# ASSESSMENT OF DIABETES MANAGEMENT REGIMENS AND EFFECT OF DIABETES EDUCATIONAL INTERVENTION AMONG DIABETICS ATTENDING NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL NNEWI ANAMBRA STATE, NIGERIA.

**By**

**OBIDIOZOR, JULIE UCHE**
**PG/PhD/2002/33202**

**DEPARTMENT OF HOME SCIENCE, NUTRITION AND DIETETICS**
**UNIVERSITY OF NIGERIA NSUKKA**
**SUPERVISOR: PROF H.N. ENE-OBONG**

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**APPROVAL PAGE**

This dissertation has been approved for the Department of Home Science, Nutrition and Dietetics, University of Nigeria, Nsukka.

By

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| Prof. H.N. Ene-Obong | Prof . N.M. Nnam |
| Supervisor | Head of Department |
| ---------- | ---------- |
| Prof. S.O.C Ugwu | Prof. A.C. Uwaegbute |
| Dean of faculty | External Examiner |

## CERTIFICATION

Obidiozor Julie Uche (Mrs), a post graduate student of Department of Home Science,Nutrition and Dietetics, University of Nigeria Nsukka with registration number PG/PhD/2002/33202 has satisfactorily completed the research work for the degree of Doctor of philosophy in Human Nutrition. The work embodied in this dissertation is original and has not been submitted in part or full for any other diploma or degree of this or any other university

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**Prof. H.N. Ene-Obong** **Prof . N.M. Nnam**
**Supervisor** **Head of Department**

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**Prof. A.C. Uwaegbute**
**External Examiner**

## DEDICATION

This work is dedicated to the loving memory of pa Obidiozor who could not see the completion of this work before he joined his ancestors.

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I am very grateful to God Almighty, the author of wisdom and knowledge for his sustenance through the rigorous period of this study and for His grace upon my life and my family. May His name be praised forever. Amen.

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## ABSTRACT

This study investigated diabetes management regimens and effect of diabetes educational intervention on diabetics attending Nnamdi Azikiwe University Teaching Hospital(NAUTH), Nnewi. A total of 146 diabetics were interviewed with structured questionnaire to obtain information on their lifestyles, diabetes management, diabetes knowledge and compliance to management regimens. Diabetes educational intervention materials were developed to educate the subjects on 3 crucial areas of diabetes management- diet, exercise and drug. A sub-sample of 33 subjects with uncontrolled diabetes (fasting blood sugar >160 mg/dl) was followed up for 3 months to assess the immediate effect of the intervention on blood-sugar. Post intervention questionnaire interview was repeated on the subjects after two years of the intervention to assess the long term effect of the intervention. The subjects were predominantly non- insulin dependent (type 2) diabetics (96%) and a few insulin dependent (type1) diabetics (4%); 62 % females and 38% males. Majority (75.7%) of the subjects used drugs and diets for diabetes management, 7% used drugs alone, 0.7% used diet alone and 16.6% used liquid extract of bitter and pumpkin leaves in addition to drug and diet. Fifty seven percent of the subjects had poor diabetes knowledge while 43% had good diabetes knowledge. Similarly, 53% and 47% of the subjects had poor and good nutrition knowledge respectively. Diabetes knowledge had significant ($p<05$) effect on diabetes control. The subjects restricted the consumption of some carbohydrate foods like rice (10%) and garri (2%) and increased the consumption of unripe plantain (78%). Consumption of legumes was high; cowpea and its products ranked highest (82%) followed by bread fruit pottage (27%). Fruits mostly consumed were garden eggs (56%), avocado pear (27%), firm-ripped pawpaw (14%) and orange (9%). There was marked decrease in the intake of alcohol (17%) and cigarette (23%). Sixty-three percent (63%) of the subjects were either inactive or maintaining light physical activity in their daily life, while 37% were active. Controlled diabetes (Fasting blood sugar < 160 mg/dl) was significantly ($p<0.05$) higher among active subjects. The educational intervention had significant ($p<0.05$) effect on the blood-sugar levels of the subjects within 3 months of the intervention. There were positive lifestyle changes on the diabetics two years after the intervention. Diabetes knowledge significantly ($p<0.05$) improved from 43% to 57%. More subjects became more active, blood sugar control significantly ($p<0.05$) improved from 59% to 63%. Rigidity and monotony in their food consumption pattern became less and there was more diversification in their food selection.

# INTRODUCTION

## 1.1 Background to the Study

Diabetes Mellitus is a group of multi-system endocrine disorder characterized by a raised blood glucose concentration due to defects in insulin secretion or action or both (Chuwhak, Peupet & Ohwovoriole, 2002; Mathur, 2006). Diabetes occurs throughout the world. Mokdad, Ford & Bowman (2000) observed that an epidemic of diabetes mellitus was occurring worldwide and warned that communities in developing countries were now at greatest risk of the disease. Obesity and physical inactivity comprise an important worldwide epidemic that has been linked to the increased prevalence of diabetes and the metabolic syndrome (Carlos, 2008). It has been projected that by the year 2025 the current incidence of diabetes worldwide will double, with an inevitable and profound impact on global health care systems and budget (Williams, 2004). Lifestyles in resource poor countries are changing, putting population at much higher risk of diabetes. Nwosu (2000) noted an increase in the incidence of diabetes mellitus among Nigerians and observed that diabetes constitutes 10% of patients seen by General Practitioners in Anambra State of Nigeria.

Diabetes mellitus is recognized as type 1 or insulin dependent diabetes and type 2 or adult onset diabetes. In type 1 diabetes, the insulin production from the pancreas is virtually absent, patients must be managed with exogenous insulin in addition to dietary manipulation in an attempt to regulate blood glucose level. Type 2 diabetic patients may produce insulin that would be insufficient and ineffective in regulating blood glucose level, management could thus be with hypoglycemic drugs and/or diet. American Diabetes Association (ADA) opined that dietary management is crucial for all types of diabetes. The basic nutritional requirement of diabetic patient is the same as those of a non-diabetic. However, the regimentation of food intake is the

cornerstone of diabetic therapy. Timing of food intake, the caloric value of food ingested, the proportions and quality of carbohydrate, fat and protein are all-important aspect of the diet (ADA, 2004). The major principle is to reduce hyperglycemia, avoid hypoglycemia, and maintain appropriate weight. In an attempt to lower blood glucose, the patient should avoid easily absorbable simple carbohydrates and highly processed and refined foods. The levels of energy recommendation for a patient depends on the age, body weight and activity. During the National African Congress in 1994, the reconstruction and development programme in South Africa had specifically targeted diabetes as one of the chronic diseases in need of special attention.

The increasing prevalence worldwide of diabetes is associated with levels of modernization (Popkin, 1999). Apart from genetic implications, diabetes has been associated with changes in lifestyle such as migration from rural to urban settings, over-eating, sedentary habits, a change to high-fat diets, consumption of refined sugar with lower fibre diet, smoking, social and economic stress ( ADA, 2004).

Certainly, strategies on diabetes management need to focus on dietary and physical activity behavior. Evidence of successful control and prevention of type 2 diabetes was previously published from the Finish Diabetes Prevention Study (Lindstrom, Louheranta & Mannelin, 2003). In the study, 522 middle aged (40-65 years) over weight individuals (BMI $\geq$ 25 kg/m$^2$) with impaired glucose tolerance were put through an intervention programme consisting of weight loss, reduced total and saturated fat intake, increased dietary fibre and physical activity. Another study has demonstrated that behavioral interventions are more successful if they adopt ideas of informed choice and the acquisition of skills for self-management (Conor, 2003).

If diabetes-associated morbidity and mortality are to be reduced, establishing sustainable mechanisms to achieve good diabetic care is essential. Diet therapy is

known to be a primary therapy in the management of type 2 diabetes and vital injunctive in type 1 diabetes. This is because the type of food consumed by the patient plays a fundamental role in their glycaemic control (Rekha, 2000; ADA, 2004). It is imperative therefore that dieticians counsel diabetic patients appropriately, according to their social circumstances. This requires time to educate patients on the use of household measures and to point out the quantity of cheap but appropriate foods that are available locally.

## 1.2 Statement of the Problem

The increasing prevalence of diabetes mellitus around the world appears so dramatic as to have been characterized as an epidemic (Mokdad *et al.,* 2000). Diabetes mellitus causes prolonged ill-health, imposes morbidity and mortality risks, and necessitates a change in lifestyle, with a meticulous daily routine and long-term self-care.

The cardiovascular complications of diabetes, which is also a leading cause of blindness, amputation and kidney failure, account for much of the social and financial burden of the disease (Williams, 2004). The prediction that diabetes incidence will double by the year 2025 indicates a parallel risk in cardiovascular related illness and death, an inevitable and profound impact on global health-care system and a rise in co- morbid diseases. The burden on the health-care system and budget are enormous. An expenditure of up to 13% of the world's health-care budget is on diabetes care and high prevalence countries may be spending up to 40% of their budget annually (International Diabetes Federation, 2003). It is important to note that these estimates of a burden on national health-care are for type 2 diabetes only and do not, as yet, estimates the additional burden of cardiovascular disease associated with metabolic syndrome where clinical diabetes is not yet present.

The Nigerian diabetics, unlike their counterparts in developed countries, have extremely limited chances for achieving self-care living with diabetes because of their limited knowledge of nutrition (Osisianya, Delda, Ogbonnaya & Ogundana, 2006). The study reported a low nutrition knowledge among the diabetics and suggested that adequate nutrition education should be employed in diabetic counseling. Everybody claims to know about nutrition. In the face of nutritional ignorance, myths and quackery gained stronghold. To maximize the effect of chronic disease management programmes, patients must be empowered to self-help, a policy that has been shown to improve diabetic care (ADA, 2004).

ADA (2004) observed that drastic change from the traditional diet that consists of high fibre, high carbohydrate, low animal protein, generous vegetable and low saturated fat to the so-called western diet, with low fibre, high protein and high fat content has been implicated as one of the causative factors for the development of diabetes mellitus. Although allopathic drugs for management of this disorder are available in the market but the high cost and the need for prolonged use (Balkrishnan, 2004) have influenced the desire for alternative medicine. Coincidentally, intensive promotion of herbal medicine through exhibition, print and electronic media has greatly increased the awareness of medicinal potential of some local and common herbs, vegetables, fruits and spices even among the highly educated.

The Diabetes Control and Complication Trial (DCCT, 1993) demonstrated that intensive blood sugar control delays the onset and slows the progression of diabetic complication. ADA (2004) advised that good diabetic management is more than blood sugar control and maintained that diabetic management with drugs only could not tackle some of the risk factors like obesity, hypertension and serum lipid level. Most diabetics skip the numerous locally available high fibre foods due to

ignorance. Studies have reported improvement in blood sugar level of diabetic patients using high fibre diets (Osisanya *et al.,* 2006; ADA, 2004; Tumilehto, Lindstrom & Eriksson, 2001). Strategies on diabetes management need to focus on dietary and physical activity behavior. The role of professional nutritionist is to positively guide the public on scientifically proven sound nutrition messages. There is therefore need to investigate the lifestyles and various management combinations used by diabetics in Anambra State in order to plan effective intervention measures.

### 1.3 Objective of Study

**General Objective:** The general objective of the study is to assess the diabetic's lifestyles and management regimens and effect of diabetes educational intervention on diabetes care.

**Specific Objectives:**

The specific objectives of this study were as follows: to

1. assess the diabetes knowledge of the subjects.
2. determine the diabetic's compliance to management regimen.
3. determine the lifestyle factors affecting diabetes control
4. develop appropriate diabetes educational intervention.
5. assess the immediate effect of intervention on the blood glucose.
6. assess the impact of the intervention on target population two years following the intervention.

### 1.4 Significance of the study

In order to reduce diabetes-associated morbidity and mortality, an evidence-based study of this kind is essential to establish factors militating against good diabetes control and to institute measures to enhance good diabetes care. Living with diabetes requires knowledge and experience. Diabetes management is not only an element of

treatment but also a preventive treatment in itself for maintaining normal-glycemia (Tumilehto *et al.*, 2001), hence the importance of investigating the various diabetes management regimens among diabetic patients in our locality. The present study will be beneficial in that it will highlight the major problems militating against good diabetes control as well as the factors facilitating good diabetes control and then institute diabetes educational intervention to enhance good diabetes care.

Highlighting the major problems militating against good diabetic control will guide the researcher on the area to emphasize in the educational intervention in order to enhance good diabetes care which will in turn enable the diabetics to:

– Maintain a good glycaemic control
– Prevent diabetic complications which are caused by "swings" in the blood glucose levels.
– Correct misinformation on diabetic management that abounds in our society
– Provide a positive guide to the diabetics and the public at large on scientifically proven sound nutrition message.

### 1.5 Definition of Key Terms

**Gylycaemic control:** means maintaining as near normal blood glucose level as possible (80 – 110 mg/d1)

**Lifestyle behavior**: means such habits as physical activity, drinking habits, smoking habits and eating habits including meal combinations and feeding pattern.

**Management protocol:** means treatment guidelines that is suitable and socially acceptable

**Diabetic complications**: any additional development of ill-health as a result of the diabetes state, e.g. neuropathy, retinopathy, liver diseases, cardiovascular diseases, and others.

# CHAPTER TWO

## 2.0 REVIEW OF RELATED LITERATURE

### 2.1 Introduction

Diabetes mellitus is an endocrine disorder with variable clinical expressions. It is characterized by a raised blood glucose concentration due to defects in insulin secretion or diminished effectiveness of insulin or both (Mathur, 2006). Diabetes is a chronic disorder that affects the metabolism of carbohydrate as well as fats and protein. This usually leads to glycosuria, which is associated with polyuria and weight loss. Diabetes could be a primary disorder in some patients. The pancreas release insulin that regulates blood glucose levels as well as converts glucose to energy. Glucose is simple sugar in the blood stream, produced when starchy foods are eaten and digested in the body. A non-diabetic releases insulin from the pancreas to keep the blood glucose at constant level irrespective of the amount of carbohydrate foods eaten. However, diabetic with impaired pancreatic function cannot keep the blood glucose at constant level. The long-standing metabolic derangement caused by lack of insulin is freely associated with functional and structural changes in the body cells. The changes lead to the development of the so-called complications of diabetes.

**2.1.1 Definitions:** Diabetes is defined on the basis of elevated blood glucose levels. Chuhwak *et al.* (2002) defined diabetes as heterogeneous disorders with a striking diversity of pathogenic mechanism as well as clinical manifestation. It can be defined as clinical syndrome characterized by hyperglycemia due to deficiency or diminished effectiveness of insulin (Alberti, Defronzo, Keen & Zimmet, 1992).

Mathur (2006) defined diabetes as a group of metabolic diseases characterized by high glucose level, which result from defects in insulin secretion or action or both.

### 2.1.2 Clinical Presentation

Diabetes Mellitus may present as an acute disorder with the classical triad symptom of polyuria, thirst, and weight loss. In some acute cases, patients may presents for the first time in a coma. Diabetes Mellitus can present as a sub-acute condition over several months, particularly in elderly patience, in whom this triad is usually not so dramatic and may even be absent (Chuwhak *et al.,2002).* These elderly patients may seek medical attention for vague symptoms – such as 'weakness of the body' and blurred vision – or may be seen with non-resolving infections. Patients may also present with established complication, but there may be no symptoms or signs at all. Such patient may be found accidentally on routine screening when they come for other problems such as surgical operations

### 2.1.3. Classification of Diabetes mellitus

There are three main categories with specific clinical pathological features which led to the classification of diabetes by World Health Organization (WHO, 1999) to: Insulin-dependent diabetes mellitus (IDDM) or type I DM, non-insulin dependent diabetes mellitus (NIDDM) or type II DM and gestational diabetes mellitus (GDM)

#### 2.1.3.1 Insulin-dependent Diabetes Mellitus (Type 1 DM)

This kind of diabetes is also called Type 1 DM, as well as juvenile-onset DM. It is a chronic disease in which insulin production from the pancreas is diminishing or absent. The patients are usually less than 40 years at diagnosis. The patients are managed with exogenous insulin with diet -therapy ( World Health Organization, 1999 ).

#### 2.1.3.2. Non insulin-dependent Diabetes Mellitus (Type 11 DM)

This disease is called Type II DM as well as maturity-onset DM. It appears in adult above the age of 40 years.

Type II diabetes, the most common type, is characterized by disorders of insulin resistance and insulin secretion, either of which may be the predominant feature (Mathur, 2006). The important point here is that insulin secretion has not ceased when the disease develops but may be inadequate for the purpose of which it is being secreted. Patients are usually overweight, obese and ketosis resistant. Patient's pancreas may produce some quantity of insulin that would be insufficient and unable to keep the glucose at constant level. The development of type 11 diabetes mellitus passes through several stages in its natural history. The most important of these is impaired glucose tolerance (IGT) and the International Diabetes Federation (IDF) identified this stage as a marker for identifying those at risk of developing diabetes mellitus (International Diabetes Federation, 2003). Patients with this marker are usually obese and/or hypertensive and management can be by diet alone or diet and oral hypoglycemic drugs with occasional insulin injection (ADA, 2004).

#### 2.1.3.3 Gestational Diabetes mellitus (GDM)

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy (Major, Conway, Berkus, Xenakis & Gonzales, 2000 ). The definition applies whether insulin or only diet modification is used for treatment and whether or not the condition persists after pregnancy. The gestational diabetes mellitus (GDM) is common in women who are genetically predisposed to diabetes mellitus during pregnancy, and may abate after delivery and reoccurs on a subsequent test

**i Detection and diagnosis**

Risk assessment for GDM should be undertaken at the first prenatal visit. Women with clinical characteristics consistent with a high risk of GDM (marked obesity, personal history of GDM, glycosuria, or a strong family history of diabetes) should

undergo glucose testing as soon as feasible. If they are found not to have GDM at that initial screening, they should be retested between 24 and 28 weeks of gestation. Women of average risk should have testing undertaken at 24–28 weeks of gestation. A fasting plasma glucose level above 126 mg/dl (7.0 mmol/l) or a casual plasma glucose >200 mg/dl (11.1mol/l) meets the threshold for the diagnosis of diabetes, if confirmed on a subsequent test.

**ii Perinatal complications of GDM**

Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (2003) reported that the presence of fasting hyperglycemia (plasma glucose level >105 mg/dl or >5.8 mmol/l) may be associated with an increase in the risk of intra-uterine fetal death during the last 4–8 weeks of gestation. Although uncomplicated GDM with less severe fasting hyperglycemia has not been associated with increased perinatal mortality, GDM of any severity increases the risk of fetal morbidity, high birth weight (about 4.5 kg or above), respiratory distress syndrome. It affects 4% of all women, about 135,000 cases in the United States every year (American diabetes Association, 2010). Neonatal hypoglycemia, jaundice, polycythemia, and hypocalcemia may complicate GDM as well. GDM is associated with an increased frequency of maternal hypertensive disorders and the need for cesarean delivery.

**iii Long-term complications of GDM**

Women with GDM are at increased risk for the development of diabetes, usually type II, after pregnancy. Reclassification of maternal glycemic status should be performed at least 6 weeks after delivery and according to the guidelines of the "Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Offspring of women with GDM are at increased risk of obesity, glucose intolerance, and diabetes in late adolescence and young adulthood.

### 2.1.4 Prevalence of diabetes mellitus

The increasing prevalence of diabetes worldwide is associated with urbanization and modernization. Kim, Moon and Popkin (2000) highlighted the association of diabetes with changes in lifestyle

The International Diabetes Federation (IDF) reported that diabetes mellitus is one of the most common chronic diseases worldwide and the fourth leading cause of death in the developed world (IDF, 2006) In countries with a high diabetes incidence, such as those in the pacific and the middle east, as many as one in four deaths in adults aged 35 to 64 years is due to diabetes (IDF, 2003). In Saudi Arabia it has increased from 4.9% in 1987 (Fatani and Mira, 1988) to 7.4% in 1995 (Alhasmi, Swallem & Wasry, 1995). In Nigeria it has increased from 1.7% in 1988 (Ohwovoriole, Kuti & Kabiawu, 1988) to 10% in 2000 (Nwosu, 2000). Nwosu (2000) opined that adoption of western diet and increased urbanization has escalated the prevalence of diabetes Mellitus to this level in Nigeria. One point which emerges in the epidemiology of diabetes in developing countries is that its prevalence is associated with affluence (Unwin and Ablerti, 2000). The International Diabetes Federation (IDF) reported that 230 million people worldwide had diabetes mellitus and predicted that the world incidence of diabetes will double by the year 2025 with a parallel rise in cardiovascular –related illness (IDF, 2003).

### 2.1.5 Global Burden of Diabetes Mellitus

The cardiovascular complications of diabetes, which are also leading cause of blindness, amputation and kidney failure, account for much of the social and financial burden of the disease (Williams, 2004). The predictions that diabetes incidence will double by 2025 indicates a parallel risk in cardiovascular related illness and death, with an inevitable and profound impact on global health-care system and a rise in co-

morbid diseases. The burden on the health-care system and budget are enormous. This will mean an expenditure of up to 13% of the world's health-care budget on diabetes care and high prevalence countries spending up to 40% of their budget annually (IDF, 2003). It is important to note that these estimates of a burden on national health-care are for type 2 diabetes only and do not, as yet, estimates the additional burden of cardiovascular disease associated with metabolic syndrome where clinical diabetes is not yet present. The number of patients with type 2 diabetes is increasing rapidly in both developed and developing countries around the world. Prentice (2006) highlighted that the emerging pandemic of diabetes is driven by the combined effects of population, ageing, rising levels of obesity and inactivity.

The vascular complications of type 2 diabetes account for majority of the social and economic burden among patients and society. IDF (2003) further reviewed the burden of type 2 diabetes, impaired glucose tolerance, and their vascular complications and projected that by 2025 there will be 380 million people with type 2 diabetes and 418 million people with impaired glucose tolerance. Diabetes is a major global cause of premature mortality that is widely underestimated, because only a minority of persons with diabetes die from a cause uniquely related to the condition. Approximately one half of patients with type 2 diabetes die prematurely of a cardiovascular cause, approximately 10% die of renal failure and global excess mortality attributable to diabetes in adults was estimated to be 3.8 million deaths (Van Dieren , Beulens , Van der Schouw , Grobbee & Neal, 2010).

Diabetes causes an estimated 12–14 years of life lost to premature death (Narayan *et al.,* 2006) In the United States in 2002, people with diabetes spent six times more money on healthcare than people without diabetes; mostly due to costly complications like cardiovascular disease, renal failure and blindness. Morbidity,

mortality, and quality of life for people living with diabetes in low- or middle-income countries may decline further if insulin and appropriate health care is neither available nor accessible (IDF,2003). Currently, 246 million people have diabetes, and if no action is taken, this number will increase to over 380 million in the next 20 years. Approximately 5–10% of all people with diabetes have type 1, while the remaining 90–95% accounts for type 2 diabetes, which is largely related to lifestyle and responsible for most of the increase. An additional 200 million people around the world have impaired glucose tolerance, a precursor for type 2 diabetes, and this figure is expected to rise to 420 million by 2025 (Hossain, Kawar & El Nahas, 2005 ).

