PREVALENCE OF DIABETES MELLITUS AND ASSOCIATED RISK FACTORS AMONG CIVIL SERVANTS IN EKITI STATE

BY

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CERTIFICATION

This is to certify that Lawal Yusuff Ayinde carried out this project in the Department of Epidemiology and Medical Statistics, Faculty of Public Health, College of Medicine, University of Ibadan.

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DEDICATION

This work is dedicated to the over 200 Nigerian girls of Goverment Secondary School Chibok abducted by the Boko haram terrorist group on the 14th of April 2014.

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This research paper is made possible through the help and support from everyone,
Including: parents, teachers, family, friends, and in essence, all sentient beings.

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ABSTRACT

Diabetes mellitus is one of the most common chronic diseases, and continues to increase in numbers and significance, as changing lifestyles lead to reduced physical activity, and increased obesity . Many studies on diabetes and other NCD have been hospital based which is not representative of the general population due to dearth of health care provision. In the same vein the highest percentage of people with undiagnosed diabetes abound in Africa, which is estimated at 81% . These informed the decision to conduct this population-based study. This research identifies the prevalence of diabetes mellitus and associated risk factors among civil servants in Ekiti state.

Randomly selected Civil servants were studied using stratified sampling. Target sample was 300. Data were collected on sociodemographic variables, family history and lifestyles using a structured questionnaire. Measurement of anthropometric variables, blood pressure and random blood glucose was performed. Diabetes was diagnosed when the subject was a known diabetic or random blood glucose was > or = 11.1 mmol/l . Their random blood sugar was estimated using Roche Accu-chek advantage glucometer. Chi-square and binary logistic regression were used to establish the statistical association between independent and dependent variables and to test the strength of association respectively.

Out of 300 subjects seen, 28(9.4%) were previously seen to have diabetes; while 22(7.3%) subjects were diagnosed with diabetes during the study. However 36 subjects were therefore found to have diabetes giving a prevalence rate of 12.0% [95% C.I=0.08-0.16] . The prevalence of diabetes in male respondents was 11.4%[95% C.I =0.06-0.16] while that of the female respondents was 12.9 [95% C.I=0.07-0.18]%, however the difference between the males and females was not significant. The mean random blood sugar was 9.04±1.30. Body mass index (BMI) ≥ 25 kg/m2 , family history of diabetes, physical inactivity, alcohol consumption as well as older age were associated with significantly higher prevalence of type 2 diabetes.

The prevalence of type 2 diabetes in this study is fairly high. BMI, Age and physical activity were seen to greatly influence the prevalence of diabetes mellitus among the civil servants.

Key words: Diabetes mellitus, prevalence, blood sugar

CHAPTER ONE

INTRODUCTION

1.0 Background

Diabetes mellitus is a group of disorders of carbohydrate metabolism in which the action of insulin is diminished or absent through altered secretion decreased insulin activity or a combination of both factors. It is characterized by hyperglycemia. As the disease progresses tissue or vascular damage ensues leading to severe complications such as retinopathy, nephropathy, neuropathy, cardiovascular disease and foot ulceration (Martindale).

Diabetes mellitus is one of the most common chronic diseases, and continues to increase in numbers and significance, as changing lifestyles lead to reduced physical activity, and increased obesity (Shaw et al 2010). Diabetes mellitus is a disease of insidious onset and the symptoms, when they eventually appear, do not warrant immediate attention and thus remain undiagnosed at onset and even when diagnosed is often ignored by persons afflicted by it (Harris et al 1992).

It is relatively common in societies with affluent lifestyle. Increasing age, obesity, ethnicity, and family history are the four major determinants and this is responsible for the large differences in prevalence. It is considered a disease of the rich in poor countries while in rich countries, it is believed to be a disease of the poor (King et al, 1998).

The prevalence of diabetes is growing at an alarming rate globally. Obesity and sedentary lifestyles are largely attributed to this dramatic increase in prevalence. It is a deadly disease that demands long-term medical attention both to limit the development of its devastating complications and to manage them when they do occur. It is also a disproportionately expensive disease. It constitutes a significant health and socioeconomic burden for patients and the health care systems.

Though communicable diseases still make up the greatest disease burden, but by 2020 non-communicable diseases, including hypertension and diabetes, will outstrip communicable diseases as a cause of death (Murray and Lopez 1997) .

Non communicable diseases are thus becoming a subject of great concern the world over, because of its increased prevalence which is not unconnected with its distinct features such as absence of a known agent, multifactorial causation, long latent period, indefinite onset. It is also noteworthy the roles of both epidemiologic and demographic transition in the increased prevalence of NCD. Most governmental and non governmental agencies in Nigeria and sub Sahara Africa at large focus much on infectious diseases, shifting the burden on NCD. Thus there is a decrease in communicable diseases which disproportionately affect children and in turn increasing the life expectancy. The future incidence of NCD is therefore increased due to this demographic transition.

Many studies on diabetes and other NCD have been hospital based which is not representative of the general population due to dearth of health care provision. In the same vein the highest percentage of people with undiagnosed diabetes abound in Africa, which is estimated at 81% (IDF 2012). These informed the decision to conduct this study at community level.

About 366 million people are reported to have diabetes in 2011 and this is projected to rise to 552 million by year 2030. 80% of people with diabetes live in low and middle income countries and the greatest number of these people are between 40 to 59 years of age (IDF 2011).

Africa and Nigeria have sparse and inadequate information on diabetes mellitus. But based on available data, the disease is emerging as a major and most challenging health problem in this region (Mbanya et al 1996) . In Africa 81% of people with diabetes are undiagnosed, most of whom may be asymptomatic or have mild symptoms which they ignore or attribute to other myths. Due to poverty, some may not present in hospital even when symptomatic. Nigeria with a population of about 160 million people, the largest in Africa was considered to have a rare cases of diabetes in 1960s, where the prevalence rates were reported to be less than 1% (Umoh et al 2012) , but epidemiological studies carried out from 1990s provided evidence of a trend toward increased incidence and prevalence of diabetes in African populations (Sobngwi et al, 2001).The International Diabetes Federation in 2011 estimated that Nigeria has about 3.2 million people with diabetes which is the highest in Africa (Kinnear 1963) and diabetes related deaths in 2011 accounted for 63 340 people. The prevalence in Nigeria is 4.9% which has more than doubled when compared with the 2.2% prevalence reported by professor Akinkugbe-led National survey report of 1997.

The prevalence of diabetes in Ibadan, an urban centre in the same region as the study area of interest, was 1.5% according to the national survey of 1997 (Akinkugbe et al 1997), and 0.8% in another study. Jos, another urban centre had a prevalence rates of 3.1% in a 1994 study by Puepet and a second survey by 2004 recorded a prevalence of 10.3%.

In Ekiti state, South western Nigeria, just like the country as a whole there is no adequate record on the present prevalence of diabetes mellitus, even though the disease is on the rampage and has inflicted so much pains on the population and economy of the state.

1.2 Problem statement

Diabetes is one of the leading health problems in the world with serious and costly complications. Excess mortality attributable to diabetes has, in the past decade, caused more deaths than all wars combined. It is a major cause of morbidity and mortality in many developing countries, Nigeria inclusive.

It is important that people in the community are aware and informed of their diabetes status and other health related issues. So also the true state of diabetes prevalence will be of great benefit to government and other related agencies in checking the scourge of this disease.

According to IDF 2012 report, the global prevalence of diabetes is 8.3%,the number of people with diabetes is 371 million with 187 million undiagnosed cases. There were 4.8 million deaths and total healthcare expenditure on diabetes amounts to 471.6 million USD .

Despite the fact that Africa has the highest number of undiagnosed cases (81%), more than 14 million people in Africa have diabetes,4.3% of which are adults. This is estimated to increase to 28 million by 2030. Expenditure on diabetes treatment during this year amounts to 2.5 million USD .

It is thus important to know the estimate of the current and future burden of diabetes in order to allocate community health resources and to emphasize the role of lifestyle, and encourage measures to counteract trends for increasing prevalence (Shaw et al 2009).

1.3 Justification

Due to scarcity of data on diabetes mellitus and its associated risk factors in Nigeria in general and Ekiti state in particular, findings from this study will go a long way in providing a database for the disease which can ultimately enhance its control. The awareness of prevalence of diabetes in a community provides information that serves several purposes. First, prevalence data and associated variables can be used to assess the risk of developing diabetes, to explore hypotheses about causal factors, and to plan programs for control and prevention of the disease. Such data can serve as a guide in planning biomedical research and in developing programs to promote health. Second, prevalence determines the amount of clinical workload due to diabetes and can be used to estimate the magnitude of resources in hospital and outpatient facilities, nutritional- and patient-education services, and trained medical specialists required to care for diabetics. Third, prevalence data can be used to estimate the community impact of diabetes, to place this disease in its proper perspective compared with other competing priorities and to determine the appropriate allocation of resources for diabetes.

1.4 Objectives

1.4.1. Broad Objective

To estimate the prevalence of diabetes mellitus and to determine the associated risk factors of diabetes mellitus among the civil servants in Ekiti state.

1.4.2 Specific Objectives:

1. To determine the prevalence of diabetes mellitus among Ekiti state civil servants.

2. To determine the prevalence of risk factors of diabetes among Ekiti state civil servants.

3. To explore the influence of age, gender and lifestyle factors on the prevalence of diabetes.

CHAPTER TWO

LITERATURE REVIEW

2.0. Background

Diabetes mellitus is a metabolic disorder that either arrives during the early years of growth (Juvenile diabetes) or later in life or is referred to as maturity onset diabetes. It is observed as the body's inability to effectively regulate the sugar balance which leads to severe complications such as hyperglycemia, obesity, neuropathy, nephropathy, retinopathy, cardiopathy, osteoporosis and coma leading to death. Pancreatic damage resulting in the dysfunction of α and β cells causes disordered glucose homeostasis. In diabetic individuals the regulation of glucoselevels by insulin is defective, either due to defective insulin production which is referred to as Insulin Dependent Diabetes Mellitus (IDDM) or due to insulin resistance that is termed as Non-Insulin Dependent Diabetes Mellitus (NIDDM).

Another type of diabetes is called Gestational diabetes, which is first developed during pregnancy.

Approximately 3% to 5% of all pregnancies are complicated by diabetes mellitus. Most of these cases are attributed to gestational diabetes, while a half percent are secondary to previously diagnosed type 1 and type 2 diabetes mellitus (Lorenz RP, 1998). Their disease process may involve peripheral resistance to insulin, increased hepatic production of glucose, and lack of insulin production from the pancreas (DeFronzo R, 1987). There are also other causes of diabetic disease such as genetic abnormalities, surgery, drug usage, and infectious diseases.

