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Assessment of Depression Risk Factors in Type 2 Diabetics at an Outpatient Clinic of a Tertiary Hospital in North Central, Nigeria

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Abstract:-

➢ ***Background***

Depression and diabetes mellitus are health problems that affect people's quality of life. Some diabetic patients who are depressed may remain undiagnosed with the co-morbidity by Family Physicians. Hence there is need to draw physicians' attention to curb this.

➢ ***Aim/Objectives***

The objective of this study was to assess the prevalence and risk factors of depression among type 2 diabetic patients attending Federal Medical Centre's General Outpatient Clinic in Makurdi, Nigeria

➢ ***Methodology***

This cross-sectional study included 238 diabetic patients over the age of 18 using the random sampling technique. Self-completed questionnaires were used to collect data, and clinical parameters such as height, weight, blood pressure, and fasting blood glucose levels were noted. The questionnaire collected information on the socio-demographic characteristics, relevant history and Becks Depression Inventory (BDI). Version 21 of the SPSS (Statistical Package for Social Sciences) was used to analyze the data. P-values of less than 0.05 were considered statistically significant in all analyses, which were carried out at a 5% significance level.

➢ ***Results***

It was shown that 33.6% of people had depression. It was more common in people between the ages of 20 and 29 (50%) and in women than in men (39% vs. 25%). Mild depression was present in 56.3% of diabetic patients with depression. Depression was shown to be significantly correlated with BMI (p = 0.002), marital status (p = 0.034), gender (p = 0.026), and the kind of antidiabetic medicine taken (p = 0.036). Being overweight was substantially linked to a decreased risk of depression, according to multiple logistic regression analysis (aOR = 0.14, CI = 0.03-0.66, p = 0.013).

➢ ***Conclusion/Recommendation***

A considerable number of diabetic patients exhibited depression. Physicians should maintain a high level of vigilance, monitor the behavior of individuals with diabetes, and screen them for depression. This approach can provide a foundation for further research.

I. INTRODUCTION

Depression is a major noncommunicable disease that affects the body and mind. It is prevalent among people in all societies worldwide, affecting approximately 350 million people [1,2]. Nigeria is one of many developing countries whose health services focus on the treatment of infectious diseases in recent years, non-communicable diseases like diabetes and depression have become a significant problem. [3]. In 2016, 422 million persons worldwide were estimated to have type 2 diabetes mellitus (DM), with a prevalence of 8.5% [4].

In 2017, the global economic burden of diabetes was estimated to be $727 billion [4]. In Nigeria, the estimated cost of managing each diabetic patient was approximately $240.4 in the same year [4]. When depression is present, it becomes a co-morbidity with more financial burden that can hinder achievement of glycaemic control, increase pill burden, reduce medication adherence, cause poor quality of life and increase mortality and morbidity [5-8]. This makes it salient for doctors and others who care for people with diabetes to watch for signs of depression.

A period of two (2) weeks or more during which five or more symptoms are regularly present for the majority of the day, almost every day, is considered indicative of depression. Depression, loss of interest in enjoyable activities, changes in weight or appetite, irregular sleep patterns, psychomotor agitation or retardation, feelings of exhaustion, guilt, or worthlessness, trouble focusing or making decisions, and suicidal thoughts are some of these symptoms. It is noteworthy that these symptoms manifest in the absence of manic or hypomanic episodes [9].

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Depending on the number and severity of symptoms, depression can be classified as mild, moderate, or severe [10]. Individuals with mild depression experience some difficulty in daily and social activities, but they do not experience such difficulties at work [11]. If depression is severe, the person with depression may be unable to continue to participate in social, work, or family activities Individuals experiencing depression often exhibit unhealthy behaviors such as smoking, poor dietary habits, alcohol abuse, and a sedentary lifestyle. Research indicates that those with lower levels of education, unemployment, and lower social status are more susceptible to depression [12].

Studies on diabetic people have shown varying rates of depression [7]. For example, a study carried out in Madrid, Spain, revealed that 20.03% of subjects had the condition [13]. In a multi-centre study involving 50 centers and 2552 adult type 2 diabetic patients in Australia, the prevalence of depression, as assessed using the Diabetes Distress Score 17 (DDS17), was found to be 23% [14]. This relatively low prevalence may be attributed to the quality of medical care and the better socio-economic conditions in developed countries. Similar findings were reported in a nationwide cross-sectional study in the USA (8.3%), and two studies in Canada (9.47% and 7.3%) [15, 16].