Once considered a "disease of affluence," diabetes now places a significant burden on developing countries. Globally, diabetes affects 5.9% of the adult population. In many countries in Asia and the Pacific, diabetes affects up to one-third of the population. Eighty percent (80%) of the global diabetes burden is in the developing world, and emerging economies are particularly susceptible since undernourishment and stunting in childhood often lead to later onset of diabetes. This, combined with rapidly changing environments due to the nutrition transition and urbanization, puts future working-age populations at high risk (Menken, Munsat & Toole, 2000). China and India alone make up 25% of the total diabetes burden, and face large increases in the next two decades, with 104% and 150% escalations, respectively. This will have profound consequences on the two rapidly developing populous economies (Bjork, 2001).

### 2.1.6 Global Consequences

Diabetes is of significance because of the social, economic and health burden it places on countries, and on individuals and their families. Costs of dabetes are manifested in

both direct and indirect costs that put pressure on individuals, societies and governments. Direct costs include medical costs for long-term care and complications. Indirect costs account for losses in productivity, coping mechanisms, and the costs of quality of life which affects individuals and families and is immeasurable. In many countries, the cost of insulin and diabetes supplies far exceeds annual incomes, leaving people with diabetes unable to properly manage their condition, and susceptible to complications in the long-term. Treatment of complications is more expensive than prevention or control. Studies have shown that health care expenditure for people with diabetes is five times higher than for people without diabetes (Bjork, 2001).

For families, diabetes can be a death sentence and a straight path to poverty if the person with diabetes is the sole breadwinner. Disabilities from diabetes complications can lead to productivity loss and life-long care. The WHO estimates that China, the Russian Federation and India will lose $558 billion, $303 billion, and $237 billion, respectively in foregone national income due to diabetes, stroke and heart disease in the next decade (WHO, 2005). Despite these facts, diabetes and most non-communicable diseases (NCDs) have been largely neglected, due to lack of financial and human capital, lack of fully-informed key decision makers, and orientation of health systems toward acute care (Yach, Hawkes, Gould & Hofman, 2004) Donors tend to fund issues that are more easily addressed, such as vaccines and treatment of acute diseases, and want to see rapid results.

### 2.1.7 Disability-Adjusted Life Year (DALY)

The disability-adjusted life year (DALY) is a measure of overall disease disability expressed as the number of years lost due to ill-health, disability or early death.

Originally developed by Harvard University for the World Bank in 1990, the World Health Organization subsequently adopted the method in 2000. The DALY is becoming increasingly common in the field of public health and health impact assessment (HIA). It "extends the concept of potential years of life lost due to premature death to include equivalent years of 'healthy' life lost (WHO, 2006). In so doing, mortality and morbidity are combined into a single, common metric. Traditionally, health liabilities were expressed using one measure: Years of Life Lost (YLL). This measure does not take the impact of disability into account, which can be expressed by: Years Lived with Disability (YLD). DALYs are calculated by taking sum of the two components in the formula: DALY = YLL + YLD.

The DALY relies on an acceptance that the most appropriate measure of the effects of chronic illness is time, both time lost due to premature death and time spent disabled by disease. One DALY, therefore, is equal to one year of healthy life lost. Looking at the burden of disease via DALYs can reveal surprising things about a population's health. For example, the 1990 WHO report indicated that 5 of the 10 leading causes of disability were psychiatric conditions. Psychiatric and neurologic conditions account for 28% of all years lived with disability, but only 1.4% of all deaths and 1.1% of years of life lost. Thus, psychiatric disorders, while traditionally not regarded as a major epidemiological problem, are shown by consideration of disability years to have a huge impact on populations(Menken, Munsat & Toole, 2000).

Despite the fact that diabetes and other non-communicable diseases represent a significant proportion of the global burden of disease, proportionate global action has not occurred. International Diabetes Federation (IDF, 2003) reported on global constraints to the implementation of effective policies to curb non-communicable disease epidemics. These constraints include a lack of global advocacy, insufficient

attention from funding agencies and governments, partnerships and interactions, capacity and resources, and global norms and standards, as well as orientation of health services to acute care. Karen and Narayan (2008) reviewed the progress that has been made with regards to each constraint. They focused on the International Diabetes Federation's current diabetes campaign "World Diabetes Day" (WDD) and United Nations Resolution on diabetes to show how this WDD has helped remove some of these barriers. The Resolution declaired the IDF World Diabetes Day, November 14th as a United Nations Day to be observed every year starting in 2007, and calls on all nations to develop national policies for the prevention, treatment and care of diabetes in line with sustainable development of their healthcare systems. The Resolution does not mobilize funds, but urges national governments to allocate resources for diabetes action.

### 2.1.8 Diabetes and Metabolic Syndrome

The metabolic syndrome is defined as a cluster of the most dangerou s heart attack risk factors: diabetes and raised fasting plasma glucose, abdominal obesity, high cholesterol and high blood pressure (Alberti, Zimmet & Shaw, 2006a). They estimated that around 20-25% of the world's adult populations have the metabolic syndrome and they are twice as likely to die from heart attack or stroke compared with people without the syndrome. Alberti, Zimmet & Shaw, (2006b) stated that for a person to be defined as having the metabolic syndrome, they must have central (abdominal) obesity plus any two of the following four factors:

i Raised fasting plasma glucose (FPG) $\geq$100mg/dl (5.6mmol/L) or diagnosed DM.

ii. Raised triglycerides $\geq$150mg/d (1.7mmol/l) or are on specific treatment for it.

iii. Reduced HDL cholesterol (good cholesterol) <40mg/dl (1.03mmol/l) in male and < 50mg/dl(1.29mmol/l) in females or are on specific treatment for this abnormality.

iv. Raised blood pressure or on treatment of previously diagnosed hypertension. The pathogenesis of the metabolic syndrome and each of its components is complex and not well understood. Central obesity and insulin resistance are acknowledged as important causative factors of the metabolic syndrome (Nesto, 2003). Central obesity, easily assessed using waist circumference and independently associated with each of the other metabolic syndrome components including insulin resistance is a prerequisite factor. Nesto (2003) highlighted that people with metabolic syndrome have a fivefold greater risk of developing type II diabetes, excluding 230 million people worldwide who already have diabetes. This clustering of metabolic abnormalities that occur in the same individual appears to confer a substantial additional cardiovascular risk over and above the risk associated with each abnormalities. The more component of metabolic syndrome that are evident, the higher the cardiovascular mortality rate (Hu, Qiaoq & Tuomilehto, 2004). Note: if body mass index (BMI) is >30kg/$m^2$, central obesity can be assumed and waist circumference does not need to be measured. Insulin resistance seem to be largely genetic, and it is now pretty clear that it is an important player in the metabolic syndrome and type II diabetes. Body fat distribution in type II diabetics differs considerably from fat distribution in non-diabetics. Diabetics have less subcutaneous fat, and more visceral and intramuscular fat ( IDF, 2006)

### 2.1.9 Causes of Diabetes Mellitus

Diabetes mellitus is not a single disease entity; it is better regarded as a syndrome of which there are many causes. Diabetes mellitus is characterized by chronic hyperglycemia due to the deficient or ineffective action of insulin on target tissues due to inadequate insulin secretion, insulin resistance or both (Chuwak *et al.,* 2002;

Mathur, 2006). The deficient action of insulin is associated with disturbances of carbohydrate, fat and protein metabolism.

It is mainly a primary disorder, though, it could manifest as secondary disorder to some diseases that impair the function of factors that may increase the risk of developing diabetes include the following:

(i) **Genetic Susceptibility**

Diabetes Mellitus is primarily recognized as genetic disorder. The exact role of heredity is uncertain. Genetic factors appear as the main determinants of susceptibility of other environment factors. Zimmet, Dowse & Finch (1990 ) showed that diabetes is significantly more frequent when the subject's mother is diabetic than when the father is diabetic. He also showed high incidence of diabetes with subjects of single-parent diabetic. Evidence for the strong genetic basis of Type II DM arises from observations that include, strong concordance for Type II DM in identical twins and substantial variation in prevalence between different ethnic groups that share similar environments (Zimmet *et al.,* 1990).

**(ii) Nutrition transition**

There is worldwide moves toward the higher fat and higher refined carbohydrate Western diet and tremendous inactivity as well as marked shift in the structure of the diet (Kim *et al.*, 2000; World Cancer Research Fund, 1997 ). Changes in diet and activity patterns are fueling the obesity epidemic. These rapid changes in the levels and composition of dietary and activity/inactivity patterns in transitional societies are related to a number of socioeconomic and demographic changes. Major dietary change includes a large increase in the consumption of fat and added sugar in the diet, often a marked increase in animal food products contrasted with a fall in total cereal intake and fiber. A major change in economic structure associated with the nutrition

transition is the shift from a preindustrial agrarian economy to industrialization (Popkin, 1998). Industrial production is dominated by capital-intensive processes. Along with the shift toward occupations that require less energy to be expended, the new technologies allow those at each occupation to engage in increasingly sedentary work. It was shown that the shifts are so marked that they were linked with large increases in body mass index (BMI) and a greater risk of obesity, diabetes and cardiovascular diseases ( Popkin, 1999 ).

Related to the effect of industrialization and modernization on market production is a similar shift in time allocation and physical effort in home and leisure activities. A key thrust in the continuing development of household technology for processing and storing food has been to save time and enhance the quality of life. In the last century, the evolution of household technology seems to have accelerated. In food-preparation technology, recent developments include efficient ways to prepare and store food (canning, refrigeration, freezing, radiation treatment, packaging); food processing with tools such as electric mixers and food processors; and cooking with pressure cookers, cookware made with improved metals and alloys, metal stoves using various fossil fuels and microwave ovens. These food-preparation technologies, together with home electrification, washing machines and clothes dryers, vacuum cleaners, piped water and so forth are all shifts towards inactivity and the resultant obesity (Prentice, 2006) . Possibly an even more astounding shift has come in leisure activities. The rapid shift in television ownership and the equally important provision of cable linkages to bring the images and marketing to each household are key elements. In the past, leisure activities for children often meant active play, but leisure today may mean a quite sedentary activity such as watching television or playing a computer game.

Scholars have tried to rigorously link dietary and activity changes with body compositions changes among adults. The results have shown in longitudinal studies of these relationships among children and adults that the dietary activity patterns affected BMI (Bray and Popkin 1998; Paeratakul, Popkin, Ge Adair & Stevens, 1998; Monteiro, Benicio, Mondini & Popkin, 2000). The income-dietary fat intake changes was noted for China, indicating that China is in the early stages of this same shift towards an inverse income-BMI relationship (Guo, Mroz, Popkin & Zhai, 2000). In their China research, they found a remarkable increase in obesity among the adults they followed for 8 yrs (1989 to 1997) and obesity is a risk factor for diabetes .

**(iii) Pancreatic Diseases**

Diabetes Mellitus may occur secondary to acute or chronic pancreatitis, pancreatic carcinoma and surgical pancreatectomy. These diseases destroy the pancreas and lead to impaired secretion of insulin. Usually, such patients do not require more than 40 unit of insulin daily for treatment unlike many other insulin-dependent diabetic thsat need larger units of insulin (Davies *et al.,* 1994). Adenocarcinoma of the pancreas typically metastasizes to lymphatics, and blood-borne metastases to the liver are typically massive. Lipase production can cause cutaneous calcification. Protease production can cause a polyarthritis -- a true zebra. "Pancreatic adenocarcinoma, among the most lethal human malignancies, is resistant to current chemotherapies." (Nuttai and Ganon,1991).

An international group finds three different patterns of gene expression, and subdivides the common pancreatic adenocarciomas with the hope of eventually finding something that works (Mayne, 2001). Acinar carcinoma of the pancreas makes up about 1% of pancreatic cancers. Most often it affects young adults. It

presents stippled cells that stain for trypsin, amylase, lipase, and chymotrypsin, and often elaborates lipase into the blood (which may produce subcutaneous fat necrosis) and/or elaborate proteases into the blood, causing arthritis (Marieb and Hoehn 2004).

**(iv) Endocrine Condition**

Endocrine disorders increase the concentration of catabolic hormones or modify the regulation of insulin receptors. Hormones such as growth hormones (in acromegaly), glucocorticoids (in Cushing's syndrome) and glucagons secreting tumors could lead to diabetes. Cortisol raises blood glucose by increasing protein break down and by inhibiting utilization of glucose by the peripheral tissues (Marieb and Hochn, 2004). That is the reason why Cushing's syndrome presents with impaired carbohydrates tolerance. Adrenalin raises blood glucose by increasing breakdown of liver glycogen and by suppressing insulin secretion. Excess thyroxine aggravates diabetic states and patient with hyper-thyroidism show impaired glucose tolerance (Davis, Metcalfe, Day & Gray, 1994).

**(vi) Obesity**

Obesity is associated with insulin resistance particularly in muscle and hyper-insulinaemia. It is postulated that insulin uptake is impaired by receptors in target tissues of the obese (Marieb and Hochn, 2004). Obesity is diabetogenic in people that are genetically predisposed to the disease. Prospective and retrospective studies have established that 80% of diabetics had a history of overweight (Mokdad *et al.,*2000). They reported that the incidence of diabetes is higher among the obese. Obesity is associated with hyperinsulinism. The hyperinsulinaemia in obese and diabetics may be due to hypersecretion or slow utilization of insulin or both. The current trend of industrialization is dominated by new technologies that allow increasingly, sedentary work. It was shown that the shifts toward industrialization are so marked that they

were linked with large increases in body mass index (BMI) and a greater risk of obesity, diabetes and cardiovascular diseases ( Popkin, 1999 ).

Most Type II diabetics have insulin resistance in both liver and skeletal muscle, and this appears to be the key lesion. In addition, however, there is almost always some evidence of beta cell dysfunction. The liver continues to make and put out glucose (gluconeogenesis) when blood sugar is high, and fails to take up orally-administered glucose. The skeletal muscles fail to take up glucose in response to insulin. The amount of insulin resistance is modified by obesity and physical conditioning. There's also the baffling combination of gut polypeptides, prostaglandins and beta-endorphins (Anderson, Kendal & Jenkins, 2003). Exactly how obesity itself increases insulin resistance is enormously complex. Principal known players released by fat and more plentiful in the overweight are non-esterified free fatty acids which increase insulin resistance. These are suspected major culprit (Menken, Munsat & Toole, 2000).

### 2.1.10 Diagnosis and Assessment of Glycemia

The various symptoms presentation is essential in diabetes diagnosis as well as the investigation of glucosuria and elevated blood glucose. The commonest tests used in clinical practice are the urine glucose and the blood glucose tests.

#### 2.1.10.1 Urine Glucose Test

Urine testing is widely used to diagnose diabetes mellitus. It is easy and less expensive. Glycosuria can be detected by the reduction of the copper salts. The blue-coloured copper ion reacts with the reducing substance in the urine and forms copper oxides. The interactions of colours between the blue non-reduced copper salts and the red copper oxides give a range of colours from blue to green to orange to brick red.

Clinitest tablets or test paper can be used in this copper reduction technique. The test tablets or paper are dipped into the urine. The resultant colour is then compared with the manufacturers colour chart (Boucher and Ross, 1988).

Absence of glucose in the urine does not eliminate diagnosis of diabetes, because the urine glucose threshold is above the normal glucose level and rises with age. Likewise, positive test of glycosuria does not necessary confirm diabetes. There are individual variation in renal threshold, so that some diabetics with high renal threshold can have negative urine test and people with low renal threshold can produce false positive urine test (Boucher and Ross, 1988)

#### 2.1.10.2 Blood Glucose Test

Blood contains various kinds of sugar as glucose, fructose and ribose. But glucose is metabolically the most important sugar in the blood. The interference of these other sugar with glucose can prevent the recognition of hypoglycemia. Therefore, precise laboratory estimates of blood glucose are necessary for diagnosis. The common blood glucose tests include the following:

**(i) Random Blood Glucose**

Random blood glucose exceeding 200mg/dl (11mmol/L) is certain to confirm diabetes (Tumilehto *et al.,* 2001). However random blood glucose level below 11mmol/L does not exclude diabetes and required other tests such as fasting blood glucose and glucose tolerance test.

**(ii) Fasting Blood Glucose:-** This is done after an over night fast of 10-12 hours. Samples of the patients blood is tested in the morning before any food is eaten. Fasting blood glucose level above 100mg/dl is an indication that the patient has diabetes (WHO, 1985). A patient is diagnosed diabetic in the presences of elevated fasting blood glucose concentration on more than one occasion.

**(iii) Glucose Tolerance Test:-** This is a confirmatory test for diagnosis of diabetes. It is done to ensure the adequacy of the pancreas. The patients are given a dose of glucose, considering patient's body size. WHO expert committee on diabetes (WHO, 1985) recommended 75gm glucose in 250-350m/s of water for adults and 1.75g glucose per kg body weight (maximum of 75g) for children. The glucose is given orally after an over-night fast. Blood sample is taken from the patient before the glucose load and at half-hourly intervals after the glucose load for 2 hours. In non-diabetic, the glucose level returns to the fasting level within 2 hours after the glucose load. In diabetic, the glucose level remains abnormally high after glucose load and fails to return even after 3 hours (WHO,1985). Intravenous glucose tolerance test can only be used when patient cannot tolerate glucose orally or in patient that had gastro-enterostomy surgery. An injection of 25 gm glucose is given intravenously while blood sample is taken every 10 minutes instead of half-hourly. The glucose tolerance test may be helpful in diagnosis of false diabetes among pregnant women with an abnormal low renal threshold (Lindstrom *et al.,* 2003)

### 2.1.11 Complications of Diabetes

The diagnosis and management of early cases or less acute cases of diabetes may prevent or delay later complications. Ford (2005) reported that diabetics are at the risk of multiple complications both metabolic (hypoglycemic, hyperglycemia, dyslipdaemia) and vascular (micro and macroangiopathic). The microangiopathic complications are nephropathy retinopathy and neuropathy (peripheral and autonomic). The macroangiopathic complications include ischaemic cardiac disease and peripheral vasculopathy. Types II diabetics are mainly at risk with macrovacular diseases leading to coronary heart disease (CHD), stroke and peripheral vascular

disease. Unlike the Type 1 DM, microvascular complications prevail, leading to lesions in kidney and eye as well as neuropathy.

**(a) Diabetic Ketoacidosis**

Diabetic ketoacidosis (DKA) is one of the potentially fatal complications of diabetes mellitus. Mortality rates are 2-5% in western countries but may be much higher in developing countries (WHO, 1994). Ketoacidosis occurs as a result of loss of insulin action on the body. The resulting hyperglycemia produces an osmotic diuresis with consequent dehydration and loss of sodium, chloride and potassium ions in large quantities. In addition, there are appreciable losses of phosphate, magnesium and calcium ( Marieb and Hochn, 2004). Many of the precipitating factors for DKA are potentially avoidable by simple measures such as providing insulin to patients, educational programmes to increase awareness of the disease and its complications. Levovit (1995) observed that the DKA mortality rate has decreased to relatively low figures in many parts of the world and that the main precipitating factors for DKA were poor compliance and inadequate therapy.

**(b) Cardiovascular Disease**

Cardiovascular disease is four to five times higher among diabetic than non-diabetic (IDF, 2006). Diabetics are highly prone to lipid disorders, along with elevated blood pressure and abdominal obesity. However, it is necessary that diabetic should be screened more routinely for blood lipid levels including triglycerides, cholesterol-high-density lipoprotein (HDL) cholesterol and low-density lipoprotein (LDL) cholesterol as these conditions had proven to be a major gateway to cardiovascular diseases (Robins and Robins 2003).

Boren, Fitzner, Ranhalkar & Specky, (2009) observed a significant rise in total cholesterol concentration in diabetic patients as a potent risk for heart disease

development and proposed an intensive diabetes education as a major step to safeguard the heart.

**(c) Retinopathy**

This is one of the most serious complications of diabetes mellitus. Chumello, Bognetti and Meschi (1991) showed that it increased the risk of blindness by a factor of about 25 and favours premature onset of cataracts compared with non-diabetics.

The risk factors for diabetic retinopathy are severity of hyperglycemia, hypertension, young age of diagnosis and long duration of diabetes. They reported a close correlation between the appearance of retinopathy and poor glycemic control. Retinopathy is related more to the duration of the diabetes than its severity.

Fundoscopy through the dilated pupils should be part of the annual screening in diabetic patients. Type II DM often shows background retinopathy and hard exudates (lipid deposits in the retina). Cataracts are also a common eye problem in Type II DM patients. Retinopathy is rare in Type 1 DM patients at time of diagnosis, unlike in Type II patients, where about 6-30% was recorded as having some retinopathy at diagnosis (Mayne, 2001). The medical therapy of diabetic retinopathy includes metabolic control, vitamins especially vitamins A, B and C (Rekha, 2000)

**(d) Nephropathy**

When foods are utilized by the body, a series of toxins are generated that must be eliminated as well as external contaminants, medications and all foreign substances. Kidney nephrons are the primary organs responsible for filtering and eliminating all of these toxins and foreign substances from the body. Morphological renal lesions of different degree are present in 90% of diabetic patients and clinical signs of diabetic nephropathy are found in 30 to 40% of diabetic with a sharp fall in incidence after 15 to 20 years of the diseases (Mathur, 2006). It is therefore, necessary to diagnose early

stages of altered renal function, which might have predictive significance for the development diabetes or other metabolic syndrome. The process can be slowed down through optimal metabolic control. Screening for nephropathy includes measurements of blood pressure and microalbuminuria. Serum creatinine, urea and electrolyte concentration should be measured at each visit to the hospital.

**(e) Neuropathy**

This is a rather late complication usually in adults with Type II DM. This incidence of diabetic neuropathy shows a wide variability depending on the diagnostic criteria used. Studies measuring muscular weakness, pain and loss of sensation show a 40% incidence of neuropathy (Tumilehto *et al*., 2001). In their study they found a precise correlation between the appearance of neuropathy, the duration of the illness and glycol-metabolic control.

Peripheral neuropathy is commonly presented as numbness and parasthesia. The neuropathy may however, be sensory or sensorimotor with impairment of sensation, muscular weakness and tendon hypoplexia or are flexible in the distal part of the limbs.The major clinical manifestations of nerve damage in diabetic patients relate to the neuropathic foot. There is reduction perception and functional changes in the blood supply, which account for diabetic feet. Ulcer and gangrene threaten the feet.

For preventives measures, diabetic feet should be examined at each clinical visit. Regular podiatry is also vital. This complication was found commonest (33-48%) in two Nigerian studies (*Osuntokun et al,* 1971; Osuafor, 1998).

**2.2 Diabetes management**

Once the presence of diabetes risk factors are identified such as hyperglycemia or other components of metabolic syndrome, International Diabetes Federation (IDF) recommends primary intervention which includes

- Moderate exercise to achieve 5-10% weight loss.
- Moderate increase in physical activity.
- Change in dietary composition.

These recommendations are aimed at preventing (or at least delaying by several years) the degeneration to type 2 diabetes among high risk individuals with glucose intolerance. Hypertension, dyslipidaemia and diabetes are well-known risk factors for cardiovascular disease (CVD), which is a leading cause of death and disability worldwide (Williams, 2004).

### 2.2.1 Dietary Management

Dietary management includes restriction of calories and these should be appropriately distributed as carbohydrate, protein and fat. The ideal diet for diabetic is currently vague. However, it continues as an important cornerstone of diabetes management (Tom, 1993). The objectives of diet therapy are to optimize the blood glucose and lipid control, minimize the risk of hypoglyceamia, achieve weight control and reduce risk of long-term complication of diabetes mellitus. A diagnosis of diabetes can be overwhelming at first to any patient who faces it.