The global burden of disease study of the World Health Organization (WHO) estimated that about 177 million people in the world had diabetes in the year 2000 (WHO 2003). In the second edition of the International Diabetes Federation's *Diabetes Atlas* it is estimated that 194 million people had diabetes in the year 2003, and about two-thirds of these people lived in developing countries (IDF 2003). In 1901 Albert Cook, a medical missionary in Uganda, reported that "diabetes is rather uncommon and very fatal"(Cook 1901). Over the next 50 to 60 years diabetes continued to be regarded as rare in Sub-Saharan Africa. Communicable diseases still make up the greatest disease burden, but by 2020, non communicable diseases, including hypertension

and diabetes, will outstrip communicable diseases as a cause of death(Murray and Lopez 1997). Even allowing for the uncertainties of predicting future disease patterns posed by the unfolding of the human immunodeficiency virus (HIV) epidemic in Sub-Saharan Africa, it is clear that the relative importance of non communicable diseases will increase (Panz and Joffe 1999) This situation is a result of demographic change (populations with older age structures), increasing urbanization (WHO 1998) and associated changes in risk-factor levels, such as tobacco smoking, obesity, and physical inactivity (Hunter et al. 2000; Kaufman et al. 1999; Pavan et al. 1997). Countries of Sub-Saharan Africa are in various stages of the epidemiological transition with a multiple burden of diseases.

The available evidence suggests that non communicable diseases currently contribute substantially to the burden of mortality and morbidity in adults. Age-specific levels of diabetes and hypertension in many urban areas of Sub-Saharan Africa are as high as, or higher than, those in most Western European countries (Aspray et al. 2000; Edwards et al. 2000; Mollentze et al. 1995). In a demographic surveillance system in Tanzania they account for between one in six and one in three adult deaths (Kitange et al. 1996; Setel et al. 2000; Walker et al. 2000), with age-specific death rates from non-specific, non communicable diseases being as high or higher than in developed countries (Unwin et al 1999)

Diabetes mellitus is a major global health problem that affects more than 185 million people around the world (Amos *et al.*, 1997; Zimmet, 1999; Zimmet *et al.*, 2001). This disease is an increasingly prevalent metabolic disorder in humans and is characterized by hyperglycemia (Kumar & Clarke, 2002; Dunne *et al.*, 2004). The number of diabetic patients is expected to reach 300 million by the year 2025. The projected increase in the number of diabetic patients will strain the capabilities of healthcare providers the world over (Adeghate *et al.*, 2006).

It has been reported that epidemic of Non Communicable Diseases (NCDs), which includes cardiovascular disease, cancer and metabolic disease such as obesity and diabetes in sub-Saharan Africa (SSA) is increasing (Ezzati et al, 2005; Mensah GA, 2008; Parkin DA et al, 2008; Conor MD et al, 2007), this is unconnected to the epidemiological transition from predominantly infectious to NCDs which is currently underway in many low and medium income countries as it

is in SSA. Yet, there are few community-based studies that examine the NCD prevalence, incidence and risk factors.(Dalal et al 2011). Thus there should be a regular national survey of NCDs and each countries should ensure that at least 10% of its yearly budget is earmarked for health and social development (Oputa and Chinenye, 2012).

The worldwide prevalence of DM has risen dramatically over the past two decades. Likewise, prevalence rates of IFG are also increasing. Although the prevalence of both type 1 and type 2 DM is increasing worldwide, the prevalence of type 2 DM is expected to rise more rapidly in the future because of increasing obesity and reduced activity levels. DM increases with aging. In 2000, the prevalence of DM was estimated to be 0.19% in people less than 20 years old and 8.6% in people greater than 20 years old. In individuals greater than 65 years the prevalence of DM was 20.1%. The prevalence is similar in men and women throughout most age ranges but is slightly greater in men greater than 60 years (Harrison's principles of internal medicine, 16th edition, page 2152)

The impact is worse in those countries that are socially and economically disadvantaged. Diabetes threatens the achievement of the MDGs, increases the risk of developing tuberculosis, and is closely linked with other infections (IDF diabetes atlas, 5th edition, 2011)

In the 1960s, diabetes was considered to be rare among Nigerians; reported prevalence rates were less than 1%(Kinnear TWG,1963; Akinkugbe OO,Ojo OA, 1969; Johnson TO, 1969) . Since that time, surveys have shown a steady increase in DM over the years from between 1-2% in the 1980's. 2.8% in the 1990's and 7% to 10% in the early 21 century (Umoh et al, 2012). More recently, Dahiru et al in a study of the prevalence of diabetes among semi-urban dwellers in Northern Nigeria obtained a prevalence of 2% while Nwafor et al obtained prevalence as high as 23% among upper class urban dwellers in Port Harcourt in Southern Nigeria. This represents geographical variations within Nigeria. A prevalence of 1.43% was recorded for Ilorin, a city in the North central part of Nigeria (Erasmus et al).

Previous documentations have shown that the prevalence of the disease is on a steady increase over years. In 1971, a survey in Ibadan puts the prevalence at 0.4%, in 1989 a similar survey in Lagos metropolis puts the prevalence at 1.6%, in 1992 another group of researchers recorded the prevalence of 2.2% and in Lagos Island, the prevalence recorded was very high, about 7% (Ekpenyong et al, 2012). In Port Harcourt, Rivers State, according to a survey in adult population, the prevalence was 6.8%,with the male-female ratio of 1.4:1 . Among adults in Jos Metropolis

Plateau State, the prevalence of undiscovered diabetes was found to be 3.1% in 1994 in a survey by Puepet. By 2004, a second survey in Jos put the prevalence at 10.3% (Ebenezer AN et al 2003).

2.1. Epidemiology of Diabetes

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Uncontrolled chronic hyperglycemia results in long-term damage, particular dysfunction, and failure of the eyes, heart, blood vessels, nerves, and kidneys.

Type 1 diabetes results from autoimmune destruction of the pancreatic beta cells, causing the loss of insulin production. Children are usually affected by this type of diabetes, although it occurs at all ages and the clinical presentation can vary with age. Patients with this type of diabetes require insulin for survival.

Type 2 diabetes is characterized by insulin resistance and abnormal insulin secretion, either of which may predominate but both of which are usually present. The specific reasons for the development of these abnormalities are largely unknown. Type 2 is the most common type of diabetes. Type 2 diabetes can remain asymptomatic for many years, and the diagnosis is often made from associated complications or incidentally through an abnormal blood or urine glucose test.

Other specific types of diabetes include those due to genetic disorders, infections, diseases of the exocrine pancreas, endocrinopathies, and drugs. This last type of diabetes is relatively uncommon.

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. The definition applies whether insulin or only diet modification is used for treatment and whether the condition persists after pregnancy. It does not exclude the possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy. Approximately 7 percent of all pregnancies are complicated

by GDM. The prevalence may range from 1 to 14 percent of all pregnancies, depending on the population studied and the diagnostic tests employed.

Impaired glucose tolerance (IGT) is asymptomatic, and its diagnosis is confirmed by an elevated non diabetic level of blood glucose two hours after a 75 gram oral glucose tolerance test. Impaired fasting glycemia (IFG) is an elevated non diabetic fasting blood glucose level. Both IGT and IFG are transitional stages in the development of type 2 diabetes.

2.2. Prevalence and Incidence of Type 1 Diabetes

There is a dearth of published studies describing the incidence and prevalence of type 1 diabetes in Sub-Saharan Africa. Type 1 diabetes is considerably rarer than type 2 disease, and large populations need to be surveyed. Also, to assess incidence, the population surveyed should be accurately known, and this is in itself difficult, as complete censuses in Africa are rare and migration in and out of study areas common. Elamin and colleagues in the Sudan in 1992 reported a survey of nearly 43,000 school children (age 7 to 11 years) and found a prevalence rate of 0.95 per 1,000(Elamin et al. 1992). This rate is comparable to a reported prevalence rate of 0.3 per 1,000 in Nigeria(Afoke et al. 1992). The reported incidence is 10.1 per 100,000 children per year in Sudan and 1.5 per 100,000 (Elamin et al. 1992) per year in Tanzania (Swai, Lutale, and McLarty 1993). The discrepancy between the Sudanese and Tanzanian studies may be explained by ethnic differences, and perhaps problems related to the design of the studies.

The question of whether type 1 diabetes is truly rarer in Africa than elsewhere remains unsettled, and more detailed surveys are needed. Nonetheless, it emerges from careful clinic studies that the behavior of type 1 diabetes is different in Sub-Saharan Africa from that in the rest of the world. Studies indicate that the age of onset in South Africa and Ethiopia is later than elsewhere, (Kalk, Huddle and Raal 1993, Lester 1984) and the peak age of onset of type 1 diabetes in Sub-Saharan Africa is a decade later than in the West (Afoke et al. 1992; Kalk, Huddle, and Raal 1993). In addition it afflicts more females than males. In South Africa it has been reported that the peak age of onset was about 13 years in the white South Africans (similar to Europeans) but about 23 years in the black South Africans (Kalk, Huddle and Raal 1993). The reasons for this difference are obscure, although it has been suggested that prolonged breastfeeding, which is common in

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Africa, may be reducing the incidence and delaying the onset of type 1 diabetes. Early introduction of cow's milk protein does seem to be a risk factor for the later development of type 1 diabetes, possibly because, in neonates, bovine albumin can raise antibodies that mimic islet cell antibodies and attack pancreatic beta cells. This is, of course, speculative, and much still remains unknown about the pathogenesis and epidemiology of type 1 diabetes in Africa.

2.2.1. Genetic Factors

More than 90 percent of type 1 diabetes subjects in Sub-Saharan Africa, as in the rest of the world, have one or both human leukocyte antigens (HLA) DR3 and DR4. However, there appear to be specificities in the HLA susceptibility found in certain African populations. Recent studies using allele-specific (oligonucleotide) probes from Zimbabwe, Senegal, and Cameroon show positive and negative associations with some alleles (Garcia-Pacheco et al. 1992; Chauffert et al. 1995).

2.2.2. Immunological Factors

The main markers of immune islet cell attack are islet cell antibodies (ICA) and glutamic acid decarboxylase antibodies (anti-GAD). These substances are found in most Caucasian type 1 diabetic patients at diagnosis, but levels gradually decline with time. Interpretation of ICA and anti-GAD levels in type 1 diabetes is dependent on duration of disease, and this may explain the variable results found in the limited African studies so far carried out. McLarty, Kinabo, and Swai (1990) found that the prevalence of ICA antibodies was only 8 to 11 percent in newly diagnosed Tanzanian patients. In South Africa, Motala, Omar, and Pirie (2000) found that 44 percent of blacks with newly diagnosed type 1 diabetes were positive for GAD antibody. It appears from these preliminary results that the genetic susceptibility and risk factors for type 1 diabetes in Sub-Saharan Africa may be different from those in the Western world. It can be speculated that non-autoimmune factors are the major determinants of type 1 diabetes in sub-Saharan Africa.

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2.2.3. Environmental Factors

An environmental "trigger" factor for the onset of type 1 diabetes has long been sought. Its existence is supported by the well-known seasonality of presentation in Europe, and viral infection (perhaps of the coxsackievirus group) is considered a likely candidate. A seasonality of type 1 diabetes has been reported in Tanzania (with most cases presenting between August and November) (McLarty, Yusafai, and Swai 1989). It would therefore seem likely that potential viral triggers operate also in the rest of Africa.

