IMPACT OF PHARMACIST'S INTERVENTION ON PATIENTS' KNOWLEDGE AND ATTITUDE TOWARDS THEIR DIABETES MANAGEMENT IN A TERTIARY HOSPITAL IN NIGERIA

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NOVEMBER, 2017

Declaration

I declare that the work in this Project entitled 'Impact of Pharmacist's Intervention on Patients Knowledge and Attitude Towards their Diabetes Management in a Tertiary Hospital in Nigeria' has been carried out by me in the Department of Clinical Pharmacy and Pharmacy Practice. The information derived from the literature has been duly acknowledged in the text and list of references provided. No part of this project was previously presented for another degree or diploma at this or any other institution.

Name of Student	Signature	Date

Certification

This project entitled 'IMPACT OF PHARMACIST'S INTERVENTION ON PATIENTS KNOWLEDGE AND ATTITUDE TOWARDS THEIR DIABETES MANAGEMENT IN A TERTIARY HOSPITAL IN NIGERIA'meets the regulations governing the award of Master degree in Clinical Pharmacy of Ahmadu Bello University, Zaria.

Dr JamiluYa'u Chairman, Supervisory Committee	Signature	Date
Prof S.S Gyang Member, Supervisory Committee	Signature	Date
Dr Shafi'u Mohammed Head of Department	Signature	Date

DEDICATION

I dedicate this work to Almighty Allah for the favours He bestows on me, then to my parents for their tireless support.

ACKNOWLEDGEMENT

I acknowledge the sufficient grace of God that has sustained me through the difficult moments encountered during the course of my work and my dear parents Muhammad Auwal and Hauwa'u Abba for their prayers and unending support, I love you both.

I am sincerely grateful to my supervisor and mentor Dr. JamiluYa'u for their constructive criticism and contributions towards the realization of this work. I am grateful to them for their guidance, advice and patience going through this work. I value their support and help immensely.

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Finally, to my beloved husband S.A Tukurand all who have helped me in diverse ways I say 'May God bless you all abundantly and be with you always.

ABSTRACT

Diabetes mellitus (DM) is the most common endocrine disorder. It is a chronic metabolic condition characterized by hyperglycaemia due to impaired insulin secretion with or without insulin resistance.Most diabetic patients have inappropriateknowledge of the clinical disorder and thus unaware of the health implications of non-adherence. This study was aimed at assessing knowledge and attitude of diabetics to the management of their clinical disorder and also further examined the effect of educational intervention on their attitude towards the disease management. The study site and population were Ahmadu Bello University Teaching Hospital and consenting diabetic out patients. An interviewer' administered questionnaire was used to obtain data from 340 selected participants, data collected were baseline demographics, participant's knowledge about diabetes and their attitude towards its management, baseline blood glucose readings(documented) and medicine usage. Participants with active mobile phones 104 were followed up every two weeks for two months and were assessed post intervention using their glucose level to establish the outcome. Data generated were analysed using SPSS version 22. Descriptive statistics was used to describe data and paired T-test was used to compare pre and post intervention groups.The study showed that the overall patients' knowledge about diabetes was good because 92.4% of subjects were aware it is a chronic disease, 89.4% know it's complications, 81.8% could interpret blood glucose readings and 76.5% knew the signs of hypoglycaemia. The attitude however was not encouraging because 61.2% of them forget to take their drugs, 51.2% missed a dose two weeks pre assessment, 42.4% stopped drugs without consulting their doctors, 68.2% do not monitor their blood sugar level regularly,67.1% stop their drugs when they feel their blood glucose level is under control while 63.5% complemented their drugs with traditional medications.. In conclusion, diabetic patients of Ahmadu Bello University Teaching Hospital had good knowledge and relatively fair attitude towards their disease management. It also showed that patient education and counselling is very vital in the management of diabetes as followed up patients had remarkable improvement in their fasting blood glucose ($p<0.01$).

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CHAPTER ONE

1.0 INTRODUCTION

1.1Background

Diabetes mellitus (DM) is the most common endocrine disorder, it is a chronic metabolic condition characterized by hyperglycaemia due to impaired insulin secretion with or without insulin resistance(Elizabeth *et al.,*2008). Knowledge can be defined as facts, information and skills acquired by a person through experience or education. It is theoretical or practical understanding of a subject. Attitude on the other hand can be defined as the way a person views something or tends to behave towards it, often in an evaluative way (Ursula, 2017). The prevalence of DM is increasing globally, the worldwide prevalence was 171 million in the year 2000 and is estimated to rise to 366 million in 2030, but in Nigeria, the prevalence is between 2-7% (WHO, 2016). Urbanization with the adoption of western lifestyles has been blamed for the increasing prevalence. Evidence shows that dietary and exercise modifications offered to non-diabetic adults can reduce or delay onset of type 2 diabetes. Diabetes mellitus is common in the elderly in the western countries. In developing countries, it largely affects those between 35-64years. Some studies have shown that there is a relationship between the knowledge of DM and certain socio-demographic variables (Gholamreza *et al*, 2010; Zanchetta *et al*, 2016) For example, being in high school or university, and high socioeconomic levels were found to be associated with higher levels of knowledge. Higher levels of education and higher incomes have also been associated with better knowledge (Frederick, 2016) Similarly, findings of some studies seem to suggest that

there is a relationship between higher age and increased knowledge. Some studies have associated female gender with higher knowledge (Patricio Fernando *et al*, 2014), while some have associated it with poorer knowledge (Girish *et al,* 2015) and some have claimed that gender has no association with diabetic knowledge. Patients' view or perception of their illness seem to be an important variable affecting their health behaviour and ultimately their overall management. Research has indicated that illness perceptions are important determinants of behaviours associated with adherence to treatment and functional recovery(Keogh *et al.*, 2007; Joseph *et al.*,2009).Adherence is defined as the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider (WHO, 2003).Type 2 diabetes is considered a disease of poor lifestyle with physical inactivity, obesity and urbanisation contributing to the increased prevalence of the disease in contrast to type 1 diabetes which is a genetically caused autoimmune disease (Levitt, 2008). Of concern is the predicted relative increase in sub Saharan Africa that will occur between 2000 and 2030 (Wild *etal.*, 2004). Diabetes education and diabetes self-management education, as well as on-going support, are essential components of diabetes care. Patient participation is crucial in themanagement of diabetes. Education empowers people living with diabetes to manage their disease, improve health goals and outcome, as well as contributing to the care of other patients. Different aspects of diabetes management demand lifestyle changes, self-monitoringof treatment, and prevention of complications.A joint initiative of the World Health Organization(WHO) and International Diabetes Federation (IDF), 'Diabetes Action Now', aims to stimulate and support the adoption of effective measures for surveillance,

prevention, and control of diabetes; as well as to achieve a substantial increase in global awareness about diabetes and its complications. It has 19 healthcare domains – screening and diagnosis, care delivery, education, psychological care, lifestyle management, glucose control level, clinical monitoring, self-monitoring, oral therapy, insulin therapy, blood pressure (BP) control, cardiovascular (CV) risk protection, eye screening, kidney damage, foot care, nerve damage, pregnancy, children, and in-patient care. Self-management education provides knowledge and practice of all the various aspects of diabetes care and support. Therefore, health workers must be trained on a regular and continuous basis to impart the correct information on diabetes, and also provide general information on networking and health systems. Some countries such as Canada, the USA, and Australia provide standard courses for certified diabetes health educators (who undergo regular recertification) to ensure that such educators have current best practice knowledge and skills. The use of diabetes guidelines and standards to teach people living with diabetes can improve health outcomes 8–10 of patients.

In Nigeria the prevalence of diabetes is 2.6 million, the high burden of diabetes mellitus in Nigeria is largely attributable to cardiovascular disease which account for 15% of all DM deaths. Kaduna is the state capital of Kaduna State in north-west Nigeria. Kaduna State forms a portion of the country's cultural melting pot. Apart from six major ethnic groups found in the State including Zungeru, Kataf, Atachaat,Adara, Hausa, and Anghan (Wikipedia.org/wiki/kaduna state. 2017). There are over twenty other ethnic minority groups, each with its language and arts or religion different from the other. A study revealed that urban people of Kaduna State engage in sedentary lifestyle more than the rural counterparts, hence health problems suffered by the people of Kaduna state are

significantly related to their sedentary lifestyle and public health education is recommended to reduce health problems like obesity, hypertension, stroke and other cardiovascular disease caused by sedentary lifestyle (Hamoudi, 2012).In the last decade, illness perception has been identified as an important factor that impact on the way people may change their behaviours (Petrie *et al*., 2007).Wilgen*et al*., (2008) state that "When patients are confronted with an illness or symptoms, they create a model and representation of the illness or symptom (Illness Perception) in order to make sense of or try to cope with it." In addition, research based on health psychological theories have highlighted the importance of patients personal beliefs of their illness and treatment in their self-management for a range of chronic illnesses (Leventhal*et al.,*1980; Petrie*etal.*, 1996).

In order to assess patients illness perception, (Weinman*et al.,* 1996). developed Illness Perception Questionnaire IPQ that was later modified by Moss-Morris *et al*., (2002) into revised version, IPQ-R. Since then IPQ-R has been used for perception studies of many chronic illnesses including diabetes (Griva*et al*., 2000).Diabetes is one of the chronic diseases that affect both the young and old in our society. According to American Diabetes Association (2006), there were about 20.8 million people with diabetes in United States alone, while in developing countries, increase in prevalence is expected to occur especially in Africa, where most patients will likely be found by 2030. This increase in incidence of diabetes in developing countries follows the trend of urbanization and lifestyle changes perhaps most importantly a "Western – Style" diet (WHO, 2006). In Nigeria though no estimate of the individuals suffering from the disease has been made, a screening exercise carried out in Warri and Sapele by Urhobo National Association of

North America in 2004, where 787 people attended 65% were diabetic and hypertensive (Okolie*et al.,* 2009).Majority of studies on effectiveness of interventions to address suboptimal use of medicines focused on adherence aspect, either in a disease area or specific conditions, hence, adherence is the most important hurdle for medicines optimisation (Faria*et al*., 2014).Many studies on adherence to medication and the ways to improve it have been conducted yet it remain significantly low. However, non-adherence to treatment represents a missed opportunity for health gain and waste of resources (Atkins and Fallowfield, 2006).