Good management of type I diabetes does not involve only insulin. Dietary restrictions are essential factors in its management. Many type II diabetics can be managed with only diet. Dietary restriction and exercise rather than only insulin or oral hypoglycemic drugs should be employed in the management of obese patients. This is because insulin and sulphonylureas increase the appetite and thus leads to patients weight gain (Cuff, 2003).

Proper diet therapy in type II diabetics will lead to reduction in both hyperglycaemia and weight loss. These two factors may contribute to improvement in beta cell function. Davies *et al.* (1994) showed that sixty-nine subjects with type II diabetes

had reduction in weight, glycosylated haemoglobin (HbA1) and fasting blood glucose level following diet therapy for sixteen weeks. Hosker *et al.* (1993) reported that fifteen type II diabetic subjects who were similarly managed

with diet alone showed significance weight loss, which consequently improved insulin secretary capacity rather than insulin sensitivity.

#### 2.2.1.1. Principles of dietary Management

In order to achieve the aims of diet therapy in prevention of blood glucose fluctuation during fed and fasting states, the following factors should be considered.

1. Total calorie content
2. Dietary fibre content
3. Glycemic index of foods
4. Physical form and viscosity of foods.

Diabetic patients are counseled according to their eating habits, life-style demands and presence of complications. Whatever the dietary modifications possible, the total energy intake should relate to age, body weight and activity. This is to normalize and maintain ideal body weight. Researchers observed that energy restriction to maintain normal weight improves glucose tolerance as well as weight control (Quinn, 1993). According to recommendation by the American Diabetes Association (ADA, 2004), complex carbohydrates should comprise 50-60% of total energy, dietary protein should not be more than 20% of the total energy (It may be restricted further or increased in case of catabolic states). Fat intake should be up to 20-30% of the total energy. Fat intake may be restricted further in diabetic with dyslipidemia.

**Carbohydrate:** The main rationale for an increase of carbohydrate foodstuffs is that it can contribute to and improve metabolic profile. This is because the structure of the

food is important for blood glucose and hormone responses after a meal (Vessby, 1994). ADA (2004) reported that high-carbohydrate and high-fibre diets providing 55-60% of energy as carbohydrate. 15-20% as protein and 20-25% as fat, including 50gm of fibre daily, reduced insulin requirements. It improved glycemic control, lowered fasting serum cholesterol and triglyceride values. It also promoted weight loss. The amount of carbohydrate in the diet as long as the level of energy remains the same has relatively little impact on blood and urine glucose levels.

Factors that have been identified as influencing glycemic responses are the energy level physical form and processing of the carbohydrate. The structure of the carbohydrate is of importance for the blood glucose and hormone responses after a meal (Brand, Thornburn & Trustwell, 1987). Limitation is restricted only to rapidly absorbed carbohydrates such as simple sugar and sugary foods. The simple carbohydrate which include glucose and fructose is rapidly absorbed and produces a greater and faster rise in postprandial glucose and insulin response unlike the complex carbohydrate such as garri, yam and rice, etc which are digested and absorbed at a much slower rate. All starchy foods as well as simple sugars have different responses. Lactose and fructose have lower glycemic response compared to glucose and maltose. Brand *et al.* (1987) reported that addition of cowpea in bakery products reduced blood glucose as well as improved peripheral insulin activity by its system modification. A high proportion of simple carbohydrate in a meal aggravated the postprandial hyperglycemia in fifteen diabetics. However, the substitution with complex carbohydrates suppressed the hyperglycemia (Brand *et al.*1987).

The term “glycemic index” (GI) indicates glycemic response of a carbohydrate food expressed as a proportion of the glycemic response to an equivalent amount of pure

glucose (Frost and Dornhorst, 2000). They explained that foods high in viscous fibres influence carbohydrate absorption and show slower rates of digestion and absorption and are referred to as low glycemic index or lente carbohydrate foods. Jenkin *et al.* (1994) also reported that low glycemic index or lente carbohydrate foods lower the rates of carbohydrate absorption which may have advantages in reducing postprandial glycemia and insulinemia and in turn, reduce serum low-density-lipoprotein (LDL) cholesterol. The GI of cereal products i.e. bread, cornflakes are higher than that of legumes e.g. cowpea. Jenkins *et al.* (1994) proposed that combined high carbohydrate high fibre diet might blunt the postprandial elevation of blood glucose and reduce insulin requirements of type II diabetes. Thus, a high carbohydrate food should be accompanied by a high intake of dietary fibre. Also, food preparation influences the patients blood glucose level. For instance, boiled potato lowers blood glucose more than baked or mashed potatoes (Jenkins *et al*., 1994).

**Protein** The primary role of dietary protein is for growth, development and tissue maintenance. It is also important in regulation of glucose metabolism. Some specific amino acids like leucine and arginine enhance insulin secretion, additionally, arginine and oral intake of protein stimulate glucagon secretion. Amino acids stimulate insulin secretion in both normal and diabetic patients (Nuttal and Gannon,1991). It has been shown that moderately low protein diets are beneficial in preventing and delaying the risk of nephropathy in diabetic patients. The minimum recommendation in adult diabetic diets should be about 50 grams, and diabetic children of pre school and school age should be allowed protein intake of not less than lg/kg body weight daily (Chiumello *et al.*, 1991).

Diabetics may require an additional supplement of 0.5g/kg body weight to counteract losses from gluconeogenesis and ketogenesis associated with impaired glucose

utilization. However, it could be restricted further if the patient has renal problems. Rekha (2000) has shown a relationship between low protein intake with intake of only high biological value (HBV) protein and a reduction in proteinuria of the early phase of diabetic nephropathy with a retardation in its development. HBV proteins are more digestible than low biological value (LBV) protein and could be more readily available for urea production.

**Fat**

The general limitation of fat to < 30% of the total energy is most desirable. This percentage could be manipulated further in relation to specific disease states of the patient.

ADA (2004) reported that the decision regarding the level of fat in the diet is based both on patient preference as well as weight of the patient. The percentage in the diet should be considered. The supplementation of low saturated fat diets with high amounts of polyunsaturated fats make the diet more palatable and may also lower serum cholesterol. The intake of cholesterol should not exceed 250mg daily.

**Energy**

The amount of energy recommended for diabetics must be adjusted to allow patients obtain ideal body weight. It is particularly necessary for the Type II diabetics to loose excess weight gain. The low calorie and high fibre intake will quickly bring about a fall in blood glucose concentration with reduction and decrease in insulin resistance (ADA, 2004). Osisianya *et al.* (2006) examined the effect of energy restriction (vegetarian diet) on obese type II diabetic patients. The findings of the research showed significant weight loss and low fasting blood glucose in the subjects. The distribution of energy intake throughout the day is an important aspect of dietary management for type 1 DM and type II DM patients. The additional need of insulin

and oral hypoglyceamic drug in management of diabetes can be assessed in the setting of constant appropriate levels of energy intake.

#### 2.2.1.2 Fibre in Diabetes diet

Many studies had shown that dietary fibre is very essential in diabetic diet for both the type 1 and II diabetics. It improves glyceamic response and delays absorption rate of nutrients, especially, carbohydrate absorption. Fibre has the property of viscosity which increases the viscosity of the intestinal content, thereby making the food in the intestine less accessible to digestive enzymes (Kumar, Ajaya & Sulimath, 2006). They found that only or mainly soluble fibre had a beneficial effect on post-prandial plasma glucose and insulin levels, also that food stuff rich in soluble fibre without an excessive increment of total fibre causes limited discomfort (occasionally dyspepsia) and represents satisfactory tolerance to patients.

In order to meet up with the high fibre intake, patients are advised to increase the consumption of vegetables, legumes and fruits rather than pharmaceutical fibre supplements that are often expensive and not too palatable. Daily consumption of fruit and vegetables is necessary to furnish essential vitamins, minerals and fibre. Vitamins are essential for carbohydrate metabolism. For instance, deficiency of vitamins $B_1$ leads to incomplete carbohydrates metabolism. Partial metabolism of carbohydrate leads to accumulation of pyruvic acid in the blood and brain and this damages the nerve cells to cause peripheral neuropathy (Passmore and Eastwood, 1986). Diabetics with infection, polyuria or ketoacidosis may require vitamins supplement (Mayne, 2001), especially the water-soluble vitamins (vitamin B complex and vitamin C). These vitamins are high in foods like fruits, legumes and vegetables.

**i. Effect of Dietary Fibre on Carbohydrate Metabolism:** Blood glucose concentration at any point reflects the balance between entry of glucose and the

removal by peripheral tissues for energy metabolism, storage as glycogen or conversion to fat or with glucose removal via glucosuria. Conceivably, any of these might be affected directly or indirectly by dietary fibre (Mayne, 2001).

Two principal approaches have been used to study the effects of increasing carbohydrates and fibre in diabetes mellitus: use of fibre supplement and increased use of foods high in dietary fibre (Alberti *et al*.,1992). Leguminous vegetables are of particular interest in so far as carbohydrate metabolism is concerned. Mixing of meals with fibre is essential for blunting the glycemic response. Kumar *et al,* (2006) highlighted that ingestion of fibre, particularly the water-soluble fibre, attenuates the glycaemiuc response to a given carbohydrate load as well as modulating the altered glycosidase activities in diabetic tissues.

Nothlings, Wilkins, Murph, Hankin & Henderson (2007) highlighted that dietary fiber and butyric acid supplementation at 500 mg/kg body weight/day was found effective in modulating the altered glycosidases activity in liver, spleen, heart, lungs, testis, and brain during diabetes. This is an indication that butyric acid along with dietary fiber is involved in minimizing the oxidative stress-induced tissue damage thereby regulating the altered enzyme activities in different tissues during diabetes.

ii. **Effect of Dietary Fibre on Blood Lipids Metabolism**

Dietary fibres are indigestible by pancreatic and intestinal enzymes. It interacts with intestinal mass in several ways. Each affects lipid metabolism through its water holding property and absorption of solutes (Alberti *et al*., 1992). This leads to dilution of intestinal content. The dilution alters the digestion and absorption of fats.

Dietary fibre modulates lipid metabolism by:

- Altering cholesterol and acid absorption.
- Altering hepatic production of lipoproteins.

- Altering peripheral disposal of lipoproteins.

Biesenbach *et al.* (1993) studied the lipid-lowering effect of a new pectin fibre mixture in type II DM patients with hypercholesterolemia. The study revealed that the intake of the fibre mixture led to a significant decrease in blood lipids. The study further indicated that dietary fibre is more effective in subjects with initial high levels of lipids and cholesterol and that bile acids are involved in the enterohepatic circulation with a feedback on the absorption and metabolism of cholesterol. Some dietary fibres bind bile acid for faecal excretion. This diverts cholesterol into bile acid pool while less cholesterol is available for incorporation into lipoproteins that is released in the venous circulation. Among fibres and their individual components, the viscous fibre and lignin appear to have the greatest bile acid sequestering ability. Kumar *et al.* (2006) reported that dietary fibre is also involved in minizing the oxidative tissue damage thereby regulating the altered enzyme activities in different tissues of the diabetic.

**2.2.1.3 Alcohol in Diabetic diet**

Precaution is necessary in the consumption of alcohol in order to prevent hypoglycemia and hyper lipidaemia and for weight control in overweight DM patients. The caloric contributions from alcoholic drinks and beverages must be considered in the patient's meal plan. Beer on the average contains 45Kcal/100mls, dessert wines (sweet sherry) contains 150kcal/100mls. Distilled spirits such as whisky, brandy, gin contains 240Kcal/100mls therefore, type II DM patients should omit 2 fat exchanges for each drink and type 1 DM patients should eat their food as prescribed without omission (Sue, 1994). The author also highlighted that moderate consumption of alcohol may not be too bad. This is because alcohol does not require insulin for its metabolism. It raises HDL-cholesterol and it enhances glucose-lowering

effect of hypoglycemic agents when used in moderate amounts. However Sue (1994) cautioned that high alcohol intake may lead to errors in insulin dosage and accentuation of hypoglycemic attacks. Sue (1994) also maintained that alcohol must be consumed with meals to prevent the incidence of hypoglycemia and that patients with high triglyceride level, hypertension or obesity should abstain from alcohol.

**2. 2 .2 Management with hypoglycemic drug**.

In people for whom lifestyle change is not enough and who are considered to be at high risk of cardiovascular diseases, drug therapy is considered. There is need for drug that could modulate the underlying mechanism of the risk factors and thereby reduce the impact of all the risk factors and long term metabolic and cardiovascular consequences. Large-scale clinical trials have shown that pharmacological treatment can reduce the morbidity and mortality associated with CVD and that long-term or lifelong treatment is often indicated (Knowler, Barret-Connor & Fowler, 2002; Balkrishnan, 2004). Diabetes prevention studies showed that metformin therapy in people with prediabetes prevents or delays the development of diabetes (Knowler *et al*., 2002). Durbin (2004), demonstrated the efficacy of thiazolidinedione in preventing type II diabetes in people with diabetes risk factors. These agents are sulfa drugs (sulfonylurea) that appear to stimulate the secretion of additional insulin by the pancreas in addition to enhancing the sensitivity of body tissues to insulin (Bell, 2004). Other oral hypoglycemia agents include biguanide, tolbutamide and chlopropamide. Their mechanism of action is different from each other. Oral hypoglycemia drugs are recommended to patients as soon as diet therapy alone proves inadequate. Obese Type II DM patients that cannot be properly managed with diet alone will respond well to biguanide, while the non-obese Type II DM will respond

better with sulphonylurea. If adequate control is not achieved, the two drugs may be used and if this fails, insulin will then be required.

The Sulfonylurea as a group generally tend to loose their effectiveness over time after an initial period of success (Bell, 2004). Based on this, continual treatment with a particular sulphonylurea may not be advised. Dosage may have to be adjusted to be able to control blood sugar level fully and effectively using these drugs. Possible side effects include allergic skin reactions, headache, indigestion, nausea, vomiting and liver damage. Tolbutamide is the commonest and well tolerated of the Sulfonylurea. Binguanides are the drug of choice for obese type II diabetes because its administration is not associated with weight gain.

Bell (2004) highlighted that insulin may be used as an additional therapy in type II diabetes in which the maximum dose of oral hypoglycaemic agents have not been able to improve the glycaemic control.

### 2.3 Medicinal Potential of Dietary Plant

The consumption of a variety of dietary plants and herbal preparations as medicine by man is believed to contribute significantly to the improvement of human health, in terms of prevention, and or cure of diseases because plants have long served as a useful and natural source of therapeutic agent (Arnoldi, 2004). The concept of functional food is not new as our ancestors are known to have recognized and highly regarded the health and medicinal values of certain local plants which are part of current daily diet. There is now increased recognition that dietary plants, in addition to providing nutrients, contain phytochemicals which can play important roles in disease prevention by reducing the risk of certain chronic diseases (Lindstom and Uusttupa, 2008).

Aqueous leave extract of bitter leaf (*Venonia Amygdalina*) are used throughout West Africa for the management of diabetes and other metabolic diseases associated with the liver (Leonard, Karim, Bruce & Jay, 2002). The plant has acquired special relevance recently, having been proved in human medicine to possess potent anti-malarial and anthehminitic properties (Abosi and Raseroka, 2005). The pharmacological studies have shown that the leaf extracts have both hypoglycemic and hypolipidemic properties in experimental animals and so could be used in managing diabetes mellitus (Leonard *et al*., 2002).The sesquiterpene lactone extract from the leaves has antihepatotoxic activity in CC14 induced hepatic damage in rats (Babalola, Anetor & Adniyi, 2001). Liver disease is a world-wide problem, conventional drugs used in the treatment of liver disease are sometimes inadequate and can have serious adverse effects. Anti hepatotoxic activity of the leaf extracts of vernonia amygdalina has been reported (Orjiako and Nwanjo, 2006).

Aqueos-extracts of Pumpkin leaf (*Telfaria Occidentalis*) is very high in phenols which can minimize the toxic advanced glycation endproducts (AGEs) caused by diabetic high blood sugar and reduce inflammatory degenerative complication (Debinska-klec, Mykkanen, Klec-wak & Mykkanen, 2008). They highlighted that a major consequences of hyperglycemia is an increased reaction between the blood glucose and amino acids that make up the proteins of the blood serum, e.g. serum albumin and hemoglobin. The sugar-protein reaction is called non-enzymatic glycation and after several further spontaneous reactions, the results are advanced glycation end-products (AGE). AGEs bind to protein receptors found on cells throughout the body and trigger inflammation conditions in diabetics.

### 2. 4 Compliance to Management Regimens

According to the World Health Organization, non-compliance with long-term medication for conditions such as hypertension, dyslipidaemia and diabetes is a common problem that leads to compromised health benefits and serious economic consequences in terms of wasted time, money and uncured disease (WHO, 2003). In addition, a recent editorial referred to the overwhelming evidence for a decrease in morbidity and mortality with the use of antihypertensive therapy, and concluded that the greatest potential for improving control of hypertension lies in improving patient compliance (Baune, 2004). Compliance with medication has become a topic of much research, and various interventions have been proposed to improve patient compliance. However, it has proved difficult to compare studies of compliance because of a lack of standard terminology and methodology.

A literature review of research into patient compliance with antihypertensive, lipid-lowering or oral anti-diabetic medications was therefore performed to aid current understanding of the medical significance of patient compliance in the treatment of CVD. The aims of the study were to review original research papers measuring compliance and/or persistence with anti hypertensive (AHTs), lipid-lowering therapies (LLTs) and oral anti diabetics (OADs) published between 2000 and 2005; to compare the methodology used within the studies to measure compliance/persistence and to assess whether compliance/persistence correlates with clinical outcomes (Karen and Venkat-Naryan 2008). The definitions and measures of compliance/persistence used varied widely between studies making comparisons difficult. However, the use of standard terminology and methodology was adopted. They reported that majority of studies investigating the relationship between compliance and outcome found that compliance had a positive effect on outcome,

suggesting that the management of cardiovascular disease (CVD) may be improved by improving patient's compliance.

## 2.5 Lifestyle and Glycemic Control

The increasing prevalence of diabetes in the world is associated with modernization. Kim *et al. (*2000) highlighted the association of diabetes with changes in lifestyle such as migration from rural to urban settings, over eating, sedentary habits, a change to high fat diets, consumption of refined sugar with lower fibre diets and obesity.

Certainly, strategies on diabetes management need to focus on dietary and physical activity behavior. Evidence of successful control and prevention of type II diabetes was published from Finish Diabetes Prevention Study (Tumilehto *et al.,* 2001). In the study, 522 middle-aged (40-65 years) over weight individuals (BMI > 25 $kg/m^2$) with impaired glucose tolerance were put through an intervention programme consisting of weight loss, reduced total and saturated fat intake, increased dietary fibre and physical activity. The people randomized to the intervention programme received a detailed dietary advice aimed at reducing weight by 5% or more, limiting fat intake to less than 30% of total calories, increasing fibre intake to at least 15g per 100 kcal, and encouraging moderate exercise for at least 30 minutes per day. The group were advised to increase endurance–type activities such as walking, jogging, swimming, etc. The study showed that the increased physical activity and the small weight loss achieved, produced a marked clinical benefit in terms of preventing or delaying by several years the progression to type2 diabetes. The study provided further evidence to strengthen the view that type II diabetes is preventable by behavior change. Previous work has also demonstrated that behavioral interventions are more successful if they adopt ideas of informed choice and the acquisition of skills for self-management (Roter, Hall & Meriska, 1998*).* Understanding the

determinant of human behavior and developing successful approaches to facilitating health promoting behavior change is a major challenge not only in diabetes care but many other areas of chronic diseases.

**Physical Activity and Glycaemic Control**

Exercise plays a key role in the management of diabetes. William (2007) reported that exercise has the general benefit of lowering blood pressure and blood lipids, regular exercise reduce insulin requirements and improve overall blood glucose control in type I diabetes. Exercise can affect blood glucose levels in two ways:
i. If blood glucose control is poor and there is insufficient insulin, the adrenaline released as a result of the exercise can make blood glucose level rise.
ii. If blood glucose is reasonably well controlled, there is usually some supply of insulin and exercise would enhance the potency of available insulin (Cuff, 2003). Here caution should be taken to avoid hypoglycemia by taking extra carbohydrate before the exercise. This would take the form of small quantity of complex carbohydrate as a quick snacks, 2-3 medium-sized garden-egg or a bottle of carbonated beverage about 120 kcal (Cuff, 2003)

It is important that the insulin is not injected into the limb involved in the exercise (the thigh before running) since its absorption may then be enhanced. The abdomen is the preferred site before exercise because it absorbs insulin more consistently slowly. Top-ups of carbohydrate may be needed for endurance exercise and it is imperative that extra carbohydrate is consumed after exercise since its hypoglycemic effect can last for several hours (Cuff, 2003). Barllett (2003) advised that all individuals with diabetes who exercise should be encouraged to follow these guidelines:

- Use proper footwear, and other protective equipment if necessary
- Avoid exercise in extremely hot and cold environment

- Inspect feet daily and after exercise for open areas, blisters, puncture, swelling and redness; report any of these signs to to the physicians immediately.

**2 . 6 Diabetes Education intervention**

Although primary health care physicians currently provide most of the diabetes care in this country, they cannot do all that is required. Often people are discouraged that the current medical system does not function adequately for people with diabetes. The challenge is to find a way to meet the needs of patients with diabetes by broadening the care delivery opportunities available to primary care providers and other health care professionals. Team care meets this challenge by integrating the skills of different health care professionals with those of the patient and family members into a comprehensive lifetime diabetes management program.

**Diabetes Self Management Educational (DSME)**

In this team care programmes, the sessions are interactive between the educators and the patients. The DSME care plan involves discussion between the patient and members of the health team maximizing the self-care knowledge, skills, self awareness, and sense of personal autonomy of patients to enable them to take charge of their own diabetes care.

Diabetes self- management education (DSME), has been considered an important part of the clinical management of diabetes. The American Diabetes Association (ADA, 2004) recommends assessing self-management skills and knowledge of diabetes at least annually and providing or encouraging continuing education.

.Davis, Heller & Skinneric (2008) reported some behavioral changes as shown by the improvement in weight control, reported smoking status and physical activity level, metabolic control and concluded that DSME can successfully engage patients on starting effective life style changes sustainable over time.

**Maintenance-phase interventions**

The DSME intervention goes further than delivering diabetes care in the clinic setting to deliver diabetes education in homes and community gathering places to ensure continuity. Evidence of the effectiveness of DSME was reviewed in community gathering places, the home, the worksite and the school. The effectiveness of educating coworkers and school personnel about diabetes was also reviewed. The effectiveness of intervention for type 1 and type II diabetes was examined separately, as the education of children and adolescents who usually have type I diabetes) is very different from the education of adults (who usually have type II diabetes).

**The Home**

. Robins and Robins *(*2008) reviewed a home diabetes education programme and found that in most home based interventions, educators come to the home of the person with diabetes and assess and address issues that may not be apparent or may be more difficult to manage in the clinical setting.

