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RISK AND PREVALENCE OF TYPE 2 DIABETES MELLITUS IN PATIENTS WITH MAJOR MENTAL HEALTH DISORDERS
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RISK AND PREVALENCE OF TYPE 2 DIABETES MELLITUS IN PATIENTS WITH MAJOR MENTAL HEALTH DISORDERS

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ABSTRACT

Background: **The bi directional association between major mental health disorders (MMHD) and diabetes mellitus (DM) is well established. Presently, there is little information on the risk and prevalence of DM in Nigerians with MMHD.**
Objective: **To determine the risk and prevalence of DM in Nigerians with MMHD.**
Design: **Cross-sectional study**
Setting: New World Psychiatry Hospital, Ibadan, Nigeria
Subjects: **Plasma levels of glucose was determined after an overnight fast and at 120 minutes (2-h PG) of a standard 75-g oral glucose tolerance test in 124 patients with MMHD. Thereafter, normoglycaemia, pre-diabetes and diabetes were defined using the American Diabetes Association criteria. Also, the risk of developing DM within 10 years was assessed using the Finnish Diabetes Association DM Risk Assessment Form.**
Results: **Seventy eight (62.9%), 37 (29.8%) and 9 (7.3%) of the patients had normoglycaemia, pre-diabetes and DM respectively. Only 2 patients had high diabetes risk score. There was progressive rise in 2-h PG level as the diabetes risk score increases. The mean 2-h PG was significantly higher in moderate-and-high risk group combined (MHR) compared with the low risk (LR) group. Also, the proportion of patients with pre-diabetes increased progressively from LR through MHR.**
Conclusion: **Dysglycaemia is not a rare occurrence in Nigerians with MMHD and it appears to be more prevalent in them than in the Nigerian general population. Also, high diabetes risk score could be a strong indication for glucose tolerance testing.**

INTRODUCTION

Psychiatric disorders and diabetes mellitus (DM) can present as independent conditions with no obvious direct connection. Alternatively, diabetes can be complicated by the emergence of psychiatric disorders or *vice-versa*(1).Correll et al.

(2) reported that the prevalence of type 2 diabetes mellitus (T2DM) is two-three times higher in individuals with major mental illnesses (MMI) than in the general population. Similarly, the risk of incident MMI is high in individuals with DM (3,4).

The mechanism underlying glycaemic alteration in mental illnesses is poorly understood.It has been shown that tendency to lead a sedentary lifestyle, consumption of fewer fruits and vegetables, indulgence in risk factors for cardiovascular diseases such as tobacco smoking, symptoms of mental health disorders, biochemical changes due to mental illness and, second-generation (atypical) antipsychotic agents used in the treatment of mental health disorders increase the risk of diabetes (5,6). Linkage analyses have also shown that certain loci are commonly associated with T2DM and some types of MHD (7).

This unholy relationship between MHD and DM has been associated with impaired quality of life, increased cost of care, poor treatment adherence, poor glycaemic control, increased emergency room visits and higher frequency of hospitalization(1,8,9).Therefore,earlyidentificatio n of patients with MHD at risk of developing T2DM will facilitate prompt management and minimize adverse health and cost effects. The characteristics of the study participants are already reported (11).Several non-invasive risk assessment tools have been developed to identify individuals at high risk for impaired glucose tolerance and diabetes, and to limit the number of individuals requiring diagnostic glucose tolerance tests. One of such assessment tools is the Finnish Type 2 Diabetes Risk Assessment Form (10). It is a simple, reliable, practical, non-invasive, inexpensive and time saving patient questionnaire to identify individuals at high risk for type 2 diabetes. It has eight scored questions: age, body mass index (BMI), waist circumference, physical activity, frequency of vegetables, fruit or berries consumption, medication for high blood pressure, medication for high blood glucose and family history of diabetes.

The total test score provides a measure of the probability of developing type 2 diabetes over the following 10 years. Presently, there is little information on the prevalence of T2DM in Nigerians with major mental health disorders (MMHD). Therefore, studies like ours will provide this important information as early identification of patients with MMHD at risk of developing DM will facilitate prompt management and minimize adverse health and cost effects.This study was therefore, designed to determine the 10 years risk of T2DM as well as the prevalence of pre-diabetes and T2DM in adults with MMHD.

MATERIALS AND METHODS

Study participants

The characteristics of the study participants are already reported (11). Briefly, 124 patients with either schizophrenia, depression or bipolar were selected from a total of 135 adults with mental illnesses enrolled into the study after obtaining necessary ethical approval and informed consent/assent.