2.3. Prevalence of Type 2 Diabetes

Before the 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 et al, 2001). Indeed, Africa is experiencing the most rapid demographic and epidemiological transition in world history (Mosley, Bobadilla, and Jamison 1993). It is characterized by a tremendous rise in the burden of non communicable diseases (NCDs), underlined by the increasing life expectancy and lifestyle changes resulting from the reduction in infectious diseases and increased fertility, as well as Westernization.

Almost all the reports published between 1959 and 1985 showed a prevalence of diabetes below 1.4 percent, except those from South Africa, where higher prevalence was reported. Differences in diagnostic methods and criteria, however, made comparison between countries difficult. Since then, uniform diagnostic criteria has become more available, allowing comparison across countries.

The prevalence of diabetes in Africa was approximately 3 million in 1994; but the region is due to experience a two-to threefold increase by the year 2010 (Amos, McCarty, and Zimmet 1997). The highest prevalence is found in populations of Indian origin, followed by black populations and Caucasians. Among the population of Indian origin in South Africa and Tanzania, the prevalence is between 12 and 13 percent (Ramaiya, Swai, McLarty, and Alberti 1991). The prevalence in blacks follows a Westernization gradient, with that of rural Africa generally below 1 percent but that of urban Africa between 1 and 6 percent. In general the prevalence of type 2

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Almost all the reports published between 1959 and 1985 showed a prevalence of diabetes below 1.4 percent, except those from South Africa, where higher prevalence was reported. Differences in diagnostic methods and criteria, however, made comparison between countries difficult. Since then, uniform diagnostic criteria has become more available, allowing comparison across countries.

The prevalence of diabetes in Africa was approximately 3 million in 1994; but the region is due to experience a two-to threefold increase by the year 2010 (Amos, McCarty, and Zimmet 1997). The highest prevalence is found in populations of Indian origin, followed by black populations and Caucasians. Among the population of Indian origin in South Africa and Tanzania, the prevalence is between 12 and 13 percent (Ramaiya, Swai, McLarty, and Alberti 1991). The prevalence in blacks follows a Westernization gradient, with that of rural Africa generally below 1 percent but that of urban Africa between 1 and 6 percent. In general the prevalence of type 2

diabetes is low in both rural and urban communities of West Africa except in urban Ghana, where a high rate of 6.3 percent was recently reported (Amoah, Owusu and Adjei 2002). Moderate rates have been reported from South Africa: 4.8 percent in a semi-urban community in the Orange Free State, 6.0 percent in an urban community of the Orange Free State, 5.5 percent in Durban (mostly occupied by the Zulu tribe), and 8 percent in Cape Town (mostly occupied by the Xhosa tribe).

2.4. Risk Factors for Type 2 Diabetes

There are marked differences between diabetic and non diabetic individuals in the prevalence of some risk factors for diabetes and its complications, notably anthropometric variables, such as obesity. Although it is true that these data are from cross-sectional studies that have limitations in establishing causality, they at least support the hypothesis that increasing prevalence of diabetes can be attributed largely to changes in lifestyle resulting in reduced physical activity and increased calorie intake and subsequent weight gain. Such changes have important implications for the provision of health care and for health education to promote behavioral change in order to control the emergence of diabetes in Sub-Saharan Africa.

2.4.1 Age and Ethnicity

Age and ethnicity are the two main non modifiable risk factors of diabetes in Africa. However, published studies lack uniformity on the age range in which the prevalence of diabetes is observed. According to King, Aubert and Herman (1998), in most developed communities the peak of occurrence falls in the age group of 65 years or older, whereas in developing countries it is in the age group 45 to 64, and in Sub-Saharan Africa it is in the age groups 20 to 44 and 45 to 64 years.

The prevalence of diabetes appears to be substantially higher in African-origin populations living abroad than in indigenous Africans. West Africans from Nigeria (Cooper et al. 1997) and central Africans from Cameroon (Mbanya et al. 1997) were compared with populations of West African origin in the Caribbean (Cooper et al. 1997; Mbanya et al. 1997), United Kingdom (Cooper et al. 1997; Mbanya et al. 1997), and the United States (Cooper et al. 1997). These studies suggest that environment determines diabetes prevalence in these populations of similar genetic origin.

2.4.2. Urban-Rural Differences

Residence seems to be a major determinant of diabetes in Sub-Saharan Africa, since urban residents have 1.5- to 4.0 times higher prevalence of diabetes than their rural counterparts. This is attributable to lifestyle changes associated with urbanization and Westernization. Urban lifestyle in Africa is characterized by changes in dietary habits involving an increase in the consumption of refined sugars and saturated fat and a reduction in fiber intake (Mennen et al. 2000). Sobngwi and colleaugues (2002) have recently reported an increase in fasting plasma glucose in those whose lives have been spent in an urban environment, suggesting that both lifetime exposure to and recent migration to or current residence in an urban environment are potential risk factors for obesity and diabetes mellitus. The disease might represent the cumulative effects over years of dietary changes, decrease in physical activity, and psychological stress.

The population of Africa is predominantly rural, but the 1995–2000 urban growth rate was estimated at 4.3 percent (compared with 0.5 percent in Europe). Thus, more than 70 percent of the population of Africa will be urban residents by 2025(UNFPA 2000). There will therefore be a tremendous increase in the prevalence of diabetes attributable to rapid urbanization. In addition, life expectancy at birth is rapidly increasing. For example, in Cameroon in 1960 it was about 35 years but in 1990 was raised to approximately 55 years. An increase in diabetes prevalence simply because of the change in the age structure of the population is therefore expected. However, the HIV pandemic may change these estimates and projections.

2.4.3. Family History of Diabetes

A significant proportion of the offspring of Cameroonians with type 2 diabetes have either type 2 diabetes (4 percent) or IGT (8 percent) (Mbanya et al. 2000). A positive family history seems to be an independent risk factor for diabetes, but this was not the case in the Cape Town study (Levitt et al. 1993), in which family history was not an independent risk factor.

2.4.4 Measure of Adiposity

Several studies from Sub-Saharan Africa have confirmed the association between the prevalence of diabetes and a surrogate of obesity, body mass index (BMI). Reports from Mali (Fisch et al. 1987), Nigeria (Cooper et al. 1997) and Tanzania (McLarty et al. 1989) have shown that the prevalence of diabetes increases with increasing BMI. BMI and obesity seem to be independent risk factors for diabetes (Levitt et al. 1993).

2.4.5. Physical Activity

There seems to be a significant relationship between physical inactivity and diabetes and obesity (Sobngwi et al. 2002). Physical activity is more common in rural than urban regions of Africa because rural populations rely on walking for transport and often have intense agricultural activities as their main occupation. In Sub-Saharan Africa, walking time and pace is drastically reduced (by factors of 2 to 4 for walking at a slow pace and 6 to more than 10 for walking at a brisk pace) in an urban community as compared with a rural community. The main difference in physical activity between the two types of community, however, is the use of walking in rural areas as a means of transportation.

The reduction in physical activity associated with life in a city partly explains the excess prevalence of obesity in urban areas. In a South African study, the prevalence of a sedentary lifestyle in Cape Town in subjects age 30 years and over was 39 percent for men and 44 percent for women (Omar et al. 1993). Low physical activity was normal for 22 percent of men and 52 percent of women in urban Tanzania, whereas it was usual for only 10 percent of men and 15 percent of women living in rural areas (Edwards et al. 2000). Rural dwellers' higher level of physical activity and related energy expenditure compared with urban subjects goes far to explain why obesity was found to be at least four times higher in urban areas than rural (Aspray et al. 2000). Thus, lack of physical activity appears to be a significant risk factor for diabetes in Sub-Saharan Africa.

2.5. Complications of Diabetes

The escalating prevalence of type 1 and type 2 diabetes and their complications in Sub-Saharan Africa are a major drain on health resources in financially difficult circumstances, in addition to having a considerable physical and social impact on the individual and community.

2.5.1. Acute Complications of Diabetes

The three main metabolic complications of diabetes in Sub-Saharan Africa are diabetic ketoacidosis, hyperosmolar nonketotic coma, and hypoglycemia. Diabetic ketoacidosis is a common diabetic emergency in developing countries and carries with it relatively high mortality, ranging from 25 percent in Tanzania to 33 percent in Kenya. The major contributing factors to such high mortality are the chronic lack of availability of insulin, delays in seeking medical assistance by newly diagnosed type 1 patients presenting in ketoacidosis, misdiagnosis of diabetes, and poor health care in general and diabetic care in particular (Rwiza, Swai, and McLarty 1986).

Hyperosmolar nonketotic coma is usually a complication of type 2 diabetes and is less common and accounts for about 10 percent of all hyperglycemic emergencies in developing countries (Zouvanis et al. 1997). Infection is the leading precipitating factor for both diabetic ketoacidosis and hyperosmolar nonketotic coma, followed by first presentation of diabetes at a health institution and noncompliance with a medical regimen (Zouvanis et al. 1997). It carries a high mortality of up to 44 percent according to studies from South Africa, which may be because the patients are usually elderly and have other major illnesses (Rolfe et al. 1995).

Hypoglycemia is also a serious complication of treatment in patients with diabetes. Of a total of 51 episodes in 43 patients admitted at the Baragwanath Hospital, Johannesburg, South Africa, 14 cases (33 percent) were associated with sulfonylurea treatment. The major cause precipitating the event was a missed meal (36 percent), although alcohol (22 percent), gastrointestinal upset (20 percent), and inappropriate treatment (18 percent) were also important contributory factors (Gill and Huddle 1993). No mortality was associated with hypoglycemia in this study.

2.5.2 Chronic Complications of Diabetes

The seriousness of diabetes is largely a result of its associated complications, which can be serious, disabling, and even fatal. Prevalence studies on complications reported up to the early 1990s gave widely variable figures. These have been reviewed in two studies and include figures ranging from 9 to 16 percent for cataract, 7 to 52 percent for retinopathy, 6 to 47 percent for neuropathy, 6 to 30 percent for nephropathy, and 1 to 5 percent for macroangiopathy (Mbanya and Sobngwi 2003; Rolfe 1997). The variations are due to diagnostic criteria problems, local and geographical factors, type of diabetes, and variation in duration of diabetes. Since 1995, however, many more vigorous and well-conducted studies have taken place, giving a much clearer picture of complication prevalence.

Ethnic differences in the prevalence of retinopathy have been observed in multiethnic communities. In South Africa, the highest prevalence of retinopathy is observed in Africans, rather than Indians or Caucasians (whites), at diagnosis and after a similar duration of follow-up (Kalk et al. 1997). Although genetic predisposition may not be ruled out, lack of blood glucose and blood pressure control because of difficult access to health care might account for most of these differences.

