particular, one should be aware that diabetes occurs in 2 percent of treated

hypertensive patients per year (Verdecchia, et al. 2004). Furthermore, new onset diabetes increases the cardiovascular risk. The adverse impact of newly diagnosed diabetes is similar to that of known diabetes.

Not Being Physically Active

Physical activity (PA) is considered a key component for the prevention and treatment of hypertension in children and adolescents. Regular physical activity (PA), fitness and exercise are critically important for the health and well-being of people of all ages. Prospective studies have demonstrated that moderate-to-vigorous intensity physical activity, at baseline seems to be associated with a lower incidence of hypertension among white men, regardless of body size (Barengo, Hu & Tuomilehto, 2007). Further, interventional studies (Atkinson, Leary, George, Murphy & Jones, 2009; Haydeh & sara Dorari, 2013; Rodríguez-Rodríguez, Perea, López-Sobaler & Ortega, 2009) have demonstrated that increased physical activity reduces blood pressure in hypertensive and normotensive individuals independently from weight loss.

In light of these, physical activity should be practiced at a moderate intensity level in order to reduce systolic and diastolic blood pressure. Exercise increases blood flow through all arteries in the body, which leads to release of natural hormones and cytokines that relax blood vessels, which in turn lowers blood pressure. Lack of physical activity also increases the risk of being overweight. Thus, physical activity should also be considered as an important measure for the prevention and treatment of hypertension in adulthood. Even though for adults, the effect of physical activity on blood pressure is well established, the data are still limited. Physical activity is a key component of the

therapeutic lifestyle changes recommended for preventing and treating hypertension in children and in youth (Williams, et al. 2002).

Randomized clinical trials have demonstrated that physical activity is associated with lower levels of blood pressure in both hypertensive and normotensive individuals (Arroll & Beaglehole, 1992; Fagard, 2001; Kelley & Kelley, 2000; Whelton, Chin, Xin & He, 2002). Also, a study have shown that the relative risk of developing hypertension decreased in individuals who were physically active (Hu, et al. 2004).The contribution of physical activity to health outcomes is independent even when the traditional cardiovascular risk markers and genetic factors are considered (Gulati, et al. 2003; Kokkinos, et al. 2008; Myers, et al. 2002; Myers, et al. 2004). Moreover, the degree of risk associated with physical inactivity is similar to and in some cases even stronger than the more traditional cardiovascular risk factors (Gulati, et al. 2003; Kokkinos, et al. 2008; Myers, et al. 2002; Myers, et al. 2004).

Evidence from large cohort studies demonstrates that physical activity in general provides a highly effective way to delay or avert the development of diabetes mellitus. In addition, physical activity has been shown to reduce the risk of mortality in diabetics. The incidence of type 2 diabetes mellitus was inversely related to leisure time physical activity among men in the Harvard alumni study (Helmrich, Ragland, Leung and Paffenbarger, 1991) .

Diet

A high dietary intake of sodium and/or low dietary intake of potassium, calcium and magnesium have been associated with the rise in blood pressure (BP) that occurs with

age. Raised blood pressure is a major, preventable risk factor for cardiovascular disease (CVD) including: stroke, coronary heart disease, heart failure, peripheral vascular disease and kidney failure. The risk of disease increases as the level of blood pressure increases. In addition to the physiological effects resulting from variations in the intakes of electrolytes, there may be significant interactions between them that affect CVD risk.

Each molecule of ordinary salt is composed of an atom of sodium (Na) joined to an atom of chloride (Cl); the chemical designation is NaCl. Because chloride is heavier than sodium, it contributes more to the weight of the molecule. But when it comes to health, it's the sodium that counts, whether it comes from table salt or from other sources, such as baking soda (sodium bicarbonate or monosodium glutamate). While it is well established that dietary sodium restriction in humans will reduce blood pressure, the relationship between dietary sodium and BP varies in both hypertensive and normotensive individuals. Some of this variation may be due to increased 'salt sensitivity' that is associated with older age, race, medication use and obesity. These variations have been the basis of the debate around the extent of salt reduction required in the entire population and in hypertensive individuals. (Dickinson, Nicolsoson, Campbell, Beyer & Mason, 2006; Midgley, Matthew, Greenwood & Lodan, 1996).

Scientists know that sodium has an important influence on blood pressure, but they are not sure exactly how it works. It's no surprise, since the systems that control blood pressure include dozens of complex vascular, neurological, and hormonal elements. Although the body can rid itself of excessive dietary sodium, it seems likely that eating salt expands one blood volume by retaining fluid, and also causes the arteries in your

body to constrict, at least to a subtle degree. In turn, the extra volume may signal the kidneys to trigger a cascade of hormonal and vascular effects that raise blood pressure. And some experts suspect that these hormones may have adverse effects on vascular health even if blood pressure remains stable. Increasing salt intake stimulates the thirst center in one brain which will result to water intake. Increasing water intake raises body fluid and blood volume and increases blood pressure. This normally causes the kidneys to increase water and salt excretion to lower blood pressure. However, some people with hypertension are salt-sensitive, meaning their blood pressure fluctuates broadly in response to dietary sodium levels. In people with salt sensitivity, the kidneys become tolerant to a larger body fluid and blood volume associated with excess sodium intake, which further elevates blood pressure. Increased levels of sodium in the brain are at least partly responsible for development of salt-sensitive hypertension.

It has been estimated that a reduction of 2 mm Hg in systolic pressure would result in 6 percent reduction in risk of stroke and a 4 percent reduction in risk of chronic heart disease, and an overall reduction in mortality of 3 percent (Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, 2003). In another study a reduction of 10 mm Hg in systolic blood pressure is predicted to reduce stroke by approximately one third, chronic heart disease by one quarter and heart failure by one quarter in those between 60-80 years with systolic hypertension (He, Markandu & MacGregor, 2005).

Potassium helps to balance the amount of sodium in the cells. Potassium causes the smooth muscle cells in the arteries to relax, which lowers blood pressure. Increasing

potassium intake lowers blood pressure in people with hypertension who also have a high salt intake. High intake of simple sugars may also promote salt-sensitive hypertension. Findings on the association between a high dietary potassium intake and reduced blood pressure are inconsistent. Four meta-analyses have pooled randomized trials of potassium supplementation (Dickinson et al., 2006; Geleijnse, Kok & Grobbee, 2003; Whelton, et al. 1997). Three of these analyses have documented a significant inverse relationship between dietary potassium intake and blood pressure (Cappuccio & MacGregor, 1991; Geleijnse, et al. 2003; Whelton, et al. 1997).

Numerous meta-analyses have found an inverse association between calcium and blood pressure (Ruidavets, et al. 2006). A meta-analysis of observational studies indicated a modest inverse association between dietary calcium intake and blood pressure, while another study reported a modest reduction in blood pressure in hypertensive subjects (van Mierlo, et al. 2006). None have recommended calcium supplementation for the prevention and treatment of hypertension.

2.6 PREVENTION CO-MORBIDITY OF HYPERTENSION AND TYPE 2 DIABETES

Prevention of hypertension in diabetic patient involves wide range of activities known as "interventions" aimed at reducing risks or threats to health. Public health is characterized by planning and intervening for better health in populations rather than focusing exclusively on the health of identifiable individuals. Where public health cannot control health problems through upstream environmental measures (removing the cause), efforts focus on modifying behavior.

Public health typically uses a range of intervention strategies mostly in combination to achieve effective outcomes. These strategies can be grouped into primary, secondary and tertiary prevention.