Diagnosis of Pre-diabetes and Diabetes

Pre-diabetes was defined as impaired fasting glucose (100 mg/dl – 125 mg/dl) or impaired glucose tolerance (140 mg/dl – 199 mg/dl) while diabetes mellitus was defined as fasting plasma glucose (FPG) of ≥126 mg/dl or 2-hours plasma glucose (2-h PG) of ≥200 mg/dl (12).

Type 2 diabetes risk assessment

The risk of developing T2DM within 10 years was assessed using the Finnish Diabetes Association T2DM Risk AssessmentForm(http://www.idf.org/diabetes-prevention/questionnaire). Scores <7, 7-11, 12-14, 15-20 and >20 were defined as low, slightly elevated, moderate, high and very high risk respectively.

Laboratory analyses

Plasma levels of glucose was determined after an overnight fast (8 – 10 hours) and at 120 minutes of a standard 75-g oral glucose tolerance test using glucose oxidase method.

Statistical analysis

Statistical analysis was done using chi-square, ANOVA and Sudent's t-test. P-values less than 0.05 were considered to be statistically significant.

RESULTS

The mean plasma levels of glucose pre and post glucose challenge in the 124 patients are 91.4 ± 15.7 mg/dl and 123.7 ± 31.1 mg/dl respectively. These mean values are within the acceptable cut-off limits. As shown in Table 1, there were no significant differences in mean FPG and 2-h PG levels between the 3 MMHD groups.

Table 1

Fasting and two hour plasma glucose levels in the study participants

	Schizophrenia (n = 82)	Depression (n = 14)	Bipolar (n = 28)	F-value	*P*-value
FPG (mg/dl)	92.8 ± 16.3	87.4 ± 12.2	89.2 ± 15.1	1.063	0.349
2-h PG (mg/dl)	121.3 ± 28.5	128.8 ± 40.5	128.1 ± 33.6	0.698	0.499

FPG = Fasting Plasma Glucose, 2-h PG = 2-hours plasma glucose

Seventy eight (62.9%) of all the patients had normoglycaemia,thirty seven (29.8%) had pre-diabetes while 9 (7.3%) had DM of the number with DM, 3 were known diabetics while the remaining 6 were newly diagnosed.The proportion of patients with pre-diabetes and DM was slightly higher in patients with schizophrenia than in patients with depression and bipolar (Table 2)

Table 2

Prevalence of pre-diabetes and diabetes mellitus in patients with schizophrenia, depression and bipolar

	Schizophrenia (n = 82)	Depression (n = 14)	Bipolar (n = 28)	N	X^2	*P*-value
Normoglycaemia	51 (62.2%)	9 (64.3%)	18 (64.3%)	78 (62.9%)	0.055	1.00
Pre-diabetes	25 (30.5%)	4 (28.6%)	8 (28.4%)	37 (29.8%)		
Diabetes mellitus	6 (7.3%)	1 (7.1%)	2 (7.1%)	9 (7.3%)		

T2DM Risk was assessed in all the patients excluding the 9 patients with DM of the remaining 115 patients, reliable information on the eight components of the questionnaire was obtained from 85 patients only of the 85 patients,50 (58.8%), 25 (29.4%), 8 (9.4%) and 2 (2.4%) had low, slightly elevated, moderate and high risk of T2DM respectively. No patient had the very high risk score (>20).A breakdown of the patients with moderate risk of T2DM revealed that 5 out of the eight patients had pre-diabetes.In addition, 1 out of the 2 patients with high risk had pre-diabetes. Since only 2 patients had high risk of T2DM, they were pooled together with the 8 patients with moderate risk of T2DM. The mean FPG and 2-h PG levels were compared among the low risk (LR), slightly elevated risk (SER) and moderate/high risk (MHR) groups. The mean FPG levels were similar among the 3 groups. However, there was progressive rise in 2-h PG from LR through MHR and the mean 2-h PG was significantly higher in MHR compared with LR (Table 3)

Table 3

Fasting and two hour plasma glucose levels in patients with low, slightly elevated and moderate/high risk scores for diabetes mellitus

	LR (n = 50)	SER (n = 25)	MHR (n = 10)	F-value	*P*-value
FPG	90.00 ± 12.5	88.0 ± 7.7	94.2 ± 10.4	1.141	0.325
2-h PG	116.1 ± 24.6	125.2 ± 20.4	133.2 ± 25.1*,[a]	2.824	0.065

**Significant at P<0.05, [a]Compared with LR, LR=low risk, SER=slightly elevated risk,*

MHR=moderate and high risk.

