



ORIGINAL RESEARCH PAPER

Health Science

INFLUENCE OF MEDICATION ADHERENCE ON BLOOD GLUCOSE CONTROL AMONG DIABETIC PATIENTS ATTENDING DIABETIC CLINIC IN A TERTIARY HEALTH FACILITY IN EDO STATE.

KEY WORDS: Adherence, Medication, Blood, Glucose, Control, Diabetic patients

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ABSTRACT

Diabetes mellitus is a group of metabolic disease characterized by elevated levels of glucose in the blood (hyperglycemia) resulting from defects in insulin secretion, insulin action, or both. Behavioral changes and adherence to medication treatment are fundamental to prevent acute and chronic complications in the medium and long term even when these changes occur, maintaining metabolic control for a long time is complicated because it depends on several components involved in the treatment of diabetes. **Aim:** to assess the influence of medication adherence on blood glucose control among diabetic patients attending diabetic clinic in a tertiary health facility in Edo State. **Method:** A cross-sectional descriptive survey design was adopted for the study. A simple random sampling technique was used to select 278 patients. Data was collected with a researcher structured questionnaire comprising three sections with 13 items closed-ended questions. The data were analyzed using simple descriptive statistics and inferential statistics of Chi-Square to test hypotheses at $p < 0.05$ significant value. Results show that there was a significant association between the mean age ≥ 51 years and blood glucose control at a p -value ≤ 0.014 . **Findings:** There is a significant association between medication adherence and blood glucose control. It was observed that the duration of illness of 7years and above have uncontrolled blood glucose level. **Conclusion:** there were significant associations between medication and blood glucose control, but educational levels have no significant association with blood glucose control but high educational level can be of importance in blood glucose control. Finally, it was therefore recommended that the government should finance diabetic patients' treatment by subsidizing their medication, provide personal blood glucose monitoring kits, formulate and implement policy statement on routine blood glucose monitoring for all and also need for creation of recreation centers to aid exercises.

BACKGROUND

Diabetes mellitus is a global clinical and public health problem. **Diabetes** is a common disease in our society, affecting large proportion of the general population, with many more people unaware that they may be affected by this condition (Leon et al., 2021). Diabetes results from a lack of insulin, or insensitivity of the body towards the level of insulin present. In the diabetic state, the cells of the body may stop responding to insulin or the pancreas may stop producing insulin entirely (Lim & Song, 2020). Diabetes mellitus affects millions of people whom are undiagnosed. It was predicted that by 2045, 1 in 5 people will have diabetes (International Diabetes Federation [IDF], 2021). The prevalence of diabetes mellitus is growing rapidly worldwide and is reaching epidemic proportions.

More so, in Africa, diabetes was responsible for 416,000 deaths in 2021 (IDF, 2021). People with high risk of developing diabetes disease are described as over 30years old, hereditary and have, obesity, body mass index, lack of physical activity and high density lipoprotein (Olesen & Jorgensen, 2022). Diet and drug adherence and blood glucose monitoring are the most important factors for controlling diabetes and <50% of patients in developing countries do not comply to appropriate treatment (Spence et al., 2022). The main goal in the treatment strategies is controlling blood glucose which will improve life quality of the patients (Ogbera et al, 2014). Several factors are responsible for poor blood glucose control which can be associated with personal characteristics, poor nutritional intake, non adherence to medication intake, inadequate fluid intake and blood glucose monitoring.

are fundamental to prevent acute and chronic complications in the medium and long term even when these changes occur, maintaining metabolic control for a long time is complicated because it depends on several components involved in the treatment of diabetes (Asif, 2014, Powers et al., 2020).. Adherence to regular use of medication is still a challenge for health, especially in people with diabetes, and when it comes to the use of insulin this becomes even more acute (Spence et al., 2022). Difficulties were perceived in the course of this study, especially in the restricted dispensation of drugs in primary care. Also, due to the irrelevant importance attributed to the medication by the patients, by their signs and symptoms not apparent, and the low income of the population, many do not prioritize the purchase of medication and do not use it. However, by empowering treatment, they feel co-responsible, and adherence rates improve (Arrelias et al., 2015; ElSayed et al., 2023).