Primary Prevention (National Institutes of Health, 2012)

This seeks to prevent the onset of specific diseases via risk reduction: by altering behaviors or exposures that can lead to disease. Primary prevention reduces the incidence of hypertension in diabetics by addressing disease risk factors or by enhancing resistance, for instance, thorough health promotion.

Health promotion activities are non-clinical life choices, for example, eating nutritious meals and exercising daily, that both prevents disease and creates a sense of overall well-being. Preventing disease and creating overall well-being, prolongs our life expectancy. Health-promotional activities do not target a specific disease or condition but rather promote health and well-being on a very general level.

On the other hand, specific protection targets a type or group of diseases and complements the goals of health promotion. These include

- Engage in regular aerobic physical activity such as walking (at least 30 minutes per day, most days of the week). Regular physical activity — at least 30 minutes most days of the week — can lower your blood pressure by 4 to 9 millimeters of mercury (mm Hg). It's important to be consistent because if one stops exercising, the blood pressure can rise again. If one has slightly high blood pressure (Prehypertension), exercise can help him avoid developing full-blown

hypertension. If one already has hypertension, regular physical activity can bring the blood pressure down to safer levels. The best types of exercise for lowering blood pressure include walking, jogging, cycling, swimming or dancing. Strength training also can help reduce blood pressure.

- Maintain normal body weight for adults (BMI 18.5-24.9 kg/m^2). Blood pressure often increases as weight increases. Being overweight also can cause disrupted breathing while you sleep (sleep apnea), which further raises your blood pressure. Weight loss is one of the most effective lifestyle changes for controlling blood pressure. Losing just 10 pounds (4.5 kilograms) can help reduce ones blood pressure.
- Alcohol can be both good and bad for your health. In small amounts, it can potentially lower your blood pressure by 2 to 4 mm Hg. But that protective effect is lost if one drink too much alcohol. Limit in alcohol consumption to no more than 1 oz (30ml) ethanol (E.g. 24 oz (720ml) of beer. 10 oz (300ml) of wine, or 2 oz (60ml) 100- proof whiskey) per day in most men and to no more than 0.5 oz (15ml) of ethanol per day in women and higher weight person.
- Reduce dietary sodium intake to no more than 100 mmol per day (approximately 2.4g of sodium or 6g of sodium chloride). Even a small reduction in the sodium in your diet can reduce blood pressure by 2 to 8 mm Hg. The effect of sodium intake on blood pressure varies among groups of people. In general, limit sodium to less than 2,300 milligrams (mg) a day or less. However, a lower sodium intake — 1,500 mg a day or less — is appropriate for people with greater salt sensitivity.

Maintain adequate intake of dietary potassium (more than 90mmol (3,500mg) per day).

- Chronic stress is an important contributor to high blood pressure. Occasional stress also can contribute to high blood pressure if one reacts to stress by eating unhealthy food, drinking alcohol or smoking. Take some time to think about what causes one to feel stressed, such as work, family, finances or illness. Once one knows what's causing his stress, consider how he can eliminate or reduce stress. If one can't eliminate all of his stressors, one can at least cope with them in a healthier way.
- Each cigarette one smoke increases blood pressure for many minutes after one finish. Quitting smoking helps one blood pressure return to normal. People who quit smoking, regardless of age, have substantial increases in life expectancy.
- Consume diet that are rich and vegetable and in low fat dairy products with a reduced content of saturated and total fat. Eating a diet that is rich in whole grains, fruits, vegetables and low-fat dairy products and skimps on saturated fat and cholesterol can lower one blood pressure by up to 14 mm Hg. This eating plan is known as the Dietary Approaches to Stop Hypertension (DASH) diet.
- Periodic medical checkup will help in early finding of prehypertension in diabetic patient which will help to initiate prevention of full development hypertension.
- Education about healthy and safe habits (e.g. eating well, exercising regularly, not smoking).

Secondary Prevention

This includes procedures that detect and treat pre-clinical pathological changes and thereby control disease progression to prevent potential future complications and disabilities from the disease.

Screening procedures (such blood pressure check) are often the first step, leading to early interventions that are more cost effective than intervening once symptoms appear. Screening is usually undertaken by health professionals, either at the level of individual doctor-patient encounters (e.g., routine blood pressure checks) or via public health screening programs. These includes

1. Regular examination and screening tests to detect disease in its earliest stages

Screening for Heart Disease. All patients with diabetes should be tested for high blood pressure (hypertension) and unhealthy cholesterol and lipid levels and given an electrocardiogram. Other tests may be needed in patients with signs of heart disease. The electrocardiogram (ECG or EKG) is used extensively in the diagnosis of heart disease, from congenital heart disease in infants to myocardial infarction and myocarditis in adults. Several different types of electrocardiogram exist.

Screening for Kidney Damage. The earliest manifestation of kidney damage is microalbuminuria, in which tiny amounts of a protein called albumin are found in the urine. Microalbuminuria typically shows up in patients with type 2 diabetes who have high blood pressure. The American Diabetes Association recommends that people with diabetes receive an annual microalbuminuria urine test. Patients should also have their

blood creatinine tested at least once a year. Creatinine is a waste product that is removed from the blood by the kidneys. High levels of creatinine may indicate kidney damage. A doctor uses the results from a creatinine blood test to calculate the glomerular filtration rate (GFR). The GFR is an indicator of kidney function; it estimates how well the kidneys are cleansing the blood.

Screening for Retinopathy. The American Diabetes Association recommends that patients with type II diabetes get an initial comprehensive eye exam by an ophthalmologist or optometrist shortly after they are diagnosed with diabetes, and once a year thereafter. (People at low risk may need follow-up exams only every 2 - 3 years.) The eye exam should include dilation to check for signs of retinal disease (retinopathy).

Screening for Neuropathy. All patients should be screened for nerve damage (neuropathy), including a comprehensive foot exam. Patients who lose sensation in their feet should have a foot exam every 3 - 6 months to check for ulcers or infections.

2. Population based intervention

Community level weight loss and exercise programmes to control metabolic syndrome.

Tertiary Prevention

Once a disease has developed and has been treated in its acute clinical phase, tertiary prevention seeks to soften the impact caused by the disease on the patient's function, longevity, and quality of life. Examples include cardiac rehabilitation following a complication of co-morbidity of hypertension and type 2 diabetes, seeking to alter behaviors to reduce the likelihood of a rein faction. Tertiary prevention can include modifying risk factors, such as making environmental modifications in assisting a cardiac

patient to lose weight. Where the condition is not reversible, tertiary prevention focuses on rehabilitation, assisting the patient to accommodate to his disability. For reversible conditions, tertiary prevention will reduce the population prevalence. Goals of tertiary prevention include: preventing pain and damage, halting progression and complications from disease, and restoring the health and functions of the individuals affected by disease. Examples include:

Referral to cardiac rehabilitation clinics for cardiac or stroke rehabilitation programmes, chronic disease management programmes for diabetes.

Vocational rehabilitation programmes to retrain workers for new jobs when they have recovered as much as possible.

2.7 SUMMARY OF LITERATURE REVIEW

Diabetes mellitus and hypertension are two of the most common diseases in westernized, industrialized civilizations, and the frequency of both diseases increases with increasing age (Oster, Materson & Epstein, 1990). Although diabetes mellitus is associated with a considerably increased cardiovascular risk, the presence of hypertension in the diabetic individual markedly increases morbidity and mortality (European Society of Hypertension, 2003). Thus, the coexistence of these two diseases likely contributes substantially to overall mortality in industrialized societies. Despite the critical importance of the coexistence of these two diseases, much information regarding their interaction remains unclear and controversial.