In contrast, higher rates of depression among diabetic patients have been reported in other regions. For example, a study in Mexico found a prevalence of 48.27% [17], while in Jazan province, Saudi Arabia, it was 20.6% [18]. A systematic review across Pakistan, Bangladesh, and India reported a range of 14% to 41%, with a pooled prevalence of 27.7% [19]. In Africa, particularly in Addis Ababa, Ethiopia, a meta-analysis of nine studies indicated a prevalence of 39.73% [7]. In Dares Salaam, Tanzania, the prevalence was reported to be 87% [20], and in Benin, Nigeria, 30% of diabetic patients were found to be depressed compared to 9% among healthy individuals [21]. However, a study in suburban communities in Sokoto State, Nigeria, reported a lower prevalence of 4.3% among diabetics [22].

Several factors have been identified as associated with depression among diabetic patients, including age, gender, marital status, educational level, income, family support, medication adherence, and anthropometric indices [13, 19, 20, 23-26]. Studies have consistently shown higher prevalence of depression among females with diabetes compared to males in India, Saudi Arabia, the USA, and Nigeria [1, 19, 27]. Additionally, depression prevalence tends to decline after the age of 60 in some regions, such as Saudi Arabia, while younger age groups in the USA are at higher risk [28, 29]. Nonetheless, Coker et al. found no significant correlation between the age of diabetic patients and the occurrence of depression in a study conducted at Lagos State University Teaching Hospital and Jos University Teaching Hospital in Nigeria [27, 29].

Studies carried out in Palestine, Saudi Arabia, and Nigeria have repeatedly demonstrated that single people are more likely to experience depression [28, 29, 30]. In their research, Floriana et al. noted that there is a correlation between obesity and an increased risk of depression [31]. Gender differences in obesity and depression have been brought to light by independent research conducted in China by Luo et al. and in the USA by Xiang. They discovered that while obesity raises the risk of depression in females in the same age range, it lowers the likelihood of depression in middle-aged and older males. Compared to men and racial/ethnic minority groups, females and non-Hispanic Whites tend to have a higher association between obesity and the onset of depression [32, 33].

Screening for depression in diabetic patient is advocated in clinical practice [34]. A systematic approach to early identification of diabetic patients with depression patients has been shown to be effective in reducing the burden of depression in diabetes [35]. Therefore, in the General Out-Patient Clinic of the Federal Medical Centre, Makurdi, this study evaluated the prevalence of depression and its risk variables among adult diabetic patients.

II. MATERIALS AND METHODS

➢ *Study Space*

The Federal Medical Center (FMC), Makurdi's General Out-Patient Clinic (GOPC) served as the study's site.

➢ *Study Population*

The study population consisted of adult patients with type 2 diabetes who attend the GOPC and are eighteen (18) years of age or older.

➢ *Ethical Approval*

Ethical approval for this study was obtained from the Health Research Ethics Committee of the Federal Medical Centre, Makurdi, with approval number FMH/FMC/MED/105/1/X. Written informed consent was obtained from all participants prior to their involvement in the study.

➢ *Inclusion Criteria For This Study Included:*

- Adult patients with type 2 diabetes who gave their agreement and were at least 18 years old.
- Patients who, for at least three months before to the trial, had been regularly following up and taking their medicine.
- Individuals who have not previously experienced substance misuse or mental illness, as these may serve as confounding variables.

➢ *Exclusion Criteria Were:*

- Patients who did not provide consent to participate.
- Patients who were too ill to participate.
- Pregnant individuals.

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III. RESEARCH METHODOLOGY

The research was a cross-sectional analytical study conducted in a hospital.

➢ *Determining the Sample Size*

The Leslie and Kish formula for descriptive studies was utilized to determine the minimal sample size that was necessary [36].
descriptive studies [36].
$N = Z^2pq/d^2$
Where:
N = Minimum sample size
Z = A constant at 95% confidence level = 1.96
P = Prevalence of depression among diabetic in Jos North-Central Nigeria [27]. (19.4%) = 0.194
q = I – p (i.e. 1 – 0.194) = 0.806
d = desire precision if 5% = 0.05
$N = (1.96)^2 (0.194 \times 0.806)$

$(0.05)^2$

$$N = \frac{(1.96)^2 (0.194 \times 0.806)}{(0.05)^2} = 240$$

Since the total number of patients was < 10000, the sample size was calculated using the formula,

$$nf = \frac{n}{1+\frac{n}{N}}$$

Where:
nf is desired sample size for a population < 10000.
n is the desired sample size for a population > 10000 which was 240

N is total number of diabetic patients which was

$$Nf = \frac{240}{1+\frac{240}{2112}} = 216$$

The total sample size for the study was 238 patients when 10% of the minimum sample size (21.6) was added to account for expected non-response, incompletely filled data, and missing questionnaires (216).