The relationship between the diabetic risk score, FPG and 2-h PG are shown in Figures 1 & 2.

Figure 1

Bivariate relationship between diabetes risk score and FPG (G0)

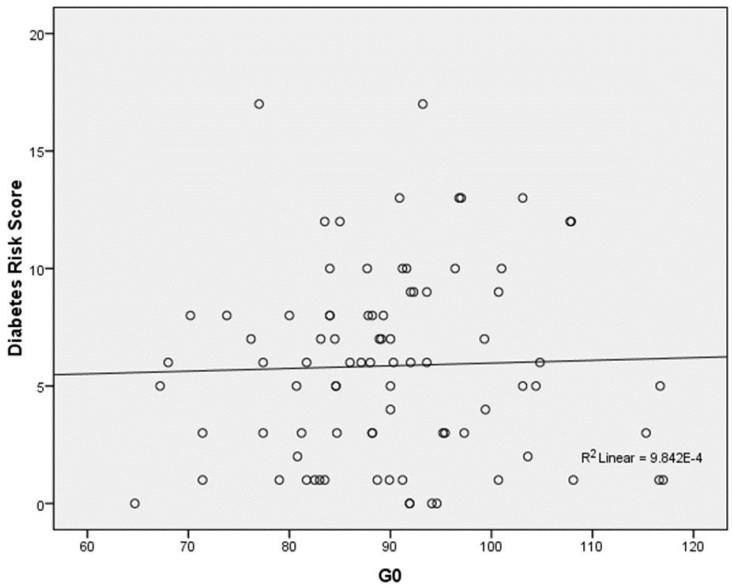
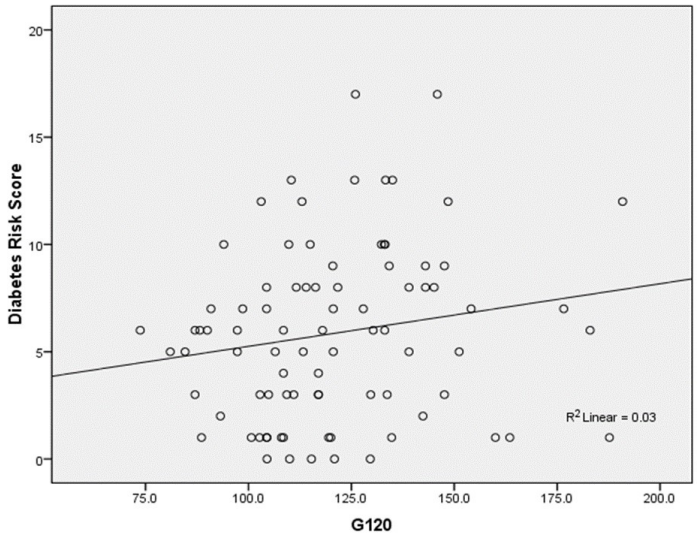


Figure 2

Bivariate relationship between diabetes risk score and 2-h PG (G120)



The diabetic risk score (DRS) had insignificant positive correlation with FPG and 2-h PG (DRS vs FPG; r-value = 0.031, P-value = 0.776; DRS vs 2-h PG; r-value = 0.172, P-value = 0.116). Among the 85 patients with diabetes risk score, 56 of them had normoglycaemia while 29 of them had pre-diabetes. The proportion of patients with pre-diabetes increased progressively from LR through MHR **(**Table 4) while the proportion of patients with LR, SER and MHR was similar in patients with schizophrenia, depression and bipolar (Table 5)

Table 4

Diabetic risk scores and glycaemic status

	LR (n = 50)	SER (n = 25)	MHR (n = 10)	N
Normoglycaemia	35 (70.0%)	17 (68.0%)	4 (40.0%)	56
Pre-diabetes	15 (30.0%)	8 (32.0%)	6 (60.0%)	29

Table 5

Relationship between diabetic risk score segments and various groups of major mental health disorder

	LR	SER	MHR	N	X^2	*P*-value
Schizophrenia	38 (67.9%)	12 (21.4%)	6 (10.7%)	56	7.383	0.117
Depression	4 (44.4%)	3 (33.3%)	2 (22.2%)			
Bipolar	8 (40.0%)	10 (50.0%)	2 (10.0%)			

LR=low risk, SER=slightly elevated risk, MHR=moderate and high risk

DISCUSSION

Psychiatric disorders and diabetes mellitus (DM) share a bidirectional association with the two influencing each other in multiple ways (1,3). The prevalence of pre-diabetes and diabetes vary worldwide. It was reported in the National Diabetes Fact Sheet (13) that 35% and 50% of US adults aged 20 years and 65 years or older respectively have prediabetes.