Diabetes and hypertension frequently coexist, leading to additive increases in the risk of life-threatening cardiovascular events. Hypertension is a common co-morbid condition in patients with type 1 or type 2 diabetes when compared with the general population (Sowers & Epstein, 1995). Essential hypertension accounts for the majority of hypertension in individuals with diabetes, particularly those with non insulin dependent diabetes mellitus (type 2 diabetes), who constitute more than 90 percent of people with a dual diagnosis of diabetes and hypertension (Epstein & Sowers, 1992; The National High Blood Pressure Education Program Working Group, 1994). Although hypertension may be present at the time of diagnosis of type 2 diabetes, hypertension often precedes diabetes onset or vice versa (Marks & Raskin, 2000), suggesting that it is either an independent process or part of the metabolic syndrome (Newton & Raskin, 2002).

Hypertensive subjects have a 2.5 times greater risk of developing diabetes within 5 years than normotensives matched for age, sex, and race. The predilection for hypertensive to develop diabetes may be due to insulin's diminished ability to promote relaxation and glucose transport in vascular and skeletal muscle tissue (Gress, Nieto, Shahar, Wofford & Brancati, 2000; Sowers, 2004). Conversely, type 2 diabetes and insulin resistance are strongly associated with increased prevalence of hypertension (Gress, et al. 2000; Nathan, et al. 2003; Sowers, 2004).

Hypertension is 1.5 to 3 times more prevalent in the diabetic population than in non diabetic age-matched subjects (Wingard & Barrett-Connor, 1995). This further supports the notion that these two common chronic diseases are frequently concordant (Sowers & Epstein, 1995). The association between hypertension and diabetes is distinctively

different depending on the type of diabetes. In patients with type 1 diabetes, the lifetime risk of elevated blood pressure (BP) is approximately 60 percent (Warram, Gearin, Laffel & Krolewski, 1996). The majority of type 1 diabetics are not hypertensive at onset of microalbuminuria, but its presence accelerates hypertension (Bakris, et al. 2000), while 15 to 25 percent of microalbuminuric type 1 diabetic patient are hypertensives, the prevalence of hypertension increases to 75 to 85 percent in patients with diabetic nephropathy (Mogensen, Hansen, Pedersen & Christensen, 1991). These two diseases present a major public health risk.

Hypertension occurs in 75 percent of type 2 diabetics (Arauz-Pacheco, Parrott & Raskin, 2003). In a recent cross-sectional study of German primary care practices, the co-presentation was 10.4 percent in men and 8.1 percent in women who had both of these conditions. In 81 percent of cases, complicating diseases were also found (Pittrow, Wittchen & Kirch, 2003; Sharma, et al. 2004). Cardiovascular disease is the same in diabetic women as in men, implying that diabetes removes the normal sex difference in the prevalence of coronary heart disease (Sowers, 1998). In hypertensive diabetics, the mortality risk of cardiovascular events is 4 times that of subjects in whom these two diseases are absent (European Society of Hypertension, 2003).

Type 2 diabetes constitutes more than 90 percent of diabetes in the United States and is associated with a 70 to 80 percent risk of premature death from cardiovascular disease and stroke (Haffner, Lehto, Ronnemaa, Pyorala & Laakso, 1998). The presence of components of the metabolic syndrome adds oxidative stress leading to endothelial dysfunction, a key component of the pathogenesis of hypertension (Sowers, 2003).

Research has identified a number of risk factors for type 2 diabetes mellitus and cardiovascular diseases (Keamey, Whelton & Raynolds, 2005; Wild, Roglic, Green, Sicree & King, 2004). According to Ogbu & Neboh, (2009), hypertension shares some similar risk factors with type 2 diabetes. This is not surprising why the two conditions co-exit. The presence of these risk factors in adult diabetic patient is important in screening intervention for hypertension in primary care settings. It is therefore quintessential to detect early the addition of hypertension on primary diabetes as these may affect morbidity and mortality outcome. Screening high risk adult diabetic patient specifically for hypertension and its risk factors is a primary care clinic imperative as persons with diabetes are at increased risk for the development of cardiovascular complications independent of progression to diabetes mellitus (Kuller, et al. 2000; Tuomilehto, Lindstron, Erikson, et al. 2001).

CHAPTER THREE

MATERIALS AND METHODS

In this chapter, the method that was used to carry out this study is presented. The methodological aspect of the study is presented under the following subheadings: Research design, Area of study, Study population, Sample size and sampling technique, Instrument for data collection, Validation of the instruments, Reliability of the instruments, Method of data collection, Method of data analysis and Ethical considerations/Informed consent.

3.1 RESEARCH DESIGN

The researcher adopts a comparative, retrospective, survey research design for the study. This research design is most appropriate for this study because it described the conditions of respondents as they exist in their natural settings and permits the collection of original data on potential relationship of a suspected factor or attribute to the disease that is being examined, by comparing the diseased and non diseased subjects with regard to how frequently the factor or attribute is present in each of the groups.

The “first group" for this study includes male and female human subjects, of about 20 years and above, who have been diagnosed of type 2 diabetes and hypertension. The “second group” subjects includes male and female human subject, of about 20 years and above who have been diagnosed of type 2 diabetic patient without hypertension. Subjects of both groups were validated by the physician and nurses of the health facilities used for the study, by diagnostic examination and through checking their medical history, and these was confirmed by the researcher through measurement of their blood pressure,

blood sugar level and information's given while filling the questionnaire. Subjects who are validated by the physician or nurses as having both hypertension and type 2 diabetes and conform with the result of blood pressure and sugar level with that of their information given in the questionnaire were grouped as "Hypertension-Type 2 diabetes subjects" while Subjects who are validated by the physician or nurses as having only type 2 diabetes and conform with the result of blood pressure and sugar level with that of their information given in questionnaire were grouped as "Type 2 diabetes subjects".

3.2 AREA OF STUDY

This study covered all cases of co-morbidity of hypertension and type II diabetes in Abia State, but was carried out on patients attending Federal Medical Centre (FMC), Abia Specialist Hospital and Diagnostic Centre, and Ojike Health Centre, all in Umuahia, Abia State, Nigeria. FMC, Umuahia is a Federal government owned hospital while Abia Specialist Hospital and Diagnostic Centre, and Ojike Health Centre is Abia State government owned hospital, all located in Umuahia, the capital of Abia State in the south east geopolitical zone of Nigeria. It serves an estimate of 3 million people of Abia State as well as neighboring states of Nigeria. Abia State is a State in the south eastern part of Nigeria. The capital is Umuahia and the major commercial city is Aba, formerly a British colonial government outpost. The State was created in 1991 from part of Imo State and its citizens are predominantly Igbo people (95 percent of population). It is one of the nine constituent States of Niger Delta regions.

The State occupies about 5, 834 square kilometers; and is bounded on the north and northeast by the States of Anambra, Enugu, and Ebonyi. To the west of Abia is Imo State,

to the east and southeast are Cross River State and Akwa Ibom State, and to the south is Rivers State. In 2006, the National Population Commission allotted 2,833,999 as the population of Abia State which is more of ibos.