These issues include cultural, family, and environmental factors affecting lifestyle (particularly diet and physical activity), problem solving, self-monitoring of blood glucose, glycemic control, and the prevention and management of complications

**The Worksite**

The worksite presents important issues for people with diabetes. A worksite intervention could target both the person with diabetes or his or her coworkers or supervisor, making the worksite a potentially important place for DSME. Sussan, Worris, Phyllis & Carl Michael, (2002) maintained that interventions at the worksite may make it easier for people with diabetes to attend, and supervisors, managers, and co-workers may gain valuable information. The supervisor and manager need to support healthy lifestyles; make allowances for meal and snack-time requirements,

self-monitoring of blood glucose, and medical appointments; and promote understanding, tolerance, and support among coworkers.

**Education of School Personnel about Diabetes**

Professionals in the school setting may receive diabetes education with the ultimate goal of improving the health and well-being of children (students) with diabetes. School personnel must have sufficient knowledge about diabetes and its management because they are required by law to provide health-related services to children who required specific health needs (Jarret, Hillam, Lindsay, 1993). Unfortunately, the level of teacher's knowledge about diabetes, especially of life-threatening emergencies such as hypoglycemia, is inadequate and poses a serious threat to the safety and well-being of children who require assistance. To this effect, Krier (1993) proposed involvement of school personnel, particularly teachers in the diabetic team care plan having reported they received inadequate or no training to prepare them for dealing with children who have health conditions. The failure of school personnel to respond in a prompt and appropriate manner could have serious health consequences.

## CHAPTER THREE

# 3.0 MATERIALS AND METHODS

## 3.1 Study Area

The study was carried out in Anambra State at the University of Nigeria Teaching Hospital, Nnewi. The State is located in the South-eastern part of Nigeria and shares boundaries with Abia, Imo, Delta and Enugu States. The climatic condition is tropical rain forest with a temperature of about 30-32$^{o}$C. The people of Anambra State are ethnically Igbo and widely known to be very resourceful and hard working. They are mainly traders and subsistence farmers; skilled manpower resources are also readily available in almost every field. The vernacular spoken is Igbo but English is also widely used as a generic language for administrative and economic transactions.

The State is made up of four health zones – Awka, Onitsha, Nnewi and Aguata. Anambra State contains some of Nigeria's leading commercial cities like Onitsha and Nnewi which play hosts to lots of travelers from all over the country who come to transact business. All classes and categories of people inhabit these two commercial towns; therefore each is suitable for an evidence-based study.

## 3.2 Study Design

The study was multi-stage clinic-based intervention survey using both cross-sectional and longitudinal study design.

## 3.3 Scope of the Study

The study was done in four stages

**1$^{st}$ Stage:** Baseline information on the life-styles and management regimens of the diabetics was collected using structured, validated and pretested questionnaire.

**2nd Stage:** Diabetes educational intervention was instituted to address the identified issues.

**3rd Stage:** Longitudinal study: A sub-sample of 33 subjects with poor diabetic control (Fasting blood sugar (FBS) $\geq$ 160 mg/dl) was followed up for 3 months (taking monthly FBS) to assess the immediate effect of the educational intervention on blood glucose.

**4th Stage:** Post intervention questionnaire was administered 2 years after the intervention on 27 of the initial study population using same questionnaire to assess the effect of the intervention on diabetes management regimens and lifestyles. The 27 Subjects used were recruited by contact tracing.

### 3.4 Study Population

The study population were known type 2 diabetics who were attending the diabetes clinic of Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, Anambra State. The hospital is the biggest tertiary hospital to which patients from every part of the State are referred to for expert medical treatment.

### 3.5 Sample Size Determination

Sample size was obtained using 10% prevalence rate (Nwosu, 2000). Sample size was calculated using the formula $N = 4p\frac{(1-P)}{W^2}$ (Yaro,1964)

Where N = total number of patients required

P = proportion of people assumed to have diabetes, p = 10% (Nwosu, 2000)

W = required precisions level or probability level. For this study, W was taken to be 0.05(5%)

$$N = \frac{4P(1-P)}{W2} = \frac{4 \times 0.1\ (1-0.1)}{(0.05)2} = \frac{0.4 \times 0.9}{0.0025} = \frac{0.36}{0.0025} = 144$$

A sample size of 146 was used for the study.

### 3.6 Sampling Technique.

The subjects used for the cross-sectional study were the confirmed Type II diabetics who had been attending the hospital for at least 6 months. One hundred and forty-six subjects were selected by convenient sampling technique based on willingness to participate in the study after the purpose of the research and their involvement had been explained to them and their consent sought.

The sub-sample with poor diabetic control (blood sugar $\leq$ 160 mg /dl) used for the longitudinal study to access the immediate effect of intervention were similarly selected by convenience sampling technique based on their willingness to participate in the study having been intimated with their involvement.

### 3.7 Exclusion Criteria

Patients with any obvious internal organ disorder e.g renal failure, severe heart or liver diseases were excluded from the study. Patients in very poor state and bed-ridden patients were also excluded from the study

### 3.8 Ethical Clearance

Ten copies of the study proposal were submitted to the Ethical Committee of NAUTH, Nnewi and subsequently their written approval was obtained. Written consent was obtained from the subjects

### 3.9 Tools for data Collection

Tools for data collection were different instruments:- questionnaire, vital signs monitor such as blood pressure, anthropometric measurements and bio-chemical assay.

### 3.10 Data Collection

**3.10.1 Questionnaire:** The questionnaires were validated for content by six lecturers from the Department of Home Science, Nutrition and Dietetics, University of Nigeria, Nsukka. Every necessary correction was effected to get the final draft of the questionnaire. The selected questionnaire items were pre-tested using diabetics from the outpatient clinic of General Hospital, Onitsha.

The questionnaires were administered to the subjects to collect information on personal data, socio-economic characteristics, diabetic management regimens, drug use, activity and food consumption pattern. Vernacular was used where necessary to extract the relevant information.

A twenty-four hour dietary recall was also obtained from the subjects. Subjects were asked to recall all the foods eaten in the past 24 hours preceding the interview and the time the foods were eaten, including snacks and foods eaten outside the home.

#### 3.10.2 Blood Pressure

Blood pressure (BP) readings were obtained from the patient's case folder as it is routinely done on every patient. The doctor`s diagnosis of hypertension was used to identify the subjects as hypertensive or not.

#### 3.10.3 Anthropometric Measurement

Anthropometrics measurements of weight and height were done to determine their body mass index (BMI). All measurements were made using standardized procedure (WHO, 1995). Weight in kilogram was taken in light clothing using standard weighing balance (Hanson bathroom scale) which was graduated in kilograms from 0 -120 kg. The body weight was recorded to the nearest 0.1 kg. Height in meter was measured bare-footed using a standard height meter. The subjects were made to stand

on a horizontal platform with feet parallel to each other and the heels level on the ground. Measurement was taken to the nearest 0.1cm and recorded.

### *3.*11 Biochemical Assay

Fasting blood glucose levels of the subjects were estimated at monthly intervals and used to assess the diabetic status. The mean of the last three consecutive fasting blood glucose readings was used to categories the subjects into two groups-

Good diabetic control (≤160mg/dl or < 8.9 mmol/L (**Source:** NAUTH diabetic clinic routine FBS interpretation chart)

Poor diabetic control (>160mg/dl or ≥8.9 mml/L

Fasting venous blood samples were drawn from the subjects into fluoride oxalate bottles for analysis

**Glucose analysis**

Ultimate 5 GLUC HK an in vitro diagnostic reagent system for use in the quantitative determination of glucose in serum, plasma or urine was used. The analysis was based on an HK/G6P-DH, UV test method. The samples were mixed with reagents and incubated for 10 minutes against a blank at 365 nm. The principles involved in this analytical method is summarized in this equation:

D-glucose + ATP------- HK--------D-glucose-6-p+ADP
D-glucose-6-p + NAD+_____D-glucose-6-p + NADH + H

The formation of NADH is directly related to the glucose concentration present in solution. The complex formed is measured photo-metrically. A Roche controlled serum was used. The coefficient of variation obtained in the analytical technique was 0.7%. (AOAC,1995)

### 3.12 Diabetes Educational Intervention Programme

This was done for all the subjects on the following three key areas of diabetes management:

i Dietary Management

ii Counseling on behavioral modification

iii Exercise/physical activity

**1. Dietary Management :** Meals were predominantly high fibre, low fat, complex carbohydrate and moderate protein. The following age modified calories were used:

**Table 3.1: Age modified caloric requirements for diabetics**

| | Sedentary | | Moderately active | | Active | |
|---|---|---|---|---|---|---|
| **Age** | **M** | **F** | **M** | **F** | **M** | **F** |
| <40 yrs | 2400 | 2000 kcal | 2600 | 2200 | 3000 | 2600 |
| 40-50 yrs | 2200 | 1800 kcal | 2400 | 2000 | 2800 | 2200 |
| 51-60 | 2000 | 1600 kcal | 2200 | 1800 | 2400 | 2000 |
| 61-70 | 1800 | 1400 kcal | 2000 | 1600 | 2200 | 1800 |
| < 70 | 1400 | 1200 kcal | 1800 | 1400 | 2000 | 1600 |

**Source: ADA (2004)**

The energy distribution was based on 55 - 60% total carbohydrate, total fat contributed 25% of which saturated fat was limited to < 8%, poly unsaturated 15%, monounsaturated 7%; total protein 20% (animal protein 8% and plant protein 12%); the micronutrients needed for bone mineralization, electrolyte balance and cellular metabolism were provided by vegetables and fruits. The menu was planned according to patients food choices and given in 6 divided small meals

**Conversion of kcal to grams using 1,800 Kcal**

Carbohydrate 55% = 55/100 x 1800 = 990/4 = 247.5g x1/6 = 41.25 g

Fat 25% = 25/100 x 1800 = 450/9 = 50g x 1/6 = 8.3

Protein 20% = 20/100 x 1800 = 360/4 = 90g x 1/6 = 15.0 g

Table 3.2 shows the energy distribution in grams from various sources. The daily intake was given in 6 divided meals with lunch having greater quantity.

**Table 3.2 : Energy distribution (grams) from various sources**

| Meal time | Proportion of daily intake | Carbohydrate | Fat | Protein |
|---|---|---|---|---|
| Breakfast | 1/6 | 41.25g | 8.3g | 15g |
| Midmorning | 1/6 | 41.25g | 8.3g | 15g |
| Lunch | 2/6 | 82.5g | 17g | 30g |
| Mid afternoon | 1/6 | 41.25g | 8.3g | 15g |
| Dinner | 1/6 | 41.25g | 8.3g | 15g |
| Bedtime | 1/6 | 41.25g | 8.3g | 15g |
| **Total** | **6/6** | **249g** | **50g** | **90g** |

**Diabetic Food Exchange Guide**

Below are few rules of thumb for exchanging one food for another within the parameters of a diabetic diet. An exchange equals one serving, and allowed exchanges will contain almost identical caloric, carbohydrate, protein and fat values.

**Diabetic Carbohydrate Exchanges**

Nutrient content of 1exchange from this group is as follows:

Carbohydrate 15g, protein 3g, fat 1g, giving a total calorie of 81 kcal. In this group are bread, cereals, grains, tubers, starchy vegetables like Irish-potatoes. One slice of a medium loaf of bread, $^{1}/_{3}$ cigarette cup cooked rice, ½ cup boiled Irish potato, $^{1}/_{3}$ cup cooked garri and equivalent servings of unripe plantain, cocoyam, yam among others.

**Diabetic Meat Exchange (1 oz servings).**

1 meat exchange is about 7g protein such as lean beef, fish, chicken, eggs, snail.

Legumes such as cowpea, breadfruit, bambara groundnut and other nut groups about $^{1}/_{2}$ cup.

**Diabetic Fat Exchange (mainly mono and poly unsaturated fat).** 1 fat exchange is 5g fat.

1 tsp oil, 1 tbsp peanut/cashew nut, 1tbsp low fat margarine or 1tsp regular margarine.

**Diabetic Vegetable Exchange ( non-starchy vegetables only)**

Green leafy vegetables- pumpkin leaf, bitter leaf, lettuce, cabbage, fresh tomatoes- about $1\text{-}1^{1}/_{2}$ kitchen spoon (cooked). One vegetable exchange is 5g carbohydrate.

**Diabetes Fruit Exchange** A serving is about 1 small apple, 1 medium finger of banana, 1 medium mangoes, 2 medium 1 large guava, 2 medium cashew, 2 African star apple (*udala*). 1exchange is 10g carbohydrate.

**Diabetic Milk (Dairy) Exchange:**

1 cup of milk, 2/3 cup of yogurt. One milk exchange supplies the following:-

Skim milk – 12g carbohydrate, 8g protein and 0-3g fat, a total calorie of 90 kcal.

Low fat milk – 12g carbohydrate, 8g protein and 5g fat, a total calorie of 120 kcal.

whole milk – 12g carbohydrate, 8g protein and 8g fat, a total calorie of 150kcal

**Source: http//www.diabeticdietfordiabetes.com/foodexchange.htm; Retrieved 26/11/10**

**2. Counseling the subjects on Behavioral Modification**

An interactive session was held with every subject, (146 in number) counseling him/her on how to adopt good habits and discouraging detrimental habits, helping them to know the relevance of compliance to their dietary advice, activity pattern and drugs as prescribed by the doctor. Frequent nibbling of food was discouraged as well as sedentary life style like continuous watching of TV all day or constant sleeping all day. Use of visual aids like food guide pyramids containing locally available food products was employed. Household food measures were also used in helping subjects to quantify their intake. The household food measures included: kitchen spoon (ksp), tablespoon (tbsp), teaspoon (tsp), cups and plates of various sizes. The subjects were encouraged to keep to the study instructions.

**Table 3.3:2-day menu for age range 40-50 years and 1,800 kilocalorie per day.**

| Food items | Kcal | Prot(g) | Fat(g) | CHO(g) |
|---|---|---|---|---|
| **breakfast:** ***Moi moi and Pap*** | | | | |
| 100g Cowpea | 116 | 9 | - | 20 |
| 5g oil & 30g crayfish in *moi moi* | 73 | 7 | 5 | - |
| 200 mls *pap* | 140 | - | - | 33 |
| **Mid morning:** 2fruit exchange garden egg | 120 | - | - | 30 |
| **Lunch: Wheat and vegetable soup** | | | | |
| 400g wheat *fufu* | 372 | 7 | - | 86 |
| Soup ingredients: 3oz lean meat, 2veg exchange, | | | | |
| 1meat exchange of crayfish, 10g oil | 366 | 32 | 22 | 10 |
| **Mid afternoon:** 1milk exchange of low fat milk | 120 | 8 | 5 | 12 |
| **Supper: Plantain pottage & vegetable** | | | | |
| 200g Plantain | 194 | 4 | 2 | 40 |
| Ingredients: 60g fish, 1veg. exchange and 10g oil | 208 | 16 | 16 | - |
| **Bedtime snacks:** 2 medium finger of carrot | 60 | - | - | 15 |
| **Total** | **1797** | **90** | **50** | **247** |
| **Day ii** | | | | |
| **Breakfast:** 2 slices of medium loaf bread | 80 | 3 | 1 | 15 |
| 1milk exchange of low fat milk | 120 | 8 | 5 | 12 |
| **Mid-morning:** 1 wrap of 100g *okpa* | 80 | 3 | 1 | 15 |
| **Lunch: Rice and vegetable stew** | | | | |
| 350g of rice | 322 | 8 | 4 | 75 |
| Stew with 3oz lean meat, 2 veg. exchange , 15g oil | 405 | 26 | 24 | 10 |
| 2 fruit exchange of tomato | 120 | - | - | -30 |
| **Mid afternoon:** 2 fruit exchange of watermelon | 120 | - | - | 30 |
| **Supper: Cowpea pottage** | | | | |
| 250g Cowpea | 288 | 22 | - | -50 |
| Ingredients:10g oil, 30g crayfish | 108 | 7 | 10 | - |
| **Bed time snacks**; 1milk exchange of low fat milk | 120 | 8 | 5 | 12 |
| **Total** | **1773** | **85** | **50** | **249** |

Moi moi = cowpea pudding; fufu = cooked paste from various flours;

okpa = steamed bambara-nut pudding

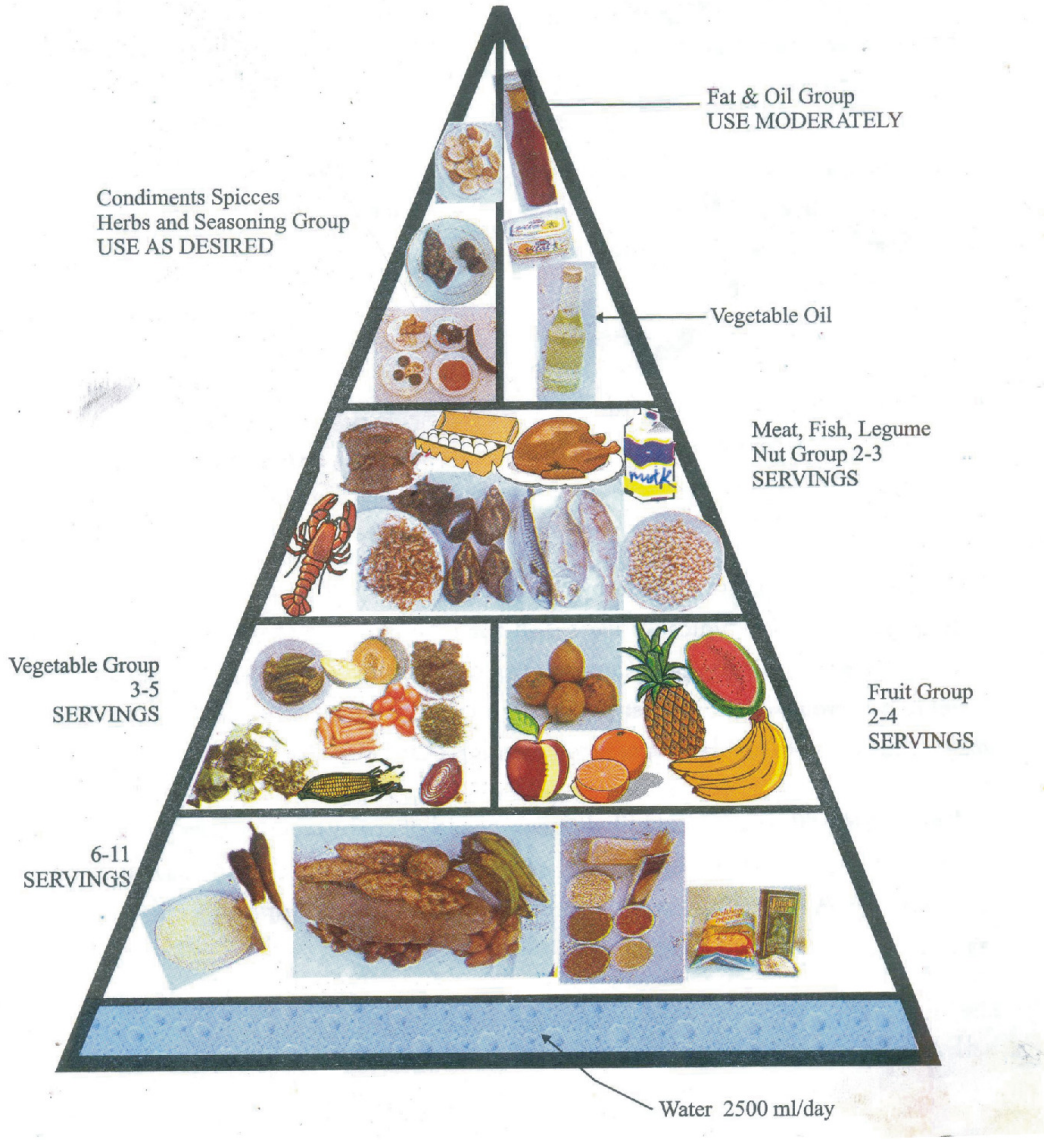


**Figure 3.1 Proposed Food Guide Pyramid for Nigeria**
**Source: Ene-Obong (2001)**

### 3. Exercise/Physical Activity

The group A subjects were put through to physical activities individually depending on age, sex and health condition. The physical activities ranged from active to moderate and mild activities. Any activity to increase energy expenditure was instituted taking into consideration the intensity, duration and frequency of the activities weekly. The subject's BMR was calculated using the arithmetical equation for BMR. The general equation for the calculation of BMR was based on gender, age and weight of the individual.

The following equation for the estimation of BMR (FAO / WHO / UNU, 1985) was adopted:-

| **Gender** | **Age** | **B M R** |
|---|---|---|
| **Male** | 30-60 yrs | = 11.6 w +879 |
| | Above 60 yrs | = 13.5 w + 487 |
| **Female** | 30-60 yrs | = 8.7 w + 829 |
| | Above 60 yrs | = 10.5 w + 596 where w = weight in kg |

For example the BMR of a 70 yrs male subject, weighing 75kg =13.5x75 + 487 =1499.5 = 1.4995 kg/$m^2$ and for a woman of the same age and weight, the BMR =10.5 x75 =596 =1383.5 = 1.3835 kg/$m^2$. The estimated BMR of the subjects were used as a guide to plan individual activities to increase their BMR.

Depending on the subject's BMR, appropriate activity was selected from the under listed activities (Table 3.3) and subjects were encouraged to continue the activity for at least 30minutes, 3-5 times per week throughout the 3 months follow-up period.

**Table 3.4 : Gross Energy Expenditure on Specified Activities**

| Activity range (for >30 mins 3-5 times per wk) | BMR Equivalent (kg/m$^2$) | |
|---|---|---|
| | **Male** | **Female** |
| Sitting and stretching hands and legs | 2.2 | 2.1 |
| Standing and moving around | 1.6 | 1.6 |
| Washing clothes | 2.2 | 3.0 |
| Walking to markets, work place and | | |
| Social visits at normal pace | 3.2 | 3.4 |
| Winnowing/minor weeding | 3.9 | 2.7 |
| Cooking and other house chores | 1.8–2.5 | 1.8–2.5 |

**Source; FAO / WHO / UNU (1985).**

### 3.12 Assessment of the Educational Intervention

#### 3.12.1 Assessment of Immediate Effect of Intervention on Blood Glucose

Thirty eight (38) subjects with poor diabetic control (blood sugar level above 160mg/dl) were recruited to assess the educational intervention developed by the researcher, but 33 completed the session. They were enlightened on the crucial aspect of diabetic management, helping them to quantify their food intake to recommended level using various house-hold measures of glasses and plates. They were randomly divided into 3 study groups (A.B.C) according to the type of diabetes management they were using. Group C served as control.

Group A: Drug, diet and exercise. (13 recruited, 12 reported and completed the study)

Group B: Drug, diet and aqueous vegetable extracts.(12 recruited,12 reported and 11 completed the study.

Group C: Drug and diet only (13 recruited, 10reported and completed the study).

These three study groups were monitored and followed up for 3 months. During this period the subjects had their fasting plasma blood sample taken monthly for fasting blood sugar estimation. Blood sample collection was taken between 8 and 10am on

collection days then followed by brief counseling to note any complaint the subject may have. The results were compared after three months.

### 3.12.2 Assessment of the Impact of Intervention on Target Population after 2 yrs

A repeat cross-sectional data were collected after 2 years of the Intervention using the same questionnaire used in the initial study. A sub sample of 27 subjects who participated in the first phase of the study was used. The results were compared to assess the long term effect of the intervention on target population after two years.