➢ *Sampling Technique:*

A systematic random sampling technique was utilized for participant selection.

➢ *Method of Data Collection:*

Data collection involved a combination of structured interviews and clinical measurements. Prior to the main study, a pre-test of the questionnaire was conducted at the National Health Insurance Scheme (NHIS) Clinic of the hospital, involving 30 diabetic patients recruited consecutively.

➢ *Study Tool:*

The questionnaire consisted of four sections and was self-administered.

The first segment gathered socio-demographic information, the second section included additional risk factors for depression among diabetic patients, such as tenure of diabetes and details about antidiabetic medications (type and dosing frequency), the third section utilized the 21-item Beck Depression Inventory (BDI) rating scale to assess and quantify the severity of depression. Each answer on the BDI is assigned a score from 0 to 3, indicating the severity of depression. The questionnaire covered aspects such as mood, pessimism, sense of failure, self-dissatisfaction, suicidal thoughts, crying, irritability, social withdrawal, body image, work difficulties, insomnia, exhaustion, appetite changes, weight loss, bodily preoccupation, and loss of libido. Questions 1 to 13 focused on psychological symptoms, while items 14 to 21 assessed more physical symptoms [37].

There are 63 potential scores. Merely depressive scores range from 0–13, mild depression from 14–19, moderate depression from 20–28, and severe depression from 29–63. The weight, height, waist circumference, and hip circumference were all measured in the last part.

➢ *Measured Variables*

- *Height and Weight Measurement*

Height and weight were measured using a stadiometer attached to a weighing scale (ZT – 120 Health Scale). Measurements were taken with participants standing erect, wearing light clothing, without footwear, and ensuring their pockets were emptied of items such as cell phones, keys, and pocket diaries. The weighing scale was zero-calibrated before each measurement. Height was recorded to the nearest 0.01 meter (m), and weight to the nearest 0.5 kilogram (kg) [38].

Body Mass Index (BMI) Calculation:
BMI = Weight(kg)/Height^2 (m^2)

BMI values were categorized into four classes:
(i) Underweight: BMI < 18.5 kg/m², (ii) Normal weight: BMI between 18.5 kg/m² and 24.9 kg/m², (iii) Overweight: BMI between 25 kg/m² and 29.9 kg/m², (iv) Obesity: BMI ≥ 30 kg/m².

- *Measuring the Waist Circumference:*

The waist circumference was measured with a measuring tape at the midpoint between the iliac crest and lower rib margin, wrapped horizontally around the body. The participants in the trial would stand with their feet spaced roughly 12 to 15 centimeters apart and their weight evenly spread across both legs. They were instructed to breathe normally; the measurement should be obtained after they had finished gently exhaling. This will stop participants from holding their breath

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or tensing their abdominal muscles. The investigators were able to insert one finger between the tape and the subject's body since it was sufficiently loosened. The measurement was made using the measuring tape's resolution, which was reported to the closest centimeter (cm) [38].

- *Measuring the Hip Circumference*

A measuring tape was used to measure the hip circumference. To the closest centimeter (cm), it was measured at the maximum circumference around the buttock posteriorly and the pubic symphysis anteriorly [39]. Waist circumference / hip circumference equals the waist-hip ratio (WHR). Male and female norms are 1.0 and 0.8, respectively.

- *Blood Pressure*

Using a properly sized cuff and a 3M Littmann® stethoscope, the individuals' blood pressures were measured using an auscultatory approach with an Accusson® mercury sphygmomanometer. After the participant was sat and allowed to relax for around five minutes, with their legs extended and their arm resting at heart level, their blood pressure was taken. The cuff was fastened to the arm, inflated to a level approximately 30 mmHg above the systolic pressure that was felt, and then deflated at a rate of 2 mmHg per second. The first, fifth, and Korotkoff sounds, which represent the systolic and diastolic blood pressure, were audible during this process. Two blood pressure readings that were recorded at least two minutes apart were averaged [39]. Subjects were categorized as having (1) normal blood pressure when SBP < 140 mmHg and DBP < 90 mmHg, or (2) abnormal blood pressure when SBP > 140 mmHg and/or DBP ≥ 90 mmHg based on blood pressure measurements [39].