Some Medications affect blood glucose levels, an extreme example is steroids, which can cause blood glucose to increase dramatically. Birth control pills, antidepressants, antipsychotics, some diuretics, nasal decongestants may also increase blood glucose reading than the normal (Namkoong, 2015). Dose of medication directly impacts blood glucose – in most cases (but not always), taking a higher dose of a diabetes medication means a greater blood glucose-lowering effect (Rooney et al., 2021). Medication timing can also be critical; taking rapid-acting insulin (Humalog et al., 2014). If a new medicine is taken for something other than diabetes, it may interfere with or perhaps even enhance the effectiveness of diabetes medications (Rooney et al., 2021). The same might happen if one stop taking a drug one is currently using. Arrelias et al. (2015), also stated that adherence to the food plan is recognized as one of the greatest challenges faced by

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the Family Health Strategy teams due to the inherent complexity of eating behavior (Mendez et al., 2023). However, as evidenced, the diet of most Brazilians includes many carbohydrates because it is low cost and easier to access, unlike the diet with fruits and vegetables still consumed in a restricted way. Upon this background, the current study is aimed at ascertaining the influence of medication adherence on blood glucose control among diabetic patients attending diabetic clinic in a tertiary health facility in Edo State.

MATERIALS AND METHOD

The researchers employed cross-sectional descriptive study design to elicit information from the diabetic patients in Irrua Specialist Teaching Hospital (ISTH) Irrua, Edo State. The target population for all the diabetic patients was nine hundred and sixty (960). The sampling technique was a simple random sampling technique used to select 308 sample of diabetic patient out of the nine hundred and sixty target population. All diabetic patients who attended clinic were given equal chance to participate on each clinic day and an average of twenty-six (26) patients were selected per day twice weekly within the period of study. Only those who gave consent were selected.

The instruments used for data collection is the researcher self developed questionnaires, made up of three sections with a total of fifteen closed ended items questions. **Section A:** Socio-demographic data based on personal characteristics of the respondents, **Section B:** Consist of close ended questions assessing diabetic patient blood glucose level measures, **Section C:** influence of medication adherence on blood glucose control among diabetic patients attending diabetic clinic in a tertiary health facility in Edo State. Face validity was achieved as self structured questionnaire was presented to the researcher's supervisor who scrutinized it and made necessary corrections. While content validity was achieved as the questionnaire was further presented to an expert in measurement and evaluation who validated the instrument fit for the study. The reliability of the instrument was tested by conducting a pilot study using 36 (thirty six) patients attending the endocrinology clinic of University of Benin Teaching Hospital Benin city, Edo state to test the feasibility of the study. The pilot study data was analyzed using SPSS version 21 (2016), using Pearson's Product moment correlated coefficient index of 0.89 reliability.

The researchers sorted permission to collect data from the Hospital Research Ethical Committee (HREC), Irrua Specialist Teaching Hospital and approval was granted. The participants were educated and told to participate voluntarily. Consent form was given to individual patient who signify their willingness to participate in the study. Same were filled and signed after due explanation. Anonymity and respect for dignity was assured and maintained. The data was collected using the researcher self-structured questionnaire. The patients were approached for participation while waiting to see the physician on clinic days. The data collection took six weeks. At the completion of data collection all the questionnaires were handed over to the statistician. Data analysis was performed using Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics used to analyze research questions while inferential statistic of chi-square at 0.05 significance was used to test hypotheses.

Data Analysis and Findings

From analysis, out of the three hundred and eight (308) questionnaires distributed, only two hundred and seventy eight (278) (95.7%) correctly completed and used for analysis.