Diabetic nephropathy also occurs early in the course of diabetes, because between 32 and 57 percent of diabetic patients with a mean duration of diabetes between 5 and 10 years have microalbuminuria (Kalk et al. 1997; Rahlenbeck and Gebre-Yohannes 1997; Sobngwi et al. 1999). The diagnosis of nephropathy may, however, be faulty because of the presence of proteinuria due to renal infections and sickle-cell anemia. In Africa, diabetes mellitus accounts for a third of all patients who are admitted to dialysis units (Diallo et al. 1997), and renal replacement is both expensive and not widely available. It appears, therefore, that diabetic end-stage renal failure is the first cause of hospital mortality in diabetic patients in Africa. In South Africa, for example, 50 percent of all causes of mortality in type 1 diabetic patients may be due to renal failure (Gill, Huddle, and Rolfe 1995).

The estimates of the prevalence of neuropathy vary widely, depending on the methodology used to assess them. Macrovascular complications of diabetes are considered rare in Africa despite a

high prevalence of hypertension. Lower-extremity amputation varies from 1.5 to 7 percent, and about 12 percent of all hospitalized diabetic patients have foot ulceration. A high proportion of patients have lower-limb arterial disease that contributes to the development of diabetic foot lesions. It is common to see patients with diabetic foot ulcers as the presenting complaint of diabetes. Data from Tanzania have shown that the vast majority (over 80 percent) of ulcers are neuropathic in origin and not associated with peripheral vascular disease (Abbas, Lutale, and Morback 2000). Audits of diabetes care carried out in Cape Town, South Africa; Dar es Salaam, Tanzania; and Yaoundé, Cameroon, have demonstrated poor glycemic control and inadequate foot care as risk factors for diabetic foot. Fewer than 22 percent of patients had their feet examined during a year of attendance at primary health care clinics in these three cities, even though in Cape Town, 37 percent demonstrated either peripheral neuropathy or peripheral vascular disease (Abbas, Lutale, and Morback 2000; Boulton 1990). Limited patient knowledge of proper foot care. practices relating to foot care, and cultural beliefs, including the association of diabetes, leg ulcers, and lower extremity amputation with bewitchment, are also common problems encountered in Sub-Saharan Africa countries (Abbas, Lutale, and Morback 2000; Boulton 1990).

Data on cerebrovascular disease are scarce because of the mortality associated with this complication, the low proportion of patients seen in hospitals, and the lack of death certificates or proper records of the cause of death. Recent results from the general population of Tanzania, where a morbidity and mortality surveillance system has been set up, show that stroke mortality was three to six times that of England and Wales and that 4,4 percent of type 2 diabetic patients presented with stroke at the diagnosis of diabetes (Walker et al. 2000). Coronary heart disease may affect 5 to 8 percent of type 2 diabetic patients and cardiomyopathy up to 50 percent of all patients. Whereas microvascular complications of diabetes are highly preventable and occur early during the course of the disease, macrovascular disease is rare. Late diagnosis of diabetes, poor metabolic control, and non standardized diagnostic procedures rather than genetic predisposition may account for this difference with other populations around the world.

2.6. Mortality Associated with Diabetes

There have been relatively few structured mortality studies from Africa, making quantification of outcome difficult. However, a major study from Zimbabwe in 1980 (Castle and Wicks 1980) recorded follow-up of 107 newly diagnosed diabetic patients (both type 1 and type 2). In-patient mortality was 8 percent, and the survivors had a mortality rate of 41 percent within six years of follow-up. Most deaths were due to infection, hyperglycemic emergencies (ketoacidosis and nonketotic coma), or hypoglycemia. Particular risk factors for an adverse outcome were male gender, alcohol abuse, and insulin treatment.

Another outcome study was reported from Tanzania in 1990. A cohort of 1,250 newly diagnosed patients was followed from 1981 to 1987, and actuarial five-year survival rates were calculated (McLarty, Kinabo, and Swai 1990; Swai, Lutale, and McLarty 1990). Eighty-two percent of those not on insulin survived five years, but only 60 percent of the group on insulin treatment survived that long. Once again, the causes of death were predominantly metabolic and infective. The authors concluded that in Africa "diabetes was a serious disease with a poor prognosis." One reviewer also observed that the Tanzanian study indicated that five years from diagnosis, 40 percent of those on insulin would die, whereas in Europe 40 percent of similar patients would survive more than 40 years (Deckert, Poulsen, and Larsen 1978; Gill 1997).

There is some evidence, however, that at least in some parts of Africa the prognosis of diabetes is improving. Figures reported from Ethiopia (Lester 1991,1996), for example, are considerably better than the Zimbabwean (1980) and Tanzanian (1990) data. Interestingly, although metabolic emergencies were still the major cause of death, the mortality from renal failure was substantial, presumably from diabetic nephropathy and large vessel disease. A cohort of type 1 diabetic patients who were followed in Soweto, South Africa, has also shown relatively prolonged survival (Gill, Huddle, and Rolfe 1995). At follow-up after 10 years, with a mean diabetes duration of 14 years, only 16 percent had died. This figure was still in excess of Western rates, although almost all these deaths were due to nephropathy, a complication mostly untreatable in Africa even now.

Obviously, many factors affect mortality patterns among diabetic patients in different parts of Africa. These include provision of medical care and supply of insulin and other treatment modalities, as well as a variety of social, cultural, and ethnic factors. As seen earlier, the gradual lengthening of the duration of diabetes in itself contributes to changing patterns of mortality, to which diabetic nephropathy and macroangiopathy are rapidly playing a larger part in many areas. Large vessel disease is likely to accelerate in prevalence also because of Western influences, such as smoking, obesity, reduced exercise, and high-fat diets.

2.7. Cost of Diabetes

Studies on the economics of diabetes care in Sub-Saharan Africa are limited. A Medline search of such studies over the past 20 years yielded only the Tanzanian study (Chale et al. 1992). In Tanzania about US$4 million would have been required to take care of all patients with diabetes in 1989/90, which translates to US$138 per patient per year. This sum is equivalent to 8.1 percent of the total budgeted health expenditure for that financial year and well above the allocated per capita health expenditure in Tanzania of US$2 for the year 1989/90 (Chale et al. 1992). In Cameroon the average direct medical cost of treating a patient with diabetes in 2001 was US$489, of which 56 percent was spent on hospital admissions, 33.5 percent on antidiabetic drugs, 5.5 percent on laboratory tests, and 4.5 percent on consultation fees. The direct medical costs for treating all diabetic patients in Cameroon represented about 3.5 percent of the national budget for the year 2001/2002 (Nkegoum 2002). Estimates of diabetes care management in Malawi, based on international prices for essential drugs and Malawi hospital cost data, suggest that a type 1 diabetic patient spends about US$100 per year for the purchase of insulin, and a type 2 patient spends US$25 annually on oral hypoglycemic agents (Vaughan, Gilson and Mills 1989).

The average age at onset of diabetes in Tanzania was 44 years and the average age at death was 46 years; population life expectancy was 53 years. The calculated number of healthy life days (HLDs) lost because of diabetes was 4,100 days per patient, of which 69 percent was because of premature mortality. This calculation was based on an average case-fatality rate after five years

of 29 percent and a severe chronic disablement rate of 14 percent. The estimated HLDs lost per capita because of diabetes were 820 person-days per 1,000 people per year (Chale et al 1992). In Ghana the average age at onset of diabetes was 40 years, with 50 percent case fatality after 15 years and an average age at death of 55 years, with 30 percent disablement before death. The total days lost were calculated as 217 per 1,000 people per year, of which 52 percent were due to premature death (Vaughan, Gilson and Mills 1989).

2.8. Diabetes Health Care

More than 50 years ago people with diabetes were mostly treated in hospitals by specialists. With limited resources and shrinking health budgets, together with a sharp rise in the prevalence of type 2 diabetes, specialist care in a hospital is not possible for everyone. An increasing number of primary and community health care professionals are responsible for managing people with diabetes. The ongoing health sector reforms in most of the countries of Sub-Saharan Africa have promoted more responsive and appropriate planning through decentralized and demand-driven health care, in which district managers decide how to divide their budgets between prevention and control of different health problems (WHO 2000).

In order to plan for proper delivery of diabetes health care, Sub-Saharan Africa countries need epidemiological and health services information. There is also a need to know the estimates of the prevalence of diabetes, its risk factors, and its complications. Finally, adequate knowledge of the overall burden of diabetes in high-risk populations and countries is a prerequisite for effective diabetes health care delivery (King et al, 1998).

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2.9. Prevention

Sufficient evidence exists from countries outside Africa that weight loss, diet, and exercise can prevent or delay diabetes in people with IGT (Pan et al. 1997; Tuomilehto et al. 2001; Vijan et al. 1997) and that physical activity may exert an independent effect on the prevention and control of diabetes .(Wojtaszewski et al. 2000)

The strategies for primary prevention, mostly involving support for behavior change through different forms of focused education and mass-media campaigns, are highly cost-effective (Swai et al, 1990). Prevention strategies in Sub-Saharan Africa have their own limitations. Lack of awareness by the population of and facilities for detection and monitoring contributes to the high prevalence of diabetic complications, and poorly skilled or inadequate health care staff, delay in seeking medical attention, and lack of access to affordable drugs contribute to the high rate of diabetes-related mortality. Unless these factors are taken into account when planning effective preventive strategies, the objectives will not be attainable.

The United Kingdom Prospective Diabetes Study (UKPDS 1998a) and the Diabetes Control and Complication Trial (DCCT 1993) have shown that intensive control of glucose results in a 25 to 70 percent reduction in the number and severity of microvascular complications in people with diabetes. The UKPDS also demonstrated a 12 percent reduction in mortality related to type 2 diabetes. In the UKPDS, control of high blood pressure reduced the risk of microvascular complications by 37 percent and death from type 2 diabetes–related disease by 32 percent (UKPDS 1998b), better reductions than those from tight blood glucose control (UKPDS 1998a), although the combination of blood pressure and blood glucose control was the most effective.

Health beliefs are still deeply enshrined in the healing cultures of people in Sub-Saharan Africa, thereby predisposing most patients to alternate between modern and traditional clinics. There are places in Sub-Saharan Africa where chlorpropamide and tolbutamides are still drugs of choice (and the only ones available) together with alpha methyldopa (for blood pressure control) in people affected with diabetes. The newer classes of drugs—sulfonylurea group, glinides—are unaffordable for the majority of the population.