- *Measurement of Fasting Blood Glucose*

The patient was required to have abstained from food for at least eight hours prior to the measurement. The glucometer (Accucheck®) was used to measure the fasting blood glucose. It included lancets, a lancing device, testing strips, and a meter to read the result. Results were compared to the standard, with values between 3.9 and 5.5 mmol\L considered normal [40].

➢ *Data Interpretation*

The Statistical Package for Social Sciences (SPSS Version 20) was used to sort, code, and impute the obtained data in order to conduct analysis. Frequency tables and charts were used to present the results. Proportions were used to represent qualitative characteristics, whereas mean and standard deviation were used to convey quantitative data. To examine the relationship between category or qualitative variables, the chi square test was employed. Every variable that had a significant connection (5% level of significance) with depression was subjected to a multiple logistic regression analysis. The study was conducted at the 5% significance level, and the adjusted odds ratio (OR) and its 95% confidence interval were computed.

IV. RESULTS

➢ *Socio-Demographic Characteristics of the Respondents.*

Table 1 Socio-Demographic Characteristics of the Respondents

Variables	Total (%)	Not depressed	Depressed	χ^2	p-value
Age (in years)				χ^2=4.93	0.417
20-29	2(0.8)	1(50.0)	1(50.0)		
30-39	7(2.9)	4(57.1)	3(42.9)		
40-49	46(19.4)	33(71.7)	13(28.3)		
50-59	95(39.9)	59(62.1)	36(37.9)		
60-69	56(23.6)	42(75.0)	14(25.0)		
≥70	32(13.4)	19(59.4)	13(40.6)		
Mean (SD)= 56.3 (11.3)					
Gender				χ^2=4.99	0.026*
Male	92 (38.7)	69(75.0)	23(25.0)		
Female	146(61.3)	89(61.0)	57(39.0)		
Marital status				χ^2=6.50	0.011*
Divorced	3(1.3)	120(71.4)[a]	48(28.6)[a]		
Single	4(1.7)	38(54.3)[b]	32(45.7)[b]		
Separated	5(2.1)				
Widowed	58(24.4)				
Married	168(70.5)				
Level of education				χ^2=1.71	0.634
Secondary	36 (15.1)	45(62.5)	27(37.5)		
Primary	49(20.6)	32(65.3)	17(34.7)		

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Informal	72(30.3)	27(75.0)	9(25.0)		
Tertiary	81(34.0)	54(66.7)	27(33.3)		
Employment status				χ^2=0.14	0.708
Employed	129(54.2)	87(67.4)	42(32.6)		
Unemployed	109(45.8)	71(65.1)	38(34.9)		
Ethnicity				χ^2=3.28	0.350
Igede	5(2.1)	113(63.5)	65(36.5)		
Idoma	32(13.4)	24(75.0)	8(25.0)		
Others	23(9.7)	3(60.0)	2(40.0)		
Tiv	178(74.8)	18(78.3)	5(21.7)		
Religion				χ^2=0.92	0.815
Christianity	228(95.8)	150(65.8)	78(34.2)		
Islam	9(3.8)	7(77.8)	2(22.2)		
Others	1(0.4)	1(100.0)	0(0.0)		
Average income				χ^2=1.11	0.776
Less than 18,000	58(24.4)	41(70.7)	17(29.3)		
18,000-49,999	114(47.9)	76(66.7)	38(33.3)		
50,000-99,999	41(17.2)	26(63.4)	15(36.6)		
Above 100,000	25(10.5)	15(60.0)	10(40.0)		
Who do you live with?				6	0.092
With parents	3(1.3)	5(71.4)	2(28.6)		
With brother or sister	4(1.7)	14(63.6)	8(36.4)		
Alone	7(2.9)	100(73.5)	36(26.5)		
With extended family	11(4.6)	1(33.3)	2(66.7)		
With spouse or significant other					
With grown up child	22(9.3)	29(52.7)	26(47.3)		
With spouse and children	55(23.1)	2(50.0)	2(50.0)		
	136 (57.1)	7(63.6)	4(36.4)		

*=p<0.05 a- currently married, b- not currently married

Table 1 reveals that the respondents who answered most frequently (95, 39.9%) were in the 50–59 age range. The respondents ranged in age from 23 to 80 years old, with a mean age of 56.39 (± 11.39) years. Most were females (146, 61.3%), married (168, 70.6%) and had tertiary level of education (81, 34%). Slightly above half were employed (129, 54.2%), most had monthly income of 18,000-49,999 naira (114, 47.9%) Over half of the respondents lived with their spouse and children (136 individuals, accounting for 57.1% of the total).