Table 1: Demographic Characteristics (N = 278)

Characteristic	Frequency	Percentage
Gender		
Male	127	45.7

Female	151	54.3
Age Group (Mean = 51 years, SD=11 years)		
<40 years	40	14.4
40 - 49 years	126	45.3
50 - 59 years	46	16.5
>=60 years	66	23.7
Religion		
Christianity	200	71.9
Islam	57	20.5
Others	21	7.6
Level of Education		
Primary	10	3.6
Secondary	92	33.1
Tertiary	128	46.0
No formal education	48	17.3

Table 1 above shows personal characteristics of respondents attending diabetic clinic of ISTH. The data revealed that males attending the diabetic clinic were 127 (45.5%) and females were 151 (54.3%), indicating that women are more than men. The mean age is 51 years whereby the greatest proportion of them (126, 45.3%) were between 40–49 years, followed by those who were 60 years and above (66, 23.7%), then those between 50-59 years (46, 16.5%), while the least proportion were those 40 years and below (40, 14.4%). With respect to religion a vast majority were Christians (200, 71.9%) followed by the Muslims (57, 20.5%) while others which include African religion and pagans were (21, 7.6%). As regards the educational attainment, primary school holders were only 10 (3.6%), secondary school holders were 92 (33.1%) while majority were tertiary school holders (128, 46.0%). Those with no formal education were 48 (17.3%).

Table 2: Blood glucose monitoring influence blood glucose control among diabetic patients attending diabetic clinic in ISTH, Irrua, Edo State, Nigeria (N = 278)

Duration of diabetes diagnosis	Frequency	Percentage	Blood Glucose Control (mean) level 135.5 mg/dl
1 - 3 years	36	12.9	60-140mg/dl (101.7mg/dl)
4 - 6 years	90	32.4	60-200mg/dl mean=130.5mg/dl
7 - 9 years	73	26.3	80 -250mg/dl mean =151.1 mg/dl
10 years & above	79	28.4	100-above 250mg/dl mean- 180.5 mg/dl
Blood glucose test pattern			
Once daily	66	23.7	60-140mg/dl (100.7mg/dl)
Twice weekly	130	46.8	60-200mg/dl mean=130.5mg/dl
Once monthly	42	15.1	80 -250mg/dl mean =161.1 mg/dl
When necessary	40	14.4	100-above 250mg/dl mean- 170.5 mg/dl

Mean =130.mg/dl, Standard Deviation (SD)=29.4mg/dl
 From table 2 above, shows; 1-3 years duration of illness diagnosis 36 (12.9%) of diabetic patients have blood glucose 60-140mg/dl (mean =101.7mg/dl), 4-6 years duration of illness diagnosis is 90(32.4%) mean=130.5, 7-9 years duration of illness diagnosis 73(26.3%) 80 -250mg/dl mean=151.

1mg/dl and 10 years and above duration of illness diagnosis 79 (28.4%) mean =180.5mg/dl.

The blood glucose test showed that 130 (46.8%) 60-200mg/dl mean=130.5mg/dl test their blood glucose level twice weekly, 23.7% of them test once daily, 66 (15.1%) 60-140mg/dl (100.7mg/dl), 42 (15.1%) 80 -250mg/dl mean =161.1mg/dl once monthly and 40 (14.4%) 100-above 250mg/dl mean- 170.5mg/dl test when necessary.

Table 3: Medication adherence and blood glucose control among diabetic patients attending diabetic clinic in ISTH, Irrua, Edo State, Nigeria (N = 278)

Medication adherence	Frequency	Percentage	Blood Glucose Control (mean level = 130.5 mg/dl)
Regularly as prescribed	138	49.6	60 - 120mg/dl mean=90.4mg/dl
At will	72	25.9	60-160mg/dl mean=110mg/dl
Skip when I do not have	38	13.7	80-200mg/dl mean=140mg/dl
When blood glucose is high	30	10.8	100-250mg/dl mean= 175,2mg/dl

From table 3 above, the results shows that 138(49.6%) diabetic patients with blood glucose range 60 – 120mg (mean = 90.4mg/dl) take their medication as prescribed, 72 (25.9%) diabetic patients with blood glucose range of 60-160mg/dl (mean= 110mg/dl) take their medication at will, 38 (13.7%) blood glucose range 80 – 200mg/dl (140mg/dl) skip their medication when they do not have while 30 (10.8%) 100 – 250mg/dl (mean=175mg/dl) diabetic patients take their medication only when the blood glucose is high.

