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Correlation Between Glycaemic Control and Body Mass Index in Nigerian Type II Diabetic Patients Attending Medical Outpatient Clinics UITH Ilorin.

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Abstract

Diabetes mellitus is characterized by hyperglycaemia resulting from a variable interaction of hereditary and environmental factors due to defects in insulin secretion, action or both. Apart from the research which has examined the relationship between glycaemic control and changes in weight, there is paucity of data focusing on relationship between body mass index categories and glycaemic control in Nigerian type II diabetic patients. We therefore aimed to demonstrate the effect if any, of BMI on glycaemic control in Nigerians with type II diabetes by correlating glycaemic control level with BMI. Weight of patients and height were taken and BMI was calculated as weight (Kg) / height (M²). A total of 2.5mls of blood sample was collected from each patient in sitting position from the dorsum of the ante-cubital vein or vein at the dorsum of the hand. Glycated haemoglobin was estimated. The absorbance of samples and standards were measured against reagent blank. Statistical analysis was done using Statistical Package for Social Science (SPSS version 15.0) and results were expressed as means ± SD. Paired sample t-test was used to compare means of results where appropriate. Pearson's correlation analysis was used to examine the relationships between the variables. A p-value less than 0.05 were considered statistically significant. There was a statistically significant difference when the mean BMI of diabetic subjects were compared with that of controls ($p < 0.05$). There was statistical significant difference between levels of glycaemic control and BMI. Significant positive correlation was observed

when BMI was compared with glycaemic control with r values of 0.533 and p -value < 0.05 . We concluded from our study that levels of glycaemic control in Diabetes Mellitus strongly correlates with BMI. So, optimal result in the management of diabetic patients entails but not limited to regular exercise and weight loss along with drug therapy, regular diabetes screening.

Keywords: Correlation, Glycaemic Control, BMI and Type II Diabetic Patients.

Introduction

Diabetes mellitus is the most prevalent endocrine problem which is characterized by hyperglycaemia resulting from a variable interaction of hereditary and environmental factors due to defects in insulin secretion, action or both (Adebisi et al., 2003; Adedeji, 2002).

Diabetes mellitus is associated with considerable morbidity and mortality. In Nigeria where healthcare services and accessibility are poor, diabetes is associated with a high disease burden (Ward, 1991). The present global pandemic of type II diabetes is accounted for by westernization of lifestyle, population growth, ageing with consequent dietary



change, sedentary lifestyle, and obesity (Claude and Mbanya, 2003). The burden of complications and premature mortality resulting from diabetes constitutes a major public health problem for most countries.

Excess body weight has been identified as an issue of concern for both type 1 and type II diabetes mellitus and 80% of individuals with type II diabetes mellitus are overweight or obese (National Institutes of Health, 2004). In patients with type II diabetes mellitus, obesity increases the possibility of developing many common diabetic complications, including heart disease, retinopathy, dyslipidaemia, and hypertension (American Diabetes Association, 2014). Previous studies have shown that the glycaemic control of patients with type II diabetes mellitus worsen with weight gain but also tend to improve with weight loss (American Diabetes Association, 2014; Neiberg *et al.*, 2012), while significant weight loss, such as that associated with gastric bypass surgery, has been shown to lead to a partial or total remission of type II diabetes mellitus (Scopinaro *et al.*, 2014). Clinical trial evidence shows that weight gain among patients with type II diabetes mellitus is associated with an increased cardiovascular risk (Purnell *et al.*, 1998) and that this risk is lower among patients with improved glycaemic control (Williams *et al.*, 1999). Apart from the research which has examined the relationship between glycaemic control and changes in weight, there is paucity of data focusing on relationship between body mass index categories and glycaemic control in Nigerian type II diabetic patients. We therefore aimed to demonstrate the effect if any, of BMI on glycaemic control in Nigerians with type II diabetes by correlating glycaemic control level with BMI.

Materials and Methods

This was a cross-sectional study of consenting type II diabetic patients attending Medical Outpatient Department (MOPD) of the University of Ilorin Teaching Hospital (UIITH) Ilorin, Kwara state Nigeria.

A total of 160 consenting type II diabetic patients were recruited for the study consisting of 49(30.6%)

male and 111(69.4%) female, while 70 non-diabetics subjects matched for age and sex with the patients were recruited as control consisting of 25 (35.7%) males and 45 (64.3%) females.

Weight of patients was taken using Hanson type bathroom weighing scale, height was determined with rigid measurement against a vertical wall. The body mass index (BMI) was calculated as weight (kg)/height (m²). Classification of BMI was done according to the WHO expert committee for the classification of overweight (Seidell and Flegal, 1997). A total of 2.0mls of blood sample was collected from each patient in sitting position from the ante-cubital vein or veins at the dorsum of the hand. The sample was put into EDTA bottle and analysis was carried out within six hours of collecting the samples, analytical accuracy and precision was ensured by simultaneous analysis of commercially prepared control sera in each batch that was analyzed.

Haemoglobin (HbA_{1c}) was estimated by micro column method (Abraham *et al.*, 1978) using commercially prepared kit by Agappe Diagnostics Ltd (India). Statistical analysis was done using Statistical Package for Social Science (SPSS version 15.0). Results were expressed as means± SD. Paired sample t-test was used to compare means of results where appropriate, Pearson's correlation analysis was used to examine the relationships between variables. A p-value less than 0.05 were considered significant.