1.2 Statement of Research Problem

Diabetes Mellitus is a public health concern worldwide. Most diabetic patients have inappropriate knowledge of their clinical disorder and thus, unaware of the health implications of non-adherence to its management. Most patients are also unaware of life style modifications necessary to achieve normoglycaemic status (Bhutani, 2014).DM is a pandemic of major public health importance. It is the biggest endocrine driver for global burden of diabetes (GBD), it directly led to 1,281,300 deaths in 2010, a 92.7% rise over the 1990 figure of 665,000 for lost lives (WHO, 2016).

WHO (2016)global reports on diabetes demonstrate that the number of adults living with diabetes has almost quadrupled since 1980 to 422millionadults.DM is one of the leading causes of death in the world. In 2012, diabetes was the direct cause of 1.5million deaths globally. The majority of diabetes deaths occur in low and middle income countries (WHO, 2016).The WHO has projected diabetes to be the 7^{th} leading cause of death in 2030.It is very disturbing that 35 – 44% of people with diabetes do not know they have it

(D'Cunha*et al.,* 1999).Diabetes is a major cause of premature death, blindness, kidney disease, heart disease, stroke, limb amputation and other significant health problems.The estimated prevalence of diabetes in Africa is 1% in rural areas, and ranges from 5-7% in urban sub-Saharan Africa.(Kengne*et al.,*2005).One of the hidden impacts of diabetes is the loss of productivity from disability, sickness, premature retirement and premature death (D'Cunha*et al.,* 1999).

Currently, few health programs educate the public about preventing diabetes. Despite educational programs for preventing complications, the proven effectiveness of lifestyle changes, and advances in treatment, some people remain unaware or unconvinced of the seriousness of this disease (D'Cunha*et al.,* 1999). Research advances in diabetes, including new drug therapies, are often not communicated effectively (D'Cunha*et al.,* 1999).Type 2 diabetes patients attending a tertiary care hospital lacked knowledge about their disease in all aspects: symptoms, complications, prevention and control (Mukhopadhyay*et al.,* 2010). Canada spends 9 billion dollars annually on healthcare, disability, work loss, and premature death costs related to diabetes.Diabetes is estimated to cost the Ontario health system just under 1 billion dollars annually.An American study suggest that 14% of the US healthcare budget (1 in 7 US healthcare dollars) is spent on diabetes (D'Cunha*et al.,* 1999).Ben Abdelaziz*et al.,* (2007) in their cross-sectional study concluded that Tunisian patients with type 2 diabetes lacked knowledge regarding the definition and pathophysiology of diabetes. Interestingly, the knowledge by Zimbabwean diabetics' about their health and illness was strongly underlined by traditional and religious beliefs (Hjelm&Mfunder, 2010.) Odili*et al.,* (2011) found that Nigerian type 2 diabetics also lacked knowledge of their disease regarding diets and lifestyle changes. A

cross sectional study conducted in the Indian city of Kolkata found that people with type 2 diabetes attending a tertiary care hospital lacked knowledge about their disease in all aspects: symptoms, complications, prevention and control (Mukhopadhyay*et al.*, 2010).

1.3Justification of the Study

The increase prevalence of diabetes and its complications indicates the sub-optimal level of diabetes knowledge among the patients and the population at large. This inadequate knowledge affects quality of life, causes therapeutic failure, poor prognosis and increased morbidity and mortality rates. Patients' views or perceptions of their illness seem to be an important variable affecting their health behaviour and problem management. Research has indicated that illness perceptions are important determinants of behaviour which are associated with adherence to treatment and functional recovery (Keogh *et al*., 2007; Joseph*etal.*, 2009) In a qualitative study conducted in Malaysia with a specific focus on medication, it was found that patients had a moderate knowledge about their illness and it was recommended that more attention be given to improving provider and patient relationships, providing more education on medication adherence and self care (Al-Qazzaz*et al.*, 2011). The French DIABASIS survey highlighted the importance of understanding patient's perceptions of type 2 diabetes as it enhances education strategies (Mosnier-Pudar*et al.*,2009).Patients' perceptions of their illness impacts greatly on their disease management and self-care. However, a longer duration of disease was associated with a higher knowledge score. It is thus hoped that this study will be the initiation of research into this pertinent aspect of diabetes in Northern Nigeria.

1.4 Aim of the Study

The aim of this study is to assess the knowledge and attitude of patients with diabetes towards the management of their disease and also, to evaluate the impact ofpharmacist intervention on their clinical outcome.

1.4.1 Objectives of the Study

1. To assess patients' knowledge and attitude towards diabetes management.
2. To evaluate the impact of an educational intervention on patientsattitude towards diabetes management using FBG and 2HPP as indices

CHAPTER TWO

2.0 LITERATURE REVIEW

Diabetes mellitus can be defined as a group of metabolic disease characterized by increased levels of glucose in the blood (hyperglycaemia) resulting from defects in insulin secretion, insulin action or both (American Diabetes Association, 2009a).Consequently, diabetes carries an increase rise of morbidity and disability from neuropathy especially diabetic foot ulcer. All forms of diabetes are characterized by chronic hyperglycaemia, ketoacidosis, hypoglycaemia which are macrovascular complications as well as the development of diabetes-specific microvascular pathology in the retina, renal glomerulus and peripheral nerve (Centre for Disease Control and Prevention (CDC), 2007). As a consequence of its microvascular pathology, diabetes is a leading cause of blindness, end-stage renal disease and a variety of the debilitating neuropathies. Diabetes is also associated with accelerated artherosclerosis micro vascular disease affecting arteries that supply the heart, brain and lower extremities. As a result, patients with diabetes have a much higher risk of myocardial infarction, stroke and limb amputation (Brownlee, 2001). It is sixth leading cause of death in the U.S and incurs annual medical cost of over $100 billion (Agency for health research and quality (AHRQ), 2007). Diabetes is associated with increased risk of cardiovascular diseases, such that a person with diabetes has a risk of myocardial infarction (MI) as high as that of a non-diabetic person with a previous MI. Infact, cardiovascular disease accounts for >50% of all deaths in the diabetic population (Calkin*et al.*, 2006). The diabetic control and complication trial (DCCT) and the UK prospective diabetes study (UKPDS) established that hyperglycaemia is the initiating

cause of the diabetic tissue injury that we see in daily clinical practice. Although this process is modulated by genetic determinants of individual susceptibility and by independent accelerating factors such as hypertension and dyslipidaemia, glycaemic control remains crucial for preventing such diseases (Schiavoni*et* al., 2007).

Adherence refers to the willingness and ability of an individual patient to follow health-related advice, take medication as prescribed, attend scheduled clinic appointments, and complete recommended tests and consultations (Osterberg, 2005). Although often used interchangeably with compliance, adherence also refers to the extent to which patients follow through decisions about medicines taking (i.e.,leaving open the question of who makes these decisions or how they are made, the patient has a choice of decision.) (Horne *et al.*,2005). The importance of optimizing treatment adherence rises in proportion to the potential benefit from therapy.As to whether patients achieved goal blood glucose despite not having fully complied with prescriptions, or failed to achieve goal blood glucose (in part) because of imperfect adherence the first implication is that optimal compliance with prescribed medications should not be assumed, since it seems not to occur about half the time (Osterberg, 2005). Prominent reasons for low adherence included forgetfulness, lack of funds, high pill burden, feeling of well-being and cure, and side effects of medications. Premature discontinuation of treatment due to drug side effects and lack of money to buy drugs interrupted consistent use of antidiabetic medications. However, The most common discouraging factors cited in the literature such as forgetfulness, side effects, cost of medication and lack of access to medication have not shown any statistically significant associations with non-adherence (Hashmi*et al.*, 2007). Factors showing significant

associations with adherence are age, number of drugs prescribed and patients' knowledge of the disease and treatment, including their beliefs and practices (Hashmi*et al.,* 2007).

2.1 Classification of Diabetes Mellitus

The Canadian Diabetes Association(2013) classified diabetes as below;

1. Type 1 (Juvenile onset or insulin-dependent) diabetes mellitus
2. Type 2 (Maturity onset or Noninsulin-dependent) diabetes mellitus
3. Gestational diabetes mellitus and Others

Others are;

1. Genetic defects of beta-cell function
3. Genetic defect in insulin action
3. Diseases of the exocrine pancreas
4. Endocrinopathies
5. Drug or chemical induced e.g. Nicotinic acid, Glucocorticoids, high dose thiazides, pentamidine, interferon-alpha
6. Infections

2.1.1 Type 1 Diabetes Mellitus

This results from the body's failure to produce insulin and presently requires a person to inject insulin. Type 1 diabetes is an auto immune disease that is a condition in which the

body's disease fighting immune system goes awry and attacks healthy tissues. Scientists have so far identified 20 genes that play a role in diabetes such as HLA-DQA1, HLA-DQB1, HLA-DRB1 IDDM2, and CTLA4 genes, these genes provide instructions for making proteins (including insulin) and have regulatory roles in immune responses In addition to causing hyperglycaemia, type 1 diabetes if left untreated affects fat metabolism.

2.1.2 Type 2 Diabetes Mellitus

Referred to as non-insulin dependent diabetes mellitus formally is more common above the age of 40 with a peak age of onset in developed countries of between 60 and 70 years. It is caused by a relative insulin deficiency and or insulin resistance. It can progress to the extent whereby exogenous insulin is required to maintain blood glucose levels (Elizabeth *et al.*, 2008). Of the nearly 21million people in the US with diabetes, 90-95% have type 2 diabetes. In addition, there is a strong relationship between obesity and type 2 diabetes with about 80%diabetics with this form of disease being overweight.