Testing of Hypotheses

Hypothesis One: There is no significant association between socio-demographic data (gender, Age, level of education, duration of illness) and blood glucose control among patients attending diabetic clinic in ISTH, Irrua, Edo State, Nigeria.

Socio-Demographic Data	Blood Sugar control		Test statistics
	Controlled (n=93) ≤120mg/dl	Uncontrolled (n=185) ≥120mg/dl	
Gender			
Male (n=127)	40 (31.5%)	87 (68.5%)	$\chi^2 = 0.402, df=1, P=0.526$
Female (n=151)	53 (35.1%)	98 (64.9%)	
Age group			
< 50 Years (n=166)	65 (39.2%)	101 (60.8%)	$\chi^2 = 6.021, df=1, P=0.014^*$
≥ 50 Years (n=112)	28 (25.0%)	84 (75.0%)	
Education			
Educated (n=230)	82 (35.7%)	148 (64.3%)	$\chi^2 = 2.893, df=1, P=0.089$
Uneducated (n=48)	11 (22.9%)	37 (77.1%)	
Duration of diagnosis / illness			
< 7 Years (n=126)	53 (42.1%)	73 (57.9%)	$\chi^2 = 7.674, df=1, P=0.006^*$
≥ 7 Years (n=152)	40 (26.3%)	112 (73.7%)	

χ^2 – Chi square, df – Degree of freedom, *P<0.05 is significant
From table 4 above the results shows that 93 (40 males and 53 females) had blood glucose control and 185 had uncontrolled

glucose. It was observed that the diabetic patients blood glucose control is independent of gender and education (p=0.526 and p=0.089).

The observed proportions showed that patients who are 50 years and above had significantly greater percentage of uncontrolled blood sugar level (75.0%) and lower percentage of controlled, The hypothesis is thus accepted with respect to these characteristics. Greater proportion of uncontrolled blood glucose level (>120mg/dl) was observed in both male (68.5%) and female (64.9%) subjects likewise greater proportion of uncontrolled blood glucose level (>120mg/dl) was observed in both educated (which comprised patients with primary, secondary and tertiary level of education) and uneducated patients (64.3% and 77.1% respectively). It can therefore be said that there is no significant difference in the influence of gender and education on adherence to blood glucose control among the study population.

A statistically significant result (p<0.014 and p=0.006) was seen in the association of blood glucose control with both age and duration of diagnosis. The observed proportions showed that patients who are 50years and above had significantly greater percentage of uncontrolled blood glucose level (75.0%) and lower percentage of controlled blood glucose level (25.0%) compared to that of those who are below 50years likewise, those whose duration of diagnosis is greater than or equal to 7 years had significantly greater percentage of uncontrolled blood glucose level (73.7%) and lower percentage of controlled blood glucose level (26.3%) compared to that of those whose duration of diagnosis is less than 7 years. The hypothesis is thus rejected for these two characteristics.