A statistically significant difference in the prevalence of depression (39% among female respondents compared to 25% among male respondents) was found by bivariate analysis (χ2=4.99, df=1, p= 0.026). Furthermore, it was shown that widows had the highest prevalence of depression (29, 50%), which was statistically significant. (Exact Fisher's = 9.21, p = 0.034).

- *Relevant History and Biophysical Measurements*

Table 2 Relevant History and Biophysical Measurements

Variables	Total (%)	Not depressed	Depressed	χ^2	p-value
Duration of diagnosis (years)				χ^2=4.96	0.084
1-5					
6-10	119(50.0)	87(73.1)	32(26.9)		
>10	67(28.2)	39(58.2)	28(41.8)		
Mean (SD) = 7.5 (6.1)	52(21.8)	32(61.5)	20(38.5)		
Type of medication				χ^2=6.63	0.036*
Insulin	12(5.0)	132(70.2)	56(29.8)		
Both	38(16.0)	5(41.7)	7(58.3)		
Oral hypoglycaemic agent					
	188(79.0)	21(55.3)	17(44.7)		
Body mass index (BMI)				Fisher's exact=15.63	0.001*
Underweight					

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Normal Overweight Obesity	10(4.2) 80(33.6) 81(34.0) 67(28.0)	4(40.0) 45(56.3) 66(81.5) 43(64.2)	6(60.0) 35(43.7) 15(18.5) 24(35.8)		
Fasting blood glucose Normal Abnormal	 62(26.1) 176(73.9)	 39(62.9) 119(67.6)	 23(37.1) 57(32.4)	χ^2=0.46	0.500
Blood pressure status Normal Abnormal		 90(63.8) 68(70.1)	 51(36.2) 29(29.9)	χ^2=1.01	0.314

***=p<0.05**

According to Table 2, 119 (50.0%) of the respondents received their diagnosis fewer than five years before the study period, with a mean (SD) diagnostic duration of 7.5 (6.1) years. 62 (26.1%) of the responders had normal fasting blood glucose, while 188 (79.0%) took oral hypoglycemic agents. During the study period, 81 respondents (34.0%) were overweight, while more than half, 141 respondents (59.2%), had normal blood pressure.

The respondents using insulin had the highest prevalence of depression (7, 58.3%), while the respondents using oral hypoglycemic medications had the lowest prevalence (56, 29.8%). The statistical significance of this link was shown (χ2=6.63, df = 2, p = 0.036). The underweight (6, 60%) had the highest prevalence of depression, followed by the normal weight group. Overweight people (15, 18.5%) had the lowest prevalence. The statistical significance of this link was established (Fisher's exact = 15.63, p = 0. 001).