One of the major challenges facing insulin-treated patients in Sub-Saharan Africa is the lack of a constant supply of insulin at affordable cost (Yudkin 2000). The supply of insulin in Sub-Saharan Africa is erratic, even at large hospitals, and the prospects for people with type 1 diabetes are poor (Amoah et al. 1998; Dagogo-Jack 1995). The exact burden of poor insulin access in developing countries is still unknown, because no good scientific study has been carried out in these countries. However, 16 percent of the world's population in developed countries with about 35 percent of all diabetic patients use over 40 percent of the world's total insulin each year (Jervell 1996; King 1998). Moreover, a small percentage of type 2 diabetes patients in developing countries require insulin when they become severely wasted and hyperglycemic. Therefore, insulin is underutilized in Sub-Saharan Africa. In the second edition of *Diabetes Atlas*, the IDF's Task Force on Insulin Survey reports that no country in Africa had 100 percent accessibility to insulin. In fact two countries in Africa had the lowest accessibility in the world: the Democratic Republic of Congo, where people with type 1 diabetes had access to insulin for less than 25 percent of the time, and Zambia, where those with type 2 diabetes had access to insulin only 26 to 49 percent of the time. The high cost of insulin appears to be the most important cause of lack of access to insulin in people with type 1 diabetes in most countries of Africa (IDF 2003). There is therefore an urgent need for the initiation of international programs to alleviate the plight of insulin-treated patients in Africa. These programs may include (a) a selection of type of drug through the essential drug list; (b) improving affordability of the price charged by applying such measures as national price information, patent status, availability of generics, equity pricing schemes, review of general taxes and margins, and as a last resort, parallel import and compulsive licensing; and (c) sustainable financing of medical supplies through general tax levies, insurance schemes, copayment or full payment by the patient, loans, and donations (IDF 1998). One of the solutions to the problem being discussed is donation of insulin combined with a mechanism to support logistics, education, and monitoring. The limiting factor with this scheme is long-term sustainability.

Very few countries in Sub-Saharan Africa can afford to screen and treat the complications of diabetes (nephropathy, retinopathy, neuropathy, peripheral vascular disease) (Dagogo Jack 1995). ACE inhibitors are a cost-effective way to reduce mortality and end-stage renal failure in people with type 1 diabetes (and type 2 diabetes) with microalbuminuria, but they are of limited

use because most people cannot afford them (Hendry et al. 1997; Tooke, Thomas, and Viberti 2000). The potential for intervention and prevention of diabetic foot lesions is very high as a cost-effective strategy.

CHAPTER THREE

METHODOLOGY

3.1. Study Area

This study was carried out in Ekiti state government secretariat, Located in Ado-Ekiti, the state capital. Ekiti state, created on October 1st 1996, is situated entirely within the tropics and has a population of 2,384212 according to 2006 population census. It is predominantly a homogenous society and carefully populated by Yoruba speaking people of the South West zone of Nigeria.

The state civil service comprises of sixty one (61) ministries departments and agencies (MDA's), with a population of 9021 (Ekiti state civil service commission). Twenty four (24) of these are present in the state secretariat out of which twelve (12) are core ministries, some of which include : Justice, Health, Agric and rural development, Integration, Education, Youth and Sport, Finance, Women affairs, Information, Education, Housing and physical planning, and Trade, Investments and Innovations.

3.2. Study Design

A cross-sectional population-based study

3.3. Study Population

The Study population include randomly selected civil servants age 18 to 64 years, willing to participate and comply with the instructions of the study as well as given an informed consent. Pregnant women were excluded due to the transient nature of gestational diabetes.

3.4. Sample Size Determination

The required sample size was estimated using statistical formula for estimating minimum sample size in descriptive studies [n= $\frac{Z^2pq}{d^2}$] and findings from a previous study where a prevalence of 23% was recorded among the high socio-economic group (Nwafor, A ; Owhoji, A 2001) . The minimum sample size would be inflated by 10% to take care of non-response, incomplete responses, and refusals.

n= estimated sample size

z= 1.96 (Standard normal deviate at 95% confidence level);

p= Proportion of subjects with diabetes mellitus= 0.23

q= 1-p, expected proportion of subjects without diabetes= 0.77

d= degree of accuracy/allowable error =5%= 0.05

n= $\frac{(1.96) \times (1.96) \times (0.23) \times (0.77)}{(0.05) \times (0.05)}$

= **272.13 ~ 272**

Adjusted number of sample size (n) = $\frac{n}{1-0.1}$ = $\frac{272}{0.9}$

= 300

Therefore the minimum sample size for this study is 300.

3.5. Sampling Technique

Stratified random sampling method was used, in which the sample size was sub-divided in proportion to the population size in each stratum. Each of the participating ministries forms the stratum.

The secretariat is made up of twelve (12) ministries, thus making a total of twelve (12) strata. Six (6) out of the twelve (12) strata were selected using simple random sampling. Samples were then selected from each stratum proportionately. The selected strata were ministries of Integration (5), Justice (21), Land (36), Health (57), Finance (58), and Agric (123).

3.6. Data Collection Method

Data was collected by the use of a set of comprehensive and structured questionnaire, which comprises of socio-demographic data, anthropometric (height, weight, body mass index), blood sugar (random blood glucose) and blood pressure measures. These procedures (anthropometric, blood glucose and blood pressure measures) were conducted with the assistance of a doctor, a nurse and a laboratory scientist. The questionnaire sought information on the possible risk factors such as dietary habit, alcohol intake, smoking, socio-demographic data (age, sex, marital status, educational level achieved and work status), family history of diabetes, presence of diabetes symptoms (polyuria, polydipsia, polyphagia and weight loss) and drug history to sort out those on hypoglycemic medications.

3.7. Data Collection Instruments

Questionnaire

Questionnaires was self-administered (for educated subjects) and administered by the investigator to those without formal education. In either case, the content of the questionnaires was dully explained to each respondents and each was given the opportunity to ask questions which were answered and all areas of misunderstanding clarified. In cases where the instructions had not been followed or sudden illness had intervened, screening was deferred. The questionnaire was divided into different sections: namely socio-demographic characteristics, family history, tobacco use, alcohol use, diabetes mellitus, blood pressure, fruits and vegetables, physical activity and clinical and laboratory measurements.

Level of Physical Activities

Physical activity was assessed based on the intensity of activity undertaken by the respondents. Those that performed activities that made them breathe faster than normal in the past week were classified as active, why those that did not were classified inactive.

Physical measurements

Height, weight and BP of respondents were measured. Height was measured using a collapsible meter rule in meters (m), while weight was measured using a standardized bathroom weighing scale (Hana scale) in kilograms (kg). BP was measured using an automated Sphygmomanometer; OMRON M2 (HEM-7116-E) Sphygmomanometer. OMRON Sphygmomanometers have been evaluated for accuracy and reliability. They have also been used in some community-based studies (Loinel and Yackoob, 2005, WHO, 2008c, Anastase et al., 2012, Amos et al., 2013).

Blood glucose measurements

Random blood sugar (RBS) was obtained using finger prick with Roche ACCU-CHEK advantage glucometer, made by Roche diagnostics. This meter has a memory of 480 tests which is 60 more than the average for all blood glucose meters. Recent studies have shown that modern handheld glucose measuring have excellent technical characteristics and yield results that are similar to reference laboratory methods, and besides various studies (Solnica et al 2003) have reported that capillary glucose measurements are as suitable as venous glucose measurements in the diagnosis and detection of type 2 diabetes mellitus in epidemiological studies. Respondents with random blood sugar ≥ 11.1 mmol/l and symptoms of diabetes were classified as diabetic.

Method and criteria for diagnosing diabetes mellitus

Diabetes was defined according to WHO guideline as;

1) Diabetes symptoms (i.e polyuria, polydipsia and unexplained weight loss) plus

- a random venous plasma glucose concentration ≥ 11.1 mmol/l or
- a fasting plasma glucose concentration ≥ 7.0 mmol/l or
- two hour plasma glucose concentration ≥ 11.1 mmol/l two hours after 75g anhydrous glucose in an oral glucose tolerance test (OGTT)

2) With no symptoms diagnosis should not be based on a single glucose determination but requires confirmatory plasma venous determination. At least one additional glucose test result on another day with a value in the diabetic range is essential, either fasting, from a random sample or from the two hour post glucose load.

Definition of Body Mass Index (BMI) Status

Body Mass Index (BMI) was determined by dividing weight in kilograms (kg) by the square of height in metres (m^2), i.e., (kg/m^2). BMI was determined according to WHO classification.

Table 1: BMI CLASSIFICATION

Classification	BMI(kg/m^2)	
	Principal cut-off points	Additional cut-off points
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	**18.50 - 24.99**	**18.50 - 22.99**
		23.00 - 24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

3.8. Data Analysis and Management

All questionnaires were screened for completeness. Data analysis was done using SPSS version 16.0.

Descriptive statistics such as mean, frequency tables, charts and proportion, were used for data summarization.

Appropriate inferential statistics was carried out using chi-square and binary logistic regression. Chi-square test was carried out to establish statistical association between independent and dependent variables, while binary logistic regression tested their strength of association as well showed the predictors among the variables.

3.9. Ethical Consideration

Informed consents were obtained from civil servants chosen. They were informed that they have the right to reject or accept to participate in the study. Those that accept to participate were then recruited for the study. Approval was obtained from Ekiti State Ethical Review Committee, Ministry of Health, Ado-Ekiti, before conducting the survey. All diabetics both old cases and newly diagnosed cases were dully counseled and urged to seek further medical treatment.

CHAPTER FOUR

RESULTS

4.1 Frequency distribution of socio-demographic characteristics of respondents.

A total of 300 subjects selected for this study participated in the survey giving a response rate of 100%. The socio-demographic characteristics of the respondents are shown in Table 2 below.

The subjects were aged 22 – 62 years. The male to female ratio was 1.14:1. The males were significantly older than the females. The mean age of the sample population was 38.27±10.2years while the mean age was 39.85±10.64years (male), 36.4±9.31years (female). The mean age for male is significantly higher than the mean age for female. Majority of the respondents were 45 years or older (30.3%), females (26.4%) and males (33.8%). The Yoruba comprised 92.3%, the Ibos 4.0%, Hausas 1.0% and others 2.7% . More than half of the respondents were Christians (60.3%), while 39.0% were Muslims. Majority of the respondents had tertiary education (80.7%) while more than half of the respondents had secondary education (17.7%) and 1.7% with primary education. Males had a higher level of education (83.8%) than the females (77.1%). A higher proportion of the respondents were married 195(65.0%). However, more males 105 (65.6%) than females, 90 (64.3%) were married.