## 3.13 Data Analysis

**Body Mass Index**

The body mass index (BMI, technique was used in the assessment of the adequacy of weight of the subjects. The BMI was calculated as $BMI = \frac{\text{Weight (kg)}}{\text{Height.(m)}^2}$

BMI classification were done according to WHO recommendation (WHO,1997).

| | | |
|---|---|---|
| **Under weight** | = | < 18.5 |
| **Normal weight** | = | 18.5–24.9 |
| **Over weight** | = | > 25 |
| **Pre obese** | = | 25.0-29.9 |
| **Obese type 1** | = | 30.0-34.9 |
| **Obese type 2** | = | 35.0-39.0 |
| **Obese type 3** | = | > 40.0 |

3.13.2 Diabetes Knowledge

Out of the 20 test questions on diabetics knowledge, scoring 10 (50%) or more questions correctly was deemed good knowledge while scoring 40 - 49% was deemed fair knowledge and below 40% was deemed poor knowledge.

Good diabetic knowledge - Scores 50 % or more of the test questions

Fair diabetic knowledge - Scores 40 - 49 % of the test question

Poor Diabetes Knowledge - Scores less than 40% of the test questions

**Nutrition Knowledge**

| | |
|---|---|
| Good nutrition knowledge | Scores 50 % or more of the test question |
| Fair nutrition knowledge | Scores 40 - 49 % of the test question |
| Poor nutrition knowledge | Scores less than 40 % of the test question |

### 3.13.3 Compliance with management Regimens

**Drug Compliance**

| | |
|---|---|
| Good drug compliance | Take drug daily as prescribed by the doctor. |
| Partial drug compliance | Take drug daily as prescribed, omitted drug once occationally |
| Non-compliance to drug | Not taking drug daily as prescribed by the doctor and omits drug often. |

**Dietary Compliance**

| | |
|---|---|
| Good dietary compliance | Keep to dietary instructions and rarely skip meals |
| Partial dietary compliance | Not keeping to dietary instructions and skip meals occationally |
| Non dietary compliance | Not keep dietary instruction and skip meal often. |

**Compliance to Laboratory test**

| | |
|---|---|
| Good compliance to Laboratory test | Keep to doctor's instructions or do self monthly blood glucose monitoring. |
| Partial compliance to Laboratory test. | Do not keep to doctor's instruction but do test only occasionally. |
| Non compliance to Laboratory | Rarely do test except when ill. |

**Compliance to Medical check-up**

| | |
|---|---|
| Full compliance | Keep doctor's appointment and/or regular blood glucose monitoring |
| Partial compliance | Not keeping doctor's appointment and occasional glucose monitoring |
| Non compliance | Rarely go to hospital except when ill. |

### 3.13.4 Diabetic Status

Controlled DM — Fasting blood sugar (FBS) of 160mg/dl or less (≤8.9mmol/L) for three consecutive times

Uncontrolled DM — Fasting blood sugar above 160mg/dl (>8.9mmol/L) for 3 consecutive times

### 3.13.5 Activity Pattern

Active: All household activities like washing clothes, scrubbing etc; long trekking 30 mins or more, weeding, farm work, recreational activities. All these for 3 -5 times per week.

Semi Active — Trekking for less than 30 minutes and some house chores for less than 3 times per week.

Inactive — Strolling occasionally for 10 minutes or less, sitting or lying down most times.

### 3.14 Statistical Analysis

The data were analyzed using statistical package for social sciences (SPSS) computer software. Descriptive statistics, e.g. frequencies, percentages, mean and standard deviations (SD) were calculated. Chi-square and *t*-test analyses were used to identify possible facilitators and hindrances to diabetes control at baseline and after the intervention. Differences in consumption pattern at baseline and after the intervention were also examined using chi-square and t-test analyses. A p-value of$<0.05$ was considered statistically significant.

# CHAPTER FOUR

# RESULTS

## Personal characteristics of the subjects by sex

Table 1 shows the distribution of age and marital status of the subjects by sex. Of the 146 subjects that participated in the study, 38% were males and 62% were females. The subjects had an overall mean age of 59.1±11.2 years with a range of 22-83years. The mean age for males and female were 59±10.7 and 59.2±11.4, respectively. Seven percent (7%) of the subjects were below 40 years; 14% were within the age range of 40 - 49yrs; 27% were between the ages of 50-59 yrs; 52% were 60 years and above. Majority of the subjects (73%) were married, 18% were widowed, 9% were either single or divorced.

**Table 1: Age and marital status of the subjects by sex**

| Variables | Male (%) | Female (%) | Total (%) |
|---|---|---|---|
| **Age (Years)** | | | |
| < 40 | 3 (5.5) | 7 (8.0) | 10 (7.0) |
| 40 – 49 | 9 (16.0) | 11 (12.0) | 20 (14.0) |
| 50 – 59 | 12 (21.0) | 28 (31.0) | 40 (27.0) |
| 60 – 69 | 24 (43.0) | 22 (24.5) | 46 (31.5) |
| 70 & Above | 8 (14.5) | 22 (24.5) | 30 (20.5) |
| Total | 56 (100.0) | 90 (100.0) | 146 (100.0) |
| Mean | 59 ± 10.7 | 59.2 ± 11.4 | 59.1 ± 11.2 |
| **Marital Status** | | | |
| Married | 47 (84.0) | 60 (67.0) | 107 (73.0) |
| Widowed | 6 (10.7) | 20 (22.0) | 26 (18.0) |
| Single/Divorced | 3 (5.3) | 10 (11.0) | 13 (9.0) |
| Total | 56 (1000) | 90 (100.0) | 146 (100.0) |

**Socio-economic characteristics of the subjects by sex**

Table 2 shows the educational, occupational and income levels of the subjects. Few subjects (9%) had no formal education. Thirty-eight (38%) percent of the subjects had primary education. Twenty-five subjects (17%) had secondary education and 52 subjects (36%) had post secondary and tertiary education.

Forty percent (40%) of the subjects were engaged in petty trading; 16.0% of them were civil servants; 14.0% of the subjects were aged and dependent; 12% were retired; 11% of the subjects were business executives; 5% were artisan farmers and 2% were house wives.

More than a half of the population (60%) could not quantify their income. Of the 58 subjects who quantified their income, 19% of them earned less than ₦10,000 per month; 33% earned ₦10,000-19,000 per month; (17%) earned ₦20-29,000 per month; 14.0% earned ₦30-39,000 and the remaining 17% earned ₦40,000 or more per month.

**Table 2: Educational, occupational and income levels of the subjects by sex**

| Variables | Male | Female | Total ) |
|---|---|---|---|
| **Education** | | | |
| Non-formal | 2 (3.5) | 11(12.0) | 13 (9.0) |
| Primary | 31(55.5) | 25(28.0) | 56 (38.0) |
| Secondary | 10 (18.0) | 15(16.5) | 25 (17.0) |
| Post sec Ed | 13 (23.0) | 39(43.5) | 52 (36.0) |
| **Total** | **56 (100)** | **90(100)** | **90(100 )** |
| **Occupation** | | | |
| Housewives | 0 | 3(3.3) | 3 (2.0) |
| Farmers | 3(5.5) | 5(5.5) | 8 (5.0) |
| Business executive | 11(19.5) | 5 (5.5) | 16(11.0) |
| Retired | 11(19.5) | 7 (8.0) | 18(12.0) |
| Aged | 8(14.5) | 12(13.3) | 20(14.0) |
| Civil servant | 9 (16.o) | 14(15.4) | 23(16.0) |
| Petty trading | 14(25.0) | 44(49.0) | 58(40.0) |
| Total | 56 (100) | 90(100 ) | 146 (100.0) |
| **Income** | | | |
| <10,000 | 4(12%) | 7 (28) | 11(19) |
| 10-19,000 | 13 (40.0) | 6 (24) | 19 (13) |
| 20-29,000 | 7 (21.0) | 3(12) | 10 (7) |
| 30-39,000 | 3 (9.0) | 5 (20) | 8 (14) |
| >40,000 | 6 (18.0) | 4 (16) | 10 (17) |
| **Total** | **33(100)** | **25 (100** | **58(100)** |

**Health and medical profile of the subjects**

Table 3 shows the predominant symptoms experienced by the subjects at onset of the disease and duration of symptoms before treatment. The predominant symptoms experienced by the subjects at onset of the disease were mainly excessive urination (47%), excessive thirst (31%), weight loss (13%), weakness (8%) blurred vision (7%), excessive hunger (5%). However, 25 subjects (17%) had no symptoms but were diagnosed diabetic during laboratory tests for other ailments.

The Table also shows that 43 subjects (29.5%) reported to hospital within one month of their experiencing the symptoms, 33% waited for 1-6 months before reporting to hospital, 16.5% waited for 7-12 months before going for treatment, 4% delayed for more than 1yr before reporting to hospital. The remaining 17% had no symptoms but were discovered when they were being treated for another illness.

**Table 3: Predominant symptoms experienced by the subjects at the onset of the disease and duration of the symptoms before seeking treatment.**

| | Frequency | Percentage |
|---|---|---|
| **Initial symptoms** | | |
| . | | |
| Excessive urination | 69 | 47 |
| Excessive Thirst | 45 | 31 |
| No symptoms | 25 | 17 |
| Weight loss | 19 | 13 |
| Weakness | 12 | 8 |
| Blurred vision | 10 | 7 |
| Excessive Hunger | 7 | 5 |
| **Duration of symptoms** | | |
| **before going for treatment** | | |
| 1 - 6 month | 48 | 33 |
| < 6 months | 43 | 29.5 |
| No **symptoms** | 25 | 17.0 |
| 7 – 12 months | 24 | 16.5 |
| > 12 months | 6 | 4.0 |
| **Total** | **146** | **100.0** |

Figure I shows other disease conditions suffered by the subjects. Many (40%) were hypertensive, 20.5% had cataract and other eye problems, 12.5% complained of weakness and malaise and 5% infective conditions like boils and infected wound. The remaining 22% had no other disease condition except diabetes.

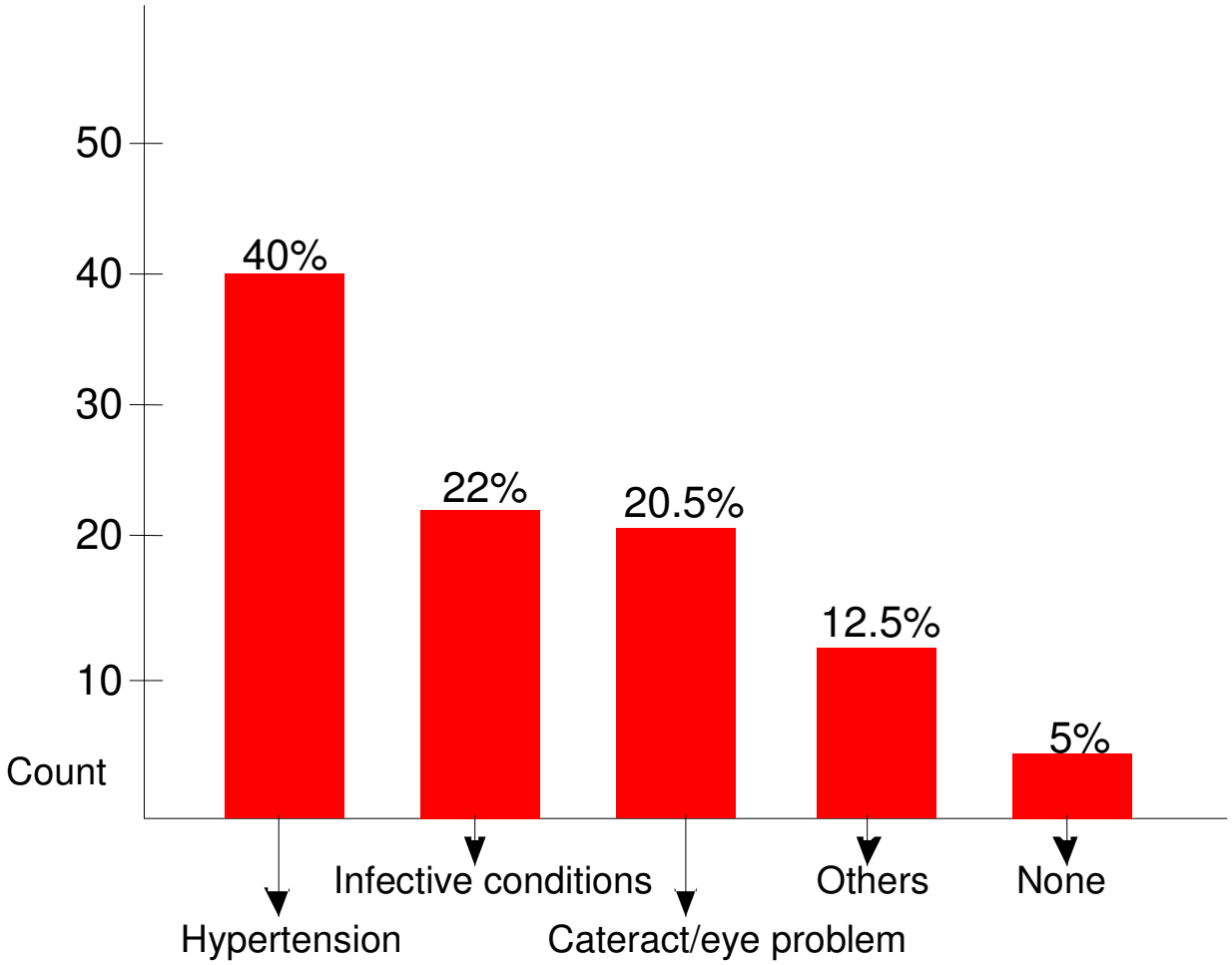


**Fig. 1: Other Disease Conditions of the subjects**

Table 4 shows the initial places consulted by the subject in seeking diabetes treatment. The initial places consulted by the subjects in seeking diabetes treatment were as follows: hospitals 78%, traditional healers 13% and spiritual homes 9%.

**Table 4: The first place visited in seeking diabetes treatment**

| Place of Treatment | Frequency | Percentage |
|---|---|---|
| Hospital | 114 | 78 |
| Traditional healer | 19 | 13 |
| Spiritual home | 13 | 9 |
| **Total** | **146** | **100** |

The subjects received dietary counseling from both professionals and non professionals (fig 2). Slightly more than a half of the population (51%) were counseled by doctors, 19% by dieticians, 13% by nurses and other paramedical, 8% by non medical friends and relations and 9% by fellow diabetic patients

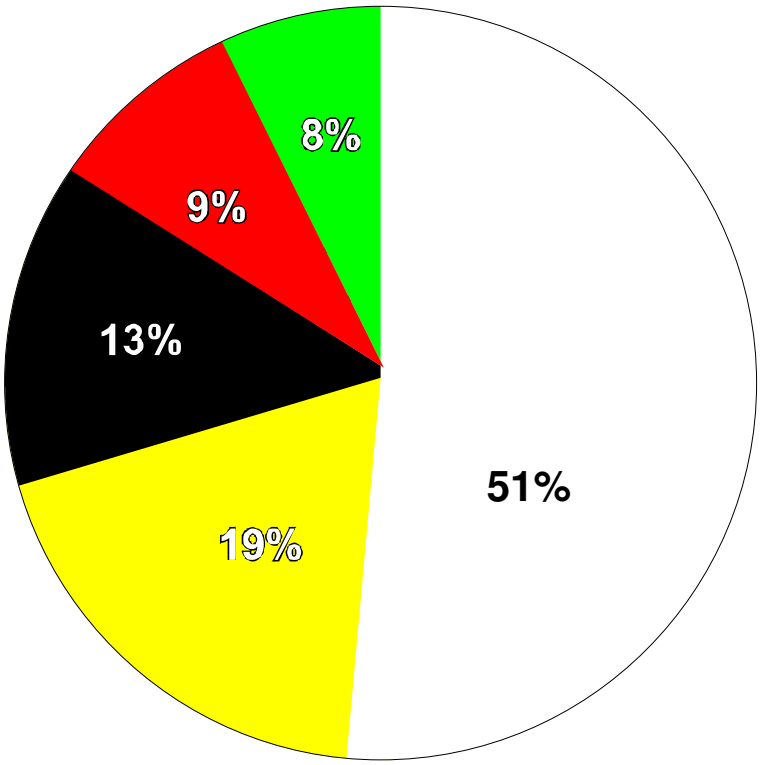


**Fig. 2 Dietary Counselling**

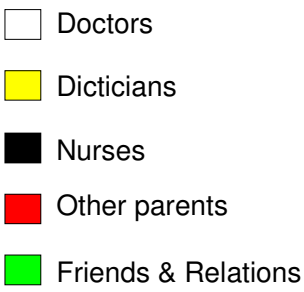

Figure 3 shows the type of diabetes management regimens utilized. Majority (75.7%) of the subjects used drug and diet for the management of their diabetes, 16.6% used liquid extracts of bitter-leaf and pumpkin-leaf in addition to their drug and diet, 7% used drug alone and only one subject (0.7%) used diet alone.

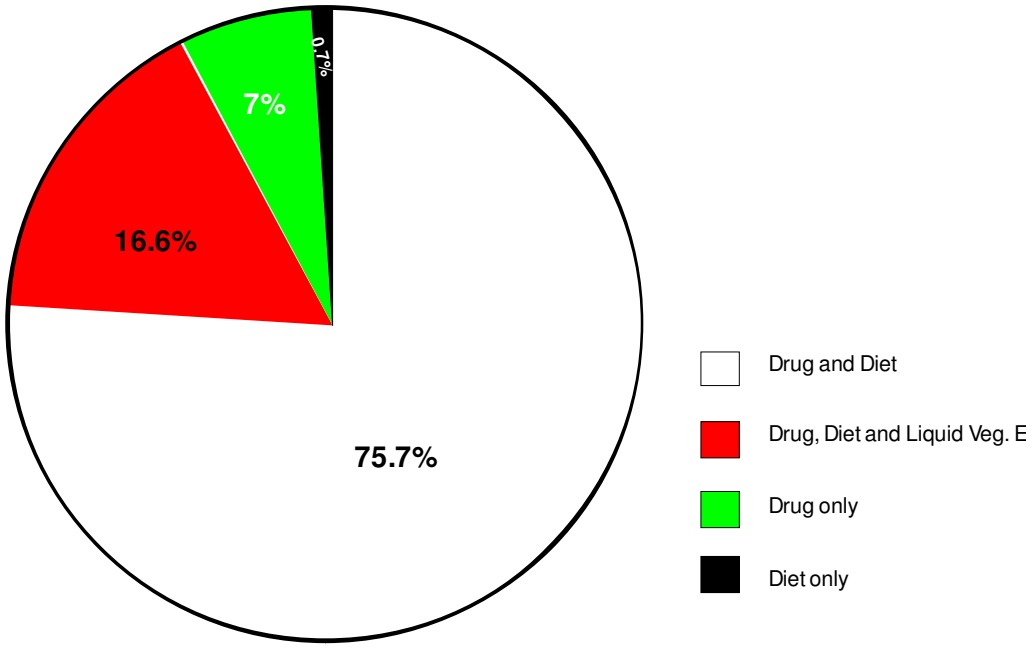


**Fig 3: Types of Diabetic managment used by the subjects**

Figure 4 shows that 71% of the subjects used a combination of daonil and glucophage tablets for their diabetes management, 14.5% used both insulin injection and daonil or glucophage tablets, 6% used daonil tablets alone, 5.5% used glucophage tablets alone and 3% used diet alone or diet and occasional drug for the control of their diabetes.

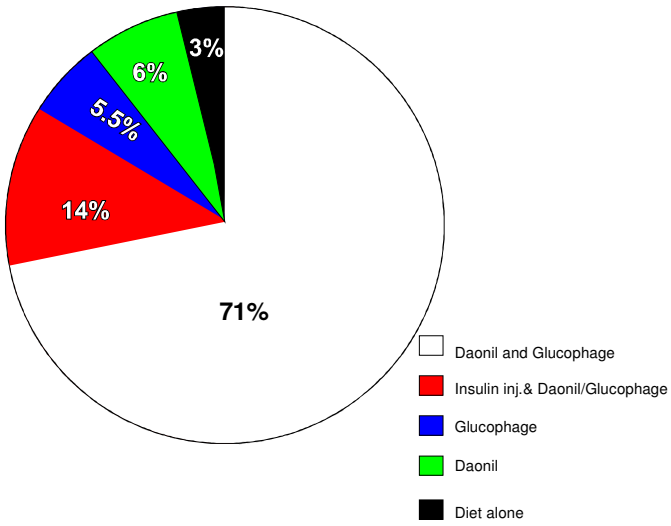


**Fig. 4: Types of Drug used by the Subjects**

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**24- Hour Dietary Recall of the Subjects.**

Table 5 shows the 24 hour dietary recall of the subjects. Foods recalled for breakfast were as follows: cowpea porridge (15%), cowpea with yam or coco-yam or unripe plantain (8%), lipton tea and milk/soya milk with okpa / moi-moi (8%) or with crackers / wheat bread (5%), pap and okpa / moimoi / akara (12%).

During lunch, the foods mostly recalled were still cowpea porridge (27%), cowpea and yam / cocoa yam / unripe plantain pottage (13.5%). These were followed by unripe plantain in various combinations (13%). Recall of breadfruit porridge was 10%

For supper, unripe plantain prepared in various ways with vegetables ranked highest among the foods recalled (40%). Combinations of wheat flour fufu and vegetable soup (19.5%) ranked 2$^{nd}$, followed by cowpea porridge (18%) and bread-fruit (15%). Fish (59%) and meat (45.8%) were mostly recalled for lunch and supper.

Fruits mostly recalled by the subjects were garden egg (56%), avocado pear (28%) and firm-ripened paw-paw (14%). The commonest snacks recalled by the subjects were garden-egg (36%), okpa or moi-moi often with soya milk (12%) and crackers and carbonated drink (8%).Recall of alcoholic, carbonated and malt drinks were16%, 13% and 4%.respectively.