Results

A total of 160 type II diabetic subjects were recruited for the study consisting of 49(30.6%) males and 111 (69.4%) female (Table1) while 70 non-diabetics were recruited as control consisting of 25 (35.7%) male and 45(64.3) females. The mean age of the subjects was 60.7±8.7 (range 42-80 years) while the mean age of control was 54.8±13.0 years (range 30-79 years). Table 1 shows the gender distribution of diabetic subjects. 111(69.4%) of subjects were females while 49 (30.6%) of the subjects were males. Age characteristic of type II diabetics under study is as shown in table 2. A total of 24 (15%) of the subjects are within 41-50 years of

age, 49 (36.9%) of the patients were between 51-60 years of age, 55(34.4%) are within 61-70 years of age, while the remaining 22(13.7%) of the patients are between 71 and 80 years of age. There was a statistically significant difference when the mean BMI of diabetic subjects were compared with that of

controls ($p < 0.05$) (Table IV). There was statistical significant difference between levels of glycaemic control and BMI (Table V). Significant positive correlation was observed when BMI was compared with glycaemic control with r values of 0.533 and p -value < 0.05 (Table VI).

Table 1: Gender Distribution of Type II DM

Gender	Number	Percentage (%)
Female	111	69.4%
Male	49	30.6%
Total	160	100%

Table 2: Age Distribution of Type II Diabetic Subjects

Age Group (Years)	Number	Percentage (%)
41-50	24	25.0
51-60	59	35.9
61-70	55	34.4
71-80	22	13.7
Total	160	100

Table 3: Glycaemic Control Characteristics Of Subjects and Control using Glycated Haemoglobin

Glycaemic Control (%)	Number %	Male No. %	Female No. %
Good (<6.5)	64 (40%)	21 (13.1%)	43 (26.9%)
Acceptable (6.5-7.5)	24 (15%)	7 (4.4%)	17(10.6%)
POOR (>7.5)	74 (54%)	21 (13.1%)	51(31.9%)
Total	160 (100%)	49 (30.6%)	111 (69.4%)

Table 4: Comparing Mean BMI in Subjects and Controls

Variable	Subjects (Mean±SD)	Control (Mean±SD)	p-value
BMI (kg/m ²)	26.5± 5.0	22.6±2.7	0.000*

Table 5: Comparing Levels of Glycaemic Controls Using HbA1c with BMI.

Variable	Control	Good GC	Acceptable GC	Poor GC	p-value
Mean BMI±SD	22.6± 2.7	23.7±3.3	25.3±3.4	29.3±4.	0.000*

Where GC= Glycaemic Control

**Table 6: Correlation of Levels of Glycaemic Control Using HbA1c with BMI**

Levels of Glycaemic Control Using HbA1c (%)	Mean BMI (kg/m ²) ± SD
Good Glycaemic Control (<6.5)	23.7± 3.3
Acceptable Glycaemic Control (6.5-7.5)	25.3± 3.4
Poor Glycaemic Control (>7.5)	29.3± 4.0
Calculated “r”	0.533
p-value	0.000*

Discussion

The higher number of female diabetic patients than the male diabetics has been reported in a previous study (Okesina *et al.*, 1999) and elsewhere in Nigeria (Dagogo-Jack, 1991). This may be due to the fact that in Africa settings males are the bread winner and probably with less time to visit the clinics.

The mean age of the diabetic patients and the duration of DM were not statistically different from previous study (O'Connor *et al.*, 2006). In our study, there was a statistically significant difference between the mean BMI of diabetic patients (26.5± 5.0) and that of the control group (22.6±2.7). Similar studies indicated a strong interrelation between BMI and type 2 Diabetes Mellitus indicating that increase in BMI predisposes to type 2 Diabetes Mellitus (Considine *et al.*, 1996). Weight is the single most important predictor of diabetes. After adjustment for BMI, lack of exercise and a poor diet were also associated with increased risk of diabetes (Chan *et al.*, 1994). This study showed that there was a statically significant difference in mean BMI when compared with levels of glycaemic controls in diabetics and the controls. This supports the association between diabetes and obesity as an integral component of metabolic syndrome. Alterations in cortisol metabolism and the local activation of cortisol in adipose tissue provide an important link between glucocorticoids and development of the metabolic syndrome in clinically obese individuals (Rask *et al.*, 2001). Cortisol induced insulin resistance is partly explained by its metabolic effects in opposing insulin action (Rizza *et al.*, 1982). Apart from their antagonizing action on insulin sensitivity, glucocorticoids also inhibit pancreatic β -cells from secreting insulin (Delaunay *et al.*, 1997). The diabetic patients have increased physical and mental stress. On response to stress the

catecholamines are secreted by the adrenal medulla and sympathetic nerve endings. The catecholamines decrease the insulin's effect on glucose utilization and leads to elevation of blood glucose (Rizza *et al.*, 1980).

As shown in our results there was a strong positive correlation between levels of glycaemic controls and mean BMI amongst type II diabetics. This simply means that the better the glycaemic control the lower the BMI or the higher the BMI the poorer the glycaemic control. Weight loss seems to be a desirable goal for most individuals in this population with a high mean BMI, because glycaemic control, hyperlipidemia and hypertension are all improved with weight loss in the short term (Heilbronn *et al.*, 1999; Redmon *et al.*, 1999). When there is an increase in weight, as indicated by increased BMI, insulin resistance also increases, which denotes that the ability of insulin to mobilize glucose into fat and muscle and release of glucose from liver is decreased. But when there is a reduction of weight, BMI is decreased and the insulin resistance is also decreased and the reversal occurs (Ganong, 2012).

Conclusion

We concluded from our study that the level of glycaemic control in Diabetes Mellitus strongly correlates with BMI. Education should therefore include but not limited to essence of exercise and weight loss through regular exercise along with drug therapy, regular diabetes screening in optimal management of type II diabetics and thereby reducing to the barest minimum complications due to the Diabetes Mellitus.

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