Original Research Article

GLYCAEMIC CONTROL AND EVIDENCES OF ISCHAEMIC HEART DISEASE OF KNOWN TYPE 2 DIABETICS ATTENDING THE ENDOCRINOLOGY CLINIC AT THE FEDERAL MEDICAL CENTRE, YENAGOA

ABSTRACT

Introduction: Diabetes mellitus is a chronic disease with life-threatening complications with cardiovascular complications being the major cause of death among those with type 2 diabetes.
Aim: The study was aimed at evaluating the glycemic status and evidences of Ischaemic heart disease, associated with type 2 diabetes mellitus among diabetic patients attending the endocrinology clinic in FMC Yenagoa during the study period.
Materials and Methods: The study made use of 162 apparently healthy individuals and 300 diabetic patients. Interviewer-administered questionnaire and fasting blood sugar were the study tools. The data obtained were analyzed using descriptive statisticsand paired sample T-test.
Results and Discussion: The results revealed that the body mass Index, Blood Pressure and Fasting Blood Sugar of the diabetics were significantly higher than those of the non-diabetics. Again, 41.7% of the experimental subjects had a normal glycemic control, 49.7% had a fair glycemic control while 8.7% of them had a poor glycemic control.The symptoms of Ischaemic heart disease associated with type 2 diabetes in the experimental subjects were chest pain, chest discomfort, pain in the leg, ischaemic gangrene and loss of strength. Again, age, gender,Body mass index, smoking and Fasting blood sugarwere other risk factors found to be associated with ischaemic heart disease.
Conclusion and Recommendation: Implementing lifestyle changes such as regular exercise, a healthy diet, and smoking cessation to reduce the risk of cardiovascular abnormalities in diabetics is recommended. A close and regular monitoring of the Fasting blood sugar, Blood Pressure and cardiac abnormalitiesis also recommended for diabetic patients.

Keywords: Diabetes mellitus, blood sugar, glycemic control, heart diseaseand symptoms

INTRODUCTION

Diabetes mellitus (DM) refers to a set of metabolic diseases characterized by a rise in blood sugar (hyperglycemia) and abnormalities in insulin secretion, insulin activity, or both. [1] When the pancreas can no longer generate insulin or when the body cannot effectively use the insulin it does produce, diabetes develops. [2]Against a backdrop of insulin resistance, type 2 diabetes mellitus (T2DM) is brought on by a progressive loss of B-cell insulin production [1]. It is a chronic disease with life-threatening micro- and macro-vascular complications. [3] Multiple organ systems are affected by the disease, which is largely defined by hyperglycemia brought on

by insufficient insulin secretion, ineffective insulin action, or occasionally a mix of both. It can lead to early atherosclerosis, which can damage both the micro- and macro-vasculature and frequently manifest as nephropathy and coronary artery disease. [4]

The American Diabetes Association (ADA) classifies DM into three broad categories: type 1 (insulin-dependent DM), type 2 (non-insulin-dependent DM), and gestational DM. Diabetes mellitus is a significant and quickly rising public health issue in low- and middle-income countries. Globally, 387 million individuals have diabetes as of 2014, and by 2035, that figure is projected to grow by an additional 205 million. 77% of diabetics live in low- and middle-income countries, and nearly 46% of them have undiagnosed diabetes. [5]The number of diabetic patients worldwide has increased from 108 million in 1980 to 465 million in 2019. Current forecasts indicate that by 2045, this number will surpass 700 million. [6]

Diabetes is currently a worldwide epidemic. It is a formidable metabolic condition due to its evolution, which is typically subtle. This causes a delay in diagnosis, which in turn exposes patients to consequences, particularly cardiovascular. [7]

The prevalence of diabetes mellitus is rising quickly worldwide, especially in middle- and low-income nations like Sub-Sahara, which is made worse by changes in socioeconomic conditions, dietary habits, and lifestyles. [1]