2.1.3 Gestational diabetes mellitus

This type of diabetes develop only during pregnancy, it occurs more in African Americans, American Indians, and among women with a family history of diabetes. Women who have had gestational diabetes have 20-50% chance of developing diabetes within 5-10 years (National Institute of Health, 2012.) This form of diabetes could pose risks to the baby such as macrosomia (high birth weight), respiratory distress etc (www.diabetes.co.uk, 2016).

2.2 Prevalence of Diabetes Mellitus

The prevalence of DM is increasing globally, the worldwide prevalence was 171 million in the year 2000 and is estimated to rise to 366 million in 2030, but in Nigeria, the prevalence is between 2-7% (WHO, 2016). The overall prevalence of diabetes is 2% in Dakace village near Zaria.(Dahiru,*et al.*, 2008). Despite advances in diabetes therapy, control rates continue to be sub-optimal. Programs that improve diabetic control and prevention of its complication are urgently needed.

2.3 Risk Factors in Diabetes

In majority of patients, risk factors associated with diabetes are either of genetic or environmental origin. Type 1 diabetes mellitus is mostly genetic while type 2 diabetes is due to some physical factors. Some conventional risk factors includes; dyslipidaemia, hypertension, coagulopathy. (Calking *et al.*, 2006). Other possible risk factors include; obesity, alcohol use, family history, smoking and diet.

2.3.1 Obesity

Being overweight is one of the strongest predictors of developing diabetes. Lack of physical activity (Sedentary lifestyle) leads to poor weight management and increases the risk of diabetes and many heart conditions. Maintaining a normal body and daily exercise such as walking and jogging increase metabolic as well as cardiovascular efficiency. (Malka, *et al*, 2000).

2.3.2 Diet

Excessive carbohydrate intake results in hyperglycaemia where the insulin present is inadequate for normal glucose metabolism. Also saturated fats accumulate over time resulting in hypercholesterolemia which can subsequently lead to artherosclerosis and ketoacidosis. (Malka, *et al*, 2000).

2.3.3 Smoking

Cigarette smoking results in vasoconstriction due to release of chemo mediators which activates the sympathetic nervous system thus increases the risk of heart diseases and eventually diabetes. Nicotinic acid from tobacco is an important chemical which induces diabetes. Smoking therefore should be avoided in diabetic patients. (Malka, *et al*, 2000).

2.3.4 Alcohol Abuse

Consumption of large amount of alcohol increases the risk of diabetes. Alcohol interferes with steroid production (Glucocorticoids) which could induce hyperglycaemia where control is inadequate. Reduction or total withdrawal from alcohol intake will help in lowering blood glucose in predisposed individuals. (Malka, *et al*, 2000).

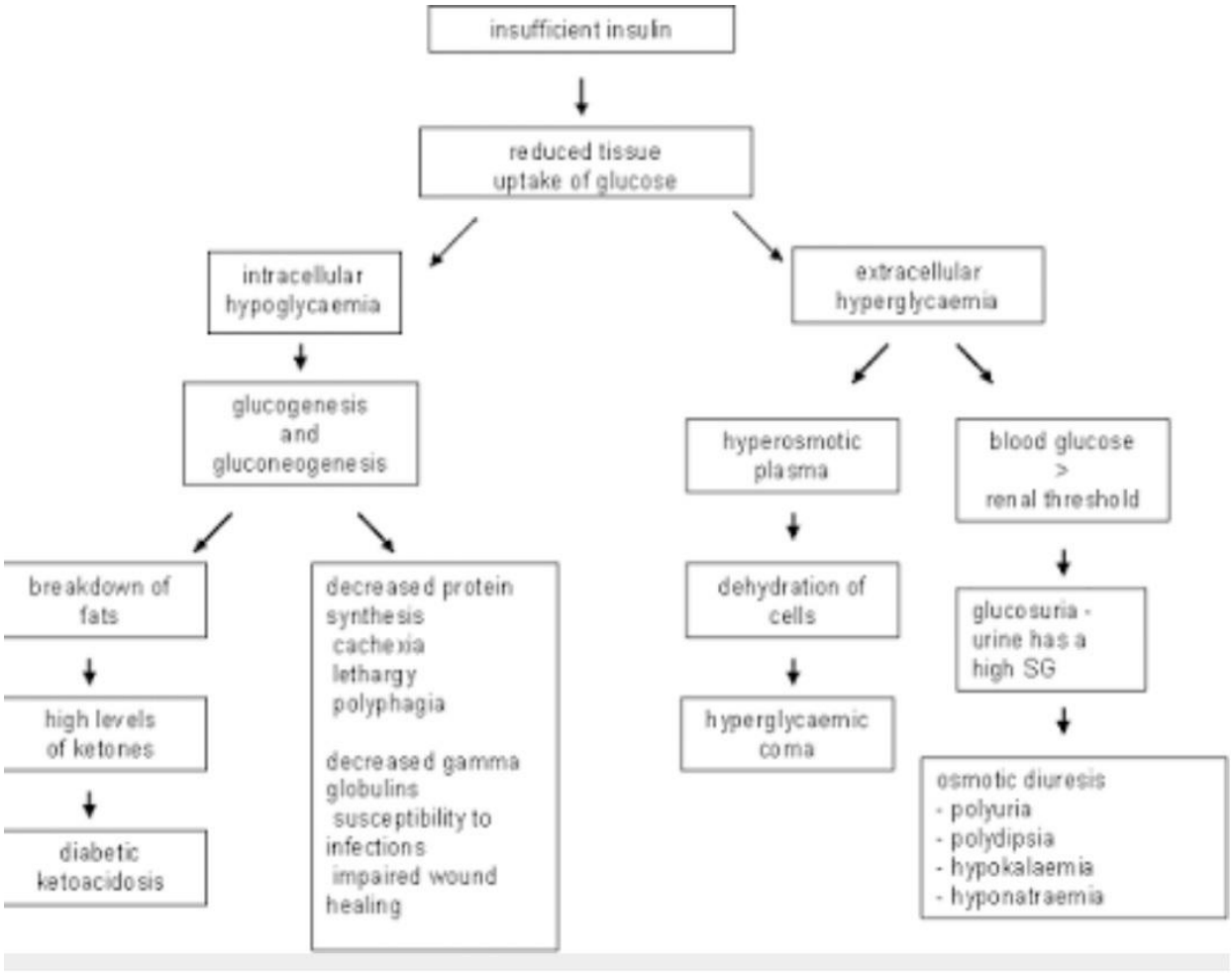
2.3.5 Ageing and Family History

Over time, the number of collagen fibre in artery and wall increases making blood vessels stiffer. The reduced elasticity brings about a smaller cross sectional area in systole leading to hypertension (Akubue, 2006). Hypertension is an important risk factor for the development of diabetes. Children from parent with diabetes have higher risk of

developing hyperglycaemias compared to those without family history of the disease. This is as a result of genetic transfer from one generation to the other(Malka, *et al*, 2000).

3.4 Pathophysiology of Diabetes

A Chart Showing the Pathophysiology of Diabetes



(Zdychova, 2014).

The islets of langerhans are the endocrine component of the pancreas constituting 1% of total pancreatic mass. Insulin is synthesized in the pancreatic beta-cells, initially as a polypeptide precursor, prepro insulin. The latter, is rapidly converted to proinsulin in the pancreas. This forms equal amounts of insulin and C-peptide, through removal of four amino acid residues. Insulin consist of 51 amino acids in 2 chains (Achain contains 21 amino acids and B chain contains 30), connected by two disulphide bridges. Insulin, C-peptide and some pro insulin in the islets are packaged into granules. Insulin associates spontaneously into a hexane containing two zinc ions and one calcium ion.

Glucose is a major stimulant of insulin release. The response is triggered both by intake of nutrients and the release of gastrointestinal peptide hormone. Following an intravenous injection of glucose, there is biphasic insulin response. There is an initial rapid response in the first two minutes, followed after 5-10 minutes by a second response which is smaller but sustained over one hour. The initial response represents the release of stored insulin. Once released, it enters portal circulation where the liver rapidly degrades it; only 50% reaches the peripheral circulation. In basal state, insulin secretion is at a rate of approximately 1 unit/hour which increases by 5-10 folds when food is ingested. The half-life of insulin is 4-5 minutes.

In diabetes mellitus, there is relative or absolute lack of insulin or both leading to hyperglycaemia explaining the pathogenesis of diabetes. (Hackett *et al.*,2008).

2.5Diagnosis of diabetes

The Clinical Practice Guidelines for Diabetes Management in Nigeria adopted the (WHO) criteria for diagnosing diabetes (WHO, 2016). They consist of the following;

Diabetes symptoms (polyuria, polydipsia, and unexplained weight loss) plus:

A random venous plasma glucose concentration of > 11.1mmol/L.A fasting plasma glucose concentration of 7.0mmol/L (6.1mmol/L for whole blood).Plasma glucose concentration of > 11.1mmol/L 2 hours after 75g anhydrous glucose in an oral glucose tolerance test.With no symptoms, diagnosis should not be based on a single glucose determination but requires confirmatory plasma venous determination. At least one additional glucose test result on another day with the value in diabetic range is essential. Current recommendation are that the diagnosis is confirmed by a glucose measurement in an accredited laboratory on a venous plasma sample. A diagnosis should never be made on the basis of glucosuria or a stick reading of a finger prick blood glucose alone. Glycated haemoglobin (HbA1c) is not used alone as diagnostic tool. (Hackett *et al*., 2008).

2.6 Management of Diabetes Mellitus

The main goal of diabetes management is to restore carbohydrate metabolism to a normal state as possible. To achieve this goal, individuals with an absolute deficiency of insulin require insulin replacement therapy, which is given through injections or an infusion pump. Insulin resistance, in contrast can be corrected by dietary modification and exercise. Other goals of diabetes management are to prevent and/or treat the many complications that can result from the disease itself and from the treatment. (American Diabetes Association, 2008).Treatment of diabetes includes pharmacological and non-pharmacological approaches.