3.3 POPULATION FOR THE STUDY

Subjects of this study include patients attending diabetic and hypertensive clinic of Federal Medical Centre, (FMC) Umuahia, Abia Specialist Hospital and Diagnostic Centre Umuahia, and Ojike Health Centre Umuahia, from the month of September to November of 2015. The main justification for choosing these health facilities for this study was because they are tertiary, secondary and primary health institution respectively and patients from all over Abia State and beyond with varied diagnosis such as diabetes, hypertension and other medical or surgical needs seek medical care from these health facilities. The population in this study includes males and females human subject of about 20 years and above.

3.4 SAMPLE SIZE AND SAMPLING TECHNIQUE

3.4.1 Sample Size

The minimum sample size (N) was calculated using formula for comparative study of Cochran, 1977. A sample size of 74 was gotten, however 140 sample size was used.

Therefore, the "Hypertension-Type 2 diabetic subject group" comprises of about 140 patients while "Type 2 diabetic subject group" about 100 patient. The samples of the study consist of a total of 240 subjects.

In the study, the researcher used systematic sampling technique to select the samples (group subjects) from the study population. He also used random sampling process to

select the health facility used in the study after he made visit to different health facility, taking record of diabetic subjects in order to get a good representation of each population from the study area and listing them in a sample frame.

3.5 INSTRUMENT FOR DATA COLLECTION

The instrument for data collection for the study include sphygmomanometer used in measuring blood pressure, standard weight scale (in kg) was used for weight measures, standard stadiometer (in meters) was utilized for height measures and a self structured questionnaire developed by the researcher. The researcher attached an introduction letter to the instrument to establish rapport with the respondents and acquaint them in a nutshell with the rationale for the study. The respondents were asked to tick (√) against any of, the responses that best appealed to them on the issues raised. This gives room for the respondent to be allowed to choose appropriate answers that suites him or her.

The instrument has 5 sections. Section A was developed to get information on the respondent's bio-data such as age, sex, occupation, level of education, BMI, and marital status. Subjects age were recorded in years as a continuous variable, sex was recorded as males and females, occupation has six categories of student/unemployed, trading, farming, artisans, civil servant, and retiree, level of education has four categories of primary, secondary, tertiary, and no formal education, BMI was recorded in kg/m and has five categories of < 18 kg/m^2 , 18-24.9 kg/m^2, 25-29.9 kg/m^2, 30-39.9 kg/m^2 and ≥ 35 kg/m^2 and three classes were made for the marital status which included single, married and widowed. Section B, C, D and E was designed to assist in providing answers to the research questions.

Section B seeks to obtain information on patient medical history of hypertension and type 2 diabetes, its co-morbidity, duration of disease, and type of treatment regimen. It addressed the issue of medical history of hypertension and type 2 diabetes and its duration to its co-morbidity.

.Section C seeks to obtain information on patient type of diet. The information includes level of salt intake, content of diet, and extent of patronizing fast food restaurants. It addressed the issue of salty diet to co-morbidity of hypertension and type 2 diabetes.

Section D seeks to obtain information on patient life style. The information includes smoking status, alcohol intake and engagement in physical activities. It addressed the issue of individual life style to co-morbidity of hypertension and type 2 diabetes.

Section E seeks to obtain patient information on family history of diabetes and hypertension. This addressed the issue of family history of hypertension and type 2 diabetes to its co-morbidity.

3.6 VALIDATION OF THE INSTRUMENTS

The instrument (questionnaire) was developed by the researcher and was approved by the researchers' supervisor after few corrections, to be a correct and a comprehensive reflection of the concept the questionnaire intended to measure (face validity).

To ensure the content and construct validity of the instrument that was used for the study; three copies of the questionnaire accompanied with the purpose of the study, research

questions and hypothesis were given to three experts in research study, two experts in statistics/ research analysis department from Federal Medical Centre, (FMC) Owerri, Imo State and the third validator was from public health department, Federal Medical Centre, Umuahia, Abia State, they all determined the clarity, appropriateness of language, adequacy of the items and instructions to respondents.

Based on the expert constructive inputs, three of the items were dropped, while eight were modified and three new ones were introduced. The comments and corrections by these experts and the project supervisor were extensively used in arriving at the final copy of the questionnaire with (30) items.

The diabetic-hypertensive and diabetic only subjects were validated by the physician and nurses of the health facilities used for the study, by diagnostic examination and through checking their medical history and was confirmed by the researcher through measurement of their blood pressure, blood sugar level and their information's given while filling the questionnaire.

3.7 RELIABILITY OF INSTRUMENTS

In order to establish the internal consistency of the instrument used for the study, eighteen copies of the questionnaire were administered to already known diabetic patients attending diabetic clinic of University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu State, Nigeria. Nine of them were Hypertension-Type II diabetic subjects and six Type II diabetic subjects, the remaining three copies could not be retrieved. This serve as a similar population for the study. The researcher then used the cronbach alpha reliability coeffient method to estimate and analyze the data collected.

Finally, a reliability coefficient of 0.71 of the entire instrument was obtained. Thus, the researcher considered it high enough and fit for this study.

3.8 METHOD OF DATA COLLECTION

The administration of the copies of the questionnaire was done by the researcher himself with the help of nine researcher assistants after an informed consent was obtained. The assistants were informed of the objectives of the study by the researcher and a qualified nurse, on how to distribute the copies of the questionnaire, measure blood pressure and sugar level and how to collect back the copies of the questionnaire. To ensure that the actual respondents were indeed those who filled the instrument, the research assistants were selected from among the staff in diabetic and hypertensive clinic of the three health institution used.

The literate respondents were allowed to fill the questionnaire themselves but for non-literate respondents, the questions were asked in local language and their responses were filled by the researcher and the assistants. The instrument was distributed to 270 respondents. Twelve of the copies of the questionnaire could not still be retrieved from the respondents while eighteen were not properly filled. Thus 240 copies of the questionnaire from the three health facilities were used for analysis.

Prior to the measurement of blood pressure, the subject were seated and rested for about 10 minutes in sitting position on a chair that supported the back comfortably. A cuff of suitable size was applied evenly to the exposed arm and BP reading taken. The systolic and diastolic blood pressure readings were measured three times after 2 minutes time gap in between and the average of the last two values taken.

The subjects were asked to fast for nine hours before checking their plasma glucose level. The subjects were asked to put on light cloths and stand on the weight scale bare footed and the weight was recorded in kg, and also height value also taken using standiometer in meters. The BMIs were then calculated with these readings.

3.9 METHOD OF DATA ANALYSIS

Data obtained were summarized using simple descriptive statistics. Frequency distribution table were constructed for the two groups and were all expressed as the percentage of the distribution. To answer the researcher questions, the responses of the patients and the data obtained were analyzed using logistic regression of SPSS version 21 and Microsoft excel 2010 (Levesque, 2007). To test the five hypothesis posed in the study, odd ratio (OR) was utilized. It was tested at 95 percent confidence interval at 0.05 level of significance and appropriate degrees of freedom. The decision rule for the hypothesis was that if odd ratio < 0.05 levels of significances ($P < 0.05$) at 95 percent confidence interval; the null hypothesis of a relationship was not rejected. On the other hand, if odd ratio > 0.05 level of significance ($P > 0.05$) at 95 percent confidence interval; the null hypothesis of a relationship was rejected.