The global prevalence of diabetes increased from 151 million in 2000 to 366 million in 2011 and is anticipated to reach 551 million by 2025. [8]T2DM is currently on the rise throughout the world, with 80% of cases occurring in low- to middle-income nations. [1]Changes in the human environment, behavior, and way of life have led to a major increase in the incidence and prevalence of diabetes among individuals with a genetic vulnerability to the disease. [8]T2DM makes up 90–95% of all diabetes cases in Africa. Nearly 49.7% of diabetes cases worldwide

and 69.2% of cases in Africa go untreated. T2DM may manifest with or without symptoms and may result in long-term cardiovascular system harm. [1]Numerous long-term consequences are connected with diabetes, including retinopathy, nephropathy, and neuropathy. Additionally, they are at risk for macrovascular problems, coronary artery disease (CAD), stroke, and peripheral vascular disease. More than 70% of type 2 diabetes patients die from cardiovascular disease. [8]

AIM OF THE STUDY

This study was therefore carried out to evaluate the glycemic control and evidences of Ischaemic heart disease of known type 2 diabetic patients attending the endocrinology clinic at the Federal Medical Centre, Yenagoa.

MATERIALS AND METHODS

The glycaemic control and evidences of ischaemic heart disease was carried out at the endocrinology clinic of the federal medical centre in Yenagoa using a cross-sectional comparative study design. The Federal Medical Centre Yenagoa, often known as FMC Yenagoa, is a tertiary hospital located in Bayelsa State, Nigeria, in the heart of Yenagoa. It acts as a referral centre for patients from private and public hospitals in Bayelsa State and surrounding Rivers State villages.

Study population

Thestudy population consisted of individuals with type 2 diabetes who attended the endocrinology clinic during the study period

Inclusion Criteria

(1) Type 2 DM patients aged 35 and above, who fulfilled the following criteria for the diagnosis of diabetes mellitus

(2) Symptoms of diabetes plus random blood glucose concentration ≥11.1 mmol/L (200 mg/dL) or Fasting plasma glucose ≥7.0 mmol/L (126 mg/dL) orHaemoglobin A1c ≥ 6.5%

(3) Patients with no cardiovascular complaints.

Exclusion criteria

(1) T2DM patients with concomitant diseases or conditions affecting lipid levels like chronic liver disease and hypothyroidism.

(2) Patients on drugs like oral contraceptive pills, steroids, diuretics, antiarrhythmics and anti-Ischaemic drugs.

(3) Patients with Type 1 DM

Study Tools

The study tools were an interviewer-administered questionnaire, a glucometer and ECG Leads.

Sample sizedetermination

The sample size of this research was calculated using Taro Yamane (Yamane, 1973) formula which gave a 95% confidence level.

The calculation formula of Taro Yamane is presented as follows

$n= N/1+N(e)^2$

Where:

n= sample size required

N=number of people in the population

e= allowable error (%) as 0.05

Substituting numbers on formula:

n= 900/1+900x0.05 x 0.05

=900/1+900 x 0.0025

=900/1+2.25

=900/3.25=276.923 (calculated sample size)

To ensure fairly reliable research data, the sample size for the study is therefore approximated to 280 participants.

Sampling Techniques

All consecutive diabetics who presented to the clinic and met the inclusion criteria were enrolled with their informed consent until the sample size requirement was met.

Data collection

The investigator administered a questionnaire to each participant. The investigator and trained research assistants explained the questionnaire in their local language to those who did not understand English but did comprehend Ijaw, Epie, or other Nigerian languages. The subject's demographic details were recorded, and a physical examination was performed. The body weight of each subject was determined with the person standing barefoot and on a Hanson bathroom scale (model 1989) with a 500g resolution. Each subject had his or her height measured in meters by standing barefoot on a flat platform with both heels against a wall in front of a wall meter rule. The formula for calculating the body mass index (BMI) was BMI = weight in kilograms divided by height squared in meters (kg/m^2). Random blood sugar samples were also taken from participants. Physical examination was carried out to ascertain the cardiovascular status of the respondents.

Data analysis

The random blood sugar measurements data were analysed statistically with the Statistical Package for the Social Sciences (SPSS 20.0). The mean values, frequencies, and standard deviation of continuous variables like age and weight were also calculated.

RESULTS AND DISCUSSION

TABLE 1: SOCIO-DEMOGRAPHIC VARIABLES OF THE EXPERIMENTAL (DIABETIC) INDIVIDUALS.