Table 2: Frequency distribution of respondents' socio-demographic characteristics

Socio-demographics	Males n (%)	Females n (%)	All n (%)
Age			
≤ 24	6(3.8)	6(4.3)	12(4.0)
25-29	24(15.0)	31(22.1)	55(18.3)
30-34	29(18.1)	26(18.6)	55(18.3)
35-39	21(13.1)	32(22.9)	53(17.7)
40-44	26(16.2)	8(5.7)	34(11.3)
≥ 45	54(33.8)	37(26.4)	91(30.3)
Marital status			
Single	52(32.5)	33(23.6)	85(28.3)
Married	105(65.6)	90(64.3)	195(65.0)
Divorced	0(0.0)	7(2.3)	7(2.3)
Separated	0(0.0)	5(3.6)	5(1.7)
Widow	3(1.9)	5(3.6)	8(2.7)
Education			
Primary	0(0.0)	5(3.6)	5(1.7)
Secondary	26(16.2)	27(19.3)	53(17.7)
Tertiary	134(83.8)	108(77.1)	242(80.7)
Tribe			
Yoruba	150(93.8)	127(90.7)	277(92.3)
Igbo	3(1.9)	9(6.4)	12(4.0)
Hausa	2(1.2)	1(0.7)	3(1.0)
Others	5(3.1)	3(2.1)	8(2.7)
Religion			
Christianity	98(61.2)	83(59.3)	181(60.3)
Islam	60(37.5)	57(40.7)	117(39.0)
Traditional	2(1.2)	0(0.0)	2(0.7)
Salary grade level			
≤ 7	50(31.2)	60(42.9)	110(36.7)
>7	110(68.8)	80(57.1)	190(63.3)

Table 2: Frequency distribution of respondents' socio-demographic characteristics

Socio-demographics	Males n (%)	Females n (%)	All n (%)
Age			
≤ 24	6(3.8)	6(4.3)	12(4.0)
25-29	24(15.0)	31(22.1)	55(18.3)
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Marital status			
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Married	105(65.6)	90(64.3)	195(65.0)
Divorced	0(0.0)	7(2.3)	7(2.3)
Separated	0(0.0)	5(3.6)	5(1.7)
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Married	105(65.6)	90(64.3)	195(65.0)
Divorced	0(0.0)	7(2.3)	7(2.3)
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Table 2: Frequency distribution of respondents' socio-demographic characteristics

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Traditional	2(1.2)	0(0.0)	2(0.7)
Salary grade level			
≤ 7	50(31.2)	60(42.9)	110(36.7)
>7	110(68.8)	80(57.1)	190(63.3)

4.2: Frequency distribution of family history and lifestyles

In table 3 Family history of diabetes was obtained in 75 subjects; 25 of these (33.3%) had diabetic fathers, 21(28.0%) had mothers with diabetes while 29(38.7%) had relations who had diabetes (grandparents). Also 11(78.6%) reported that their father had died of diabetes while 3(21.4%) reported that their mother had died of diabetes. Respondents who ever smoked were 13.3% compared to those who never smoked(86.7%) and while those who are currently smoking are 6.3%. alcohol intake was seen in 95 respondents(31.7%) with 24.2% taking one bottle in a week, 46.5% taking two bottles and 29.3% taking more than two bottles. Also 42.0% of the respondents were seen to be physically active while more than half of the respondents were seen to be physically inactive (57.3%).

Table 3: Frequency distribution of family history, blood pressure and lifestyles

Variable	Frequency (%)
Family history of DM	
Yes	75(25.2)
No	223(74.8)
If yes who	
Father	25(33.3)
Mother	21(28.0)
Grand parents	29(38.7)
Death as a result of DM	
Father	11(78.6)
Mother	3(21.4)
Smoking(current)	
Yes	19(6.3)
No	281(93.7)
Smoking(Ever)	
Yes	40(13.3)
No	266(86.7)
Alcohol intake	
Yes	95(31.7)
No	205(68.3)
Systolic pressure	
≥ 140mmHg	24(8.0)
< 140mmHg	276(92.0)
Diastolic pressure	
≥ 90mmHg	56(18.7)
< 90mmHg	244(81.3)
Physical activity	
Yes	126(42.0)
No	172(57.3)
Fruit consumption	
Everyday	75(25.2)
Weekly	167(56.0)
Monthly	20(6.7)
Yearly	36(12.1)
Fruit servings	
One serving	179(69.4)
Two servings	70(27.1)
Three servings	9(3.5)
Vegetable consumption	
Everyday	124(43.1)
Every week	164 (56.9)
Vegetable servings	
One serving	213 (73.6)
Two servings	64 (26.4)

4.3: Anthropometric and blood pressure characteristics by gender

In table 5 the mean BMI was 22.92 ± 3.24kg/m^2. There was no significant difference in the BMI between males and females (t=0.25, P>0.05). The mean BMI for females 22.87 ± 3.42 while the mean BMI for males is 22.96 ± 3.09. Males had significantly higher DBP and SBP compared with the females.

Table 4: Anthropometric and blood pressure characteristics by gender.

Variables	Males (n=160)	Females (n= 140)	Sample (n=300)	p-value
Weight (kg) mean± SD	71.32± 9.26	68.83±7.40	70.16± 8.52	0.01
Height (m^2) mean± SD	1.76± 0.08	1.73± 0.12	1.74 ±0.10	0.015
BMI(kg/m^2)mean± SD	22.96± 3.09	22.87± 3.42	22.92 ± 3.24	0.80
DBP(mmHg) mean±SD	87.28±10.29	82.58± 8.93	85.09± 9.94	< 0.001
SBP(mmHg) mean±SD	128.69±12.06	125.88±10.13	127.38± 11.27	< 0.001

BMI= Body Mass Index, DBP= Diastolic blood pressure, SBP= Systolic blood pressure

DM= Diabetes mellitus, SD= Standard deviation.

4.4: Association between anthropometric measures, blood pressure and diabetes

Table 5 shows the association between anthropometric measures and diabetes. The diabetic patients were significantly older than the respondents with normal glucose tolerance ($t= 4.96$, $p< 0.001$). Diabetes was more frequent in people aged 45 years and above. Also BMI was seen to be significantly higher in diabetic patients than normal patients, this however was statistically significant ($t=5.76$, $p< 0.001$). This was also seen in the blood pressure of diabetics which was also significantly higher than that of normal people.

Table 5: Association between anthropometric measures, blood pressure and diabetes.

Variable	Normal	Diabetic	P-value
Weight mean± SD	69.53± 8.46	74.78± 7.55	< 0.001
Height mean ± SD	1.75 ± 0.11	1.71 ± 0.09	0.07
BMI mean± SD	22.55± 3.07	25.53± 3.26	< 0.001
Systolic mean± SD	126.31± 11.2	134.72± 9.64	< 0.001
Diastolic mean± SD	84.27± 9.93	90.89± 8.33	< 0.001
Age mean± SD	37.22± 9.88	45.83± 9.14	< 0.001

BMI= Body Mass Index, SD= Standard deviation.

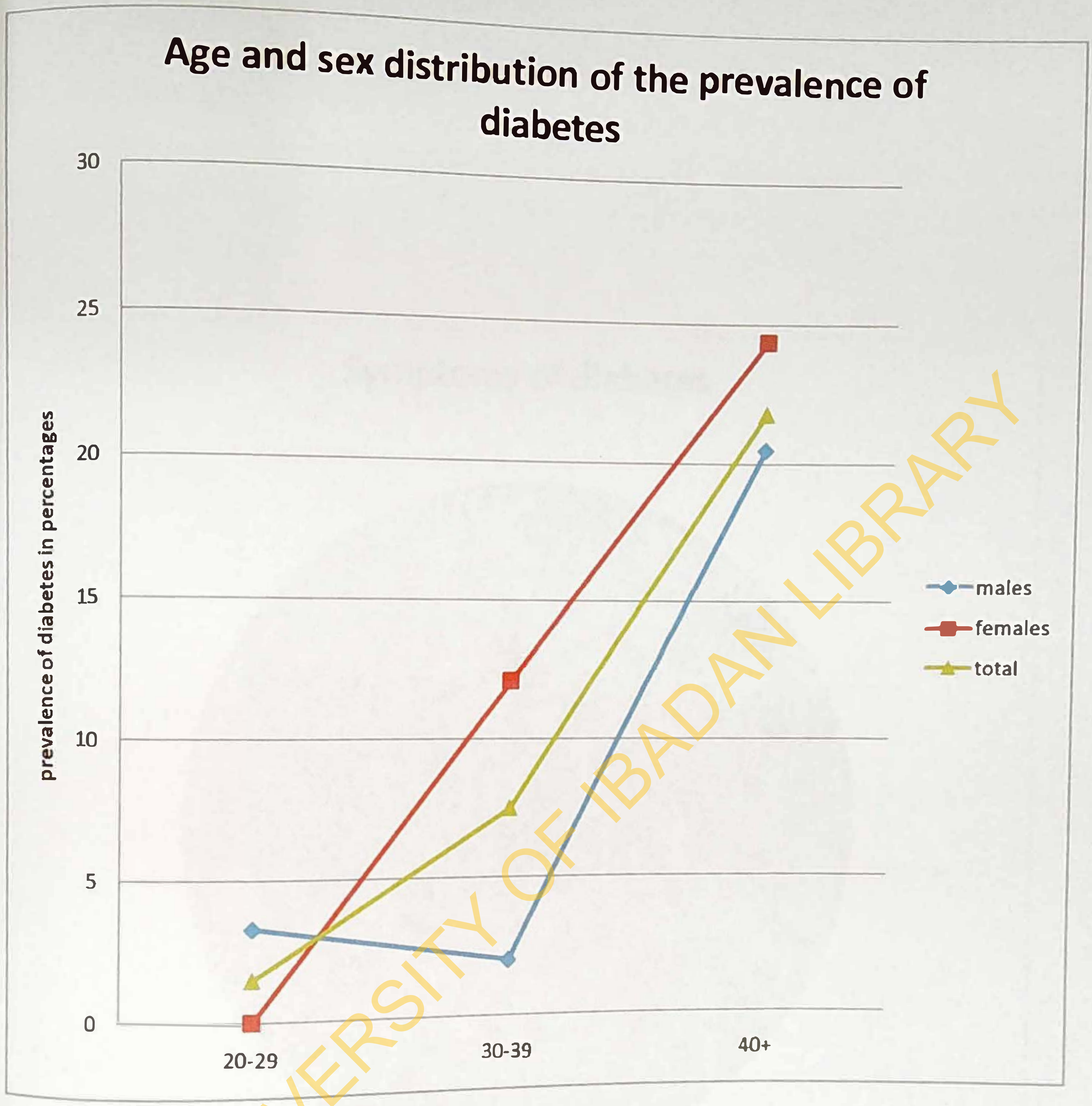

Figure 1: Age and Sex Distribution of Prevalence of Diabetes Mellitus.