Table 3.1 Demonstration of How Odd Ratio was Determined Using a 2 x2 Contingency Table

	Hypertension + Type 2 Diabetes	Type 2 Diabetes	TOTAL
Add Table Salt	A	B	AB
Do Not Add Table Salt	C	D	CD
TOTAL	AC	BD	ABCD

Odd Ratio (OR) = AD/CB

3.10 ETHICAL CONSIDERATIONS/INFORMED CONSENT

Ethical clearance was sought and obtained from research ethics committee of Federal Medical Centre, (FMC) Umuahia, Abia Specialist Hospital and Diagnostic Centre Umuahia, and Ojike Health Centre Umuahia, before commencement of the study. A written informed consent was also collected from each respondent/patient before enrolment in the study.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

This chapter presents the results and findings from the data analyzed according to the research questions and hypotheses that guided the study. The data analyzed were summarized in tables 3-8.

4.1 DATA ANALYSIS AND INTERPRETATIONS

Table 3: The Frequency and Percentage of Variables Associated to Comorbidity of Hypertension and Type 2 diabetes Among Diabetes Sufferers

VARIABLES		Hypertension-Type 2 diabetes		Type 2 diabetes		TOTAL	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Addition of Salt	Yes	28	20	29	29	57	23.8
	No	112	80	71	71	183	76.3
	Total	140	100	100	100	240	100
Eating of Salty Food	Always	14	10	28	28	42	17.5
	Most Times	43	30.7	27	27	70	29.2
	Sometimes	75	53.6	29	29	104	43.3
	Never	8	5.7	16	16	24	10
	Total	140	100	100	100	240	100
Eating of Fast Food	Always	0	0	4	1.7	5	3.6
	Most Times	4	4	0	0	5	2.1
	Sometimes	57	40.7	109	45.4	78	55.7
	Never	52	52	44	44	122	50.8
	Total	140	100	100	100	240	100
Physical Exercise	Yes	30	21.4	36	36	66	27.5
	No	110	78.6	64	64	174	72.5
	Total	140	100	100	100	240	100
BMI	<18	0	0	7	7	7	2.9
	btw 18-25	54	38.6	50	50	104	43.3
	btw 25-30	61	43.6	31	31	92	38.3
	btw 31-35	20	14.3	12	12	32	13.3
	>35	5	3.6	5	0	0	2.1
	Total	140	100	240	100	100	100
Age	20-29years	0	0	11	11	11	4.6
	30-39years	0	0	13	13	13	5.4
	40-49years	10	7.1	11	11	21	8.8
	50-59years	44	31.4	21	21	65	27.1
	60-69years	63	45	30	30	93	38.8
	≥70	23	16.4	14	14	37	15.4
	Total	140	100	240	100	100	100

	<1year"	14	10	24	24	38	15.8
DM Duration	1-5years	36	25.7	42	42	78	32.5
	6-10years	52	37.1	25	25	77	32.1
	>10years	38	27.1	9	9	47	19.6
	Total	140	100	100	100	240	100
Family History of DM	Yes	67	47.9	51	51	118	49.2
	No	73	52.1	49	49	122	50.8
	Total	140	100	100	100	240	100
Family History of HBP	Yes	66	47.1	23	22	88	36.7
	No	74	52.9	77	72	152	63.3
	Total	140	100	100	100	240	100
Family History of both HBP and DM	Yes	45	32.1	16	16	61	25.4
	No	95	67.9	84	84	179	74.6
	Total	140	100	100	100	240	100

DM= Diabetes mellitus; HBP= High blood pressure; BMI= Body mass Index

Table 3: The value of frequency and percentage of variables associated to comorbidity of hypertension and type 2 diabetes in diabetic patients. This table below shows that out of 240 subjects recruited into the study 183(76.3%) of them did not add more salt to their already cooked food and the remaining 57 (23.8%) subject added extra salt to their already cooked food. Out of this numbers, 28 (20%) and 29 (29%) represents hypertension with type 2 diabetes and type 2 diabetic subjects respectively that add extra salt to food.

Shown also in the table is high frequency of subjects that did not engaged in physical activity 174 (72.5%). High frequency was seen in hypertension with type 2 diabetic subjects 110 (78.6%) than the type 2 diabetic subjects 64 (64%).

The body mass index (BMI) frequency in this study was highest among patients with hypertension and type 2 diabetes group who were overweight (25-30kg/m^2) and type 2 diabetes group without hypertension (18-24.9kg/m^2). This represents 61 (43.6%) and 50 (50%) of the groups respectively.

In the study, the age bracket of highest frequency is age group 60-63 (38.8 %) which the hypertension with type 2 diabetes group had the highest number of 63 (45%) while the type 2 diabetes group had 30 (30%). The age bracket of lowest frequency was seen in age group 20-29 (4.6%) which occurred only in the type 2 diabetes group.

The duration of diabetes diagnosis was highest in 1-5 years (32.5%), which is closely followed by range of 6-10 years (32.1%), which we have more of hypertension-type 2 diabetic subjects 52 (37.1%). This is followed by range >10 years (19.6%) and then, < a year (15.3 %).

Subjects with hypertension and type 2 diabetic with family history of diabetes were 67 (47.9%) and those without family history of diabetes were 51 (51%) who have family history of diabetes. The frequency of hypertension-type 2 diabetic subjects 66 (47.1%) who have family history of hypertension is higher than that of the type 2 diabetes group 23 (22%) who have family history of hypertension. Frequency of hypertension with type 2 diabetic subjects 45 (32.1%) who have family history of both hypertension and diabetes is high than that of the type 2 diabetes group 16 (16%) who have family history of diabetes.

4.2 TEST OF HYPOTHESES

Ho_1: Occurrence of diabetes-hypertension co-morbidity is associated with increasing intake of salty diet.

Table 4 Multivariate Analysis for Salty Diet Associated to Comorbidity of Hypertension and Type 2 diabetes Among Diabetes Sufferers

VARIABLES		Hypertension-Type 2 diabetes		Type 2 diabetes		TOTAL	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Addition of Salt	Yes	28	20	29	29	57	23.8
	No	112	80	71	71	183	76.3
	Total	140	100	100	100	240	100
Eating of Salty Food	Always	14	10	28	28	42	17.5
	Most Times	43	30.7	27	27	70	29.2
	Sometimes	75	53.6	29	29	104	43.3
	Never	8	5.7	16	16	24	10
	Total	140	100	100	100	240	100
Eating of Fast Food	Always	0	0	4	4	4	1.7
	Most Times	5	3.6	0	0	5	2.1
	Sometimes	57	40.7	52	52	109	45.4
	Never	78	55.7	44	44	122	50.8
	Total	140	100	100	100	240	100
OR	AS = 0.6; ESF = 0.8; EFF = 0.7						
CI (95%)	AS = 0.336-1.113; ESS = 0.566-1.013; EFF = 0.434-1.002						
P –Value	AS = 0.108; ESS = 0.061; EFF = 0.051						

OR= Odd Ratio; CI= 95% Confidence Interval; * Significance at (P-value <0.05);

AS= Addition of Salt; ESF= Eating of Salty; EFF= Eating of Fast Food;

Table 4 indicated that there was no significant relationship (P-value > 0.05) in the regression analysis result of increasing intake of salty diet to comorbidity of hypertension and type 2 diabetes among diabetes sufferers.

Thus the answer to research question 1 in this study is that high intake of salty diet is not associated with occurrence of comorbidity of hypertension and type 2 diabetes among diabetes sufferers.

Ho_2: Occurrence of diabetes-hypertension co-morbidity is associated with increasing inactivity days.