Sociodemographic variables	Experimental group		
		Frequency	**Percentage**
Gender	Male	128	42.7
	Female	172	57.3
	Total	**300**	**100**
Age	30-39yrs	4	1.2
	40-49yrs	75	25.1
	50-59yrs	97	32.3
	60-69yrs	85	28.4
	70-79yrs	28	9.5
	80-89yrs	11	3.6
	Total	**300**	**100**
Educational Status of respondents	No formal education	50	16.7
	Primary	52	17.3
	Secondary	62	20.7
	Tertiary	136	45.3
	Total	**300**	**100**

Occupation	Unemployed	36	12.0
	Housewife	29	9.7
	Farming	50	16.7
	Fishing	29	9.7
	Teacher	20	6.7
	Trader	40	13.3
	Others	96	32.0
	Total	**300**	**100**
Religion	Christian	259	86.3
	Muslim	8	2.7
	Traditional worshipper	8	2.7
	Others	25	8.3
	Total	**300**	**100**

TABLE 2: SYMPTOMS OF ISCHAEMIC HEART DISEASE ASSOCIATED WITH TYPE 2 DIABETESIN THE EXPERIMENTAL SUBJECTS.

Age range	**Chest pain**	**Chest discomfort**	**Pain anywhere else**	**Pain in the leg**	**Ischaemic gangrene**	**Weakness or loss of strength**
30-39yrs	2	6	0	8	2	0
40-49yrs	17	10	4	11	5	2
50-59yrs	33	29	3	4	15	3

60-69yrs	34	30	6	2	18	3
70-79	10	8	7	12	5	6
80-89	6	3	8	9	9	8
Total	**102**	**86**	**28**	**46**	**54**	**22**
Gender						
Male	34	28	13	29	21	16
Female	68	58	15	27	33	6
Total	**102**	**86**	**28**	**46**	**54**	**22**

TABLE 3: GLYCEMIC AND OTHER RISK FACTORS ASSOCIATED WITH THE EXPERIMENTAL (DIABETIC) INDIVIDUALS

RISK FACTORS		**Frequency**	**Percentage**
Age	30-39yrs	4	1.2
	40-49yrs	75	25.1
	50-59yrs	97	32.3
	60-69yrs	85	28.4
	70-79yrs	28	9.5
	80-89yrs	11	3.6
	Total	**300**	**100**
Gender	Male	128	42.7
	Female	172	57.3
	Total	**300**	**100**
	Underweight (<18.5)	0	0

BMI	Normal weight (18.5-24.9)	76	25.3
	Overweight (25.0-29.9)	138	46.0
	Obesity class 1(30.0-34.9)	79	26.3
	Obesity class 2 (35.0-39.9)	5	1.7
	Extreme obesity (>40)	2	0.7
	Total	**300**	**100**
Smoking	Smokers	40	13.3
	Non-smokers	260	86.7
	Total	**300**	**100**
FBS	Good glycemic control (<6 mmol/l)	125	41.7
	Fair glycemic control (6-10mmol/l)	149	49.7
	Poor glycemic control (>10mmol/l)	26	8.7
	Total	**300**	**100**
Duration of diabetes	1-3 years	100	33.3
	4-6 years	110	36.7
	> 6 years	90	30.0
	Total	**300**	**100**

TABLE 4: PAIRED SAMPLE T-TEST RESULT SHOWING THE RELATIONSHIP BETWEEN SOME PARAMETERS OF THE CONTROL AND EXPERIMENTAL GROUPS

Variables	Control	Experimental	P-value
Age	57.40±0.82	60.58±0.82 [a]	0.01
BMI	27.34±0.19	29.96±0.28 [a]	0.00
Rate	76.97±0.84	77.42±0.87	0.70
Systolic blood pressure	123.33±1.01	127.83±1.30 [a]	0.01
Diastolic blood pressure	77.93±0.60	81.05±0.71 [a]	0.001
Fasting blood sugar	1.65±0.01	5.58±0.15 [a]	0.00

The data are presented as mean ± SEM with "a" representing a significant increase in the experimental group with respect to the control groups at p<0.05

DISCUSSION OF FINDINGS

Socio-demographic variables of the experimental (diabetic) individuals.