Goals of Diabetic Management

1. To achieve normal to near-normal glycaemic control
2. To prevent complications
3. To reduce morbidity and mortality from the disease
4. To improve patients quality of life

2.6.1 Pharmacological Management of Diabetes

Diabetes treatment are organised by pharmacological action with regards to the ability to address basal glucose needs, prandial needs or insulin resistance. Oral anti-hyperglycaemic therapies and new injected hormonal therapies lower glycosylated haemoglobin (HbAlc) levels only 1-2% at best (ADA, 2009). For patients with HbAlc levels >9%, combination therapies or early introduction of insulin may be essential for achieving adequate diabetes control.

Pharmacologic treatment of Type 1 diabetes

Keeping blood sugar levels under control can prevent or minimise complications. Insulin treatment is one component of a diabetes treatment plan for people with type 1 diabetes.

Insulin treatment replaces or supplement the body's own insulin, restoring normal or near-normal blood sugar level. Many different types of insulin treatment can successfully control blood sugar levels; the best option depends upon a variety of individual factors.

(McCulloch, 2012).

Insulin is classified into the following depending on whether they would be given as bolus or basal regimen;

1. Rapid-acting e.g. Insulin lispro (Humalog), Insulin aspart (Novolog), and Insulin glulisine(Apidra)
2. Short-acting e.g. Insulin regular
3. Intermediate-acting e.g. Insulin NPH
4. Long-acting e.g. insulin glargine (lantus), Insulin determir(uremir)

Insulin Regimens consist of;

1. Intensive insulin Treatment
2. Conventional Insulin Treatment

Pharmacological management of type 2 Diabetes

About 80% of patients with type 2 diabetes are overweight at diagnosis, and this is known to cause insulin resistance. This means that higher dose of medication may be required to control blood glucose levels (Wahrenberg*et al.,* 2005).The drugs used are classified as follows;

Biguanides

Metformin is the only biguanide available for use in Nigeria. The mechanism of action is still not completely understood. However, the principal mode of action is via potentiation of insulin at an unknown intracellular locus, resulting in decrease hepatic glucose production by both gluconeogenesis and glycogenolysis (Bailey, 2004). Metformin also stimulates tissue uptake of glucose, particularly in muscle, and is thought to reduce gastro intestinal absorption of carbohydrate. Metformin has advantages over other insulin

secretagogues and sulfonylureas in particular, as it does not usually cause hypoglycaemia and weight gain. Metformin is short acting with half-life of 6 hours (Bailey, 2004). It does not bind to plasma protein. It is not metabolised and is totally renallyeliminated. Side effects include; anorexia, nausea, abdominal discomfort and diarrhoea. A suggestive regimen is to start with 500mg daily for one week, then 500mg twice daily for one week. Increasing the dosage at weekly intervals until desired glycaemic response is achieved. The maximum licensed dose is 3g/day but doses of more than 2g/day often cause intolerance (Bailey, 2004).

Recently, a modified-released preparation of metformin has become available that permits once daily dosing. This formulation has fewer gastro intestinal side effects. The maximum licensed dose for the formulation is 2g/day. Other previously available biguanides, phenformin and buformin were withdrawn due to deaths associated with lactic acidosis

Sulfonylureas

The major actions of this class of drug rely on the ability of pancreas to secrete insulin and hence require functioning beta-cells to exert a beneficial effect. Sulfonylureas lower blood sugar by increasing pancreatic beta-cell sensitivity to glucose, allowing more insulin to be released from storage granules for a given glucose load. Studies also suggest that sulfonylureas may promote an increased systemic bioavailability of insulin due to reduced hepatic extraction of the insulin secreted from the pancreas (Campbell *et al.,* 2015).The frequency of adverse effects from this class of drugs is low, they are usually mild and reversible on drug withdrawal. The most common adverse effect is

hypoglycaemia, which may be profound and long lasting. The major risk factors for the development of hypoglycaemia include, use of long acting agents, increasing age, renal or hepatic dysfunction and inadequate carbohydrate intake. Other adverse effects are weight gain, blood dyscreasias and rashes. (Campbell *et al.,* 2015).

Sulfonylurea dosage should be individualized for each patient. The lowest possible choice required to attain the desired levels of blood glucose without producing hypoglycaemia should be used. For many agents, the maximum effect is seen if the dose is taken half an hour before a meal; rather than with or after food. Examples of sulphonylureas include; Glibenclamide, Glimepiride, Gliclazide.

Meglitinides

The meglitinides are insulin-releasing agents (insulin secretagogues), also called post prandial glucose regulators. They are characterized by a more rapid onset and shorter duration of action than sulfonylureas. Their site of action is pharmacologically distinct from that of sulfonylureas. Repaglinide, a benzoic acid derivative was the first member of the class. It is licensed for use as a single agent when diet control, weight reduction and exercise have failed to regulate glucose levels, or in combination with metformin. Nateglinide was introduced later and is a derivative of D-phenylalanine to be used with metformin when metformin alone is inadequate. Like sulfonylureas, the meglitinides stimulate first-phase insulin secretion by inhibiting ATP-sensitive potassium channels in the membrane of the pancreatic beta-cells. This cause depolarization and opening of voltage gated calcium channels and subsequent stimulation of insulin release. Most common side effects of meglitinides are; Hypoglycaemia, visual disturbance, abdominal

pain, diarrhoea, constipation, nausea, vomiting and rarely hyper sensitivity (Marino, 2009).Thiazolidinediones. Recent research into the action of the thiazolidinedione (glitazones) has led to greater understanding of the development of type 2 diabetes. Two glitazones are currently available, Rosiglitazone and pioglitazone. Pioglitazonehas been shown to have a significant benefit on macrovascular morbidity and mortality demonstrating the benefit of a glucose-lowering agent on macro vascular disease (dormandy*et al.,* 2005). The glitazones act as agonists of the nuclear peroxisome proliferator-activated receptor-alpha (PPAR-alpha) which is mostly expressed in adipose tissues, but also found in pancreatic beta-cells, vascular endothelium and macrophages. It is also expressed weakly in skeletal muscles, liver and heart (Hauner, 2002). The thiazodidinediones lower fasting and post prandial glucose levels in addition to lowering free fatty acid and insulin concentrations. They enhance insulin sensitivity and promote glucose uptake and utilization in peripheral tissues. The primary side effects of both rosiglitazone and pioglitazone is oedema, particularly in patients with hypertension and congestive cardiac failure. Others are weight gain, headache, myalgia, abdomimal pain and upper respiratory tract infection, both drugs cause elevated liver transaminases. Another glitazone, troglitazone was withdrawn from the UK in 1997 because of liver failure and thus liver function should be checked during initiation of therapy (Hauner, 2002).

Alpha Glucosidase InhibitorsAcarbose reduces carbohydrate digestion by interfering with gastro intestinal glucosidase activity. Although overall carbohydrate absorption is not significantly altered, the post prandial hyperglycaemic peaks are markedly reduced.The most common adverse effect of acarbose is abdominal discomfort associated with

flatulence and diarrhoea. Others are idiosyncratic elevation of plasma hepatic transaminase levels(Bischoff, 1995).Incretin-Based therapiesincretinmimetics and inhibitors of the protease dipeptidyl peptidase (DPP)-4 are new classes of antidiabetic agents first introduced in 2005 (Exenatide) and 2007 (Sitagliptin), respectively. They both use the properties of the incretin hormone, glucagon-like peptide (GLP)-1(Michael *et al.,* 2009.) They work by increasing the levels of hormones called 'Incretins'. These hormones help the body produce more insulin only when needed and reduce the amount of glucose produced by the liver when not needed. They reduce the rate at which stomach digests food and empties, and can also reduce appetite(Bailey, 2014).

Sodium glucose Co-transporter 2 (SGL T2) Inhibitors

A new class of oral antidiabetic agents. They include; Canaglifozin, Empaglifozin, and Dapaglifozin. They inhibit SGL T2 thereby preventing glucose reabsorption and increasing its excretion in urine. As glucose is excreted, its plasma levels fall leading to improvement in all glycemic parameters. The most common adverse effects of this class of drugs is Uro-genital infections especially in women and in uncircumcised men. (Bailey, 2015).

Insulin Therapy in type 2 Diabetes

Evidence has shown that overweight patients who are not acutely unwell should be initiated on once daily basal insulin (usually at night) with continuation of metformin. The basal insulin is titrated to achieve normal fasting glucose levels and the patient may be taught this self titration protocol (Davies *et al.*, 2005).

Non-Pharmacological Management of Diabetes

1. Smoking cessation

2. Reduction of alcohol consumption

3. Cutting down high calorie diets
4. Avoiding fat intake
5. Improved personal hygiene to prevent infections
6. Eating vegetables and fruit
7. Drinking water to remain hydrated

Role of Education in Diabetes Management

According to (Bonsignore, 2017). Diabetes education is the cornerstone of diabetes management because diabetes requires day-to-day knowledge of nutrition, exercise, monitoring of blood glucose and medication adherence. Diabetes education makes you more aware of diabetes, what it takes to treat it, and gives you the power to control it.

CHAPTER THREE

3.0 METHODS

3.1 Study Instruments

3.2 Methods

3.2.1 Study Site

AhmaduBello University Teaching Hospital is located at Shika, Kaduna state. It is a tertiary health facility established by the Federal Government of Nigeria on 4th October, 1962. The facility was chosen because it is one of the largest hospital in Nigeria with 430 bed capacity (Oyefabi*et al.*, 2014). It is also one of the largest serving referral centres in North-west Nigeria and it serves different ethnic groups from Kaduna State and other parts of the country.

It houses an administrative block, medical wards paediatric ward, obstetrics and gynaecology ward, psychiatric ward, labour ward, in-patient admission department, general out -patient department, orthopaedic, histopathology, oncology, haematology, chemo pathology, immunology, surgical wards, radiotherapy, main pharmacy, In-patient pharmacy, Unit dose dispensing system, Accident and emergency, antenatal clinic, eye clinic, dental clinic and several consultation rooms.

3.2.2Study Design

This was a multi-phase study conducted over a period of six months.It comprised a pre-intervention phase (baseline readings and intensive patient education andcounselling) an intervention phase (mobile phone follow up) and a post intervention phase (Outcome evaluation using blood glucose readings)

3.2.3Study Population

Consenting diabetic patients attending outpatient diabetic clinic of Ahmadu Bello University Teaching Hospital.