Table 5 Multivariate Analysis for Physical Activity Associated to Comorbidity of Hypertension and Type 2 diabetes among Diabetic Sufferers

VARIABLES		Hypertension-Type 2 diabetes		Type 2 diabetes		TOTAL	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Physical Exercise	Yes	30	21.4	36	36	66	27.5
	No	110	78.6	64	64	174	72.5
	Total	140	100			240	100
		100	100				
OR	0.5						
CI (95%)	0.273-0.861						
P –Value	*0.013						

OR= Odd Ratio; CI= 95% Confidence Interval; * Significance at (P-value <0.05)

Table 5 indicated that there was significant relationship (P-value < 0.05) in the regression analysis result of increasing inactivity days to comorbidity of hypertension and type 2 diabetes among diabetes sufferers.

Thus the answer to research question 2 is that individual physical inactivity is associated with co-occurrence of hypertension and type 2 diabetes among diabetes sufferers.

Ho_3: Occurrence of diabetes-hypertension co-morbidity is associated with obesity as measured by BMI.

Table 6 Multivariate Analysis for Obesity as measured by BMI Associated to Comorbidity of Hypertension and Type 2 diabetes Among Diabetes Sufferers

VARIABLES		Hypertension-Type 2 diabetes		Type 2 diabetes		TOTAL	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
BMI	<18	0	0	7	7	7	2.9
	btw 18-24.9	54	38.6	50	50	104	43.3
	btw 25-29.9	61	43.6	31	31	92	38.3
	btw 30-39.9	20	14.3	12	12	32	13.3
	≥35	5	3.6	0	0	5	2.1
	Total	140	100	100	100	240	100
OR	0.6						
CI (95%)	0.406-0.806						
P –Value	* 0.010						

OR= Odd Ratio; CI= 95% Confidence Interval; * Significance at (P-value <0.05); BMI= Body Mass Index.

Table 6 indicated that there was significant relationship (P-value < 0.05) in the regression analysis result of obesity as measured by BMI to comorbidity of hypertension and type 2 diabetes among diabetes sufferers.

With regards to the decision rule, the research hypothesis is accepted. Thus, the answer to research question 3 is that obesity as measured by BMI is a factor associated with occurrence of comorbidity of hypertension and type 2 diabetes among diabetes sufferers.

H_{04}: Occurrence of diabetes-hypertension co-morbidity is associated with increase in the subject age and time of diagnosis of diabetes.

Table 7 Multivariate Analysis for Subject Age and Time of Diagnosis of Diabetes Associated to Comorbidity of Hypertension and Type 2 diabetes Among Diabetes Sufferers

VARIABLES		Hypertension-Type 2 diabetes		Type 2 diabetes		TOTAL	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Age	20-29years	0	0	11	11	11	4.6
		0	0				
	30-39years	13	13	13	5.4	10	7.1
	40-49years	11	11	21	8.8	44	31.4
	50-59years	21	21	65	27.1	63	45
	60-69years	30	30	93	38.8	23	16.4
	≥70	14	14	37	15.4	140	100
	Total	140	100	100	100	240	100
DM Duration	<1year	14	10	24	24	38	15.8
	1-5years	42	42	78	32.5	36	25.7
	6-10years	25	25	77	32.1	52	37.1
	>10years	9	9	47	19.6	38	27.1
	Total	140	100	100	100	240	100
OR	Age = 0.7; DMD = 0.5						
CI (95%)	Age = 0.449-0.720; DMD = 0.370-0.664						
P –Value	Age = 0.000*; DMD = 0.000*						

OR= Odd Ratio; CI= 95% Confidence Interval; * Significance at (P-value <0.05); DM= Diabetes Mellitus; DMD= Diabetes Mellitus Duration.

Table 7 indicated that there was significant relationship (P-value < 0.05) in the regression analysis result of increasing subject age and duration of diabetes diagnosis to comorbidity of hypertension and type 2 diabetes among diabetes sufferers.

With regards to the decision rule, the research hypothesis is accepted. Thus, the answer to research question 4 is that increase in subject age and time of diagnosis of diabetes is factor associated with occurrence of comorbidity of hypertension and type 2 diabetes among diabetic sufferers.

Ho_5: Occurrence of diabetes-hypertension co-morbidity associated to individual with family history.

Table 8 Multivariate Analysis for individual family history Associated to Comorbidity of Hypertension and Type 2 diabetes Among Diabetes Sufferers

VARIABLES		Hypertension-Type 2 diabetes		Type 2 diabetes		TOTAL	
		Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Family History of DM	Yes	67	47.9	51	51	118	49.2
	No	73	52.1	49	49	122	50.8
	Total	140	100	100	100	240	100
Family History of HTN	Yes	66	47.1	23	22	88	36.7
	No	74	52.9	77	72	152	63.3
	Total	140	100	100	100	240	100
Family History of both HTN and DM	Yes	45	32.1	16	16	61	25.4
	No	95	67.9	84	84	179	74.6
	Total	140	100	100	100	240	100
OR	FHDM = 0.9; FHHTN = 3.1; FHDMHTN = 2.5						
CI (95%)	FHDM = 0.528-1.474; FHHTN = 1.774-5.636; FHDMHTN = 1.309-4.724						
P –Value	FHDM = 0.631; FHHTN = 0.000; * FHDMHTN = 0.005 *						

OR= Odd Ratio; CI= 95% Confidence Interval; * Significance at (P-value <0.05); DM= Diabetes Mellitus; HTN= Hypertension; FHDM= Family History of Diabetes Mellitus; FHHTN= Family History of Hypertension; FHDMHTN= Family History of both Diabetes and Hypertension.

Table 8 indicated that there was significant relationship (P-value < 0.05) in the regression analysis result of family history of hypertension and family history of both diabetes and hypertension; and no significant relationship of family history of diabetes with comorbidity of hypertension and type 2 diabetes among diabetic sufferers.

With regards to the decision rule, the research hypothesis is accepted for family history of hypertension and family history of both diabetes and hypertension; and rejected for family history of diabetes. Thus, the answer to research question 5, family history of hypertension and family history of both diabetes and hypertension are factors associated to occurrence of comorbidity of hypertension and type 2 diabetes among diabetes sufferers, but family history of diabetes in this study is not a factor associated with occurrence of comorbidity of hypertension and type 2 diabetes among diabetes sufferers.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

i. Summary of Findings

- This study finds out that women are more in hypertension with type 2 diabetes group than male and male are more in type 2 diabetes group than female.
- Majority of hypertension with type 2 diabetic subjects are trader while that of type 2 diabetes group are civil servants.
- Primary school level of education is more in hypertension with type 2 diabetes group while that of type 2 diabetes group is tertiary education.
- Both the hypertension with type 2 diabetes and type 2 diabetes groups have more of married subjects.
- In this study, hypertension with type 2 diabetic and type 2 diabetic subjects did not add extra salt to their already cooked food and majority of them sometimes eats canned food. More of hypertension with type 2 diabetic subjects never visit fast food while more of type 2 diabetic subjects sometimes visited fast food, thus there is no significant relationship of this variables to comorbidity of hypertension and diabetes.
- The percentage of hypertension with type 2 diabetic subjects that did physical exercise is less than that of type 2 diabetic group, thus there was significant relationship of this variable to comorbidity of hypertension and diabetes.