The socio-demographic variables of the diabetic patients are presented in table 1.The age range of the participants is from 30-89 years. Most of the participants (32.3%) are found written the age range of 60-69 years while the least population (1.2%) are between 30years to 39 years.Majority of the participants (57.3%) were females. Out of the 300 participants, 32% (96 individuals) don't have a definable type of job, 40 of them (13.3%) are traders, 50 of them (16.7%) are farmers while 36 of them (12.0%) are completely unemployed. Concerning the educational status of the respondents, 136 of them (45.3%) have attained tertiary education, 62 of them (20.7%) only have secondary school education, 52 of them (17.3%) have only attained primary education while 50 0f them (16.7%) don't have any formal education at all. Almost all

of the respondents (86.3%) are Christians, 8 of them (2.7%) represent both Muslims and African tradition practitioners. Finally, 25 of them (8.3%) don't have any religious affiliation.

These findings are similar to other research works which reported more female participants than males. [2,4]Again, the mean age of the experimental group in this study was found to be 57.50 years. This is very similar to another study which reported the mean age of 56.7%. [9]

The finding that women with T2DM were less likely to have abnormal ECG findings compared to men is also consistent with previous research. A large cohort study of over 9,000 patients with T2DM found that women had a lower risk of CVD than men, despite having a higher prevalence of several cardiovascular risk factors.[10]This study suggests that there may be gender differences in the pathophysiology of CVD in patients with diabetes.

Symptoms of Ischaemic heart disease associated with type 2 diabetes in the experimental subjects.

Table 2 shows the frequency of some cardiovascular symptoms associated the age and gender of the diabetic subjects.Overall, chest discomfort was the most commonly reported symptom, with a total of 86 cases (30 male, 56 female) across all age groups. The next most common symptom was chest pain, with a total of 102 cases (34 male, 68 female). Pain in the leg was reported by 46 patients (29 male, 17 female), while Ischaemic gangrene was reported by 54 patients (21 male, 33 female).In terms of gender differences, male patients were more likely to report chest pain, pain in the legwhile female patients were more likely to report chest discomfort and Ischaemic gangrene.

Also, chest pain, chest discomfort and Ischaemic gangrene were most commonly experienced by the diabetic patients within the age range of 60 years to 69 years with a frequency of 34, 30 and 18 respectively. Again, Pain anywhere else and weakness or loss of strength were most

commonly associated with the age range of 80-89years, with a frequency of 8 for both conditions. Finally, the diabetic patients within the age range of 70-79 years had the highest incidence of pain in the leg, with a frequency of 12 persons.

This study suggests that there may be gender differences in the pathophysiology of CVD in patients with diabetes. Again, a study of over 500 diabetic patients found that men had a higher prevalence of left ventricular hypertrophy, a marker of heart disease, compared to women.[9] This may suggest that male diabetic patients require more aggressive screening for cardiac disease and prompt management of complications.

Glycemic and other risk factors associated with the diabetic (experimental) individuals

From table 3, it was observed that when considering the Body Mass Index (BMI), 25.3% (76 individuals) have a normal weight, 46% (138 individuals) were overweight, 26.3% (79 individuals) have obesity class 1, 1.7% (5 individuals) have obesity class 2, and 0.7% (2 individuals) have extreme obesity. Again, it was found that 86.7% (260 individuals) are non-smokers, and 13.3% (40 individuals) are smokers.

The glycemic control of the patients was established by measuring their Fasting Blood Sugar (FBS). It was found that 41.7% (125 individuals) have good glycemic control, 49.7% (149 individuals) have fair glycemic control, and 8.7% (26 individuals) have poor glycemic control.

It was revealed that 33.3% (100 individuals) have had diabetes for 1-3 years, 36.7% (110 individuals) have had diabetes for 4-6 years, and 30% (90 individuals) have had diabetes for more than 6 years. Most of the diabetic patients were found with the age range of 60-69 years.

It has been established by other researchers that maintaining good glycemic control is crucial for individuals with diabetes to prevent complications. The Hemoglobin A1c (HbA1c) level is a critical marker of long-term blood glucose control. Lowering HbA1c levels has been associated

with reduced risk of diabetes-related complications.[11]Again, hypertension (high blood pressure) has been known to be common in people with diabetes and significantly increases the risk of cardiovascular complications. [11]Obesity has been found to be a significant risk factor for type 2 diabetes. Weight management, through a combination of dietary changes, physical activity, and behavioral interventions, have therefore been recognized as vital for diabetes management.[12]

Relationship between some parameters of the control and experimental (diabetic) groups

Table 4 presents a correlation of some cardiovascular parameters between the control and experimental (diabetic) groups. It was found that when compared with the control group, participants in the experimental group had a significantly higher age (60.58 ± 0.82 vs. 57.40 ± 0.82 years, $p = 0.01$) and BMI (29.96 ± 0.28 vs. 27.34 ± 0.19 kg/m², $p < 0.001$), with respect to the control. However, there was no significant difference in heart rate between the groups (77.42 ± 0.87 vs. 76.97 ± 0.84 bpm, $p = 0.70$).