3.3 SamplingTechnique

Conveniencesampling method was used to select participants.

3.3.1Sample Size

Studies have shown that the prevalence of diabetes in ABUTH is around 28% (Abdulazeez*et al*., 2013). Based on that, a total of 309 was calculated but inflated to 340 to cover for non-response.

Sample size n = [z/Δ]2 p(1-p)

- z = standard deviate = 1.96
- Δ = Absolute precision = 0.05 (5%)
- p = Anticipated population proportion = 28%

3.4 Ethical Considerations

Prior formal permission was sought from the Hospital Research and Ethics Committee of ABUTH (ABUTHZ/HREC/Q7/2016).Participants were represented with an identification code for anonymity and only the coded information was entered into the computer software (SPSS version 22, verisign class 3 code signing 2010 CA.)for analysis. Informed consent was sought from participants.

3.5 Inclusion Criteria

1. All consenting diabetic patients aged 18 years and above attending outpatient clinic.
2. Possession of an active mobile phone for the intervention group.
3. Diabetic patients with co-morbid diseases.

3.6 Exclusion Criteria

1. Diabetic patients below 18 years.
2. Diabetic patients not attending ABUTH diabetic clinic.
3. Diabetic patients with active psychosis and dementia.
4. Inability to understand written or spoken English/Hausa.
5. Non consenting diabetic patients.

3.7Study Tool

An intervieweradministered questionnaire was used to obtain data from selected subjects weekly while waiting to see the doctor.Data collected included baseline demographics,

subjects' knowledge and attitude toward diabetes management, medication regimen and usage, baseline blood glucose readings (documented).They were alsocounselled on the importance of self-monitoring of blood glucose including the target blood sugar readings;

FBS 4-6mmol/L, 2HPP 4-8mmol/L, BMI < 25 Kg/m^2, HbA1c < 6.5% and BP < 130/80 mmHg,medication adherence, complications of diabetes from non-adherence, life style and dietary modification such as eating more fruits and vegetables, skimmed milk, proteins and low calorie diets. Patients were also educated on foot care (wearing comfortable shoes, nail care, avoid walking bare footed, avoid dryness by applying petroleum jelly to feet), they were also told to avoid carrying heavy loads on their laps to keep circulation flowing, patients were advised to engage in exercise and counselled onsigns of hypoglycaemia such as autonomic symptoms like palpitations, sweating, tremors, tachycardia as intervention.Some selected participants were followed up through telephone calls twice monthly for two months and a post intervention blood glucose reading of followed up subjects was obtained to evaluate the impact of intervention on patients' attitude towards their disorder management.

3.8 Data Analysis

Data generated were entered into SPSS (statistical package for social sciences) version 22 to obtain descriptive statistics and paired t- test was used to make comparisons within groups.P value of <0.05 was considered significant in all statistical analysis.

CHAPTER FOUR

4.0 RESULTS

4.1 SocioDemographic Characteristicsof Respondents

The socio-demographic characteristics of the patients are presented in table 4.1, 340 patients were recruited for the study and all were assessed for knowledge and attitude towards their disease management. 132 subjects had active mobile phones and thus eligible for follow up out of which 28 were dropped because they declined calls. Only 104 subjects were followed up with phone calls and were assessed after intervention. Majority of subjects were Hausa 212 (62.4%),most were females 226 (66.5%). Majority of the patients were married 300 (88.2%). Majority of the patients have been diabetic for >10 years and have family histories. Majority of the subjects were between 35-60 (72.4%) years of age. The average BMI of subjects was 28.7 kg/m^2. Majority of patients are dependent on their children for drugs and feeding. (Table 4.1)

Table 4.1: Demographic Information of Respondents (N= 340)

Demographic Information	Frequency	Percentage (%)
Ethnicity		
Hausa	214	62.9
Fulani	44	12.9
Yoruba	20	5.9
Igbo	8	2.4
Others	54	15.9
Gender		
Male	114	33.5
Female	226	66.5
Educational Status		
No Formal Education	148	43.6
Primary	15	4.4
Secondary	77	22.6
Tertiary	100	29.4
Age		
35-60	246	72.4
>60	94	27.6
Marital Status		
Single	4	1.2
Married	300	88.2
Widowed	32	9.4
Divorced	4	1.2

4.2 Assessment of Knowledge of Respondents

Majority of respondents 314 (92.4%) were aware that diabetes is a chronic disease, 334 (98.2%) also knew that losing weight can help obese diabetics as increased accumulation of fats could increase insulin resistance. A large proportion of the respondents 304 (89.4%) knew the complications of diabetes from non-adherence vis-à-vis eye, kidneys and heart complications, 260 (76.5%) also knew the signs of hypoglycaemia intense hunger and other autonomic signs such as palpitations, tremors, sweating and increased heart rate as shown in (Table 4.2).

Table 4.2: Assessment of Knowledge of Respondents (N=340)

Questions	Frequency (Percentage)	
	Yes	**No**
Is diabetes a lifelong disease?	314 (92.4)	26 (7.6)
Is FBG >7mmol/L high?	278 (81.8)	62(18.2)
Can diabetes affect eyes, kidneys and heart?	304 (89.4)	36(10.6)
Can diabetes be treated without drugs?	140 (41.2)	200(58.8)
Does exercise help diabetics?	304 (90)	36(10)
Does losing weight help obese diabetics?	334 (98.2)	6 (1.8)
Does Stress affect blood glucose?	208 (61.2)	132 (38.8)
Do you know the signs of hypoglycaemia?	260 (76.5)	80 (23.5)
Does high calorie and fat reduction improve blood glucose?	304 (90)	36(10)
Do you know the names of your drugs?	200 (58.8)	140(41.2)
Does diabetes cause increased thirst?	276 (81.2)	64(18.8)
Does diabetes cause frequent urination?	274 (80.6)	66 (19.4)
Have you ever fainted or lost consciousness?	254 (74.7)	86 (25.3)
Is your regimen complex?	188 (55.3)	152 (44.7)

4.3: Attitude of Respondents Towards Diabetes Management

More than half of the respondents 196 (57.6%) had glucometer but only 108 (31.8%) actually monitor their blood glucose level regularly, reason being high cost of strips and pain from finger pricks. Most of the respondents 220 (64.7%) could not always afford the cost of their medications because they were on multiple medications. Majority of the respondents 290 (85.3%)however admit that their drugs were readily available but only 132 (38.8%) of them stick to taking their drugs as prescribed, their reasons being forgetfulness, high cost of drugs, unavailability and tired of swallowing drugs. 216 (63.5%) of the participants complement their drug regimen with traditional medicines such as dried moringa leaves, Soaked onion extract, *acacia nicoltica,* Garlic oils amongst others. As shown in (Table 4.3).

Table 4.3: Attitude of Respondents Towards Diabetes Management (N= 340)

Questions	Frequency(Percentage)	
	Yes	No
Do you have a glucometer?	196 (57.6)	144(42.4)
Do you measure your blood sugar regularly?	108(31.8)	232(68.2)
Do you sometimes forget to take your drugs?	208(61.2)	132 (38.8)
Do you take traditional medicines?	216(63.5)	124(36.5)
Do you stop taking your drugs without consulting your doctor?	144(42.4)	196(57.6)
Did you miss a dose the past two weeks?	174(51.2)	166(48.8)
Are your drugs readily available?	290(85.3)	50(14.7)
Can you always afford the cost of your drugs?	120 (35.3)	220(64.7)

4.4 Comparison of Means for Blood Glucose Readings

The mean baseline fasting glucose for the 104 followed up participants was 8.11 and dropped to 6.19 after intervention. The mean baseline 2HPP blood glucose reading was 11.19 and dropped slightly to 11.09 after intervention. Comparisons of the means using paired t-test showed a significant difference for fasting blood glucose $p<0.001$,it was however not the case for 2HPP.The mean fasting glucose level of the control group is 7.94 which a bit higher than that of the intervened group as shown in(Table 4.4)

Table 4.4: Comparisons of Blood Glucose Readings Pre and Post Intervention (N=104)

Variable	Pre-intervention Mean glucose reading (Mmol/L)	Post intervention Mean glucose reading (Mmol/L)	P-value
FBS	8.11 ± 0.33	6.19 ± 0.18	0.000
2HPP	11.19 ± 0.39	11.09 ± 0.47	0.834

Data presented as mean ± SEM

P<0.001

FBS- fasting blood sugar

2HPP- 2 hours post prandial

Type of statistical test= paired t-test

4.5 Correlation between Demographic Characteristics and Outcome (Fasting Blood Glucose)

There was no association between FBG and Ethnicity, there was a negative association (-0.166) between FBG and age. When Gender was associated with FBG, a negative association was obtained (-0.164) implying that the female gender (twice the size of

themale226 (66.5%) had better glucose control. The married 300 (88.2%) also were seen to have better glucose control when marital status was correlated with FBG (-0.105). As shown in(Table 4.5).

