



## **Prevalence of Diabetes Mellitus among Psychotropic Drug Naive Patients with Psychiatric Disorders at Federal Neuro-Psychiatric Hospital Barnawa, Kaduna**

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### **Authors' contributions**

*This work was carried out in collaboration among all the authors. Authors SYO and FTN designed the study and wrote the protocol which was approved by the leadership of authors TLS, SYO and AMM preformed the statistical analysis, authors SYO and IUE managed the literature search, author SYO wrote the first draft of the manuscript with assistance from authors TLS and FTN who was involved in the correction of the manuscript. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** It has been established that diabetes mellitus occurs frequently among psychiatric patients; however, little is known about diabetes mellitus among psychotropic drug naive patients with psychiatric disorders in Nigeria.

**Objectives:** This is to determine the prevalence and socio-demographic correlates of diabetes

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mellitus among psychiatric patients in Kaduna, Northern Nigeria.

**Method:** This study is a case control study involving 250 psychotropic drug naive patients who attended the Assessment and Emergency unit of Federal Neuro-psychiatric Hospital, Kaduna, Nigeria for the first time between November 2012 and December 2013 and 250 apparently normal individuals. The fasting blood glucose (FBG) level of both the patients and the apparently normal individuals were measured using enzymatic oxidation method and those whose FBG values were above normal range were repeated one or more times.

**Results:** The mean ages of the patients and the control individuals were 32.7 ( $\pm 4.6$ ) and 38.6 ( $\pm 5.8$ ) years respectively. Thirty-two patients (12.8%) were found to be diabetic compared to the control in which 14 (5.6%) were found to be diabetic ( $p$  value  $< 0.001$ ). Among the 32 patients who were diabetic, 10 (4.0%) were female, 22 (8.8%) were male and 28 (11.2%) patients were within 18 and 60 years old. Seventy-one (28.4%) of the 250 patients (and /or their relatives) did not know their diabetes history compared to the control group whereas 18 (7.2%) individuals did not know their diabetes history.

**Conclusion:** Diabetes mellitus is more common among psychotropic drug naive psychiatric patients than the general population, highest incidence of diabetes mellitus among mentally-ill patients is found within the ages of 18 and 60 years and one out of about four mentally-ill patients (and/or their relatives) did not know about their sugar level, neither did they know if they do or do not have diabetes in their extended family. These should therefore be borne in mind in patient's evaluation and management.

*Keywords: Diabetes; psychiatry; mental illness; psychotropic.*

## 1. INTRODUCTION

### 1.1 Diabetes Mellitus

The term "diabetes mellitus" describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs [1,2].

### 1.2 Psychiatric Disorder

Psychiatric disorder (also known as mental illness or mental disorder) is a clinically significant behavioral or psychological syndrome or pattern that occurs in an individual and that is associated with present distress (e.g. painful symptom) or disability (i.e. impairment in one or more important areas of functioning) or with a significantly increased risk of suffering death, pain, disability or an important loss of freedom. In addition, this syndrome or pattern must not be merely an expectable and culturally sanctioned response to a particular event, for example the death of a loved one. Whatever is the original cause, it is considered a manifestation of a behavioral, psychological, or biological dysfunction in the individual [3].

Diabetes mellitus is a common chronic medical condition associated with significant global morbidity, mortality and costs. Psychiatric disorders have a similar, but even greater impact on the global burden of diseases and disability. An association between these disorders becomes an extremely important area for scientific research with therapeutic and preventive implications [4]. A Study in USA has revealed psychiatric disorders having greater frequency among persons with diabetes than those without diabetes [5]. Diabetes Mellitus (DM) is the commonest endocrine system disorder and has for long been associated with psychological factors. At one time it was classified as a psychosomatic illness in the belief that psychosocial factors were significant in the manifestation of the disease [6]. For example, the report of DM after a period of stress due to social loss [7].

In developed countries, psychiatric symptoms such as irritability, anxiety, depression, suicidal ideas and cognitive deficits have been widely reported among DM mostly outside Nigeria [8,9]. In addition, some neuro-psychiatric complications have been reported, including peripheral neuropathy, erectile dysfunction, organic brain syndrome and dyskinesia [6,10-12]. In Nigeria, where a rising incidence of DM had been noted, [13] the disease poses high socio-economic burden [14-15] and is significantly associated with worries [16] and psychological symptoms [17,18].

One of the very few study done was from University college Hospital Ibadan, Nigeria, and it was found that 5% of Insulin dependent diabetes (IDD) and 4% of Non-insulin dependent diabetes (NIDD) had threshold score for anxiety; while 37.8% of IDD and 15.2% of NIDD had threshold score for depression, however, there is a dearth of literature on prevalence of DM among patients with psychiatric disorders in Nigeria especially in the northern part of the country.