Again, the participants in the experimental group had significantly higher systolic blood pressure (127.83 ± 1.30 vs. 123.33 ± 1.01 mmHg, $p = 0.01$) and diastolic blood pressure (81.05 ± 0.71 vs. 77.93 ± 0.60 mmHg, $p = 0.001$) than those in the control group. Finally, fasting blood sugar levels were significantly higher in the experimental group than in the control group (5.58 ± 0.15 vs. 1.65 ± 0.01 mmol/L, $p < 0.001$)

There was a significant association between age and some of the risk factors, including systolic and diastolic blood pressure. This finding is consistent with previous studies that have shown a positive correlation between age and cardiovascular risk factors. It is important to note that this association highlights the need for early detection and management of cardiovascular risk factors in patients with type 2 diabetes, particularly those who are older.

The study also found a significant association between BMI of both the control and experimental groups, which is in line with other studies that have reported similar findings. This result emphasizes the need for weight management in patients with type 2 diabetes, which may help to reduce the risk of cardiovascular disease. The study found that there was a statistically significant positive correlation between fasting blood sugar (FBS) and BMI. This suggests that higher BMI is associated with higher fasting blood sugar levels in type 2 diabetic patients. This finding is consistent with previous research showing that obesity is a risk factor for developing type 2 diabetes and that higher BMI is associated with poorer glycemic control. The study also found that high fasting blood sugar levels were significantly associated with the presence of electrocardiographic abnormalities in type 2 diabetic patients. This finding is consistent with previous studies in Nigeria and other parts of the world. It is well-known that hyperglycemia can lead to microvascular and macrovascular complications in diabetes, including cardiovascular disease. Therefore, effective glycemic control is essential for reducing the risk of cardiac disease in diabetic patients.

Research has shown that the prevalence of diabetes increases with age, particularly in type 2 diabetes. Aging is associated with insulin resistance and a decline in beta-cell function, contributing to the development of diabetes.[13]Elevated BMI has been established as a well-known risk factor for the development of type 2 diabetes.[14]High systolic blood pressure has been associated with an increased risk of developing diabetes, especially type 2 diabetes. This is so because hypertension has been found to be closely related to insulin resistance and can contribute to the progression of diabetes-related complications.[15]Fasting blood sugar levels are commonly used for diagnosing diabetes because its elevated levels has been found to be indicative of impaired glucose metabolism and insulin resistance.[11]

CONCLUSIONS

The current study has identified the impact of glycemic indices on known type 2 diabeticsseen at the endocrine clinic in FMC, Yenagoa and its importance in controlling, preventing or reducing various cardiovascular abnormalities. The study has also shed light on the evidences of Ischaemic heart disease associated with type 2 diabetes and highlighted the need for screening for ischemic heart disease in patients with type 2 diabetes, particularly those who are older. Additionally, the study also compared between some cardiovascular variables between normal and diabetic individuals. Finally, the study has also revealed the need for gender-specific management of diabetic complications. These findings have important implications for the management of type 2 diabetes in Nigeria and other parts of Africa.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

AUTHOR'S CONTRIBUTIONS

Author Ojeka S.O. conceived the study and designed the protocol. All the authors coordinated the experiment and contributed in the manuscript writing. Finally, author Zabbey V.Z. performed the statistical analysis and data interpretation. All authors read through and approved the final manuscript.

CONSENT

As per international standard or university standard, respondents' written consent was secured preserved by the authors.

ETHICAL APPROVAL

All the authors hereby declare that this experiment has been examined and approved by the appropriate ethics committee of both the Federal medical centre, Yenagoa and the university of Port Harcourt and have therefore been performed in accordance with the ethical standards laid down by both institutions.

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