Hypothesis Two: There is no significant association between regular glucose monitoring and blood glucose control among diabetic patients attending diabetic clinic in ISTH, Irrua, Edo State, Nigeria

Duration of diabetes diagnosis	Frequency	Percentage	Blood Glucose Control (mean level 135.5mg/dl)	Testing of Hypothesis
1 - 3 years	36	12.9	60-140mg/dl (101.7mg/dl)	$\chi^2 = 1.745, df=3, P=0.627$
4 - 6 years	90	32.4	60-200mg/dl mean=130.5mg/dl	$\chi^2 = 4.951, df=3, P=0.175$
7 - 9 years	73	26.3	80 -250mg/dl mean =151.1mg/dl	$\chi^2 = 4.918, df=3, P=0.178$
10 years & above	79	28.4	100-above 250mg/dl mean- 180.5mg/dl	$\chi^2 = 4.918, df=3, P=0.128$
Blood glucose test pattern				
Once daily	66	23.7	60-140mg/dl (100.7mg/dl)	$\chi^2 = 3.928, df=3, P=0.678$
Twice weekly	130	46.8	60-200mg/dl mean=130.5mg/dl	
Once monthly	42	15.1	80 -250mg/dl mean =161.1 mg/dl	$\chi^2 = 4.328, df=3, P=0.157$
When necessary	40	14.4	100-above 250mg/dl mean- 170.5mg/dl	$\chi^2 = 5.686, df=3, P=0.178$

χ^2 - Chi square, df - Degree of freedom, $P < 0.05$ is significant
 The results presented in Table 5 show influence of blood glucose monitoring on blood glucose control. It was observed that glucose monitoring of the diabetic patients is independent of duration of illness diagnosis ($P = 0.627$, $P = 0.175$, $P = 0.178$ and $P = 0.128$) among diabetic patients. The hypothesis is thus accepted with respect of duration of illness on glucose monitoring among the study population. Similarly, there also a influence of blood glucose monitoring in terms of time of testing on once ,daily, twice weekly, once monthly and testing necessary ($p = 0.678$, $p = 0.176$, $p = 0.157$ and $p = 0.178$). The hypothesis of blood glucose monitoring on blood glucose control is therefore accepted

Hypothesis Three: There is no significant association between medication adherence and blood glucose control among diabetic patients attending diabetic clinic in Irrua Specialist Teaching Hospital, Edo State.

Table 6: Association Between Medication Adherence and Blood Glucose Control

Medication adherence (N= 278)	Blood Glucose level Frequency (%)		Testing Hypothesis
	Controlled (≤ 120 mg/dl) (n=93)	Uncontrolled (> 120 mg/dl) (n=185)	
Regularly as prescribed (n=138)	70 (50.7%)	68 (49.3%)	$\chi^2 = 42.757$, df=3, $P < 0.001$
At will (n=72)	6 (8.3%)	66 (91.7%)	$\chi^2 = 10.192$ df=3, $P = 0.017^*$
Skip when I do not have (n=38)	7 (18.4%)	31 (81.6%)	$\chi^2 = 6.897$ df=3, $P = 0.075$
When blood sugar is high	10 (33.3%)	20 (66.7%)	$\chi^2 = 2.094$ df=3, $P = 0.553$
$\chi^2 = 42.757$, df=3, $P < 0.001^*$			

χ^2 - Chi square, df - Degree of freedom, $*P < 0.05$ is significant

The Chi square result (table 6) shows that there is highly significant association ($\chi^2 = 42.757$, $P < 0.001$) between medication adherence and blood glucose control among the diabetic patients. The hypothesis is thus rejected. The normal blood glucose control (≤ 120 mg/dl) rate was appreciably higher in those that adhere to anti-diabetic medication (50.7%), followed by those who take their medication when blood sugar is high (33.3%). Lower proportions were observed in non-adhering patients those that take medication at will (8.3%) and those that skip when they do not have (18.4%). On the other hand, poor blood sugar control (> 120 mg/dl) percentage was considerably higher in non-adhering patients those that take medication at will (91.7%) and those that skip when they do not have (81.6%).