Table 4.5 Showing Association between Demographic Characteristics and Outcome

	FastingBlood Glucose	Ethnicity	Gender	Age	Educational Level	Marital Status
Fasting Blood Glucose	1.000	.001	-.164	-.166	-.038	-.105
Ethnicity	.001	1.000	-.104	.115	.104	-.075
Gender	-.164	.104	1.000	.237	.180	-.075
Age	-.166	.115	.237	1.000	-.143	.039
Educational Level	-.038	.104	-.180	-.143	1.000	-.037
Maritalstatus	-.105	-.075	-.075	.039	-.037	1.000

CHAPTER FIVE

5.0 Discussion

The socio-demographic characteristics of the patients in this study showed the type of patients attending this resourceful setting. Since the prevalence of diabetic complications are on the increase, it is therefore, very important to educate patients on how to manage their clinical disorder effectively thereby preventing disease progression and avoidable complications because majority of studies on effectiveness of interventions to address suboptimal use of medicines, either in a disease area or specific conditions, hence, adherence is the most important hurdle for medicines optimisation (Faria*et al.*, 2014). The use of mobile phone calls are being explored in improving disease management. Behavioural change, although difficult to obtain, is possible with regular support, a study conducted by Toolbert*etal*., (2003) reported a smoking cessation rate of 36% in diabetes-hypertensive patients undergoing lifestyle modification educational programme compared with only 8% in the usual care group.Majority of the participants were females, this may be related to the presence of modifiable risk factors such as obesity, stressful life situations which have more influence on females than males, sedentary lifestyle and less engagements as compared to males. However, when gender was associated with FBG, a negative association was obtained (-0.164) implying that the female gender (twice the size of the male 66.5%) have better glucose control. This could be because females have less engagement and will hardly forget the time for their hospital appointments and time to take their drugs as they are mostly at home. The same findings were reported in a study carried out in Egypt by Hassan (2009) and also Al-Wehedy*etal*., (2014). It is also,similar to a study conducted by Anowie and Darkwa (2015) and that conducted in Jamaica by Eugene *etal.*, (2013). The same trend was seen in a study conducted in Nepal by Sharma

etal., (2014). Abdelhay and El mezayen in Egypt (2013) have similar findings (54.5 % females and 45.4 % males).A large proportion of the patients were uneducated148 (43.6%) and this could contribute to their non-adherence and certain misconceptions to treatment, although majority of the patients blamed it on lack of money to buy drugs. This category of patients may also not understand the need for adherence and may require regular counselling, monitoring and follow-up. A large number of the patients live in villages near and far and thus, have problems transporting themselves to the health facility and so do not come to see the doctor on their set appointment days.From the results obtained, subjects' knowledge about diabetes is encouraging as more than 60% answered questions concerning knowledge correctly but their attitude towards its management was poor because majority of the subjects' forgot to take their drugs, half of them missed a dose two weeks pre-assessment, a large number of them stopped drugs without consulting their doctors, most of them don't monitor their blood glucose readings regularly and quite a number of them stopped their drugs when they feel like their blood glucose is under control.Reasons for poor attitude was linked to lack of money, forgetfulness, just tired of taking pills and multiple medications.Majority of patients also complement their drugs with traditional medicines, the most commonly reported ones being*Moringaoleifera* powder, soaked onions, garlic and garlic oil, *Acacianilotica* (bagaruwa) leaves and powder.Self-monitoring of blood glucose (SMBG) can help both patient and their health care professionals better adjust to therapy and assess the responses to therapy. Benefits of SMBG include the fact that a patient can immediately assess the impact of an action on blood glucose level and consequently undertake prompt interventions designed to counter the high or low glucose concentrations. In addition, when adjusting oral agents or insulin

doses, it is important to know the pattern of blood glucose values i.e when during the day the levels are high, in the targeted range or low, since the design of the treatment regimen may differentially affect glucose concentrations at various times after drug ingestion or injection. The ADA recommends SMBG for all diabetic patients being treated with insulin. SMBG should be part of the total treatment regimen that includes diet, exercise, weight loss, and insulin or oral medications when indicated (Gavin, 2007). FBG levels help tell whether the basal insulin in the body is able to maintain blood glucose levels throughout the night, while post- prandial glucose readings tells you how well your body reacts to increase glucose level after a meal. The study showed that patient education and counselling isvery important in the management of diabetes.

CHAPTER SIX

6.0 SUMMARY, CONCLUSION, LIMITATIONS AND RECOMMENDATION

6.1 Summary

In the study conducted, the knowledge of diabetic patients attending Ahmadu Bello University Teaching Hospital was assessed and the results showed that majority of patients had good knowledge about diabetes, ranging from definition, signs and symptoms, complication from non-adherence, and life style and dietary modifications. However the attitude of patients towards their disease management was not encouragingbecause 61.2% of subjects' forgot to take their drugs, 51.2% missed a dose two weeks, 42.4% stopped drugs without consulting their doctors, 68.2% do not monitor their blood glucose readings regularly and 67.1% stopped their drug when they feel like their blood glucose is under control. Majority of patients 63.5% also complement their drugs with traditional medicines. The most commonly reported ones being*Moringaoleifera* powder, soaked onions, garlic and garlic oil, *Acacianilotica* (bagaruwa) leaves and powder. The study also showed that patient education and counselling is very important in the management of diabetes as the followed up patients had remarkable improvement in their fasting blood glucose.

6.2 Conclusion

It could be concluded from this study that ABUTH diabetes patients had good knowledge of their disease and poor attitude towards their disease management.

Pharmacist educational intervention which involved physical counselling and mobile phone follow-up had improved patients' blood glucose control.

6.3 Limitations

1. Appointment dates were long for most patients making it difficult for follow up
2. The time frame of the study was short and could probably be the cause for having only a small follow up group
3. Subjects often miss calls and don't bother to call back
4. Subjects also gave mobile numbers of their relatives as theirs making it difficult to contact them directly.

6.4 Recommendations

It is recommended that follow up interventions (mobile phone calls, texts or even patient visits) should be done regularly in order to help patients' improve on their disease management and reduce prevalence of complications. Patients in this category (old and unemployed) should also be assisted with drugs either free or at a very subsidized cost.

REFERENCES

AlQazazz H.K., Hassali M.A., Shafie A.A., Suleiman A.S., and Sundrem S., (2011). 'Perception and Knowledge of Patients with Type 2 Diabetes in Malaysia about their Disease and Medication: A Qualitative Study'*Research in Social and Administrative Pharmacy*, 7:180-191.

Angeles-Llerenas, A., Carbajal-Sanchez, N., Allen, B., (2005). Gender, Body Mass Index and Socio Demographic Variables Associated with Knowledge about Type 2 Diabetes Mellitus Among 13,293 Mexican Students. *Acta Diabetol*; 42, 36-45.

Bello, S. F., Bakari, A.G., Anumahi, F.E. (2007). Dyslipidemia in Persons with Type 2 Diabetes in Kaduna, Nigeria. *International Journal of Diabetes and Metabolism*; 15**,** 9-13.

Ben Abdelaziz A., Thabet H and Soltane I., (2007). 'Knowledge of Patients with Type 2 Diabetes about their Condition in Sousse, Tunisia'*Eastern Mediterranean Health Journal*, 13(3) 505-514.

Changing Illness Perceptions in Patients with Poorly Controlled Type 2 Diabetes, A Doi: 10.4172/2155-6156.C1.055

Duncan,.I., Birkmeyer, C.,and Coughlin, S., (2009). Assessing the Values of Diabetes Education. *Journal of Diabetes Education* 35 (7), 52–60.

Frederick., (2016) ' 12th World Congress on Diabetes and Palliative Care in Toronto, Canada' *Journal of Diabetes and Mellitus*, 2155-6156.

Gholamreza V and Pooneh M., (2010*).* 'Association between Socio-demographic Factors and Diabetes Mellitus in the North of Iran: A Population-based Study' *International Journal of Diabetes*, 2(3), 154-157.

Girish M. C., Vivek B. W., Alka D.G., Vishwajeet M.C., Randhir V.D and Girish B. D. (2015). 'Knowledge about Diabetes and Relationship between Compliance to the Management among the Diabetic Patients from Rural Area of Sangli District, Maharashtra India' *Journal of Family Medicine and Primary Care*, 4(3): 439-443. Doi: 10.4103/2249-4863.161349

Griva, K., Myers, L. B., and Newman, S., (2000). Illness Perceptions and Self-Efficacy Beliefs in Adolescents and Young Adults with Insulin Dependent Diabetes Mellitus. *Psychology and Health, 15*,733-750.

Hjelm K and Mufunda E., (2010). 'Zimbawean Diabetics' Beliefs about Health and Illness: An Interview Study'*BMC International Health and Human Rights*, 10: 7-16.http://dx.doi.org/10.1080/08870440008405578

International Diabetes Federation (2009).*IDF International Standards for Diabetes Education*; 3rd Edition. IDF: Brussels, Brussels Printing Press.

Kahn L.S., Tumiel-Berhalter L., and D'Aniello R., (2012). The Impact of 'Growing Our Own'. A Pilot Project to Address Health Disparities by Training Health Professionals to Become Certified Diabetes Educators in Safety Net Practices. *Journal ofDiabetes Education* 38, 86–90.

Keogh, K. M., White, P., Smith, S. M., McGilloway, S., O'Dowd, T., andGibney, (2007).

Leventhal, H., Meyer, D., and Nerenz, D. R. (1980). The Common Sense Representation of Illness Danger in S.Rachman (Ed.), *Medical Psychology* (pp. 17–30). New York Pergamon Press..

Levit N.S, (2008). Diabetes in Africa: Epidemiology, Management and Healthcare Challenges', *Heart*, 94(11), 1376-1382.http://dx.doi/10.1136/hrt.2008.147306.

Moss-Morris, R., Weinman, J., Petrie, K. J., Horne, R., Cameron, L. D., and Buick, D. (2002).The Revised Illness Perception Questionnaire (IPQ-R). *Psychology and Health*, 14(1), 1-16.http://dx.doi.org/10.1080/08870440290001494

Mukhopadhyay P., Paul B., Das D., Sengupta N., and Majumder R., (2010). 'Perceptions and Practices of Type 2 Diabetics: A Cross Sectional Study in a Tertiary Care Hospital in Kolkata', *International Journal of Diabetes in Developing Countries,* 30(3), 143-147.

Odili V.U., Isiboge P. and Eregie A., (2011). 'Patients' Knowledge of Diabetes Mellitus in a Nigerian City', *Tropical Journal of Pharmaceutical Research*, 10(5), 637-642.

Okesina, A.B., Oparinde, D.P., Akindoyin, K.A., and Erasmus (1999). Prevalence of Some Risk Factors of Coronary Heart Disease in Rural Nigerian Population, *East African Medical Journal*; 76**,** 212-216.