- Hypertension with type 2 diabetes group had more of overweight and obese subjects while type 2 diabetes group have more subjects with normal weight, thus there is significant relationship of this variable to comorbidity of hypertension and diabetes.
- Hypertension with type 2 diabetes group have more subjects that is more than 50years and diabetes duration which fall within the range of 6-10years than the type 2 diabetes group, thus there is significant relationship of this variable to comorbidity of hypertension and diabetes.
- More hypertension with type 2 diabetic subjects have family history of hypertension, and both hypertension and diabetes than the type 2 diabetes group, thus there is significant relationship of this variable to comorbidity of hypertension and diabetes.

ii. Interpretation of Results

Diabetes and hypertension are among the commonest diseases in developed countries and the frequency of both conditions are the most common cause of the morbidity and mortality from non- communicable disease in Africa (Unwin, et al. 2001). About 60 percent of Nigerians that was diabetic are hypertensive, as found in many other areas of the world (Wingard & Barrett- Conner, 1995). Hypertension shares some similar risk factors with type 2 diabetes (Ogbu & Neboh, 2009). This is not surprising why the two condition co-exit. This study was carried out to determine factors associated with occurrence of comorbidity of hypertension and type 2 diabetes among diabetes patient.

Findings of this study show that females (59.3%) appeared to have higher prevalence of comorbidity of hypertension and type 2 diabetes when compared with female type 2 diabetes group (41%). This is in line with the studies of Abbas, (2012), and Haydeh & sara Dorari, (2013). In type 2 diabetes, hypertension is more common in women than in men (Williams, 2003). This shows that gender could be a factor to this high prevalence.

In this study, factors independently associated with occurrence of hypertension in diabetes patients were physical activity, obesity as measured by BMI, age of the subject, duration of diabetes and family history.

There is no significant association ($P > 0.05$) between intake of salt and comorbidity of hypertension and type 2 diabetes. This could be that both the hypertension with type 2 diabetes and type 2 diabetes group did add extra salt to their already cooked food or visit fast food restaurant often. It could also mean that both groups were advised not to eat salty food when diabetes was diagnosed.

Physical inactivity showed significant association (OR=0.5; 95% CL= 0.273-0.861; $P < 0.05$) to occurrence of comorbidity of hypertension and type 2 diabetes. This means that diabetes patients are 0.5 times more likely to develop hypertension if physically inactive. The result is not in agreement with the study in Iran by Haydeh and sara Dorari, (2003), but was in agreement with a study in Owerri, Imo state, Nigeria by Gaberial, et al. (2013) which stated that physical inactivity had 9.2 strength, associated with hypertension in diabetes. Exercise increases blood flow through all arteries in the body, which leads to release of natural hormones and cytokines that relax blood vessels, which in turn lowers blood pressure. Lack of physical activity also increases the chances of being overweight.

Thus, physical activity should also be considered as an important measure for the prevention and treatment of hypertension in adulthood. Prospective studies have demonstrated that moderate-to-vigorous intensity physical activity, at baseline seems to be associated with a lower incidence of hypertension among white men, regardless of body size (Barengo, et al. 2007).

Also the result of this study shows a significant association (OR=0.6; 95% CI=0.406-0.806; P< 0.05) of overweight and obesity as measured by BMI (≥ 25kg/m ^{2}) to hypertension among diabetes patients. This means that, the chances of type 2 diabetic patients, having hypertension also, is 0.6 times more as their BMI values increases. This is in agreement with the work of Akhuemokhan, et al. (2008); Essien, et al. (2007); Fayzeh, et al. (2008) and Gabrial, et al. (2013). Emerging evidence has suggested that type 2 diabetes, hypertension and obesity may be etiologically and prognostically related through the insulin resistance syndrome which is a cluster of atherogenic cardiovascular risk factor. Although not every overweight or obese diabetic patient are at risk for developing hypertension but their chances are high.

Increase in age >50years is significantly association (OR=0.7; 95% CI=0.449-0.720; P< 0.05) with hypertension among diabetic sufferers. This means that diabetic patients have 0.7 times more chances of developing hypertension in feature as they gets older. Also diabetes duration shows significant association (OR=0.5; 95% CL= 0.370-0.664; P < 0.05) with comorbidity of hypertension and type 2 diabetes. This means that diabetic patients have 0.5 chances of having hypertension as the duration of being diabetic increases. This is in conformity with other studies in Nigeria and other parts of the world

(Akhuemokhan, et al. 2008; Fayzeh, et al. 2008; Haydeh & sara Dorari, 2013). Hypertensive subjects have a 2.5 times greater chances of developing diabetes within 5 years than normotensives matched for age, sex, and race. The predilection for hypertensive to develop diabetes may be due to insulin's diminished ability to promote relaxation and glucose transport in vascular and skeletal muscle tissue (Gress, et al. 2000; Sowers, 2004). Conversely, type 2 diabetes and insulin resistance are strongly associated with increased prevalence of hypertension (Gress, et al. 2000; Nathan, et al. 2003; Sowers, 2004). The risk of hypertension in diabetics increases as one gets older, especially after age 45years. That's probably because people tend to exercise less, lose muscle mass and gain weight as they age. Data obtained during the Framingham heart study, which followed patients for 30 years, agreed that systolic blood pressure (SBP) shows a continuous increase between the ages of 30 and 84 years or over. Diastolic blood pressure (DBP), however, has a varying pattern with ageing, increasing until the fifth decade and slowly decreasing from the age of 60 to at least 84 years of age. This leads to a steep rise in pulse pressure (PP) with ageing (Franklin, 1999). The increase in blood pressure with age is mostly associated with structural changes in the arteries and especially with large artery stiffness (Elisabete, 2007). Although being diabetic is a risk factor on its own to progresses to hypertension and developed cardiovascular complications of diabetes mellitus. However, not all diabetic patients go down with hypertension, but their chances of developing hypertension are high. This may be promoted and enhanced by modifiable risk factors of hypertension. The findings of this study therefore portends a possible increase in the incidence of hypertension among adult

Nigerians with type 2 diabetes and underscore the need to critically assess these patients during clinical encounter in primary health care setting for hypertension. This will help to reduce the health cost associated with management of their diabetic condition and possible concurrent hypertension. In these regard, primary prevention intervention for hypertension is a compelling necessity in primary health care setting.

A strong significant association was found between hypertension in diabetes and a positive family history of hypertension (OR=3.1; 95% CI= 1.774-5.636; $P < 0.05$) and positive family history of both hypertension and diabetes (OR=2.5; 95% CI= 1.309-4.724; $P < 0.05$). This means that diabetes patients that have family history of hypertension, have 3.1times greater chances of developing hypertension, but if the subject have both hypertension and diabetes family history, this study found out that he has 2.5times greater chances of developing hypertension. No significant association (OR=0.9; 95% CI= 0.528-1.474; $P > 0.05$) was seen between comorbidity of hypertension and type 2 diabetes among diabetes patients. This could be that, it was because of both the hypertension with type 2 diabetes and the type 2 diabetes groups are all diabetic, so family history of diabetes could not show association relationship to comorbidity of both health conditions. This finding is consistent with other report on positive family history of hypertension as important factors associated with development of hypertension (Corvol, et al. 1992). This genetic contribution involves multiple genes. As the prevalence of hypertension and diabetes mellitus increases worldwide so will the family history of hypertension increase. Interventions to prevent hypertension in diabetic Nigerians with family history of hypertension should be a compelling primary care

priority in the study area. Thus at primary care level, family history of hypertension may help tailor health promotion, health maintenance and risk reduction messages for the special group of diabetic patients.

5.2 CONCLUSION

The study has demonstrated a strong association of some variables to co-occurrence of hypertension and type II diabetes among diabetes patient. Physical inactivity, BMI, age of subject, duration of diabetes, family history of hypertension and family history of both hypertension and diabetes were proximate independent factors associated with occurrence of hypertension with type 2 diabetes comorbidity. The presence of this factor should therefore provide guild for screening adult Nigerian with type 2 diabetes for hypertension in primary care. More of intervention to prevent hypertension among diabetic patient should be a compelling health priority in primary care settings particularly in resource-constrained environment.