- *Prevalence of depression among the respondents*

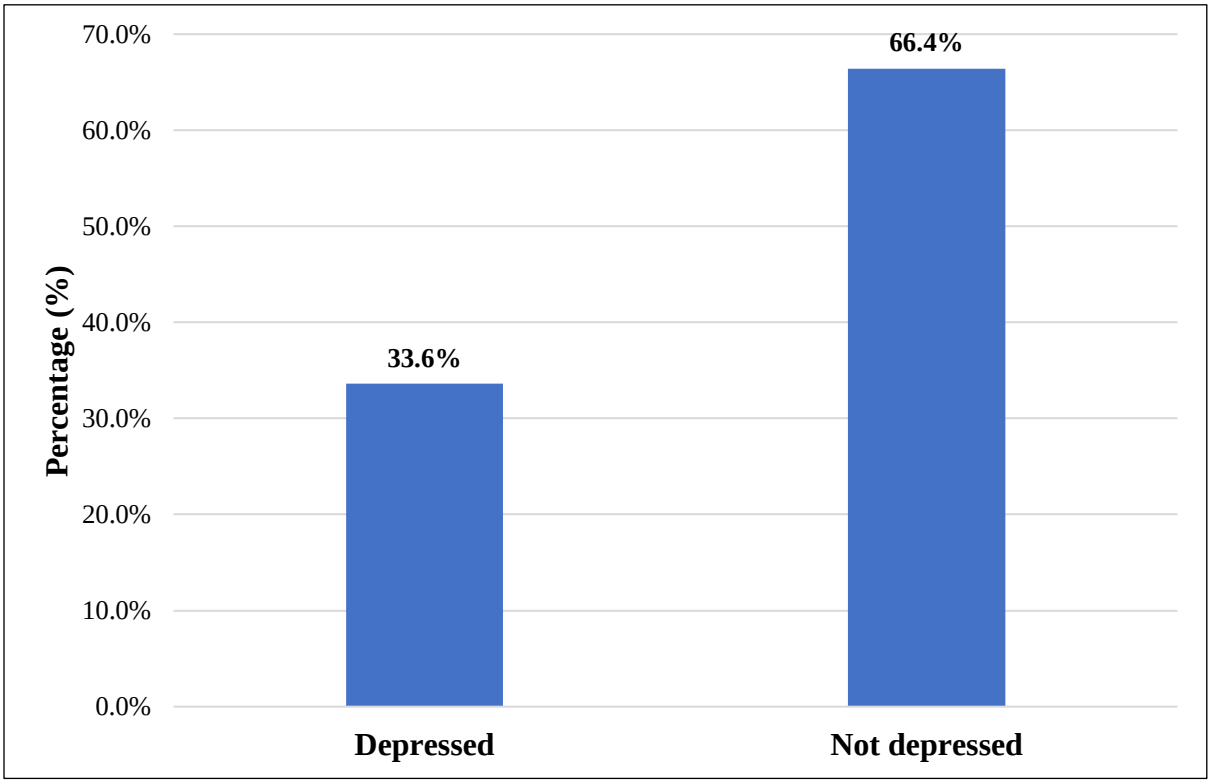

Fig 1: Depression Prevalence among those Surveyed

Figure 1 displays the prevalence of depression among study participants. Eighty respondents (33.6%) reported having depression, while 158 respondents (66.4%) did not report having depression.

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➢ *Severity Pattern of Depression*

Table 3 Severity pattern of depression

BDI-II scores	Interpretation	Frequency	Percent
14-19	Mild depression	45	56.3
20-28	Moderate depression	26	32.4
29-63	Severe depression	9	11.3

Table 3 displays the depression severity pattern and slightly more than half percent. 9 (11.3%) had severe depression, compared to 45 (56.3%) who had mild depression.

➢ *The Identified Risk Variables for Depression are Predicted by a Logistic Regression Model.*

Table 4 The Identified Risk Variables for Depression are Predicted by a Logistic Regression Model

Variables	Adjusted odds ratio (aOR)	95% confidence interval (CI)	P-value
Gender			
Male	Reference		
Female	1.68	0.84 – 3.35	0.138
Marital Status			
Currently married	Reference		
Currently not married	1.39	0.59 – 3.27	0.443
Who do you live with			
Alone	Reference		
Live with spouse or significant other	2.11	0.28 – 15.44	0.462
Live with spouse and children	1.61	0.26 – 9.87	0.605
Live with parents	6.93	0.22 – 214.65	0.269
Live with grown up child	2.87	0.43 – 19.01	0.273
Live with brother or sister	2.13	0.13 – 33.85	0.589
Live with other extended family members	1.78	0.19 – 16.28	0.610
Duration of diagnosis (in years)			
1-5	0.85	0.39 – 1.87	0.696
6-10	1.62	0.70 – 3.72	0.256
>10	Reference		
Type of medication			
Oral hypoglycaemic agent	0.50	0.22 – 1.12	0.095
Insulin	1.49	0.33 – 6.70	0.602
Both	Reference		
Body mass Index (BMI)			
Underweight	Reference		
Normal	0.46	0.10 – 2.04	0.308
Overweight	0.13	0.02 – 0.62	0.010*****
Obesity	0.39	0.08 – 1.83	0.235

Note: *=P<0.05; Hosmer-Lemeshow goodness of fit test: χ^2 =6.51, df =8, p =0.590, Nagelkerke R^2=0.200