**Table 5: The 24 hour Dietary Recall**

| Food items | Breakfast | Lunch | Super | Snack | Total |
|---|---|---|---|---|---|
| Lipton tea and milk/soya milk with *moimoi/okpa.* | 12 (8%) | – | – | – | 2 (8%) |
| Pap and *okpa/moimoi/akara* | 18(12%) | | - | - | 18(12%) |
| Unripe plantain pottage with vegetable. | 5 (3.5%) | 11 (7.5%) | 45 (31%) | – | 61 (42%) |
| Roasted unripe plantain & oil | - | 19(13%) | 13(9%) | | 32(22%) |
| Cowpea pottage | 22 (15%) | 40 (27%) | 26 (18%) | – | 98 (67%) |
| Cowpea and yam/cocoyam/ unripe plantain. | 12(8%) | 20(13.5%) | 7(5%) | | 39(26%) |
| Cowpea and rice with vegetable. | 8 (5.5%) | 12 (8%) | 2 (1.5%) | – | 22 (15%) |
| Rice and vegetable. | 3 (2%) | 12 (8%) | – | – | 15 (10%) |
| Breadfruit(*Treculia africana*) pottage | 3 (2%) | 15 (10%) | 22 (15%) | – | 40 (27%) |
| *Okpa* or *moimoi* with milk drink | | 7 (5%) | – | 18 (12%) | 30 (20.5%) |
| Cocoyam/water yam pottage with vegetable. | 3 (2%) | 3 (2%) | 10 (7%) | – | 16 (11%) |
| Wheat *fufu* with vegetable soup. | 9 (6%) | 11 (7.5%) | 28 (19.5%) | – | 48 (33%) |
| Pounded unripe banana/plantain and *garri* with vegetable soup. | – | – | 3 (2%) | – | 3 (2%) |
| ccassava/unripe plantain /wheat flours *fufu* with vegetable soup. | 5 (3.5%) | 2 (1.5%) | 15 (10%) | – | 22 (15%) |
| Only *garri* and vegetable soup. | – | 3 (2%) | – | – | 3 (2%) |
| Irish potato and vegetable sauce. | 3 (2%) | – | 4 (3%) | – | 7 (5%) |
| Crackers and carbonated drink. | – | 7 (5%) | – | 12 (8%) | 19 (13%) |
| Cracker biscuit and Malt drink | – | 4 (3%) | – | 2 (1.5%) | 6 (4.5%) |
| Alcoholic drinks | – | – | 3 (2%) | 21 (14%) | 24 (16%) |
| Garden egg (*Solanium nigrum*) | 3 (2%) | 19 (13%) | 7 (5%) | 53 (36%) | 82 (56%) |
| Avocado pear (*Persia americna)* | – | – | – | – | 40 (27%) |
| Water melon (*Citrullis vulgaris*) | – | – | – | 4 (3%) | 4 (3%) |
| Pawpaw (*Carica papaya*) | – | 6 (4%) | 3 (2%) | 11 (7.5%) | 20 (14%) |
| Orange (*Citrus sinensis*) | 2 (1.5%) | – | 3 (2%) | 7 (5%) | 13 (9%) |
| Cucumber | 4 (3%) | 6 (4%) | 2 (1.5%) | 4 (3%) | 16 (11%) |
| Bush mango (*Irvingia gabonesis* | – | – | – | 8 (5.5%) | 8 (5.5%) |
| Meat | 3 (2%) | 17 (11.6%) | 47 (32.2%) | – | 67 (45.8%) |
| Fish | 7 (5%) | 20 (14%) | 59 (40%) | – | 86 (59%) |

Moi moi = beans pudding; akara = fried bean cake; okpa = steamed bambara-nut pudding

Pap = corn gruel; fufu = cooked paste from various flours.

Tables 6a shows the relationship between carbohydrate and fat consumption of the subjects and their diabetes status. Unripe plantain consumption ranked highest in their carbohydrate consumption. Eighty three percent (83%) of the subjects that had controlled DM and 75.0% of the subjects that had uncontrolled DM increased their consumption of unripe plantain. There was no significant ($p>0.05$) difference in the consumption of unripe plantain between the controlled and uncontrolled diabetics. Majority of the subjects were avoiding bread (74% controlled DM and 70% uncontrolled DM. Similarly there was no significant ($p>0.05$) difference in the consumption of rice, wheat/cocoyam/water-yam fufu among the controlled and uncontrolled diabetic subjects. There was an increase in the intake of palm oil and a decrease in the intake of vegetable oil in both controlled and uncontrolled DM subjects.

Table 6b shows the consumption of protein foods and legumes among the subjects. Cowpea was the most commonly consumed legume by the subjects (96.5%). The controlled and uncontrolled diabetics showed no significant difference ($p>0.05$) in their cowpea consumption. Bread-fruit (ukwa) ranked 2$^{nd}$ (75%) as the most frequently consumed legume. More of those that had uncontrolled DM (80.0%) than those that had controlled DM (71.0%) had increased breadfruit intake though this did not make any significant difference ($p>0.05$).

Many subjects (51.4%) decreased their meat intake, both controlled and uncontrolled DM and 62.5% increased their intake of fish both controlled and uncontrolled DM alike. The consumption of milk (55.5%) and soya milk (60%) were high. There was no significant difference in the consumption of these protein food among the controlled and uncontrolled diabetics ($p>0.05$)

Table 6c shows the consumption of fruits, vegetables and beverages. Many subjects (56%) had increased their vegetable intake. However 56% also decreased their fruit consumptions. In all these, there was no significant ($p>0.05$) difference in the consumption pattern between the controlled and uncontrolled diabetics.

Many subjects had avoided consumption of alcoholic drinks, 64.3% and 68.3% for both the controlled and uncontrolled diabetics respectively. Lipton tea was preferred of all the beverages. Majority (86%) avoided the intake of carbonated beverages for both controlled and uncontrolled diabetics alike ($p>0.05$).

**Table 6a: Consumption of Carbohydrate and fat in relation to glycemic control**

| Foods | Controled DM | Uncontrolled DM | Total | t-test |
|---|---|---|---|---|
| **Carbohydrates: Unripe Plantain** | | | | |
| Increase | 70 (83%) | 45 (75%) | 115 (80%) | |
| Decrease | – | – | – | |
| Eat as before | 6 (7%) | 14 (24%) | 20 (14%) | |
| Avoid | 8 (10%) | 1 (1%) | 9 (6%) | t = 0.75 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Wheat/unripe plantain/cassava fufu** | | | | |
| Increase | 59 (70%) | 21 (35%) | 80 (55.5%) | |
| Decrease | – | – | – | |
| Eat as before | 5 (6%) | – | 5 (3.5%) | |
| Avoid | 20 (24%) | 39 (65%) | 59 (41%) | |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | |
| **Rice** | | | | |
| Increase | – | – | – | |
| Decrease | 58 (69%) | 37 (62%) | 95 (66%) | |
| Eat as before | 7 (8%) | 2 (3%) | 9 (6%) | |
| Avoid | 19 (23%) | 21 (35%) | 40 (28.7%) | t = 1.18 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Cocoyam/Water Yam** | | | | |
| Increase | 10 (12%) | 18 (30%) | 28 (19.4%) | |
| Decrease | 22 (26%) | 15 (25%) | 37 (25.6%) | |
| Eat as before | – | – | – | |
| Avoid | 52 (62%) | 27 (45%) | 79 (35%) | t = 0.84 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | p = 0.05 |
| **Pap** | | | | |
| Increase | 3 (3.5%) | – | 3 (2%) | |
| Decrease | 76(90.5%) | 57 (95%) | 133(92.4%) | |
| Eat as before | – | – | – | t=1.38 |
| Avoid | 5 (6%) | 3 (5%) | 8 (5.6%) | p>0.05 |
| **Red Palm oil** | | | | |
| Increase | 36(43%) | 39(65%) | 72(52%) | |
| Decrease | 20(24%) | 11(18.3%) | 31(21.5%) | |
| Eat as before | 28(33%) | 10(16.7%) | 38(26.5%) | t=1.18 |
| Avoid | | | - | |
| Total | 84(100%) | 60(100%) | 144(100%) | p>0.05 |
| **Vegetable oil** | | | | |
| Increase | | - | - | |
| Decrease | 50(59.5%) | 31(51.7%) | 81(56%) | |
| Eat as before diabetes | 13(15.5%) | 7(11.6%) | 20(14%) | |
| Avoid | 21(21%) | 22(36.7%) | 43(30%) | t=1.37 |
| Total | 84(100%) | 60(100%) | 144(100%) | p>0.05 |

**Table 6b:Consumption of protein foods and legumes in relation to diabetic**

| Food Item | Controlled DM | Uncontrolled DM | Total Response | t-test & p-value |
|---|---|---|---|---|
| **Meat** | | | | |
| Increase | 29 (34.5%) | 21 (35%) | 50 (34.7%) | |
| Decrease | 41 (49%) | 33 (55%) | 74 (51.4% | |
| Eat as before diabetes | 14 (16.5%) | 4 (6.7%) | 18 (12.5%) | |
| **Avoid** | – | 2 (3.3%) | 2 (1.4%) | t = 2.22 |
| Total | 84 (74%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Fish** | | | | |
| Increase | 51 (61%) | 39 (65%) | 90 (62.5%) | |
| Decrease | – | – | – | |
| Eaf as before diabetes | 33 (39%) | 21 (35%) | 54 (37.5%) | |
| Avoid | – | – | – | t = 0.51 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Milk** | | | | |
| Increase | 47 (56%) | 33 (55%) | 80 (55.5%) | |
| Decrease | 15 (18%) | 9 (15%) | 24 (16.5%) | |
| Eat as before diabetes | 20 (24%) | 10 (17%) | 30 (21%) | |
| Avoid | 2 (2%) | 8 (13%) | 10 (7%) | t = 2.12 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | P > 0.05 |
| **Soya milk** | | | | |
| Increase | 52 (62%) | 35 (58%) | 87 (60%) | |
| Decrease | – | – | – | |
| Eat as before diabetes | 28 (33%) | 18 (30%) | 46 (32%) | |
| Avoid | 4 (5%) | 7 (12%) | 11 (8%) | t = 1.32 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Legumes:** | | | | |
| **Cowpea** | | | | |
| Increase | `84(100%) | 55(92%) | 139(96.5%) | |
| Decrease | _ | 2(3%) | 2(1.4%) | |
| Eat as before diabetes | _ | 3(5%) | 3(2.1%) | |
| Avoid | _ | _ | _ | t=0.83 |
| Total | 84(100%) | 60(100%) | 144(100%) | p>0.05 |
| **Breadfruit** | | | | |
| Increase | 60 (71.4%) | 48(80%) | 108 (75%) | |
| Decrease | – | – | – | |
| Eat as before diabetes | 24 (28.6%) | 12 (20%) | 36 (25%) | |
| Avoid | – | – | – | t = 1.66 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | p > 0.05 |

**Table 6c: Consumption of vegetables, fruits and beverages in relation to diabetes control**

| Food Item | Diabetics with Good Control | Diabetic with Poor Control | Total Response | t-test & p-value |
|---|---|---|---|---|
| **Vegetables** | | | | |
| Increased | 51(61%) | 30(50%) | 81(56%) | |
| Decreased | 9(10.5%) | 4(6.7%) | 13(9%) | |
| Eat as before diabetes | 24(24.4%) | 20(33.3%) | 44(31%) | |
| Avoid | - | 6(10%) | 6(4%) | t-1.12 |
| Total | 84(100%) | 60(100%) | 144(100%) | p>0.05 |
| **Fruits** | | | | |
| Increase | 11 (13%) | 2 (3.3%) | 13 (9%) | |
| Decrease | 49 (58.5%) | 32 (53.4%) | 81 (56%) | – |
| Eat as before diabetes | 24 (28.5%) | 20 (33.3%) | 44 (31%) | |
| Avoid | – | 6 (10%) | 6 (4%) | t = 0.50 |
| Total | 84 (100%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Alcohol** | | | | |
| Increase | – | – | – | |
| Decrease | 30 (35.7%) | 19 (31.7%) | 49 (34% | |
| Eat as before diabetes | – | – | – | |
| Avoid | 54 (64.3%) | 41 (68.3) | 95 (66%) | t = 0.75 |
| Total | 84 (74%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Beverage-Lipton Tea** | | | | |
| Increase | 50 (59.5%) | 46 (76%) | 75 (52%) | |
| Decrease | – | – | – | |
| Eat as before diabetes | 14 (16.5%) | 6 (10%) | 20 (14%) | |
| Avoid | 20 (24%) | 29 (48.3%) | 49 (34%) | t = 0.82 |
| Total | 144 (84%) | 60 (100%) | 144 (100%) | p > 0.05 |
| **Carbonated Drink Soda Water** | | | | |
| Increase | – | – | – | |
| Decrease | 11 (13%) | 2 (3.3%) | 13 (9%) | |
| Eat as before diabetes | 6 (7%) | 1 (1.7%) | 7 (5%) | |
| Avoid | 67 (80%) | 57 (100%) | 124 (86%) | t = 5.24 |
| Total | 61 (100%) | 60 Total (100%) | 144 (100%) | p > 0.05 |

Table 7 shows the subject's perceived causes of diabetes and their expectation in taking diabetes treatment. Many subjects (43%) related the cause of diabetes to their diet, 10% knew it was lack of insulin in the body and 5% saw it as a spiritual problem The expectation of 59.5% of the study subjects in taking diabetes treatment was to achieve complete cure while 35% was to control their diabetes.

**Table 7: Causes of diabetes and expectation in taking diabetes treatment**

| | **Frequency** | **Percentag** |
|---|---|---|
| **Causes of Diabetes** | | |
| Related to my diet | 63 | 43 |
| Don't know | 31 | 21 |
| Inherited | 25 | 17 |
| Lack of insulin | 14 | 10 |
| Spiritual problem | 7 | 5 |
| Infection | 6 | 4 |
| **Total** | **146** | **100** |
| **Expectation of DM treatment** | | |
| To cure | 87 | 59.5 |
| To control | 51 | 35 |
| Don't know | 8 | 5.5 |
| **Total** | **146** | **100** |

Table 8 shows the list of foods perceived by the subjects as diabetic or non diabetic foods. Up to 63% saw consumption of beans, unripe plantain, breadfruit and coco-yam/water-yam as best for their diabetes management. Almost all (98%) knew that diabetics should eat plenty of vegetables. Many (80%) saw rice as not good for diabetics and 40% believed that diabetics could eat other carbohydrate foods with vegetables.

**Table 8: Foods perceived by the subjects as diabetic/non diabetic foods**

| . | **Agreed** | **Disagreed** | **Total** |
|---|---|---|---|
| Diabetics are better off eating beans, unripe plantain, water yam, cocoyam, bread fruit | 91(63%) | 53 (37%) | 144(100%) |
| Diabetics should eat plenty of vegetables | 141 (98%) | 3 (2%) | 144(100%) |
| Rice is not good for diabetics | 115(80%) | 30(20%) | 145(100%) |
| Diabetics can also eat other carbohydrate foods like rice, yam, potato and others with vegetables | 58 (40%) | 86 (60%) | 144(100%) |

Table 9 shows the relationship between diabetes knowledge of the subjects and their educational level. Among subjects who did not attain up to secondary education, 30.3%, 38% and 78% had good, fair and poor diabetes knowledge respectively while 69.7%, 62% and 22% of those with higher education had good, fair and poor diabetes knowledge respectively. Significantly greater proportion of subjects with higher educational level had better diabetes knowledge than those with NFE and primary education ($P < 0.01$).

**Table 9: Diabetes knowledge of the subjects and their educational level**

| Educational level | Good knowledge | Fair knowledge | poor knowledge | Total |
|---|---|---|---|---|
| **No Formal Education (NFE)** | 3 (4.8%) | 3(8.0%) | 7(15.0%) | 13(9%) |
| **Primary Education** | 16(25.5%) | 11(30.0%) | 29(63.0%) | 56(38%) |
| **Secondary Education** | 7(11%) | 12(32.0%) | 6(13.0%) | 25(17%) |
| **Post Sec/Tertiary Ed** | 37(58.7%) | 11(30.0%%) | 4(9.0) | 52(36%) |
| **Total** | **63(100%)** | **37(100%)** | **46(100%)** | **146(100%)** |

$X^2 = 21.7$ d f =6 $P<0.01$

Good diabetes knowledge ≥50% of the test question
Fair diabetes knowledge 40 – 49% of the test question
Poor diabetes knowledge < 40% of the test question

Table 10 shows the relationship between nutritional knowledge of the subjects and source of dietary counseling. Among the subjects counseled by doctors 45.6%, 56.0% and 54.5% had good, fair and poor nutrition knowledge respectively. Among those counseled by dietitians, 28.0%, 14.7 and 9.0% had good, fair and poor knowledge respectively. Among those counseled by nurses and other paramedicals, 14.7%, 9.0% and 13.5% had good, fair, and poor nutrition knowledge respectively.

Among the subjects counseled by their fellow patients, 11.7%, 20.6% and 23% had good, fair and poor nutrition knowledge respectively.

**Table 10 : Relationship between the Nutrition knowledge of the subjects and source of dietary counseling .**

| Dietary Counselors | Good Knowledge | Fair Knowledge | Poor Knowledge | Total |
|---|---|---|---|---|
| **Doctors** | 31 (45.6%) | 19(56.0%) | 24(54.5%) | 74(51.0%) |
| **Dietician** | 19(28.0%) | 5(14.7%) | 4 (9.0%) | 28 (19.0) |
| **Nurse/Paramedicals** | 10(14.7%) | 3(9.0%) | 6 (13.5%) | 19(13.0%) |
| **Other patients & friends** | 8(11.7%) | 7(20.6% | 10(23.0%) | 25 (17.0%) |
| **Total** | **68(100.0%)** | **34(100.0%)** | **44(100%)** | **146(100.0%)** |

$X^2 = 40.09$ , d f =6 $P > 0.05$

Good nutrition knowledge $\geq$ 50% of the test question
Fair nutrition knowledge 40 – 49% of the test question
Poor nutrition knowledge < 40% of the test question

Figure 5 shows the frequency of medical check-ups undertaken by the subjects. Only 31% kept their appointments with the doctor, 35% went for check-up as the need arise (ie when symptoms increased), 13.6% went for check-up every 3 months, 7% saw the doctor every 6 months, 4% once a year and 7% occasionally. However, 1.4% admitted that they do not go for any medical check-up.

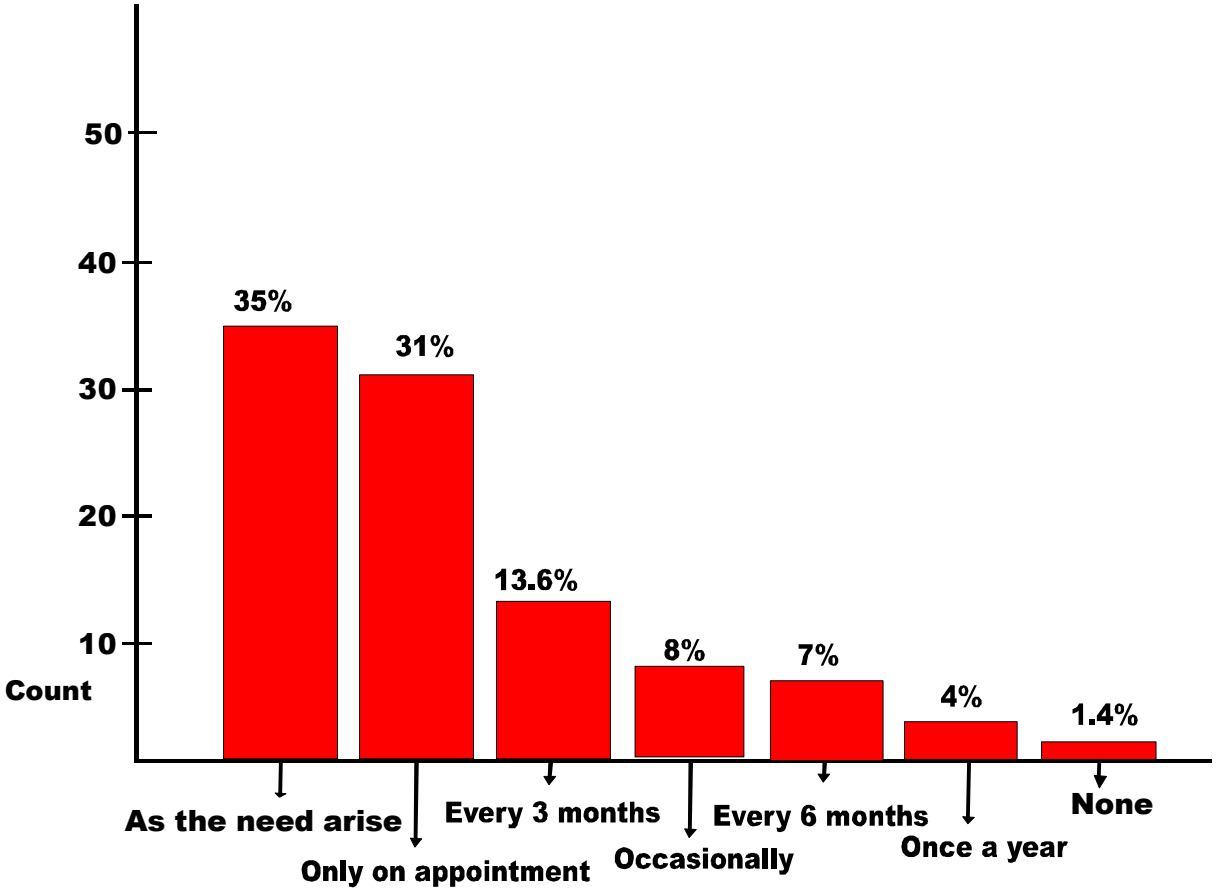


**Fig. 5: Frequency of medical check-up by the Subjects**

Table 11 shows the type of laboratory tests and frequency of the tests used by the subjects in monitoring their blood glucose level. Fifty seven percent (57%) used fasting blood glucose test, 27% combined urine test and fasting blood glucose and 7% used urine test alone. However, 9% were not checking their blood glucose. Only 29% of the subjects were checking their glucose level according to doctor's appointment, 38.5% were doing monthly checking of blood glucose on their own, 11.5% were checking it occasionally when symptoms increased and 9% were not checking their blood glucose at all.

**Table 11: Laboratory tests & frequency of the tests used by the subjects**

| **Laboratory tests** | **Frequency** | **Percentage** |
|---|---|---|
| Fasting blood glucose | 83 | 57.0 |
| Urine test & Fasting blood glucose | 40 | 27.0 |
| None | 13 | 9.0 |
| Urine test | 10 | 7.0 |
| Total | 146 | 100.0 |
| **Frequency of the test** | | |
| Monthly | 56 | 38.5 |
| On doctor's appointment | 42 | 29.0 |
| Every 3 months | 18 | 12.0 |
| Occasionally and when symptoms Increased | 17 | 11.5 |
| **Total** | **146** | **100.0** |

Table12 shows the compliance pattern of the subjects with various treatment regimens Forty percent (40%) of the subjects complied fully with their dietary instructions, 22% and 38% were partially and non compliant with their dietary instructions; 44% complied fully with their diabetes drug while 19% and 37% were partially and non compliant with their drug treatment respectively; 67% complied fully with their appointment for laboratory tests while 33% did not; 32% complied fully with their appointment for medical check-up while 68% were partially and non compliant with their medical check-up.

**Table 12: Compliance of the subjects to diabetes management regimens**

| Compliance variables | Good compliance | Partial compliance | poor compliance | Total |
|---|---|---|---|---|
| Dietary Compliance | 58(40%) | 31(22%) | 55(38%) | 144(100%) |
| Drug Compliance | 64(44%) | 27(18.5%) | 53(37%) | 144(100%) |
| Compliance to Lab tests | 98(67%) | 19(13%) | 29(20%) | 146(100%) |
| Compliance to medical check | 47(32%) | 28(19%) | 71(49%) | 146(100%) |

**Factors affecting glycemic control**

Tables 13 shows the diabetes knowledge of the subjects in relation to glycemic control. Among subjects with good diabetes knowledge, 60.5% had controlled diabetes while 18.0% had uncontrolled. Among the fair knowledge subjects, 19% had controlled diabetes while 18.5% had uncontrolled diabetes. Among the subjects with poor diabetes knowledge, 21% had controlled diabetes and 63% uncontrolled diabetes. People with good diabetes knowledge tend to have good diabetes control ($p>0.05$).