DISCUSSION OF RESULTS

Responses were gotten from 278 patients diagnosed with diabetes attending Irrua Specialist Teaching Hospital, Irrua Edo State under the period of study. The result of this study on personal characteristics relationship with blood glucose control show that greater proportion of uncontrolled blood glucose level (> 120 mg/dl) was observed in both male (68.5%) and female (64.9%) subjects respondents blood glucose level (> 120 mg/dl) for both educated. This study shows that a statistically significant result ($p < 0.05$) was observed in the association blood glucose control with both age and duration of diagnosis. The observed proportions showed that patients who are 50 years and above had significantly greater percentage of uncontrolled blood glucose level (75.0%). With duration of diagnosis ≥ 7 years

had significantly greater percentage of uncontrolled blood glucose level (73.7%). This study agrees with Chen et al. (2021), study on assessment of factors affecting diabetes management in the CCD in Tianjin where the average age of diabetes was 56 was 56.36 and the average duration of diabetes was 13.0 years This finding also agrees with the cross-sectional study conducted by Kritkantorn et al. (2017), in a study to determine the association between Socio-economic status (SES) and DM in Thailand utilizing the data from the National socioeconomics survey, by the National Statistical Office (NSO) in 2010 and 2012 which states that age and duration of illness have association with blood glucose control. Also the longer the duration of illness the more difficult the blood glucose control among patients. The findings also aliened with Aruga and Maduka (2017). On risk factors for diabetes mellitus among adult residence of rural district in Southern Nigeria which states that age and family history of diabetes showed a significant independent association. The findings also agreed with Mohammad et al. (2013) study on effective factors in controlling diabetes progression among diabetic patients in Northwest Iran.

It can therefore be inferred that diabetes progresses with ageing.

The results shows that 138(49.6%) diabetic patients with blood glucose (mean = 90.4mg/dl take their medication as prescribed. This result agreed with Adisa et al. (2014) findings on a cross-sectional study conducted at a 200-bed secondary health care facility in southwestern, Nigeria on factors contributing to non-adherence to oral hypoglycemic medications adherence among ambulatory type 2 diabetes patients between 2nd April and 31st May 2008 in which the result shown medication adherence intake have a significant association on blood glucose control among diabetic patients. It can be stated that medication adherence can help control blood glucose level within a normal range and the result also agreed with Rwegerea (2012), findings in a cross-sectional study conducted among type 2 diabetic patients who were attending the diabetic clinic of Muhimbili National hospital between May 2009 and February 2010 on adherence to anti-diabetic drugs. Result shows that majority of the respondents were reported that they adhered to their medications. It can be inferred that medication had a significant relationship with blood glucose control.

The current study result showed that those who test their blood glucose once daily, 66 (15.1%) and monitor their blood glucose daily have an average blood glucose control level of 100.7mg/dl, This findings disagreed with Bonger et al. (2018) study on adherence to diabetic self-care practices and its associated factors among patients with type 2 diabetes in Addis Ababa, Ethiopia. shows that the majority, 350 (83.5%), of the study participants did not adhere to SMBG, which means they monitored their blood glucose levels 1–2 times per week and Yao (2012) findings on Understanding the Profiles of Blood Glucose Monitoring Among Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study in Shandong. The findings also disagreed with Unachukwu et al. (2011), study on Self monitoring of blood glucose among diabetic patients in Port Harcourt, Nigeria reported that 72.8% of patients did not practice SMBG. That only 27% of diabetic patients practiced SMBG despite 96% of them being aware of its existence. It can be stated that blood glucose monitoring can be vital in treatment adjustment

It was deduced that blood glucose can be influenced by socio-demographic factors of age ≥ 50 years, duration of illness ≥ 7 years. The study also shows that daily nutritional intake have influence on good glucose control. Fluid intake can influence blood glucose level. Medication adherence and blood glucose monitoring also influence blood glucose control. Results show that there is a significant association between medication adherence and blood glucose control.

CONCLUSION

A statistically significant association was observed with both age and duration of diagnosis and blood glucose control' it was observed that age of patient at 50 years and above had significantly greater percentage of uncontrolled blood glucose level. Nutritional intake has association with blood glucose control. There was also a statistically significance association between medication adherence and blood glucose control.

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