Prevalence of psychiatric disorders in diabetes mellitus has been studied using different methodologies outside Nigeria. In a study comparing patients with chronic type1 diabetes, their first-degree relatives and normal controls, prevalence of psychiatric disorders showed influence of gender. Lifetime and 6-month prevalence of simple phobia were more in female patients with diabetes compared to other two groups, while in males lifetime prevalence of antisocial personality disorder was more than in general population. [19] Lustman and colleagues (1986) found a 71% lifetime prevalence of at least one psychiatric disorder among 57 patients each of type 1 and type 2 diabetes. The commonest lifetime diagnoses were generalized anxiety disorder (41%) and major depressive disorder (33%), while 14% had current major depression, except for simple phobias and agoraphobia (more in type 2), there was no significant difference in prevalence of psychiatric disorders between the two types of diabetes. Measure of HbA1 (glycated hemoglobin) was significantly higher in 'recently psychiatrically ill' group when compared to 'never ill' group. Most of these researches were performed outside Nigeria and none has been performed in Northern Nigeria. There is therefore the need to have a base line research on this topic in this part of the world.

### 1.3 Research Objective

This study aimed at establishing the prevalence of diabetes among psychotropic drug naive patients with psychiatric disorder in northern Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Setting

This study was conducted at Federal Neuro-psychiatric Hospital (FNPH) Kaduna, North-west Nigeria between November 2012 and December

2013. The hospital and its Medical Laboratory serve as a referral center for psychiatric disorders and biochemical investigations respectively from virtually all the Northern states and the Federal Capital Territory.

### 2.2 Inclusion Criteria

Samples were collected from subjects who were coming into the hospital for the first time and were diagnosed as psychiatric patients by Consultant Psychiatrists.

### 2.3 Exclusion Criteria

Individuals who were not Federal Neuro-psychiatric Hospital patients were excluded; Patients or individuals who came from other hospitals or on their own for such a test were excluded from this research. Patients already on psychotropic drugs were also excluded.

### 2.4 Subjects

These consisted of 250 consecutive psychotropic drug naive patients visiting the hospital for the first time and met the inclusion criteria. The control group was made up of 250 consecutive willing apparently normal subjects who were staff, students or other volunteers and certified by a psychiatrist of not having any symptom of mental disorder. The patients were classified by Consultant Psychiatrists using the diagnostic criteria based on International classification of disease 10<sup>th</sup> edition (ICD-10) and Diagnostic and Statistical Manual of Diseases 4<sup>th</sup> edition (DSM-IV) before undergoing a Fasting Blood Sugar test.

### 2.5 Reagents

Prepared buffer containing 0.1mmol/L of Phosphate buffer of PH 7.0, and 11mmol/L of Phenol with GOD-PAP reagent containing 0.77 mmol/L of 4-aminophenazone, Glucose oxidase and peroxidase of greater than or equal to 1.5 kU/L were used.

### 2.6 Reagent Preparation

Each vial of GOD-PAP reagent was reconstituted with about 50mls of the buffer. The mixture was mixed gently until the reagent dissolved and was transferred to the remaining 50 mls of buffer. It was mixed gently and used as glucose reagent.

## 2.7 Material Required

Test tubes, precision pipettes, timer, cuvette, Spectrophotometer.

## 2.8 Sample Collection

Blood was collected through venipuncture into a fluoride oxalate bottle using the best practice of phlebotomy. The plasma was harvested after it has been centrifuged for 5 minutes at 4,000 revolutions per minute. The test was done immediately.

## 2.9 Principle

Glucose level was determined after enzymatic oxidation in the presence of glucose oxidase. The hydrogen peroxide formed reacted under catalysis of peroxidase with phenol and 4-aminophenazone to form a red-violet quinoneimine dye as indicator, the concentration of glucose in the sample is directly proportional to the intensity of the color formed.

## 2.10 Procedure

Test tubes were labelled accordingly (blank, standard and control) and identification numbers of various samples were also written on various test tubes, then 0.01 ml of the various plasma was pipetted and dispensed accordingly into their respective test tubes after which 0.01ml of glucose standard and control were pipetted and dispensed into test tubes labelled standard and control respectively. One milliliter of glucose reagent was then added into the test tubes containing samples, standard, control and test tube labelled blank. The mixtures were mixed and incubated for 15 minutes at 37°C. The spectrophotometer was turned on and adjusted to zero with reagent blank. The samples', control's and the standard's absorbances were read.

The concentration of each sample was calculated using the ratio of Absorbance of test to Absorbance of Standard and the result was multiplied by the concentration of Standard to give us the respective glucose concentrations. Fasting blood sugar was measured for all the subjects and those whose values were above normal range were repeated one or more times

before the diagnosis of diabetes were established.