In this study, the prevalence of pre-diabetes (29.8%) observed among patients with MMHD is lower than that reported in the general population of US but it is higher than 8% reported by IDF in Nigeria (14). Sabir et al. (15) also reported a prevalence of 8% among Fulanis in Northern Nigeria. This observation indicates that the prevalence of pre-diabetes could be higher in individuals with MMHD than in the Nigerian general population. This thus, suggests that the risk of developing diabetes mellitus is high in patients with MMHD.

Globally, 422 million adults were reported to have diabetes mellitus in 2014. The global prevalence continues to rise with about 7.1% prevalence in Africa (16). In US, prevalence rates of 8.3% and 14.3% were reported among adults in 2011 and 2015 respectively (13). In Nigeria however, a prevalence of 4.3% was reported in 2016 (16). Earlier, Kyari et al. (17) reported a prevalence of 3.3% among adult Nigerians. Also, Ojewale and Adejumo (18) reported a prevalence of 4.4% among adults living in Ibadan.

Among patients with mental illnesses however, Ward and Druss (19) reported that the prevalence of diabetes ranged between 1.26% and 50%. Although the prevalence of DM (7.3%) observed in this study fell within this range (1.26% - 50%), it is still higher than the reported prevalence rates of DM in the Nigerian general population. This high prevalence of diabetes observed in this study is in line with the observed high prevalence of pre-diabetes in patients with MMHD. This observation, together with that of pre-diabetes, indicate that the prevalence of dysglycaemia might be higher in patients with MMHD than in the general population. This thus, suggests that there could be a strong association between MMHD and diabetes. Various diabetes risk assessment models, such as the Finnish Type 2 Diabetes Risk Assessment model, have been developed and proven to be reliable in identifying individuals who might develop diabetes over a period of time.

The observed 58.8%, 29.4% and 9.4% of the patients with low, slightly elevated and moderate risk scores indicate that 1 in 100, 1 in 25 and 1 in 6 of the patients respectively, will develop diabetes within 10 years (10). However, only 2.4% of the patients had high risk score indicating that 1 in 3 of the patients will develop diabetes within 10 years.

A number of studies using the same risk assessment model as ours have been conducted in Nigeria. Agu et al. (20) reported 9.0% high risk score in their study participants. Although the proportion of patients with high risk score in this study was lower than that reported in the studied Nigerian population, it is still not enough evidence to refute the established association between MMHD and diabetes. Our observation could be as a result of small sample size used in this study.

Alternatively, it might indicate that the model is not sensitive enough in patients with MMHD owing to their altered life style and dietary pattern secondary to the mental illness.Diabetes mellitus is characterized with hyperglycaemia. The observed significantly higher 2-h PG in MHR group compared with the LR group might indicate that the risk of dysglycaemia increases with increasing risk score. This might not be unexpected as the probability of developing diabetes within 10

years increases with increasing score.This interplay between MHR and 2-h PG probably conveys some message. One, it could be an indication that there is a significant relationship between diabetes risk score and 2-h PG more than FPG.

This notion could be supported with the observed better, albeit insignificant, correlation between the risk scores and 2-h PG compared with FPG. Second, it might mean that there is a strong call for glucose tolerance testing in individuals with high diabetes risk score. Therefore, 2-h PG might be a true reflection of glycaemic alteration than FPG determination.The proportion of patients with pre-diabetes increases progressively from LR through MHR.

This observation is similar to that of 2-h PG and might further support the view that the risk of dysglycaemia increases with increasing risk score. However, the observed insignificant association between risk score and the 3 MMHD groups probably suggests that the predictive ability of the model as well as pattern of glucose alteration is similar among the 3 groups. It could be concluded from this study that dysglycaemia is not a rare occurrence in Nigerians with major mental health disorder.

The prevalence rates of pre-diabetes and diabetes mellitus in Nigerian patients with MMHD appear to be higher than the reported prevalence rates in the Nigerian population. In addition, high diabetes risk score could be a strong indication for glucose tolerance testing.

This study has a number of limitations. First is the small sample size. Also, the unequal number of participants in each of the three groups and the non- matching of participants by age and gender are notable limitations. Thus, our results need to be interpreted with some caution. However, our results serve as template for larger sample-size studies in future.

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