5.3 RECOMMENDATIONS

In the study area, further health care based and community-based studies are recommended in order to explore other factors associated to occurrence of hypertension among type 2 diabetes sufferers and its correlates. Also, further studies are recommended on cause-effect relationship of this factors found to be associated with hypertension among type 2 diabetes patients in this study. This will provide valuable clinical and epidemiological data for collaborative purposes.

5.4 LIMITATIONS OF STUDY

The researcher had certain constraints which imposed some degree of limitations to the absolute generalization of the findings. The limitations imposed by the "comparative" nature of the study design are recognized by the researcher. Diabetes may antedate the development of hypertension or vice versa. However, this study stimulates the need for longitudinal studies. This would enable association relationship to be drawn and also for a reliable and valid conclusion to be ascertained.

Bias by the respondents in filling the questionnaire cannot be totally ruled out, because it is not in total control of the researcher. However, the researcher assured the respondents of utmost degree of confidentiality of the information given in the questionnaire, which he believes will eliminate said limitation.

More so, the limitations of not comparing the hypertensive with type 2 diabetic patients with other socio- demographic characteristics such as occupation, marital status, education and socio economic class among others are recognized by the researcher. This was designed to avoid over comparison on the patients socio-demographic characteristics which might lead to variable degree of systematic error.

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APPENDIX A

Department of Public Health Technology,
School of Health Technology,
Federal University of Technology,
Owerri, Imo State.

Dear Respondent,

I am a postgraduate student in the above mentioned institution currently pursuing a Masters degree in Public Health at Federal University of Technology, Owerri, Imo State. I am conducting a research work on a topic titled "Risk Factors of Comorbidity of Hypertension and Type 2 diabetes in diabetic patients: A case- control study". The study is meant to analyze certain factors that might lead to the development of hypertension in type 2 diabetic patient and findings from this study shall help map out strategies that will help in prevention occurrence of hypertension in type 2 diabates.

Health facilities chosen for the study are ones having diabetic and hypertensive coming for check up and whose data can be used for the study. Participation of the subject is voluntary and does not pose any risk to the patient in anyway.

This questionnaire is designed to generate information from you. I kindly request your sincere response to this information's by ticking (√) at the spaces provided for the answer(s) that most suits your opinion. All these responses would be treated with utmost degree of confidentiality.

Thank you for your anticipated cooperation.

Yours Sincerely,

Chikezie, Onyebuchi Desmond

APPENDIX B

Instructions: Please tick (√) against the option that suits your opinion where

SECTION A: DEMOGRAPHIC DATA

1 Sex: a) Male ☐ b) Female ☐

2 Age a) >19 yrs ☐ b) 20 – 29yrs ☐ c) 30 – 39yrs ☐ d) 40-49yrs ☐

e) 50- 59yrs ☐ f) 60-69yrs g) ≥70yrs ☐

3 What is your occupation?

a) Student/Unemployed ☐ b) Trading ☐ c) Farming ☐ d) Artisans ☐

e) Civil Servant ☐ f) Retiree ☐

4. What is your level of education?

a) Primary ☐ b) Secondary ☐ c) Tertiary ☐ d) No formal education ☐

5. Height ☐ b) Weigh ☐

6. Marital Status: a) Single ☐ b) Married ☐ c) Divorced ☐ d) Widowed ☐

SECTION B: MEDICAL HISTORY

7. Are you suffering from hypertension? a) Yes ☐ b) NO if yes answer ☐

the question no 7, if no go to question no 8

8. For how long have you been hypertensive?.....

9. Are you suffering diabetes? a) Yes ☐ b) No if yes answer the ☐

question no 9, if no go to question no 10

10. For how long have you been diabetic? ……

11. Are you suffering from both diabetes and hypertension? a) Yes ☐ b) No ☐

if yes answer the question no 11, if no go to question no 12

12. For how long have you been both hypertensive and diabetic? ……

13. What type of treatment do you use for your diabetes? a) Oral anti diabetic drug ☐

b) Oral anti diabetic drug and dietary control ☐ c) Insulin d) Insulin and dietary control

e) Herbal treatment f) Herbal treatment and dietary control ☐ g) Dietary control only ☐ H) No treatment used ☐

14. What type of treatment do you use for your hypertension? a) Oral anti hypertensive drug ☐

b) Oral anti hypertensive drug and dietary control ☐ c) diuretics d) diuretics and dietary control ☐

e) Herbal treatment ☐ f) Herbal treatment and dietary control ☐g) Dietary control only ☐H) No treatment used ☐

15. What is your usual fasting blood sugar value? a) Usually < 120 mg/dl ☐ b) Usually ≥ 120 mg/dl ☐

16. What is your usual blood pressure reading? ……..

SECTION C: DIET

17. Do you add additional table salt to your food? a) Yes ☐ b) No ☐

18. How often do you eat salty food such as canned food (tomatoes, sadin, corm beef, etc) sausage, sea food, etc?

a) Always ☐ b) Most times ☐ c) Sometimes ☐ d) Never ☐

19. How often do you eat from fast food restaurants?

a) Always ☐ b) Most times ☐ c) Sometimes d) Never ☐

20. What constitute your diet?

a) More of starch ☐ b) More of protein ☐ c) More of fat ☐

21. Do you add additional sugar to your food such as tea, pap, etc? a) Yes ☐ b) No ☐

22. How often do you take sugary drink?

a) Always ☐ b) Most times ☐ c) Sometimes d) Never ☐

SECTION D: LIFE STYLE

23. Do you engage in physical exercise that makes you sweat and raise your heartbeat for 30min? a) Yes ☐

b) No if yes how often? ☐ a) Every day ☐ b) Weekly ☐ c) Monthly ☐ d) Whenever I want ☐

24. How long do you spend during physical exercise? a) < 30mins ☐ b) > 30min and <90mins ☐

c) > 90mins ☐ d) Anytime ☐

25. Do you engage in a stressful work that makes you feel anxiety? a) Yes ☐ b) No ☐

If yes how often? a) Always ☐ b) Most times ☐ c) Sometimes ☐ d) Part of my job ☐

26. Do you smoke? a) Ex-smoker ☐ (if 1year ago) b) Current smoker ☐ c) Never smoker ☐

If smoker, how many stick of cigarette?

a) 1-3sticks/day ☐ b) 4-6 sticks/day ☐ c) >6sticks/day ☐ d) Occasionally ☐

27. Do you drink alcohol? a) Yes b) No If yes how many bottle of alcoholic drink?

a) 1-2 bottle/day ☐ b) >2bottle/day ☐ c) Occasionally ☐

SECTION E: FAMILY HISTORY

28. Had any person in your family suffered diabetes? a) Yes b) No

If yes who is the person?

a) Grandparents ☐ b) Parents ☐ c) Brother/Sister ☐ d) Cousin ☐

e) Nephew/nice ☐

29. Had any person in your family suffered hypertension? a) Yes ☐ b) No ☐ If yes who is the person?

a) Grandparents ☐ b) Parents ☐ c) Brother/Sister ☐ d) Cousin ☐

e) Nephew/nice ☐

30. Had any person in your family suffered from both diabetes and hypertension? a)Yes ☐

b) No If yes who is the person?

a) Grandparents ☐ b) Parents ☐ c) Brother/sister ☐

d) Cousin ☐ e) Nephew/nice ☐