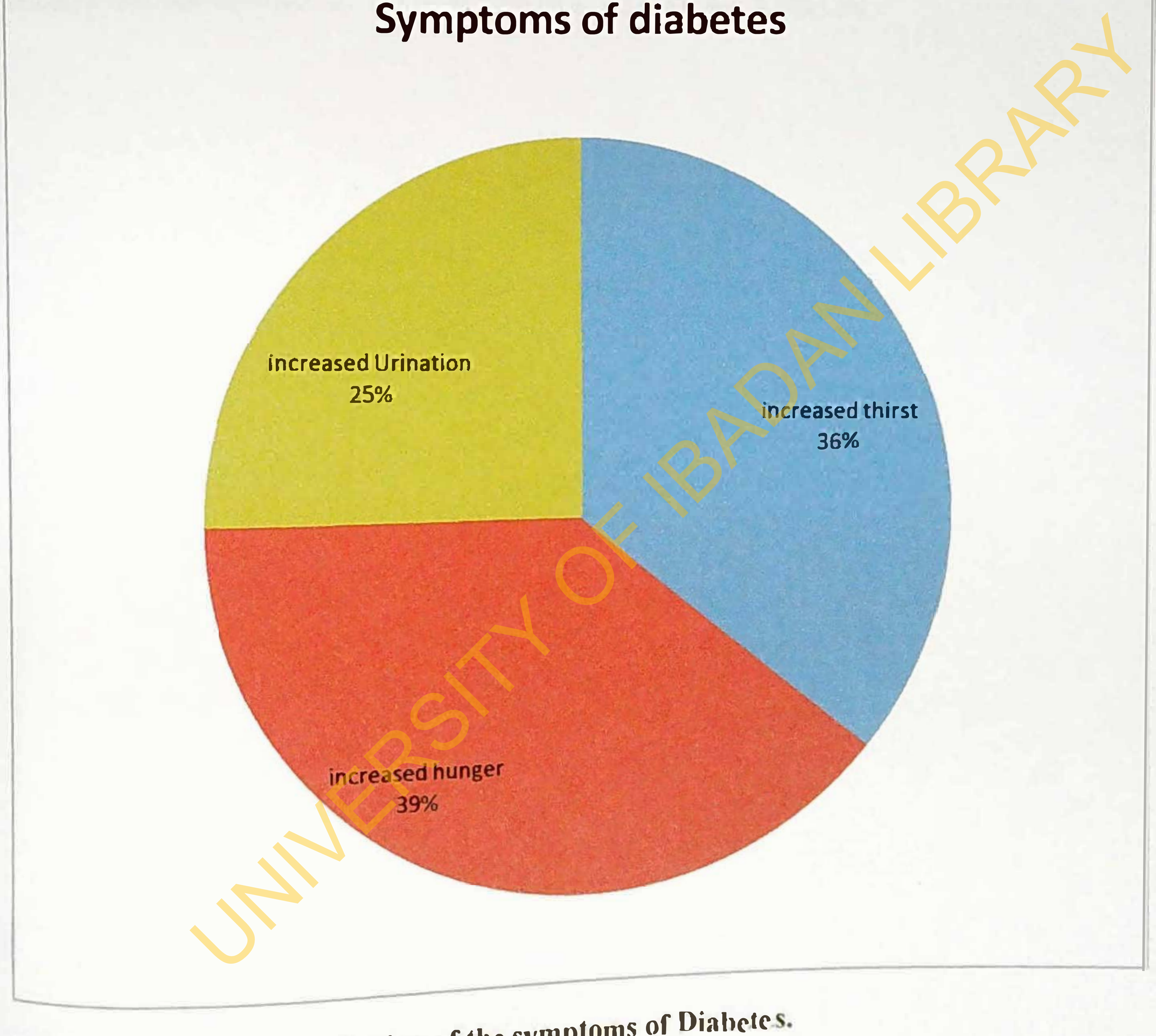

Figure 2: frequency distribution of the symptoms of Diabetes.

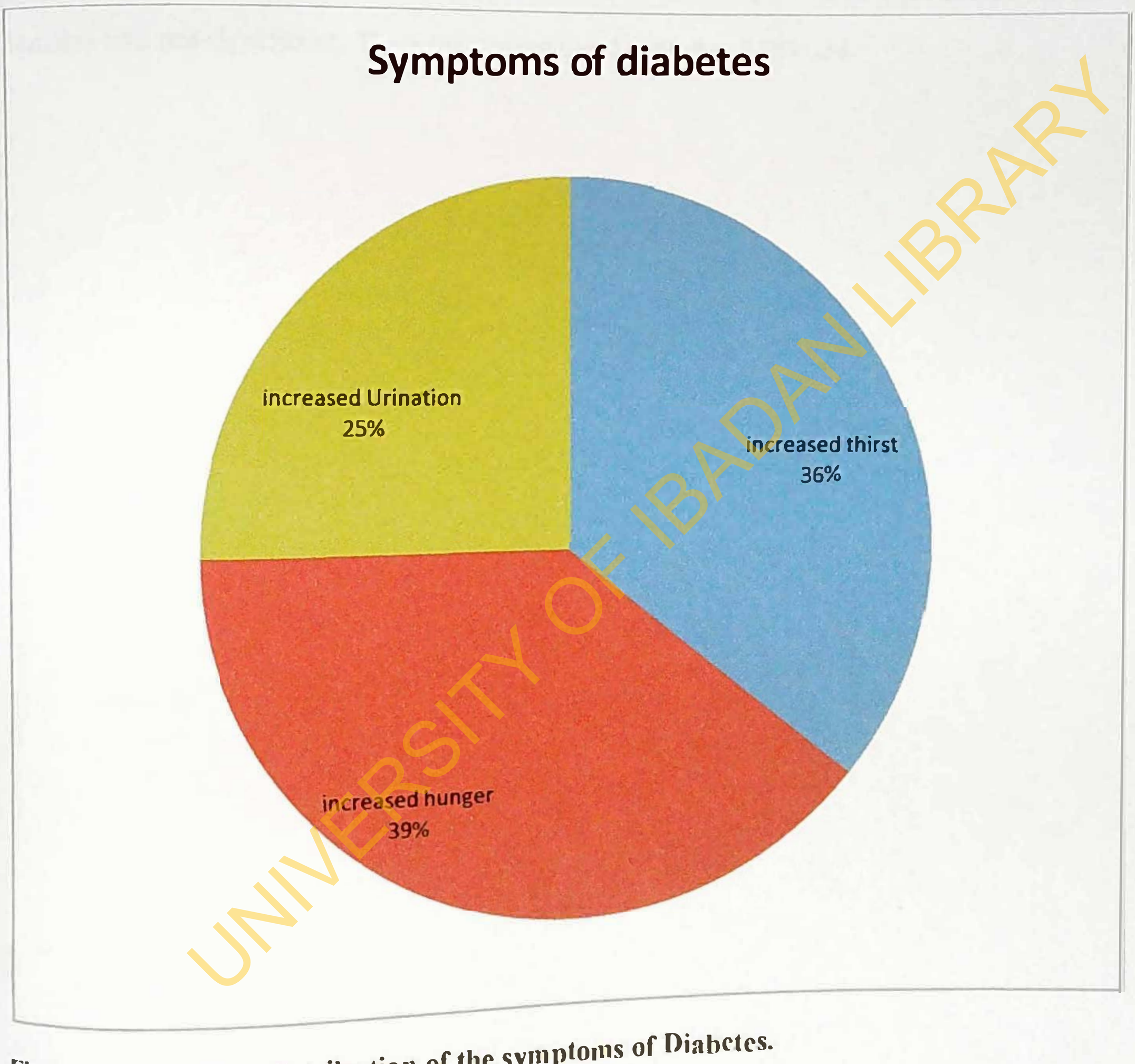

Figure 2: frequency distribution of the symptoms of Diabetes.

4.5: Prevalence of Diabetes

Out of 300 subjects seen, 28(9.4%) were previously seen to have diabetes; while 22(7.3%) subjects were diagnosed with diabetes during the study. However 36 subjects were therefore found to have diabetes giving a prevalence rate of 12.0%[95% C.I=0.08-0.16]. The prevalence of diabetes in male respondents was 11.4% [95% C.I =0.06-0.16] while that of the female respondents was 12.9% [95% C.I=0.07-0.18], however the difference between the males and females was not significant. The mean random blood sugar was 9.04±1.30.

Table 6: Prevalence of Diabetes Mellitus

Variable	Males (%)	Females (%)	Total	X^2
Diabetes(previously + current)	18(11.4)	18(12.9)	36(12.0)	0.15
Diabetes (previously diagnosed)	15(9.5)	13(9.3)	28(9.4)	0.004
Diabetes (Random blood sugar)	11(6.9)	11(7.9)	22(7.3)	0.11

Table 6: Prevalence of Diabetes Mellitus

Variable	Males (%)	Females (%)	Total	X^2
Diabetes(previously + current)	18(11.4)	18(12.9)	36(12.0)	0.15
Diabetes (previously diagnosed)	15(9.5)	13(9.3)	28(9.4)	0.004
Diabetes (Random blood sugar)	11(6.9)	11(7.9)	22(7.3)	0.11

4.6: Association between socio-demographics of respondents and prevalence of diabetes mellitus.

Table 7 shows the association between socio-demographic characteristics of respondents and prevalence of diabetes mellitus. The diabetic subjects were significantly older than those with normal glucose level ($p<0.001$). Also respondents who were divorced had more diabetic subjects than those who were married and single, marital status was an important risk factor. However, this was statistically significant ($p=0.015$). Level of education, Salary grade level and gender were however not associated with prevalence of Diabetes.

Table 7: Cross tabulations showing the associations between the socio-demographic characteristics of the respondents and the Diabetes mellitus.

Socio-demographics	Diabetes mellitus			
	Yes (%)	No (%)	Chi-square	P-value
Age				
20-29	1(1.5)	66(98.5)		
30-39	8(7.5)	99(92.5)	20.18	< 0.001
40+	27(21.8)	97(78.2)		
Marital status				
Single	3(3.6)	81(96.4)		
Married	33(15.4)	181(84.6)	7.97	0.005
Level of Education				
Secondary& lower	9(15.5)	49(84.5)		
Tertiary	27(11.2)	213(88.8)	0.80	0.37
Grade level				
≤ 7	12(10.9)	98(89.1)		
>7	24(12.8)	164(87.2)	0.225	0.64
Gender				
Male	18(11.4)	140(88.6)		
Female	18(12.9)	122(87.1)	0.15	0.69
Family history of DM				
Yes	20(26.7)	55(73.3)		
No	16(7.2)	205(92.8)	19.78	<0.001

DM= Diabetes Mellitus

Table 7: Cross tabulations showing the associations between the socio-demographic characteristics of the respondents and the Diabetes mellitus.

Socio-demographics	Diabetes mellitus			
	Yes (%)	No (%)	Chi-square	P-value
Age				
20-29	1(1.5)	66(98.5)		
30-39	8(7.5)	99(92.5)	20.18	< 0.001
40+	27(21.8)	97(78.2)		
Marital status				
Single	3(3.6)	81(96.4)		
Married	33(15.4)	181(84.6)	7.97	0.005
Level of Education				
Secondary& lower	9(15.5)	49(84.5)		
Tertiary	27(11.2)	213(88.8)	0.80	0.37
Grade level				
≤7	12(10.9)	98(89.1)		
>7	24(12.8)	164(87.2)	0.225	0.64
Gender				
Male	18(11.4)	140(88.6)		
Female	18(12.9)	122(87.1)	0.15	0.69
Family history of DM				
Yes	20(26.7)	55(73.3)		
No	16(7.2)	205(92.8)	19.78	<0.001

DM= Diabetes Mellitus

4.7: Cross tabulations between lifestyle factors, symptoms and Diabetes mellitus.