V. DISCUSSION

Depression prevalence and risk variables were studied. The majority of study participants (39.9%) were between the ages of 50 and 59, with a mean age of 56.4 ± 11.4 years. This is comparable to the mean age of 53.5 ± 11.4 years found in a cross-sectional study conducted in Jos, North Central Nigeria, by Agbir et al [27]. This matches the mean age of 55.5 ± 8.2 years found in a community-based epidemiological study conducted by Park et al. in Korea's Ansan community to ascertain the prevalence and risk factors of depression [40]. Given that type 2 diabetes is typically diagnosed in middle age, it is possible that the respondents' similar ages were caused by this. The average age of the research participants is greater than the 47.1±9.6-year mean found by Bawo et al. in Benin, Nigeria [21]. The middle age group is also represented by the study's mean age in Benin.

Research conducted in Uyo [41], Benin [21], Sokoto [22], Ethiopia [42], Cameroun [43], and other locations has also

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revealed a greater percentage of female participants. Studies conducted in Palestine [30], Australia [14], Iran [44], Korea [40], and Iran [44] also found a higher proportion of female participants. The greater percentage of female participants in this research could likely be attributed to the fact that women are more likely than men to seek health care. On the other hand, Salinero-Fort et al. found a greater percentage of male responders in a Spanish study [13].

The majority of survey respondents were middle-aged, and most widowers and widowers tended to be older as well, since diabetes typically worsens with age and the loss of a spouse typically happens later in life. Widows made up the second largest group of survey respondents, coming in at number 58 (24.4%).

In terms of education level, 34.0% of participants had a university degree. This could happen as a result of the hospital's location in a city where the majority of people work as public servants and promotions are contingent upon higher education levels. The bulk of the 129 respondents (54.2%) were employed, and their monthly salaries ranged from 18,000 to 49,999 naira. Employed respondents are more likely to be able to afford medical expenses. They might be more inclined to keep follow-ups and visits and to be more health-conscious. The next largest group were those earning less than 18,000 naira per month, mostly smallholder farmers in nearby villages and municipalities, with most of the medical expenses paid by family members.

The majority of respondents (228, or 95.8%) were Christians, while the Tiv made up the largest ethnic group in the study with 178 (74.8%). This is to be expected given that the Tiv and Christians were the predominant ethnic groupings and religions in Makurdi and Benue states. One hundred and thirty-six ie 57.1% of the study's respondents lived with their spouse and kids. This could be explained by the nuclear family's beneficial influence in motivating and assisting family members in seeking the necessary medical attention.

According to this study, 33.6% of study participants at the Federal Medical Center in Makurdi had depression. A prevalence of 37% was discovered by Aminu et al. in a community-based study carried out in Karnataka, southern India, and is extremely similar to the number in our study [45]. The cross-sectional nature of both researches, the fact that most participants were female, that most were employed, and that most had completed at least secondary education could all be contributing factors to the closeness of the results. Very comparable to the findings of this investigation, Akpalu et al. in Ghana and Ramkissoon et al. in South Africa both reported a prevalence of 31% [46, 47]. The fact that women made up the majority of responders could be the cause of the same prevalence. In a cross-sectional study conducted at the Benin University Teaching Hospital in Benin, Bawo et al. observed a similar finding of 30% [21]. The homogeneity in research design and instrument selection (BDI) across studies may account for similar outcomes. There was a higher prevalence of 33.6% found in this study compared to 19.4 % reported by Agbir et al. [27] at Jos University Teaching Hospital, Nigeria. Low prevalence rates were also reported in studies in Ethiopia, Spain, Australia, and the United States, which recorded 13 %, 20.3%, 23%, and 8.3%, respectively [7, 13-**15].** The likely explanation for the lower prevalence compared to this study, may be because they were conducted in developed countries with better medical services and where medical expenses are covered by health insurance companies. In dissonance to this study, some recorded higher prevalence rates. A 49.6% prevalence of depression was observed in the Eastern Province of Saudi Arabia [28]. In a study conducted in Palestine, researchers found that 40% of 1,400 adult diabetic patients had depression [30], but Zahra et al. in Dar es Salaam, Tanzania, reported an 87% prevalence. [20]. The Beck Depression Inventory (BDI) was utilized in this investigation, the Tanzanian study used the 9-item Patient Health Questionnaire (PHQ 9), and the Saudi Arabian study employed the Center for Epidemiological Studies Depression Scale (CES-S). The various tools used in the studies to record depression could be one reason for the significant variations in the prevalence rates that have been reported. Research conducted in Mexico found a 48.27% frequency [17]. Additionally, this prevalence is higher than what the current study found. The majority of research participants were housewives, which may account for the difference in prevalence; moreover, the percentage of overweight adults was 66% in this study as opposed to 27.7% in the previous one. It is known that each of these sociodemographic traits increases the chance of developing depression. The study participants' depression severity pattern showed that 9 (11.25%) had severe depression, 26 (32.5%) had moderate depression, and 45 (56.25%) had mild depression. This study's findings regarding the pattern of depression severity are in line with those of previous investigations [45, 47, 48], which showed that the depression severity pattern decreased from mild depression to moderate depression to severe depression. This suggests that family doctors, especially general practitioners, should be very careful in identifying depressed patients, as most depressed diabetic patients have mild depression with few or no obvious depressive symptoms. The only sociodemographic factors in this study having a statistically significant correlation to depression were gender and marital status. It was discovered that female participants in the current study had a higher rate of depression (25% vs. 39.0%) than did male participants. It was found that women were 1.5 times more likely than men to be depressed, however not statistically significant. Likewise, a reported male to female ratio of 1:3 has been documented [27]. The two investigations were cross-sectional hospital-based studies that were carried out in two Nigerian urban centers, which could account for the identical findings. In Iran, Palizgir and associates found that the frequency of depression was higher in women (77.8%) than in men (56.4%) [49]. There are physiological explanations for the female preponderance, including changes in the menstrual