**Table 13: Diabetic Knowledge of the subjects in relation to glycaemic control**

| Diabetes Knowledge | Controlled DM | Uncontrolled DM | Total . |
|---|---|---|---|
| **Good Diabetic Knowledge** | 52(60.5%) | 11(18.5%) | 63(43.0%) |
| **Fair diabetic knowledge** | 16(19.0%) | 11(18.5%) | 27(18.5%) |
| **Poor Diabetic Knowledge** | 18(21.0%) | 38(63.0%) | 56(38.5%) |
| **Total** | **86(100%)** | **60(100%)** | **146{100%)** |

$X^2 = 25.57$ $p>0.05$ $df=2$

Controlled DM $\leq$ 160mg/dl
Uncontrolled DM >160mg/dl

Table14 shows the type of diabetes treatment used by the subjects in relation to their glycemic control. Majority (75.5%) of the subjects used drug and diet for their diabetes management, 7% used drugs only, 1% used diet only and 16.5% used liquid extracts of pumpkin and bitter leaf in addition to drug and diet. Among the 24 users of the liquid vegetable extracts, 23% had controlled diabetes and 8% had uncontrolled diabetes. The percentage (23%) vegetable extract users with controlled diabetes was significantly ($p<0.05$) higher than 8% users with uncontrolled diabetes.

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**Table 14: Type of diabetes treatment of the subjects and glycaemic control**

| **Diabetes management** | **Controlled DM** | **Uncontrolled DM** | **Total** |
|---|---|---|---|
| Drug & Diet | 54(64%) | 55 (92%) | 109(75.5%) |
| Drug Only | 10(12%) | - | 10(7%) |
| Diet Only | 1 (1%) | - | 1(1%) |
| Vegetable extracts users | 19(23%) | 5(8%) | 24(16.5%) |
| **Total** | **84(100%)** | **60(100%)** | **144(!00%)** |

$X^2 = 2.83$ $P < 0.05$ $df = 1$

Vegetable extracts Liquid extracts of bitter leaf and pumpkin leaf

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**Distribution of Body Mass Index (BMI) in relation to Glycaemic control**

Table 15a shows the distribution of the subject's BMI by sex. The mean body mass index (BMI) was 27.0± 5.0(range 17.0-41 kg/m). Mean BMI for males and females were 26.8 + 4.8kg/m2 and 27.4 ± 5.4 respectively. Only 2.0% of the subjects were under-weight. Over twenty seven percent (27.5%) of the subjects had normal weight and 45.5% were over-weight, Twenty six percent (26%) of the subjects were obese.

Table 15b shows the body mass index (BMI <25 vs. > 25) of the subjects in relation to diabetes control. Thirty-four percent (34%) of normal weight subjects had controlled blood sugar level and 23% of them had uncontrolled blood sugar level. Similarly, 66% and 77% of over-weight/obese subjects had controlled and uncontrolled blood sugar level respectively. More normal weight subjects had controlled blood sugar level than over-weight/obese subjects ($P<0.05$).

**Table 15a:** Distribution of Body Mass Index (BMI)of the subjects **by sex inkg/$m^2$**

| **Variables** | **Males (%)** | **Females(%)** | **Total (%)** |
|---|---|---|---|
| Under weight (<18.5) | 2 (3.5) | 1 (1.0) | 3(2.1) |
| Normal weight (18.5-24.9) | 14(25.0) | 25(28.0) | 40(27.5) |
| Over weight (25-29.9) | 24(43.0) | 42(46.6) | 65(44.5) |
| Obese (30 and above) | 16(28.5) | 22(24.4) | 38(26.0) |
| Total | 56(100.0) | 90(100.0) | 146(100.0) |
| **Mean** | 26.8+4.8 | 27.4+5.4 | 27.0+5.0 |

**Table 15b:Body mass index of subjects in relation to glycaemic control (normal weight versus over weight/obese)**

| **BMI Status** | **Controlled DM** | **Uncontrolled DM** | **Total** |
|---|---|---|---|
| BMI < 25 | 25 (34.0%) | 14(23.0%) | 39(29.0%) |
| BMI > 25 | 48 (66.0%) | 46(77.0%) | 94 (71.0%) |
| **Total** | **73(100.0%)** | **60(100.0%)** | **133(100.0%** |

$X^2$ = 1.88 df = 1 P<0.05

**Compliance with Diabetes Management Regimens.**

Table 16 shows the compliance pattern of the subjects with various diabetes management regimens in relation to diabetes control. Forty percent (40%), (22.0%) and 38% of the subjects were fully, partially and non compliant with dietary instructions respectively. Dietary compliance had significant ($P < 0.05$) effect on diabetes control.

For drug compliance, 44.5%, 18.5% and 37% respectively were fully, partially and non compliant with their drug treatment. Drug compliance had significant ($P < 0.01$) effect on diabetes control.

Similarly, 67.0%, 13.0% and 20% respectively were fully, partially and non compliant with laboratory test appointments ($P<0.05$).

For compliance with medical check-up, 32.0%, 19.0 and 49% of the subjects respectively were fully, partially and non compliant with their appointment for medical check up ($P <0.05$) .

**Table 16: Compliance with management regimens in relation glycemic control**

| Diabetic Status | Controlled DM | Uncontrolled DM | Total | p value |
|---|---|---|---|---|
| **Dietary Compliance** | | | | |
| Full compliance | 31(37.0%) | 27(45.0%) | 58(40%) | |
| Partial compliance | 18(21.4%) | 13(21.7%) | 31(22%) | |
| Non compliance | 35(41.6%) | 20(33.7%) | 55(38%) | $x^2$= 1.21 df=2 |
| **Total** | **84(100%)** | **60(100%)** | **144(100%)** | **P < 0.05** |
| **Drug Compliance** | | | | |
| Full compliance | 46(55.0%) | 18(30.0%) | 64(44.5%) | |
| Partial compliance | 13(15.5%) | 14(23.0%) | 27(18.5%) | |
| Non compliance | 25(29.5%) | 28(47.0%) | 53(37.0%) | $x^2$ = 8.7 df = 2 |
| **Total** | **84(100%)** | **60(100%)** | **144(100%)** | **P < 0.01** |
| **Compliance to Lab test** | | | | |
| Full compliance | 61(71.0%) | 37(61.7%) | 98(67.0%) | |
| Partial compliance | 9(10.5%) | 10(16.6%) | 19(13.0%) | |
| Noncompliance | 16(18.5%) | 13(21.7%) | 29(20.0%) | $x^2$= 1.67 df=1.67 |
| **Total** | **86(100%)** | **60(100%)** | **146(100%)** | **P < 0.05** |
| **Compliance to medical check-up** | | | | |
| Full compliance | 25(29.0%) | 22(36.7%) | 47(32.0%) | |
| Partial | 18(21.0%) | 10(16.6%) | 28(19.0%) | |
| Non compliance | 43(50.0%) | 28(46.7%) | 71(49.0%) | $x^2$= 1.05 df = 2 |
| **Total** | **86(100%)** | **60(100%)** | **146(100%)** | **p< 0.05** |

**Lifestyles of the Subjects**

Table17 shows the alcohol intake, cigarette/tobacco use and activity pattern of the subjects in relation to glycemic control.

**Alcohol intake of the subjects**

Majority (83.0%) of the subjects were not consuming alcohol. Among the controlled diabetics, only12% were using alcohol while 88% were non users. The uncontrolled diabetics were 23% users and 77% non users of alcohol. Controlled diabetics were significantly ($P<0.05$) higher among the non users of alcohol.

**Cigarette/Tobacco habit of the Subjects**

Very few (21.0%) subjects smoked cigarette/tobacco, The controlled diabetics were 17.0% smokers and 70% non smokers, however 13% showed no response. The uncontrolled diabetics were 27% smokers and 73.0% non smokers. There was no significant difference between the smoking habits of controlled and uncontrolled diabetes ($P>0.05$).

**Activity pattern of the Subjects and diabetes control.**

Out of the 85 controlled diabetics, 48.0%, 33.0% and 19% were engaged in intensive, moderate and light activities respectively. Also among the uncontrolled diabetics, 21.7%, 23.3%,and 55.0% were engaged in intensive, moderate and light activities respectively. Controlled diabetics were significantly ($p< 0.01$) higher among the subjects who were engaged in intensive activity.

**Table 17: Alcohol use, cigarette/tobacco use and activity pattern of the subjects in relation to glycemic control**

| | Controlled DM | Uncontrolled DM | Total | p value. |
|---|---|---|---|---|
| **Alcohol consumption** | | | | |
| Alcohol consumers | 10 (12.0%) | 14(23.0%) | 24(17.0%) | |
| Non consumers | 73(88.0%) | 46(77.0%) | 119(83.0%) | $x^2$=3.176, df = 1 |
| **Total** | **83(100%)** | **60(100%)** | **143(100%)** | **p < 0.05** |
| **Cigarette/tobacco use** | | | | |
| Smokers | 14(19.0%) | 16(27.0%) | 30(21.0%) | |
| Non smokers | 59(81.0%) | 44(43%) | 103(71.5%) | |
| No response | 11(13%) | - | 11(7.5%) | $x^2$= 0.303 df = 1 |
| **Total** | **73(100%)** | **60(100%)** | **144(100%)** | **P > 0.05** |
| **Activity pattern** | | | | |
| Good activity | 41(48.0%) | 13(21.7%) | 54 (37.0%) | |
| Fair activity | 28(33.0%) | 14(23.3%) | 42(29.0%) | |
| Poor activity | 16(19.0%) | 33(55.0%) | 49(34.0%) | $x^2$= 6.01 df = 2 |
| **Total** | **85(100.0%)** | **60(100.0%)** | **145(100%)** | **P < 0.01** |

Only the usage of alcohol and smoking, quantity not inclusive

Table 18 shows the immediate effect of diabetes educational intervention on fasting blood sugar(FBS) of the study subjects. The base-line mean fasting blood sugar of group A subjects was 238.75+40.4mg/dl, declined steadily to187+79, 171.6+91.2, and 160.8+88 after first, second and third months post intervention respectively ($p < 01$).For group B, base line mean fasting blood sugar was 263.8+91.2mg/dl, dropped sharply to 179.1+23.8 after first month, then rose to187.5+78 and196.8$\pm$86 for second and third months respectively ($p < 01$). For group C, base line mean fasting blood sugar was 239$\pm$51.2 mg/dl, dropped sharply to 185.4$\pm$80 after first month, then declined slightly to 184.8$\pm$70 and 184.5$\pm$79 for second and third months respectively ($p<0.05$)

**Table 18: Immediate effect of Intervention on Fasting blood sugar(FBS) in mg/dl**

| Study group | Baseline-mean FBS (a) | 1 mth (b) | 2-mth (c) | 3mth (d) | t-test (a vs d) | p value . |
|---|---|---|---|---|---|---|
| A [DDE] | 238.75±40.4 N=12 | 187.0 ±79 N=12 | 171.6±.91.2 N=12 | 160.8±88 N=12 | 2.89 | p<0.01 |
| B [DDH] | 263.8±91.2 N=12 | 179.1±23.8 N=12 | 187.5±78 N=11 | 196.8±86. N=11 | 5.0 | p<0.01 |
| C [DD] | 239±51.2 N=12 | 185.4±80 N=10 | 184.8±70 N=10 | 184.5±79 N=10 | 2.5 | p<0.05 |

DDE Drug, Diet & Exercise
DDH Drug, Diet& Liquid Extracts
DD Drug & Diet

Figure 6 shows the post intervention fasting blood sugar trend among the study groups in the first three month after the diabetes educational intervention. There was a down-ward trend in the fasting blood sugar (FBS) from the first month following intervention for all the study groups. The group A subjects showed a steady drop in FBS throughout the three months study period. The group B subjects witnessed a drop in FBS the first month and thereafter FBS began to rise. The group C witnessed a slight drop for the 2nd and 3rd months of intervention after the initial sharp drop.

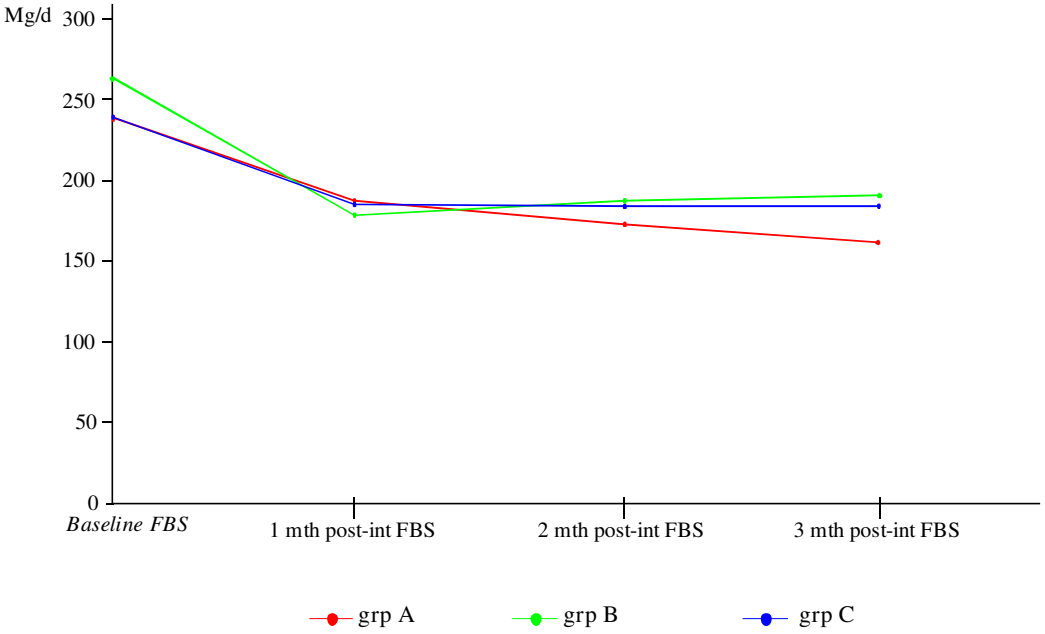


Fig. 6: Mean Blood Sugar trends among intervention group (A.B.C.)

Group A: Drug, Diet Exercise
Group B: Drug, Diet and Aqueous leaf extracts of bitter leaf and pumpkin leaf
Group C: Drug and Diet (control)

**Long term effect of the Intervention on the subjects**

Table 19 shows the lifestyle changes in the subjects 2 yrs after the intervention.

**Activity Pattern:**

About (67%) of the subjects were not engaging in intensive activity at the onset of the study, while 33% were intensively active, but 2yrs after the intervention more subjects (81.5%) became engaged in intensive activities while 18.5% were still not engaging in intensive activity. There was significant ($p<0.05$) increase in the number of subjects on intensive activity 2 years after the educational intervention.

**Diabetes knowledge:**

About 41.5% of the subjects had good diabetes knowledge before the intervention. The number rose to 55.5% 2yrs after the intervention. There was significant improvement ($P<0.05$) in the diabetes knowledge of the subjects 2 years following the intervention.

**Nutrition knowledge**

At the onset of the study, 44.5% of the subjects had good nutrition knowledge but two years after the diabetes educational intervention, the number rose to 51.5%. ($p>0.05$).

**Dietary Counselors:** Before the diabetes educational intervention, the diabetes counselors were as follows: doctors (51.5%), dietician (18.5%), Para-medical (15.0%), friends and relations (7.5%), other patients (7.5%). Two years after the intervention, diabetes counselors became dietician (44.5.0%) doctors (22.2%), para-medical (18.5%), other patients( 11.0%), friends and relations (3.7%). Dietary counseling by expert increased significantly after the intervention ($P<0.05$)

**Blood sugar Control:**

In the first phase of the study, 59.3% of the subjects had good control of their blood sugar and 40.7% had uncontrolled blood sugar. Two years after the intervention, more (65%) subjects had controlled blood sugar. There was significant ($p<0.05$) improvement in blood sugar control of the subjects after the intervention.

**Table19: Long term effect of the Intervention on the subjects**

| . | N=27 Before Intervention | N =27 2yrs after intervention | p value |
|---|---|---|---|
| **Activity pattern** | | | |
| Intensive activity | 9 (33.5%) | 22(81.5%) | |
| Moderate activity | 8 (29.5%) | 2(7.5%) | $x^2$= 12.82 |
| Light/Inactivity | 10(37.0%) | 3(11.0%) | df = 2 |
| **Total** | **27(100.0%)** | **27(100.0%)** | **P < 0.05** |
| **Diabetes knowledge** | | | |
| Good diabetes knowledge | 11(41.5%) | 15(55.5%) | |
| Fair diabetes knowledge | 4((15.0%) | 7(26.0%) | $x^2$ = 4.32 |
| Poor diabetes knowledge | 12(44.5%) | 5(18.5%) | df = 2 |
| **Total** | **27(100.0%)** | **27(100.0%)** | **P < 0.05** |
| **Nutrition Knowledge** | | | |
| Good nutrition knowledge | 12(44.5%) | 14(51.5%) | |
| Fair nutrition knowledge | 6(22.0%) | 9(33.5%) | $x^2$ = 2.68 |
| Poor nutrition knowledge | 9(33.5%) | 4(15.0%) | df = 2 |
| **Total** | **27(100.0%)** | **27(100%)** | **p > 0.05** |
| **Dietary counselors** | | | |
| Doctors | 7(51.5%) | 6(22.2%) | |
| Dieticians | 5(18.5%) | 12(44.5.0%) | |
| Para-medicals | 4(15.0%) | 5(18.5%) | |
| Friends and relations | 2(7.5%) | 1(3.7%) | $x^2$ =3.0 |
| Other patients | 2(7.5%) | 3(11.1%) | df =4 |
| **Total** | **27(100.0%)** | **27 (100.0%)** | p < 0.05 |
| **Blood sugar control:** | | | |
| Controlled DM | 16 (59.3%) | 18(65%) | $x^2$=5.0 |
| Uncontrolled DM | 11(40.7%) | 9(35%), | df =1 |
| **Total** | **27 (100%)** | **27(100%)** | **p < 0.05** |

Table 20 shows the food consumption of the subjects on major commonly consumed food items (based on 24-hour dietary recall) before and 2 years after the diabetes educational intervention.

The major food consumption before the educational intervention based on 24-hour dietary recall were: beans and beans products (83.0%), unripe plantain (81.5%), wheat fufu (37.0%) breadfruit porridge (25.0%) The consumption of other carbohydrate foods were very low but after the diabetes educational intervention, consumption of other carbohydrate foods like rice increased from 11.0% to 59.3% and garri from 3.7% to 18.5%. Fruits consumption also increased e.g. orange consumption increased from 11.0% to 40.7%, paw-paw from 14.8% to 29.6%, and garden egg from 59.2% to 70.3% **.** On the other hand there was decreased consumption of certain foods e.g. beans porridge decreased from 83.0% to 51.8%, unripe plantain from 81.5% to 55.5%.

**Table 20: Major food items consumed by subjects before and after the intervention**

| Food items | N=27 Before Intervention | N=27 After Intervention |
|---|---|---|
| Beans and bean products | 23 (83.0%) | 14(51.8%) |
| Bread fruit (ukwa) without vegetable | 7 (25.0%) | 14(51.8%) |
| Unripe plantain | 22 (81.5%) | 15 (55.5%) |
| Irish potato | 2 (7.4%) | 5 (18.5%) |
| Rice and Vegetable | 15 (11.0%) | 16(59.3%) |
| Only garri and vegetable soup | 1 (3.7%) | 5 (18.5%) |
| Coco/water yam and vegetable soup | 3 (11.0%) | 4(14.8%) |
| wheat flour fofo and vegetable soup | 10 (37.0%) | 7(26.0) |
| Oranges | 2 (7.4%) | 11(40.7%) |
| Avocado | 7 (26.0%) | 12(44.4%) |
| Pawpaw | 4 (14.8%) | 8(29.6%) |
| Garden egg | 16( 59.2%) | 19 (70.3%) |

# CHAPTER FIVE

# DISCUSSION

The impact of diabetes mellitus on quality of life and its potential economic stress makes it an important research topic. Health management intervention had always aimed at facilitating changes in behavior and the adoption of practices that could decrease the risk of disease and illness ( Davies *et al*.,2008).

## 5 .1 Background Information of the Subjects

Background information of the subjects in this study showed that their mean age of (59.1±11.2 years) and mean body mass index (27.0 $\pm$ 5.0) were consistent with some earlier descriptions of type 2 diabetic patient. Mokdad *et al.* (2001) and Marthur (2006) reported that type 2 diabetes usually occurs in patient in their middle age or old age and often overweight. Greater number of the subjects were over-weight and obese. Some of the subjects admitted lost of weight during the initial course of the disease. This again was an indication that some of them were more obese before the study. The problem of poor glycemic control among the study subjects was similar to the finding in a previous study where they reported high admission rate from poorly controlled diabetes (Akbar and Mustaq, 2000).

The mean BMI of the females was slightly higher than that of the males.. This is not surprising since women tend to be fatter than men. The World Health Organization (WHO, 1994) explained that obesity is seen more in female than male. It is possible that more females than males develope type 2 diabetes because of their susceptibility to obesity which is a risk factor for diabetes.

The study showed that there were more females than males. The female preponderance of diabetes observed in this study was in line with the findings of

Federal Ministry of health and could be related to the preponderance of obesity amongst them (FMoH, 1992) and Osisianya *et al.* (2006).

**Socio Economic Characteristics of the subjects**

The subjects were reasonably literate but they needed to be sensitized and educated on facts about diabetes . The good educational background of the subjects was very helpful in this study as it helped them to understand the need to adhere strictly to the study instructions. Some of the subjects were solely dependent on their children or relations for their upkeep. This could make some of them go without their drugs when there is delay in the arrival of the drugs from their sponsors. Many subjects did not disclose their income. Some of them were top business executives and out of those who disclosed their income, some earned ₦40,000 monthly or more.This suggests the economic potential of many of them to pay for their care given the right orientation. One point which emerged in the epidemiology of diabetes in developing country is that its prevalence is associated with affluence (Unwin and Alberti, 2000). Economic status of the subjects in this study was in line with the finding by Unwin and Alberti (2000) confirming that many of the subjects could afford any form of care given the right advice. Considering the high cost of feeding and drug, the few who earn less than ten thousand naira (₦10,000) may find it difficult to cope with their management regimens especially their daily drug.

## 5.2 Health Seeking Behavior

It is encouraging to note that majority of the study subjects went to hospital as their first source of diabetes treatment. However the remaining few still patronized traditional healers and spiritual homes. Over half of the study population were hoping for complete cure from their diabetes treatment. The disadvantage of this type of behavior is that patients easily get tired and frustrated when complete cure is not forth coming and then start looking for alternative remedy like spiritual homes. It is important during counseling to tell the diabetics that immediate cure may not be achieved but controlling their diabetes will enable them avoid many of the diabetes complications thereby enjoying a healthy and happy life living with diabetes. About half of the population stayed with their symptoms for six months to one year and above before reporting for treatment. The implication of delay for diabetes treatment is that some of the patients may have developed some complications even on diagnosis. Certain complications like cataract and other retinopathies (eye problems) are irreversible that once started would continue, though treatment may slow down their progression.