## 2.11 Statistical Analysis

A secured computerized database was established; Patients' and control individuals' names were replaced with unique identifying numbers, the age, sex and other important variables were also imputed. Statistical analyses were performed using SPSS 11.0. The mean, Standard deviation and other data were extracted. Data were presented on table and Level of significance was analyzed using chi-square test.

## 2.12 Ethical Issues

The Research and Ethics Committee of Federal Neuro-psychiatric Hospital Kaduna approved this study. Patients (or their relatives) and the control individuals were informed about the nature of the research and they gave consent to participate.

## 3. RESULTS

The mean ages of the psychiatric patients and the control individuals were 32.7 ( $\pm 4.6$ ) years and 38.6 ( $\pm 5.8$ ) years respectively. The study group consisted of 163 (65.2%) males and 87 (34.8%) females while the control population consisted of 138 (55.2%) males and 112 (44.8%) females. Thirty two (12.8%) patients and 14 (5.6%) control individuals were diabetic (P value < 0.001). Ten (4.0%) female patients and 22 (8.8%) male patients were diabetic. Out of the patients who were diabetic, 28 (11.2%) were within the age range of 18 – 60 years, 1 patient with co-occurring diabetes mellitus and epilepsy was below the age of 17 years while 4 diabetic patients were 60 years and above. Among the psychiatric patients with diabetes, depression has the highest prevalence with 11(4.4%) patients followed by schizophrenia with 9 (3.6%). Others are anxiety disorder, dementia, epilepsy, mental and behavior (M&B) disorder, and other psychosis having 3 (1.2%), 4 (1.6%), 1 (0.4%), 3 (1.2%) and 1 (0.4%) patients respectively. It was observed that 71 (28.4%) of the 250 patients did not know their diabetes history. This means that one out of about four psychiatric patients did not know their diabetes history. Other details are shown in Table 1 below.

**Table 1. Shows the results of the psychiatric patients and control, the results of family diabetic history and the prevalence of mental illness associated with diabetes mellitus**

Study	Male (%)	Female (%)	Total (%)
<b>Psychiatric population</b>	163 (65.2%)	87 (34.8%)	250 (100%)
Psychiatric with diabetes	22 (8.8%)	10 (4.0%)	32 (12.8%)
Psychiatric with diabetes (0-17yrs)	1 (0.4%)	0 (0%)	1 (0.40%)
Psychiatric with diabetes (18-59yrs)	19 (7.6%)	9 (3.6%)	28 (11.2%)
Psychiatric with diabetes (≥ 60yrs)	2 (5.0%)	1 (0.4%)	3 (1.2%)
Diabetic with depression	7 (2.8%)	4 (1.60%)	11 (4.40%)
Diabetic with anxiety disorder	2 (0.8%)	1 (0.40%)	3 (1.20%)
Diabetic with dementia	3 (1.2%)	1 (0.40%)	4 (1.60%)
Diabetic with schizophrenia	6 (2.40%)	3 (1.20%)	9 (3.60%)
Diabetic with other psychosis	1 (0.40%)	0 (0.00%)	1 (0.40%)
Diabetic with seizure	1 (0.40%)	0 (0.00%)	1 (0.40%)
Diabetic with M & B	2 (0.8%)	1 (0.40%)	3 (1.20%)
Patients with diabetes history	36 (14.4%)	17 (6.8%)	53 (21.2%)
Patients with no diabetes history	89 (35.6%)	37 (14.8%)	126 (50.4%)
Don't know if they have diabetes history or not	38 (15.2%)	33 (13.2%)	71 (28.4%)
<b>Control population</b>	138 (55.2%)	112 (44.8%)	250 (100%)
Control diabetics	6 (2.4%)	8 (3.2%)	14 (5.6%)
Control diabetics (0-17yrs)	0 (0%)	0 (0%)	0 (0%)
Control diabetic (18-59yrs)	5 (2%)	7 (2.8%)	12 (4.8%)
Control diabetics (≥ 60yrs)	1 (0.4%)	1 (0.4%)	2 (0.8%)
Control with diabetes history	25 (10%)	17 (6.8)	42 (16.8%)
Control with no diabetes history	101 (40.4%)	89 (35.6)	190 (76%)
Control who don't know if they have Diabetes history or not	12 (4.8%)	6 (2.4)	18 (7.2%)

#### 4. DISCUSSION

The results obtained in this study as presented in Table 1 revealed that out of 250 patients, 163 (65.2%) were males while 87 (34.8%) were females. This is probably as a result of more male patients than females attending the hospital. Thirty-two patients (12.8%) were found to be diabetic compared to the control group in which 250 individuals were tested for glucose and 14 (5.6%) were found to be diabetic which was found to be significant ( $p < 0.001$ ). This indicates that there was significantly higher prevalence of diabetes mellitus among psychiatric patients compared to that of the general population, it therefore agrees with the research carried out by Codami and Cross in London, although there was no control for psychotropic drugs. In their study, out of 800 psychiatric patients 82 (10.2%) had diabetes mellitus [20]. Like Codami and Cross most researchers did not control for psychotropic drug which can as well induce hyperglycemia. The incidence of diabetes mellitus in psychiatric patients has been found to be 2 to 8 times higher than in the general population [21,22,23].