In table 8, BMI was significantly higher in diabetic subjects than those with normal glucose level ($P<0.001$). Also physical activity was an important factor influencing the prevalence of diabetes ($P=0.01$). Alcohol consumption and smoking habits were not associated with the prevalence of diabetes ($P> 0.05$). Blood pressure was highly significant with prevalence of diabetes.

Table 8: Associations between lifestyle factors and the prevalence of Diabetes.

Variables	Diabetes Mellitus			
	Yes (%)	No (%)	Chi-square	P-value
BMI				
≤25	16(6.8)	220(93.2)	30.01	<0.001
>25	20(32.3)	42(67.7)		
Physical activity				
Yes	7(5.6)	118(94.4)		
No	29(17.0)	142(83.0)	9.05	0.01
Alcohol intake				
Yes	15(16.0)	79(84.0)		
No	21(10.3)	183(89.7)	1.94	0.16
Blood pressure				
Yes	14(36.8)	24(63.2)		
No	16(7.3)	203(92.7)	27.40	<0.001
Smoking status				
Yes	2(10.5)	17(89.5)		
No	34(12.2)	245(87.8)	0.046	0.83
Freq of consumption of fruits & Veg				
Everyday	12(16.0)	63(84.0)		
Every week	13(7.8)	154(92.2)	7.44	0.02
Every month	11(20.4)	43(79.6)		

4.8: Predictors of diabetes mellitus

Table 9, after logistic regression analysis, the independent predictors of Diabetes were BMI, age, physical activity, increased thirst, increased hunger and increased urination. However, blood pressure was not a predictive value for the presence of diabetes. Physical activity was a protective factor against diabetes as those who carry out physical activity were about four times less likely to have diabetes as against those who do not carry out exercise (OR= 0.27, 95%CI= 0.099-0.75). Also BMI was also seen as a protective factor as those who weigh less than 25kg/m^2 were also about four times less likely to have diabetes than those who weigh more than 25kg/m^2 (OR= 0.28, 95%CI= 0.11-0.74). However symptoms such as increased thirst, urination and hunger were all seen as risk factors for diabetes, with increased urination being the highest contributory risk factor for the presence of diabetes(OR= 7.62, 95%CI= 2.84-20.47).

Table 9: Logistic regression analysis of diabetes mellitus.

Variables	Diabetes mellitus		
	Adjusted OR	95% CI	P-value
Age			
20-29	0.05	0.007-0.410	0.005
30-39	0.29	0.13-0.67	0.004
40+	1		
BMI			
≤25	0.28	0.11-0.74	0.01
>25	1		
Blood pressure			
Yes	2.44	0.80-7.40	0.12
No	1		
Marital status			
Single	0.20	0.06-0.68	0.01
Married	1		
Increased thirst			
Yes	4.36	1.49-12.73	0.001
No	1		
Increased hunger			
Yes	3.05	1.04-8.89	0.04
No	1		
Increased urination			
Yes	7.62	2.84-20.47	<0.001
No	1		
Physical activity			
Yes	0.27	0.099-0.75	0.012
No	1		
Family history			
Yes	2.30	0.81-6.52	0.12
No	1		

CHAPTER FIVE

DISCUSSION

This study showed a high prevalence of type 2 diabetes 12.0% among the civil servants, while it was higher among the females (12.9%) compared to the males (11.4%). The higher rate was also consistent in the different age categories amongst females compared to males. The findings of this study higher predominance in women were consistent with most of other previous studies (Sayeed, Khan, Banu 1997). Some of the recent Indian investigations have shown a considerably higher prevalence of DM in women (12.7%, men 10.4%) (Ramachandran, 1999) and 13.7% in women compared to 11.1% in men (Ramanchandran, 1997). Non significant higher prevalence of type 2 diabetes for women was also observed (2.2% compared to 1.6% in men) among Mexican Indians (Sing, Bajaj 1998). But the European studies have shown a higher a higher prevalence of type 2 diabetes in males compared to females (Saheed, Khan 1997). The prevalence of type 2 diabetes in this study increased with increasing age. This observation is almost uncontroversial. Prevalence of systolic blood pressure (SBP> 140mmHg) and diastoiic hypertension (DBP > 90mmHg) were 20.5% and 25.0% respectively, younger people had lower prevalence for both systolic and diastolic hypertension. This is not consistent with studies conducted in rural Bangladesh which found that the rate of systolic and diastolic hypertension was 10.5% and 9.0% (Sayeed, Khan 1994). In this study, an association between diastolic hypertension and hyperglycemic status was observed (P=0.001). Another study found that the prevalence of systolic blood pressure and diastolic blood pressure was 23.6% and 13.6% among newly diagnosed type 2 diabetic patients (Abu Sayeed 1998). For instance in Ibadan, an urban centre had a prevalence rate of 1.5% in the National survey (Akinkugbe 1997) and 0.8% in another study (Olatunbosun, 1996). In Jos, another urban center had a prevalence of 3.1 %(Puepet 1996). Although our study included younger age groups, the wide difference may not be explained by age alone. Since the study was done amongst civil servants in a Federal establishment in Ekiti state known to be peaceful and not industrialized, high prevalence might be due to poor lifestyle such as physical activities. The effect of change in lifestyle on diabetes has been noted in Mauritius where the prevalence of type 2 diabetes is as high as 10.4% in Creoles (Zimmet, McCarty 1997).

Body mass Index (BMI) was considered as an indicator for obesity and often referred to as the prime determinant for the development of type 2 diabetes. We observed an association between BMI and diabetes in our study population. In the bivariate analysis, we have seen an excess risk of diabetes among subjects with BMI(> 25), however this was significant(P< 0.001). after adjusting with other potential confounders in the multivariate model, BMI showed an association for diabetes. Interestingly, significant protective effect was observed for those whose BMI was less than 25kg/m^2. This study is in agreement with studies conducted in the urban and peri-urban Indian population that showed a strong association between DM and BMI for both sexes, however women showed an excess risk compared to men(Ramachandran, 1992). Epidemiological data from Asian Indians(AI), Mexican Americans(MA) and Non-Hispanic Whites(NHW) from a San-Antonio heart study showed that MA had the higher rate of Obesity and highest prevalence of diabetes(men 19.6%; women 11.8%), NHW had also high rates of obesity but low prevalence of diabetes(men 4.4%; women 5.7%) while AI had lower BMI than MA. The mean BMI for males in this study was 22.96kg/m^2(95%CI= 22,48- 23.44) and 22.87kg/m^2(95%CI= 22.29-23.44) for females. This study was close to that found in studies by Raimi(2008) in South-west Nigeria(23.5kg/m^2 vs 23.8kg/m^2), Okafor(2009) in Eastern Nigeria, Gezawa(2009) in North-east Nigeria(24.3kg/m^2 vs 25.6kg/m^2). The mean BMI of urban dwellers in Sokoto was 24.0kg/m^2. 23.6kg/m^2 in Sagamu(Raimi, 2008), 26.7kg/m^2 in Enugu(Okafor, 2009) and 24.7kg/m^2 in Maiduguri(Gezawa, 2009). The mean BMI in this study 22.92kg/m^2 was lower compared with current definitions of Obesity recommended by WHO(BMI≥ 30kg/m^2)(WHO, 1999).

Multivariate analysis showed Alcohol as a strong independent risk factor for type 2 diabetes in this population. Heavy consumption of alcohol has been positively associated with diabetes (Akinkugbe, 1997). This may be due to hepatic and/or pancreatic damage which is known to complicate alcoholism (Obembe, Sijunola 1993). Adi(1994), Oli and Nwaokolo(1996)in Enugu have reported an association between liver disease and diabetes in Nigeria.

Advancing age was another identified independent risk factor for diabetes which was more prevalent in subjects' age 40 years and above. This was consistent with studies conducted by Johnson (1971) and McLarly et al (1991) which found that the peak incidence of diabetes in Nigeria and Tanzania respectively was after 45-50 years of age. It is well known that prevalence

of diabetes increases with age (Zimmet, 1982). In Nigeria, the risk of diabetes increases 3-4 folds after the age of 44 years (Akinkugbe, 1997) which is consistent with our study. The worsening of insulin resistance with age and increasing longevity of diabetic patients due to improved care all contribute to the rising prevalence of type 2 diabetes with age (Zimmet, 1997).

Physical activity is a well known risk factor for type 2 diabetes. In this study, the risk of diabetes is reduced by 27% by those who involve themselves in physical activity. This figure is lower compared to a study carried out in Portharcourt that says the risk of diabetes was reduced by 50% among men who take moderately vigorous exercise (Perry, Walker 2005). Helmrich et al (1991) showed in a prospective study that physical activity is inversely related to the prevalence of diabetes. Our study found an association between physical activity and prevalence of diabetes. Physical activity was a strong predictive factor for the prevalence of diabetes. It was seen as a protective factor against diabetes {OR= 0.27; p=0.012}. However in our study, history of diabetes was seen not to be risk factor for diabetes (95%CI=0.81-6.52; p=0.12).

Conclusion

The prevalence of type 2 diabetes in this study is fairly high. About 9.4% were previously seen to have diabetes and 7.5% were diagnosed with having diabetes during the study. It should be noted that this result is technically alarming as it has been predicted that much of the global increase in DM is predicted to be in developing countries including Nigeria. Some of the identified risk factors of type-2 diabetes are modifiable making type 2 diabetes a potentially preventable disease. It would be prudent therefore to recommend screening of subjects at risk and lifestyle modification to reduce the prevalence of diabetes in Ekiti state.

Recommendations

1. World Health Organization (WHO) African Regional Office should wake up to awareness on diabetes mellitus. This region has a growing prevalence of diabetes mellitus. Unfortunately, all the countries in this region are either low or middle-income. More funds and technical supports should be directed at the control of diabetes in this region.

2. The Federal Government should conduct a national non-communicable disease risk factors survey, as the overall prevalence of diabetes in Nigeria was last determined in the year 1997. The

survey will reveal the magnitude and distribution of diabetes and their associated risk factors in Nigeria. Interventions can thus be channeled appropriately.

3. The Federal Ministry Of Health (FMOH) should strengthen its "Department for the Control of Non-Communicable diseases. This will aid the effective control of diabetes mellitus and its complications.

4. All the thirty-six (36) states of the federation should create a department or an agency for the Control of diabetes mellitus. Just as every State has a department or an agency for the control of Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS).

5. Ekiti State Government should implement large scale population screening of diabetes, in order to mitigate the morbidity and mortality associated with diabetes.

6. Behavioral change communication (BBC) is strongly recommended at all levels of government.

7. Ekiti State Government should begin massive campaigns on the need for civil servants to regularly check their blood sugar level. This will foster early diagnosis and thus reduce diabetes-induced morbidities and mortalities.

Study Limitations

1. Abdominal obesity (waist-hip ratio) was not measured. Thus, some participants classified as normal on the global obesity scale could be suffering from abdominal obesity.
2. Respondents departments were not captured, making it difficult to determine the distribution of diabetes among the various departments and ministries.
3. Another important variables that was not captured is the frequency of consumption of high calorie and fatty foods which could have showed their effects on the prevalence of diabetes

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