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cycle and pregnancy. Gender roles, such as childrearing and household tasks, can also have an impact on women and raise the risk of depression.

In relation to marital status, participants in this study who were bereaved experienced a 50% higher rate of depression than those who were married (28.6%). Nonetheless, single individuals had the lowest likelihood of depression in multivariate analysis, albeit this was not statistically significant ($p = 0.999$). Analogous research conducted in India and Nigeria has demonstrated that single individuals are more susceptible to depression [45, 50]. Diabetes patients who were single had a higher risk of depression than those who were married, according to a Strauss et al. study conducted in the United States [34]. The support of spouses who helps each other to take care of their health may be linked to the protective effects of marriage and cohabitation. Nonetheless, Bawo et al. discovered—though not statistically significantly—that marriage raised the risk of depression in research done in Benin, Nigeria [21]. A possible reason for this observation could be that married people have more family stress, which makes them more susceptible to depression.

The study also discovered a strong correlation between depression and BMI. In this study, participants who were underweight had the highest prevalence of depression (60%) while those who were overweight had the lowest prevalence (18.5%). These findings are consistent with a study conducted in Taiwan by Kuo et al., which found that the underweight had the highest prevalence of depression, followed by those who were severely obese and finally the obese [35]. A study by Floriana et al. found that being overweight (BMI ≥ 30 kg/m2) increased the likelihood of developing depression [31]. In contrast, Lam et al.,study in Nepal did not find a significant association between depression and BMI [51]. Lam et al.'s investigation was carried out in a suburban area with a general population. According to the study, there is a statistically significant correlation ($p<0.036$) between the patients' kind of antidiabetic medicine and depression. Comparing individuals who took oral antidiabetic drugs (29.8%) to those who got insulin injections (58.3%), the latter group had a higher prevalence of depression. Insulin-using patients exhibited higher chances of depression (aOR = 1.60, CI = 0.34 to 7.45, $p = 0.553$) than those receiving oral hypoglycemic medications combined. Similar findings were found in studies conducted in Tanzania, Romania, and Zahra et al., Bìdescu et al., and Sunny et al.

Patients who utilize insulin have a higher frequency of depression [20, 23, 52]. Given that insulin use typically signifies a higher degree of illness severity, this could be a plausible explanation for the increased prevalence of depression among insulin users.

VI. CONCLUSION

According to this study, 33.6% of study participants had depression. Mild depression was present in over half (56.3%) of diabetic patients with depression. In this study, body mass index, type of medicine, gender, and marital status were risk factors for depression.

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Author contributions

Name	Role	Signature
Dr Abah Godwin Akor Dr Akwaras Ndunno Dr Swende Laadi Dr Onuh Friday Dr Aganyi Paul	1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; and (2) drafting the article or revising it critically for important intellectual content; and (3) final approval of the version to be published.	