Female patients who were diabetic were 10 in this study which accounted for 4.0% of the total

patients under study as illustrated in table 1, this was similar to the control where 8 (3.2%) were diabetic and so female gender was not statistically significant ( $p > 0.5$ ). Twenty two male patients which accounted for 8.8% of the population were diabetic as against the control in which 6 people (2.4%) were diabetic, this was also statistically significant ( $p < 0.001$ ). Many researchers have argued that incidence of diabetes in male is more than that of female [24], this was probably the contributory factor in this study.

Twenty eight diabetic patients who accounted for 11.2% of the population fell between the ages of 18 and 60 years as against the control population where 12 persons (4.8%) fell between the same age group which was statistically significant ( $p < 0.001$ ), this age group represents the work force of most organization. A research conducted in the United State shows that diabetes is a significant predictor of lost productivity and is associated with a profound negative impact on economic productivity [25]. Three diabetic patients who accounted for 1.2% of the patients under study were 60 years and above. Only one diabetic patient who accounted for 0.4% was younger than 17 years in this study.

Looking at the psychiatric diagnosis of these diabetic patients as illustrated in table 1, it was found that depressive disorder had the highest occurrence with 11 (4.4%) patients out of which 7 (2.8%) patients were male and 4 (1.6%) patients were female, this is in contrast to the report by Codami and Cross where schizophrenia had the highest occurrence [20]. This study, however, agrees with other researchers who identified depression as the highest psychiatric disorder among diabetic patients [26]. Mechanisms mediating the relationship between diabetes and depressive disorder can be numerous, physical inactivity and obesity are established risk factors for diabetes [27].

Diabetes with Schizophrenia accounted for 9 (3.6%) patients which agree with Ryan and his colleagues in 2003 who said populations with psychosis have a 2-3-fold higher prevalence of diabetes even before treatment with any antipsychotics, suggesting a possible genetic linkage or co-morbidity. [28] Four diabetic patients (1.6%) were found to have dementia in this study.

This study went further to inquire whether the psychiatric population under study and the control group know their diabetic status or not as illustrated in the Table, it was realized that 71 patients (and/or their relatives) did not know if they do or do not have diabetes in their extended family and they did not know whether they have diabetes or not, unlike the control group where only 18 people did not know whether they have diabetes history or not. Family history is a well-known risk factor for diabetes mellitus with risk estimate (relative risk [RRs]) ranging from 2 to 6 depending on study design and case definition. [29] Not knowing one's diabetes history can be a contributory factor to diabetes complications such as mental illness as many patients would have started having early complication at the time of their clinical diagnosis [30,31].

## 6. LIMITATION

The study was hospital based and the control subjects were mostly staff and students of the hospital; therefore the results will be difficult to extrapolate to the general population. Some sociodemographic characteristics were not recorded and the onset of psychiatric illness could not be ascertained. This study could not differentiate between type 1 and type 2 diabetes mellitus because it was not designed to do so.

## 5. CONCLUSION

The results obtained from this study shows that Prevalence of diabetes mellitus among psychotropic drug-naive patients with mental disorders is higher than that of the general population in this part of the world. Male patients who have diabetes and mental illness were more than female who have Diabetes Mellitus and mental illness and highest incidence of mentally-ill with diabetes mellitus are found within the ages of 18 and 60 which are the ages of work force of any organization. One out of about four mentally-ill patients did not know about their sugar level, neither did they know if they have diabetes history.

## 7. CLINICAL IMPLICATIONS

The proportion of diabetes as the comorbid condition in our psychiatric population was almost 3 times higher than that expected in the general population [21,22,23]. One of the biggest challenges in management of psychiatric disorders among those suffering from diabetes is the low rates of detection. Up to 45% of the cases of mental disorder and severe psychological distress go undetected among patients being treated for diabetes. [32] This is a result of both patient and physician related factors. Physicians should be aware of the possible co-morbid psychiatric disorders likely to be associated with diabetes. Consequently these patients should be regularly screened for common psychiatric disorders and psychiatric patients should be screened for diabetes.

Co-occurring psychiatric disorders in patients with diabetes are associated with impaired quality of life, [33] increased cost of care, [34] poor treatment adherence, [35] poor glycemic control (evidenced by elevated HbA1c levels), [36] increased emergency room visits due to diabetic ketoacidosis, [37] higher frequency of hospitalization and higher rate of absenteeism [19].

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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