## 5.3 Diabetes Management

### 5.3.1 Dietary Management

Dietary management is crucial for all types of diabetes. Many of the study subjects were in the habit of not keeping to their dietary instructions but rely on only drugs. Dietary modification and exercise rather than only insulin or oral hypoglyceamic drugs should be employed in diabetes management, more so for obese subjects. This is because insulin and sulphonylureas increase the appetite and lead to patients weight gain (Cuff, 2003). Proper diet therapy in type II diabetics will lead to

reduction in hyperglycemia as well as weight loss. Davies *et al,* (1994) showed that sixty-nine subjects with type II diabetes had reduction in weight, glycosylated haemoglobin (HbA1) and fasting blood glucose level following diet therapy for sixteen weeks. Appropriate diabetes care to ensure good diabetic control may be difficult and ineffective without adequate diet therapy and strict adherence to dietary instructions (ADA, 2004). Many of the study subjects had poor nutrition knowledge and over half of the population were counseled by non expert in diet therapy. Fadupin and Keshinro (2001) observed that most hospitals in Nigeria do not employ dieticians. The situation has not changed much and this may have accounted for the dietary counseling of the subjects by non nutrition expert. This may also be responsible for the poor nutrition knowledge of the subjects. Many graduate nutritionists / dieticians are now available in Nigeria, but they are yet to be employed in most Nigerian hospitals especially the private hospitals. It is necessary that hospitals should be encouraged to engage the services of qualified nutritionists/ dieticians.

### 5.3.2 Diabetes management with drug

Daonil and glucophage were the commonest drugs prescribed and used in the management of diabetes. Some physicians used them singly or together or in combination with insulin. The importance of drug in the management of diabetes should not be over emphasized. Large-scale clinical trials have shown that pharmacological treatment can reduce the morbidity and mortality associated with metabolic and cardiovascular diseases and that long-term or lifelong treatment is often indicated (Bell, 2004; Balkrishnan, 2004). Diabetes prevention studies showed that metformin or glucophage therapy in people with pre diabetes prevents or delays the development of diabetes (Alder, 2001). Durbin (2004) demonstrated the efficacy of thiazolidinedione in preventing type II diabetes in people with diabetes risk factors.

Continuity in administration is important for the efficacy of any drug. These agent are sulfa drugs (sulfonylurea) that appear to stimulate the secretion of additional insulin by the pancreas in addition to enhancing the sensitivity of body tissues to insulin (Bell,2004 ).

### 5.4 Factors affecting Diabetes Control

#### 5.4.1 Compliance to diabetes management regime

The major problem of the study subjects was the issue of non compliance to management regimens. The study showed that compliance with management regimens was significantly high among subjects with controlled diabetes. The World Health Organization highlighted that non-compliance with long-term medication for conditions such as hypertension, dyslipidaemia and diabetes is a common problem that leads to compromised health benefits and serious economic consequences in terms of wasted time, money and prolonged diseases (WHO, 2003b). Baune (2004) reported a decrease in morbidity and mortality with strict use of antihypertensive therapy, and concluded that the greatest potential for improving control of hypertension lies in improving patient compliance. Some of the study subjects were not going for medical check-up and some would wait for a very long time or till their symptoms deteriorate before going to hospital. Many subjects were not keeping to their dietary instructions and were taking their drugs only when their blood sugar became high and probably going off their drugs at asymptomatic periods. The implication of this type of attitude is that the blood sugar kept going up and down and the body may develop complications during those periods of high blood sugar levels. This may have accounted for the many associated conditions such as highpertension, cataract, blurred vision as seen in the study subjects. It is important for diabetics to comply with their management regimen.

### 5.4.2 Diabetic Knowledge and Diabetes Control

One of the major findings of this study was low diabetes knowledge by the subjects. It is really disappointing to note that up to 57% of the subjects had poor knowledge of their ailment. The situation has not changed appreciably from the findings of many years ago by Familiyiwa (1990) despite an apparent intensification of public awareness campaigns on diabetes. This calls for reappraisal and re-evaluation of our information strategies. Though the subjects had relatively good educational background, they needed to be sensitized and educat\ed on facts about diabetes. It was obvious that they had incorrect understanding of their disease condition. Such people are easily lured by alternative medicine practitioners who make claims of a cure for diabetes in electronic media. Similar to tShe findings of this research, Bruce, Davis, Cull, Davis, (2003) reported a low diabetes knowledge in their subjects but contrary to the present study their subjects had low educational attainment. The good diabetic knowledge among the highly literate subjects may be due to the fact that they had better opportunity of getting information and more access to both print and electronic media to enhance their knowledge.

The American Diabetes Association (ADA, 2004) recommends assessing self-management skills and knowledge of diabetics at least annually and providing or encouraging continuing education.

### 5.4.3 Activity Pattern And Diabetes Control

Inactivity was found to have significant effect on diabetes control. Many subjects with poor diabetes control were very inactive. Low levels of physical activity as in sedentary lifestyle such as excessive watching of television has been implicated as an important risk factor for both obesity and diabetes (Hu, Li, Colditz, Willett, Manson,

(2003). Physical activity is widely endorsed for persons with diabetes by the American Institute for Cancer Research (AICR, 2007). Larson *et al.* (1999) highlighted that physical exercise increases the number and binding capacity of insulin receptors, assists in lowering blood sugar level and reduces insulin requirements in persons who use insulin. It also reduces blood lipid level in those who engage in regular exercise thereby assisting in weight control and improving muscle strength and flexibility. The present study showed that the study group B which was regimented to activity/exercise programme, maintained a more consistent drop in their blood sugar throughout the follow-up period (Fig.6). Exercise plays a key role in the management of diabetes. William (2007) reported that exercise has the general benefit of lowering blood pressure and blood lipids, regular exercise reduce insulin requirements and improve overall blood glucose control in diabetics.

**5.4.4 Alcohol consumption in relation to Diabetes Control.**

Majority of the subjects were not consuming alcohol. The number of controlled diabetics were significantly ($p<0.05$) higher among the non users of alcohol. Sue (1994) was of the opinion that moderate consumption of alcohol may not be too bad. This is because alcohol does not require insulin for its metabolism. It raises HDL cholesterol and it enhances glucose lowering effect of hypoglycaemic agents when used in moderate amounts. Sue (1994) however warned that high alcohol intake may lead to errors in insulin dosage and accentuation of hypoglycemia. Sue also maintained that alcohol must be consumed with meals to prevent the incidence of hypoglycemia and that patients with high triglyceride level, hypertension or obesity should abstain from alcohol.

### 5.5 Consumption pattern of the Subjects

Majority of the subjects had drastically reduced the intake of locally available starchy staples like rice, garri and yam but at the same time increased the consumption of unripe plantain which is also a carbohydrate food. Unripe plantain was taken in a variety of ways: roasted and eaten with palm oil, pounded and used as *fufu* alone or its flour in combination with small cassava flour for *fufu* with vegetable soup; as pottage with vegetables; cooked with cowpea; as pudding. The diabetics both controlled and uncontrolled alike, erroneously consumed this unripe plantain in unlimited quantities because it has low glycemic index. Unfortunately the high consumption of these food items may have resulted in increased caloric intake thereby hindering good glycemia and weight loss for overweight and obese patients. This faulty dietary intake by the subjects is similar to the finding by Hoffermeiser *et al. (2005).* The faulty dietary habit may have accounted for the non significant difference in the consumption pattern of the Controlled and Uncontrolled diabetics.

The increased consumption of palm oil is of concern because oil has high caloric value (9 kcal. per gram) This may be due to the poor nutrition knowledge of the subjects. Bosseri (2002) observed that faulty knowledge is common in developing countries and proposed a type of education by verbal teaching session for clearer understanding. However their consumption of vegetable is commendable. There was low fruit consumption among the subjects except garden-egg. The reason given by the subjects for their restricted fruit intake was because of its sweet taste not knowing that fructose (fruit sugar) has lower glycemic index than glucose. The inadequate nutrition knowledge and nutritional myths may be responsible for these faulty dietary intakes. Fresh fruit is a good source of dietary fibre, antioxidants and other essential nutrients such as minerals and vitamins which the body needs.

The 24-hour dietary recall confirmed the poor consumption pattern of the subjects. Unripe plantain, cowpea, wheat/cocoa-yam fufu with vegetable soup ranked highest followed by bread-fruit porridge in the recalled food items for lunch and dinner. Cowpea and its combination were also highly consumed at breakfast. This was followd by fermented corn gruel with cowpea-cake balls/ bambara-nut pudding/ cowpea pudding. Soya-bean drink with bread occasionally is also consumed at breakfast. Some subjects skipped lunch or ate any of the legume-based puddings as snacks. For fufu, they use all forms of flours (from unripe plantain flour, wheat flour, cassava flour, pounded cocoyam and unripe plantain with vegetable soups.

These foods are complex carbohydrates which are good for diabetics and locally available too but the amount of food intake had to be regulated. They need sound nutrition information on how to combine the local complex carbohydrates and legumes which are good for diabetics.

### 5.6 Assessment Diabetes Educational Intervention

**Assessment of immediate effect of Educational Intervention on blood glucose**

Thirty three subjects with poor diabetes control (blood glucose >160 mg/dl) were used to assess the immediate effect of diabetes educational intervention on blood sugar. The subjects were very much excited by the education session as it really solved their various misinformation which is one of the problems of diabetics in Nigeria. No wonder almost all the subjects irrespective of their study group had a sharp drop in blood glucose level in the first month of the follow-up period (Fig.6). However the group A that was regimented to an activity/exercise programme maintained a steady drop in blood sugar throughout the 3 months follow-up period. No wonder the American Institute for Cancer Research (AICR) widely endorsed physical activity for persons with diabetes (AICR, 2007). The group B subjects (Drug, diet and vegetable

extracts) witnessed a sharp and significant ($p<0.01$) drop in blood sugar in the first month. The subjects, probably out of excitement started skipping their drugs (as they admitted) to see if the vegetable extracts alone would work for them but their blood sugar started rising indicating that the vegetable extract alone is not enough. Leonard *et al*. (2002) showed that the leave extracts of bitter leaf (*Venonia amygdalina*) has both hypoglycemic and hypolipidemic properties in experimental animals and so could be used in managing diabetes mellitus. Also Debinska-klec *et al.* (2000) reported that aqueous-extracts of pumpkin leaf *(Telfaria occidentalis)* is very high in phenols which can minimize the diabetic inflammatory degenerative complications. However, ADA (2004) recommends that the 3 components of diabetes treatment (drug, diet & exercise) should be employed where necessary to achieve a lasting result

**Assessment of long term effect of Diabetes Educational Intervention after 2 yrs**

A subsample of 27 subjects, who also participated in the first phase of the study was used to assess the long term effect of the Intervention. The same questionnaire used in the initial collection of data in the first phase of the study was repeated after two years on the above subsample.

In the present study, it was found that diabetes educational intervention on one to one basis successfully engaged patients on starting effective life style changes sustainable even after two years of the intervention. There was remarkable and significant changes in some key areas of diabetes management, notably: more

subjects were controlling their diabetes as shown by the improvement in blood sugar control after the intervention; more subjects now consult dieticians for dietary counseling; more subjects involved themselves in more intensive activities including passive exercise for the weak ones. These findings were in line with those of Davis *et al.* (2008) who reported some behavioral changes as shown by the improvement in

weight control, reported smoking status, physical activity level and metabolic control following diabetes self management education (DSME).

There was also significant improvement in the consumption pattern as many diabetics were now incorporating varieties in their meals. The success story following this study explains why the American Diabetes Association (2004) recommends assessing self-management skills and knowledge of diabetes at least annually and providing or encouraging continuing education.

## CONCLUSION

Based on the findings, the following conclusions were arrived at:

There was a lot of misguided information on the diabetes management. Non nutrition experts were doing the job of dietary counseling for the diabetics. Many diabetics were yet to accept the fact that treatment for diabetes was for life, as a result most of them kept going on and off their drug. The subjects were not complying with their management regimens. This issue of poor compliance with treatment had very serious implication on their blood sugar level as seen by the high number of uncontrolled diabetes among the subjects.

Many subject had poor diabetes knowledge despite the fact that they had had the disease for so long. The subjects had faulty dietary consumption based on 24 hour dietary recall. Their meals were monotonous, consisting of only few foods, mainly cowpeas, unripe plantains and breadfruits and they consume these foods in unlimited quantities.

The diabetes educational intervention had immediate positive effect on the blood sugar level of the subjects. The long term assessment after 2 years recorded a positive effect on the following crucial areas of diabetes management:- food consumption pattern of the subjects improved as many of them incorporated more foods in their menu instead of holding rigidly to only few foods as was the case at the onset of the study. Diabetes knowledge improved. There was increase in consumption of local complex carbohydrates like rice, yam, irish potatoes and others in their menu. Activity pattern improved as subjects became more active in their day to day life.

These improvements in diabetes management consequently resulted in increase in the number of subjects with good glycemic control following the intervention.

**Recommendation**

The study provided substantial insight into the major problems of the diabetics therefore the following recommendations if adopted would go a long way to help them.

1. Education forms an integral part of diabetes management, the Government agencies, professionals and parastatals should intensify nutrition information through print and electronic media. They can do something like celebrating Nutrition Week annually with various activities like nutrition talk on management of nutritional diseases in bus rides and in market places. Some professionals that are privileged could utilize the women August meetings to give talk on Nutritional issues.

2. As doctors are actively involved in diabetes education on diagnosis, review of nutrition content of the curriculum of medical students to ensure that they can give better information to the diabetics is recommended.

3. Federal Ministry of Health should include employment of qualified nutrition/dietetic staff as a basic requirement for approval of private hospitals. Availability of Nutritionist / dietician in hospitals will be very helpful in solving the issue of dietary misinformation.

4. Subsidy on diabetic drug by Federal Government as is the case in some countries where import duty on diabetic drugs were lifted or reduced to minimize the financial burden of diabetes.

5. Establishment of national and State diabetes control program where diabetics could get an in-depth knowledge and understanding of their problem.

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# UNIVERSITY OF NIGERIA, NSUKKA.
# QUESTIONNAIRE DIABETIC MANAGEMENT REGIME
## PERSONAL DATA:

This questionnaire is for research purposes and any information given is confidential. Please tick ( √ ) in the appropriate box.

1. **Code No. ……**
2. **Name of Subject (Optional) ……...**
3. **Hosp. No. ……**
4. **Residence: ……..**
5. **Sex:** (a) Male ☐ (b) Female ☐
6. **Marital Status:** (a) Single ☐ (b) Married ☐
   (c) Divorced ☐ (d) Separate ☐
   (e) Widow ☐
7. **How many of you live and feed in the same household?**
   (a) 1-2 ☐ (b) 3-4 ☐ (c) 5 ☐ (e) above 6 ☐ ☐
8. Tribe: (a) Igbo ☐ (b) Hausa ☐ (c) Yoruba ☐
   (d) Others, specify ……
9. **Which age range do you fall into** (a) 20-39 ☐
   (b) 40 – 59 ☐ (c) 60-79 ☐ (d) 80 and above ☐
   (e) Others specify ……
10. **Religion** (a) Christianity ☐ (b) Islam ☐
    (c) Traditional Religion ☐ (d) Others Specify ……

**11. EDUCATIONAL LEVEL:**

**Highest educational level attained?**

(a) No formal education (NFE) ☐
(b) Primary Education ☐
(c) Secondary Education ☐
(d) Post Secondary/Tertiary Education ☐

**12. OCCUPATION**

(a) Farming ☐ (b) Petty ☐ (c) Civil Servant ☐
(d) Student ☐ (e) Business Executive ☐
(f) Retired/Aged ☐ (g) Others specify ……

**13. INCOME LEVEL:**

**What is your estimated income per month in Naira**

(a) <10,000 ☐ (b) 10,000 – 19,000 ☐
(c) 20,000 – 29,000 ☐ (d) 30,000 – 39,000 ☐
(e) N40,000 and above please (specify) …….

**14. How long have you had this diabetes**

(a) < 1 year ☐ (b) 1 - 5 yrs ☐
(c) 6 - 10 years ☐ (d) 11 yrs and above. ☐

**15. MANAGEMENT:**

What symptoms did you experience before your first visit to the hospital? (a) Excessive Urination
(b) Excessive Hunger
(c) Excessive Thirst
(d) Blurred Vision
(e) Weight Lost
(f) Weakness

**16. How long did you experience the above symptoms before going to the hospital?**

(a) < 1wk (b) 1 wk <1mth
(c) 1 mth-3 mth (e) 3 - 6 mth
(e) 6 mths & above

17. Which of these symptom are you still having? ……

**18. What type of treatment do you use for your diabetes?**

(a) Diet Only (b) Drug Only
(c) Drug and Diet Others Please Specify …….

**19. Which drug are you using?**

(a) Diabenese (b) Glucophage
(c) Diabenese and glucophage (d) Insulin
(e) None (f) Others Specify …….

**20. What other things are you using for treatment? ……..**

| | Items used | Names (local etc) |
|---|---|---|
| a) | Herbs | …… |
| b) | Supplement | ……. |
| c) | Others Specify | ……. |
| d) | None | ……. |

21. **Any other associated illness**

(a) Hypertension (b) Ulcer
(c) Cataract/eye problem Others specify ……..

22. **Which of these tests do you use?**

(a) Urine testing (b) Blood testing
(c) Random blood sugar Glucose tolerance test
(e) Others specify ……

23. **How frequent do you these tests**

(a) On appointment days only monthly
(c) Every 3 months (d) Every 6 months
(e) Yearly (f) Others specify……..…

24. **How frequent do you go for medical check**

(a) Only on appointment As the need arises
(c) Once in a year (d) Every 6 months
(e) Once in a year (f) Others specify …….

**NUTRITION KNOWLEDGE**

25. **Diabetes is caused by eating too much starchy foods** Yes No
26. **If you have diabetes better eat beans, cocoyam, Breadfruit, water yam, unripe plantain only** Yes No
27. **Diabetics should ea plenty of vegetable** Yes No
28. **People with diabetes can eat rice etc with vegetables** Yes No.
29. Have you changed your food habit since you became diabetic Yes No

**DIABETIC KNOWLEDGE:**

30. **What do you think that causes diabetes**
    a. It is inherited
    b. It is caused by infected
    c. It may be related to my diet
    d. It is lack of substance in the body
    e. Don't know

31. **Is diabetes curable by medic Treatment** Yes No
32. **What form of treatment is most effective**
    a. Medical
    b. Traditional
    c. Spiritual
    d. Don't know
33. **What is the overall aim of treatment**
    a. To cure
    b. To control
    c. Don't know
    d. Any other specify ……
34. **How long are you going to take drug till I am well**
    a. For life
    b. Don't know
    c. Others specify.

**COMPLIANCE TO TREATMENT**

**35. Is drug treatment important for diabetes?** Yes ☐ No ☐
36. **How often do you take drug**
    a. Daily as prescribe by Doctor
    b. Only when my blood sugar is high
    c. Only when I feel like it.
37. **Do you ever omit drug** Yes/No
38. **If yes how often**
    a. Rarely
    b. Once in a while
    c. Often
    d. Others specify.
39. **What is your reason for omitting drug**
    a. High cost of drug
    b. I think I am cured
    c. I don't know I should continue
    d. Unavailability of drug
    e. Others specify.

**40. Drug and Diet which is more important**
(a) Drug ☐ (b) Diet ☐ (c) Both are important

41. **Were you told the importance of diet for your diabetes**? Yes or No.
42. **Have you ever received dietary counseling**? Yes or No.
**43. Who is your dietary Counselor?**
a. Doctors ☐ (b) Dietitian ☐ (c) Nurses & Paramedicals ☐
(d) Non Medical Relations ☐ (e) Other patients ☐
44. **Do you skip meals**? Yes ☐ No. ☐
45. **Which meals do you skip?**
(a) Breakfast ▱ (b) Lunch ▱
(c) Super ▱ (d) Others specify ……

46. **Why do you skip meals?**

(a) Lack of appetite
(b) Too busy to eat
(c) Lack of the required food
(d) So as not to increase my sugar level
(e) Others please specify ……

**47. How do keep to your dietary instruction?**

a. Strictly ☐ (b) Not Strictly ☐

**48. What is the reason for not keeping strictly to dietary instructions?**

a. Lack of money to purchase the right food ☐
b. Time to prepare the right food. ☐
c. Buy some meals from food vendors. ☐

**49. <u>EXERCISE PATTERN</u>**

**What type of exercise are you involved in**

| | | |
|---|---|---|
| a. | Jogging | |
| b. | Trecking to market/work | up to mins |
| c. | Trecking to market/work | 10 – 20 mins |
| d. | Trecking to market/work | for less than 10 mins |
| e. | Washing Clothes | duration (specify) |
| f. | Others ……. | |

50. Which of these food items have you increased or decreased as a diabetic?

| Food Items | Increased | Decreased | Eat as | Avoid completely |
|---|---|---|---|---|
| **Carbohydrates** | | | | |
| Garri & Cassava Product | | | | |
| Unripe Plantain | | | | |
| Potatoes (sweet) | | | | |
| Potatoes (Irish) | | | | |
| Rice | | | | |
| Yam | | | | |
| Cocoa-yam | | | | |
| Water Yam | | | | |
| Sugar | | | | |
| Pap (Akamu) | | | | |
| Fresh Corn | | | | |
| Corn Meal | | | | |
| Wheat | | | | |
| Bread | | | | |
| **Legumes and Nuts** | | | | |
| Beans | | | | |
| Bambara nut (okpa) | | | | |
| Oil bean (ukpaka) | | | | |
| Bread fruit (ukwa) | | | | |
| Fiofio (Pigeon pea) | | | | |
| Akidi (fresh) | | | | |
| Ikpa Oka | | | | |
| Ground nut (boiled or fried) | | | | |
| Cashew nut | | | | |
| **Meat and Fish** | | | | |
| Meat | | | | |
| Fish | | | | |
| Chicken | | | | |
| Snail | | | | |
| **Fat and Oil** | | | | |
| Red oil (palm oil) | | | | |
| Groundnut oil | | | | |
| Soy bean oil | | | | |
| Other veg. oil | | | | |
| **Vegetable and Fruit** | | | | |
| Pumpkin | | | | |
| Spinach | | | | |
| Others, specify | | | | |
| Tomatoes | | | | |
| Garden egg (ahara) | | | | |
| Pumpkin (green) | | | | |
| Okro | | | | |
| Oranges | | | | |
| Banana | | | | |

| | | | | |
|---|---|---|---|---|
| | Paw-paw | | | |
| | Pineapple | | | |
| | Avocado pear | | | |
| **Beverages:** | | | | |
| | Oval tea | | | |
| | Bournvita | | | |
| | Milo | | | |
| | Coffee | | | |
| | Lipton | | | |
| **Juices** | | | | |
| | Oranges juice | | | |
| | Lemon juice | | | |
| | Lime juice, | | | |
| | Five Alive etc | | | |
| **Alcohols** | | | | |
| | Guilder | | | |
| | Star | | | |
| | Stout | | | |
| | Alcoholic wine | | | |
| | Whisky/Brandy | | | |
| **Non-Alcoholic Wine.** | | | | |
| **Carbonated Drink** | | | | |
| | Coke | | | |
| | Fanta | | | |
| | Sprite | | | |
| | Soda water/Club soda | | | |
| **Snacks** | | | | |
| | Meat/Fish pie | | | |
| | Buns | | | |
| | Cakes | | | |
| | Sweet biscuits | | | |
| | Chin-chin | | | |
| **Cigarette Smoking** | | | | |
| **Tobacco snuffing** | | | | |
| **FBS** | **1.** | **2.** | **3.** | **Average** |

**24 hours Dietary Report. Please recall the food you took from rising up from bed till the time you went to bed including snacks.**

| **Breakfast** | **Lunch** | **Supper** |
|---|---|---|