Oputa R.N., (2009). National Diabetes Screening Programmes. *Diabetes International journal*; 17, 9–11 http://dx.doi.org/10.1186/1471-2296-8-36

Oyegbade, O., Abioye-Kuteyi, E., Kolawole, B., Ezeoma, T., & Bello, S. (2007). Screening for Diabetes Mellitus in a Nigerian Family Practice Population. *SA Journal of Family Practice*; 49, 15-19.

Patricio Fernando and Carlos K.B Ferrari (2014) 'Knowledge of Diabetes Mellitus: Does Gender Make a Difference? '*Osong Public Health and Research Perspectives*, 5(4): 199-203 http://doi.org/10.1016/j.phrp.2014.06.004

Petrie, K. J., Lana, A. J., and Devcich, D. A. (2007). The role of Illness Perceptions in Patients with Medical Conditions. *Curr Opin Psychiatry, 20*(2),163-167. http://dx.doi.org/10.1097/YCO.0b013e328014a871

Raheem, A. S., Ali, A. A., and Shade A., (2010). Sedentary Lifestyle and Wellness in Kaduna State. *Journal ofEthno Medicine*; 4(1**),** 15-19.

Randomised Controlled Trial of a Family-Based Intervention: Protocol and Pilot Study. *BMC Journal of Family Practice*27(8), 33-40.

Ursula .R. (Ed.) (2017). Self-Knowledge: A History. United Kingdom, Oxford University Press. P 315-316. Doi: 10.1111/ejop. 12227

WHO Global Reports on Diabetes available on http://en.m.wikipedia.org/wiki/Epidemiology_of_diabetes_mellitus

WHO, (2011).'Diabetes Fact sheet no 312', *World Health Organisation* [online]. Available athttp://www.who.int/mediacentre/factsheets/fs312/en/

Wild S., Roglic G., and Green A., (2000). 'Global Prevalence Of Diabetes: estimates for the year 2000 and projections for 2030'*Diabetes Care*, 27(5)1047-1053[online]Availablehttp://www.who.int/diabetes/facts/en/diabcare0504.pdf

Wild, S., Roglic, G., Green, A., Sicree, R., King, H., (2004). Global Prevalence of Diabetes Estimates for Year 2000 and Projection for 2030 *Diabetes Care* 27, 1047-1053.

Zanchetta F.C, Danilo D. T and Maria H.M (2016). 'Clinical and Socio-demographic Variables Associated with Diabetes Related Distress in Patients with Type 2 Diabetes Mellitus' *Einstein (Saopaula)* 14(3), 346-351.

Appendix 1

HEALTH RESEARCH ETHICS COMMITTEE

AHMADU BELLO UNIVERSITY TEACHING HOSPITAL

SHIKA - ZARIA, NIGERIA.

E-mail: abuthshika@yahoo.com website: www.abuth.org

Chairman of Board: Chief. Shuaib Oyedokun Afolabi *FnII*
Chief Medical Director: Prof. Lawal Khalid, *MBBS, FMCS, FWACS, FRCS(ED) mni*
Chairman, Medical Advisory Committee: Prof. Abdullahi Mohammed, *MBBS, FWACP, FICS*
Director of Administration: Barr. Ishak Bello, *LL.B, BL., LL.M, PGDM, AHAN, FCAI*

Our Ref: ABUTH/HREC/CL/05 Date: 26th July, 2016

Your Ref:

ABUTH HREC FULL ETHICAL CLEARANCE CERTIFICATE

Evaluation of the Impact of Intervention on knowledge and attitude of Diabetic Patients to the Management of their Clinical disorder at Ahmadu Bello University Teaching Hospital.

ABUTH Ethics Committee assigned number:	-	ABUTHZ/HREC/Q7 / 2016.
Name of the principal Investigator:	-	Auwal Fatima Idris
Address of the Principal Investigator:	-	Dept. of Clinical Pharmacy and Pharmacy Practic Faculty of Pharmaceutical Sciences A.B.U. Zaria.
Date of receipt of valid application:	-	21Th July, 2016
Date of meeting when final determination On Ethical approval was made:	-	25th July, 2016

This is to inform you that the research described in the submitted protocol, the consent forms and other participant information materials have been reviewed and given **full approval by the Health Research Ethics Committee.**

Please note: this approval dates from **26Th July, 2016 – 26Th July, 2017**

No participant recruitment into this research may be conducted outside these dates.

All informed consent forms in this study must carry the ABUTH HREC number assigned to this research and the duration of ABUTH HREC approval of the study.

This HREC expects that you submit your application as well as an annual report for ethical clearance renewal 3 months prior to expiration of study dates. This is to enable you obtain renewal of your approval and avoid interruption of your research.

If there is delay in starting the research, please inform the ABUTH HREC so that starting dates can be adjusted accordingly.

No changes are permitted in the research without prior approval by ABUTH HREC, except in circumstances outlined in national code for Health Research Ethics: http://www.nhrec.net.

ABUTH HREC reserves the right to conduct compliance assessment visits to your research site without prior notification.

Abdul 27/07/2016

for Prof. Aisha.I. Mamman MBBS, FMCPath
Chairman, ABUTH HREC

APPENDIX 2: INFORMED CONSENT FORM

TITLE OF STUDY: Evaluation of the Impact of Intervention on Knowledge and Attitude of Diabetic Outpatients of ABUTH

Dear Sir/Madams

My name is Pharmacist Fatima AuwalIdris, I am a Postgraduate student at Ahmadu Bello University, Zaria. I am conducting a study to find out the knowledge, attitudes and role of pharmacist intervention in the management of DM in diabetic patients of ABUTH.

The findings will show if there are any pitfalls in how patients are educated and then show which areas need to be improved in order to benefit the patients. I therefore invite you to participate in the study.

It is a questionnaire based study and there are no damages to you participating and there are no costs involved for you. I also request permission to look in to your medical files to check for blood sugar readings.

If you agree to be part of this study please complete below;

I ……. Agree to be part of this study conducted by Pharmacist Fatima Auwal. I acknowledge that the information obtained from my medical records and questionnaire will be solely for research/educational purposes. I also acknowledge that my identity will not be divulged. I agree that the procedures to be followed have been explained fully to me and the benefits of the study. I am free to withdraw consent and discontinue participation in the study at any time.

APPENDIX 3: Questionnaire to Evaluate Knowledge/Attitude of Diabetic Patients to the Management of their Disease.

SECTION 1: BIODATA

BP reading
RBS
FBS
2HPP
HbA1c
Waist circumference/ BMI

1. Ethnic origin (check ▪ only one): ▪ Hausa ▪ Yoruba

▪ Igbo ▪ Fulani

Other: _____

2. Sex: ▪ Female ▪ Male

3. Highest level of school completed:

4. Marital Status (check ▪ only one):

▪ married ▪ separated ▪ widowed

▪ single ▪ divorced

5. Please indicate below which chronic condition(s) you have:

▪ Diabetes type 2 ▪ Diabetes type 1 ▪ High cholesterol ▪ High blood pressure

▪ Heart disease (state type of heart disease)

▪ Lung disease (state type of lung disease)

▪ Other chronic conditions, specify:

SECTION 2: ASSESSEMENT OF KNOWLEDGE & ATTITUDE

What does diabetes mean?.....

Is diabetes lifelong disease? Yes ( ) No ( )

Most times, do people with diabetes feel anything different? Yes ( ) No ( )

If yes, what are the feelings?

Is the sugar high when it is ≥ 7mmol/L Yes ( ) No (

Can diabetes cause heart, brain and kidney problems? Yes ( ) No ( )

Is the treatment for hypertension a lifelong one? Yes ( ) No ( )

Can diabetes be treated without the use of medication? Yes ( ) No ( )

Do regular physical exercises help control diabetes? Yes ( ) No ( )

Does losing weight help control diabetes in obese people? Yes ( ) No ( )

Does reducing calori and fat intake help control diabetes? Yes ( ) No ( )

Does reducing stress help control diabetes? Yes ( ) No ( )

Do you know the name(s), strength and side effect(s) of your drug(s)? Yes ( ) No()

Do you combine it with traditional medicines? Yes ( ) No ( )

Do you think it/they is/are effective? Yes ( ) No ( )

Do you think this medication have benefits? Yes ( ) No ( )

If No, have you complained to any health care provider? Yes ( ) No ( )

Are you taking it to improve your health? Yes ( ) No ( )

Is your treatment regimen complex? Yes ( ) No ( )

Is your medication readily available? Yes ( ) No ( )

Do you always afford the cost of your drug (s)? Yes ( ) No ( )

Do you know that diabetes causes the following?

- Increased thirst? ..... ▪ No ▪ Yes ▪
- Dry mouth?..... ▪ No ▪ Yes ▪
- Decreased appetite? ..... ▪ No ▪ Yes ▪
- Nausea or vomiting? ..... ▪ No ▪ Yes ▪
- Light-headedness?..... ▪ No ▪ Yes ▪
- Frequent urination at night? ▪ No ▪ Yes ▪
- Morning headaches?..... ▪ No ▪ Yes ▪

- Nightmares?..... ▪ No ▪ Yes ▪

Do you know what to do when you feel the following signs of hypoglycemia?

- Shakiness or weakness?..... ▪ No ▪ Yes ▪
- Night sweats?..... ▪ No ▪ Yes ▪
- Intense hunger?..... ▪ No ▪ Yes ▪
- Increased heart rate

SECTION 3: INFORMATION ON GLUCOSE TESTING

- Do you have a machine to measure your blood sugar level? ▪ Yes ▪ No
- How often do you test your blood sugar?

SECTION 4: SCALE FOR DETERMINING ANTI-DIABETIC MEDICATIONS ADHERENCE

1. Do you sometimes forget to take your pills? Yes ( ) No ( )
2. Over the past 2 weeks, were there any days when you did not take your pills? Yes ( ) No
3. Have you ever cut back or stopped taking your medication without telling your doctor because you felt worse when you took it? Yes ( ) No ( )
4. When you travel or leave home, do you sometimes forget to bring along your high blood sugar medication? Yes ( ) No ( )
5. Did you take your high blood sugar medication yesterday? Yes ( ) No ( )
6. When you feel like your blood sugar is under control, do you sometimes stop taking your medication? Yes ( ) No ( )
7. Taking medication every day is a real inconvenience for some people, do you ever feel hassled about sticking to your high blood sugar treatment plan? Yes ( ) No ( )

8. How often do you have difficulty remembering to take all your blood sugar medication? Never/Rarely ( ), Once in a while ( ), Sometimes ( ), Usually ( )

FOLLOW UP CALL CHART

S/N	Mobile No.	Call 1	Call 2	Call 3	Call 4	Call 5	Call 6	Total Calls

Statistical Outputs

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FBS	8.105	104	3.3410	.3276
	FBS(PI)	6.187	104	1.8438	.1808
Pair 2	2HPP	11.186	104	4.0691	.3990
	2HPP(PI)	11.088	104	2.7511	.2698

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	FBS & FBS(PI)	104	.106	.283
Pair 2	2HPP & 2HPP(PI)	104	.089	.370

Table showing level of significance and thus, rejection of hypothesis

	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 FBS - FBS(PI)	1.9183	3.6404	.3570	1.2103	2.6262	5.374	103	.000
Pair 2 2HPP - 2HPP(PI)	.0971	4.7051	.4614	-.8179	1.0121	.210	103	.834

Correlations

		Fastingblood	Q1	Q2	Q3	Q4	Q5
Pearson Correlation	Fastingblood	1.000	.000	-.164	-.166	-.038	-.105
	Q1	.000	1.000	-.104	.115	.104	-.075
	Q2	-.164	-.104	1.000	.237	-.180	-.075
	Q3	-.166	.115	.237	1.000	-.143	.039
	Q4	-.038	.104	-.180	-.143	1.000	-.037
	Q5	-.105	-.075	-.075	.039	-.037	1.000
Sig. (1-tailed)	Fastingblood	.	.499	.001	.001	.242	.026
	Q1	.499	.	.028	.017	.028	.085
	Q2	.001	.028	.	.000	.000	.083
	Q3	.001	.017	.000	.	.004	.239
	Q4	.242	.028	.000	.004	.	.247
	Q5	.026	.085	.083	.239	.247	.
N	Fastingblood	340	340	340	340	340	340
	Q1	340	340	340	340	340	340
	Q2	340	340	340	340	340	340
	Q3	340	340	340	340	340	340
	Q4	340	340	340	340	340	340
	Q5	340	340	340	340	340	340

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	211.726	5	42.345	4.578	.000[b]
	Residual	3089.464	334	9.250		
	Total	3301.190	339			

a. Dependent Variable: Fastingblood

b. Predictors: (Constant), Q5, Q4, Q1, Q3, Q2

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.253[a]	.064	.050	3.0414	.064	4.578	5	334	.000

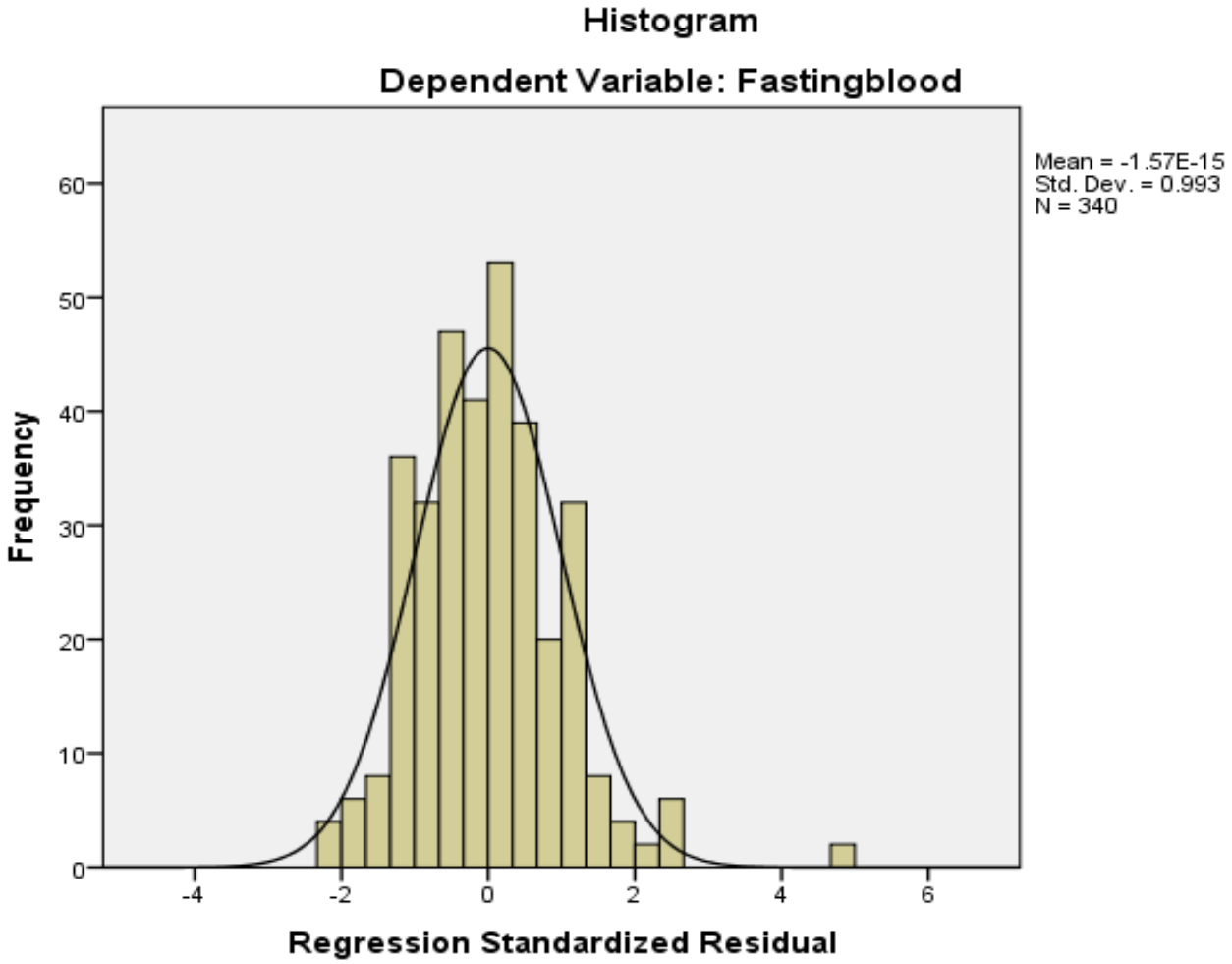
a. Predictors: (Constant), Q5, Q4, Q1, Q3, Q2

b. Dependent Variable: Fastingblood

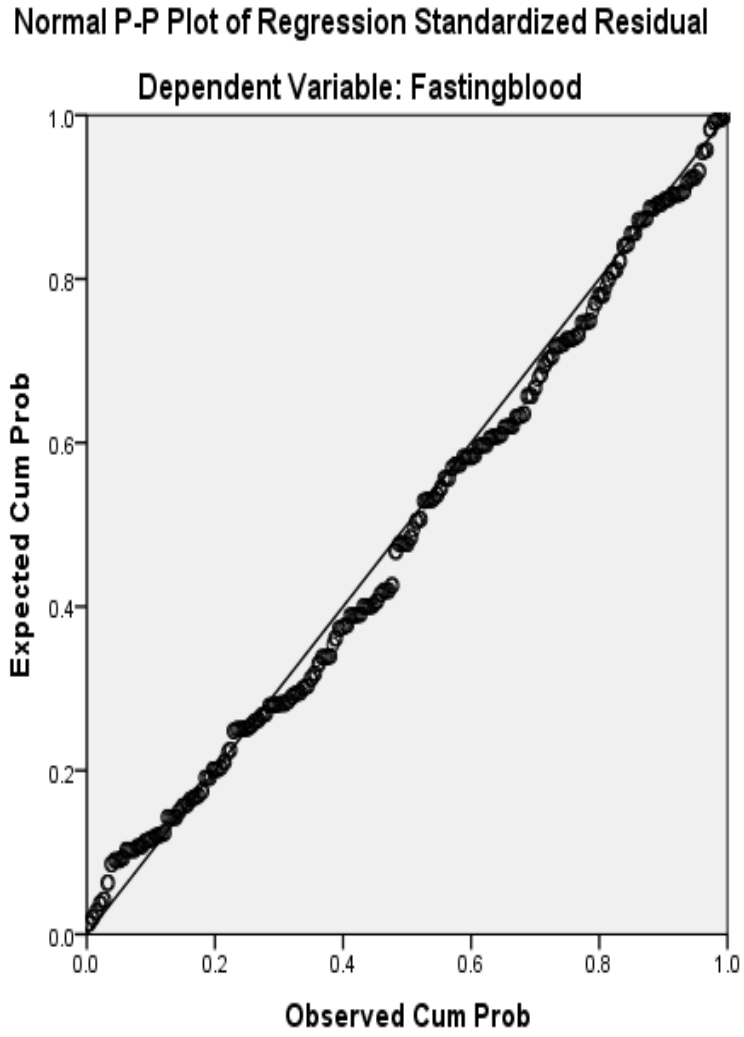
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	11.640	.901		12.924	.000	9.868	13.411
	Q1	.000	.105	.000	.004	.997	-.207	.207
	Q2	-1.031	.368	-.156	-2.798	.005	-1.756	-.306
	Q3	-.290	.117	-.138	-2.480	.014	-.520	-.060
	Q4	-.391	.236	-.090	-1.657	.098	-.854	.073
	Q5	-1.079	.501	-.115	-2.155	.032	-2.065	-.094

a. Dependent Variable: Fastingblood


Histogram
Dependent Variable: Fastingblood
Mean = -1.57E-15
Std. Dev. = 0.993
N = 340
Frequency
60
50
40
30
20
10
0
-4
-2
0
2
4
6
Regression Standardized Residual

APPENDIX 4:A Plot of Regression Standardized Residual of Association between Demographic Information and FBG



y- axis (Expected cumulative Probability)

x- axis (Observed cumulative Probability)