

## Adherence to Insulin Treatment and Glycaemic Control among Patients with Diabetes Attending Diabetic Clinic at Bugando Medical Centre, Mwanza, Tanzania

Nicodemus Madyedye<sup>1</sup>, Emmanuel Kimaro<sup>1\*</sup>, Eveline T Konje<sup>3</sup>, Benson R Kidenya<sup>5</sup>, Amani T Mori<sup>6</sup> and Eliangiringa Kaale<sup>2,4</sup>

<sup>1</sup>Department of Pharmaceutics and Pharmacy practice, School of Pharmacy, Catholic University of Health and Allied Sciences (CUHAS), Mwanza, Tanzania.

<sup>2</sup>Pharm R&D Laboratory, School of Pharmacy, Muhimbili University of Health and Allied Sciences (MUHAS), Dar es Salaam, Tanzania.

<sup>3</sup>Department of Biostatistics and Epidemiology, School of Public Health, Catholic University of Health and Allied Sciences (CUHAS), Mwanza, Tanzania.

<sup>4</sup>Department of Medicinal Chemistry, Muhimbili University of Health and Allied Sciences (MUHAS), Dar es Salaam, Tanzania.

<sup>5</sup>Department of Biochemistry, School of Medicine, Catholic University of Health and Allied Sciences (CUHAS), Mwanza, Tanzania.

<sup>6</sup>Department of Global Public Health and Primary Care, Section for Ethics and Health Economics, University of Bergen, Norway.

### \*Correspondence:

Emmanuel Kimaro, Department of Pharmaceutics and Pharmacy practice, School of Pharmacy, Catholic University of Health and Allied Sciences (CUHAS), Mwanza, Tanzania.

Received: 01 Nov 2024; Accepted: 02 Dec 2024; Published: 15 Dec 2024

**Citation:** Nicodemus Madyedye, Emmanuel Kimaro, Eveline T Konje, et al. Adherence to Insulin Treatment and Glycaemic Control among Patients with Diabetes Attending Diabetic Clinic at Bugando Medical Centre, Mwanza, Tanzania. *Endocrinol Metab Nutr.* 2024; 3(1): 1-7.

### ABSTRACT

**Background:** Diabetes mellitus (DM) is still one of the utmost public health problems affecting over 537 million people worldwide. Tanzania is the leading country in Sub Saharan Africa for age – adjusted prevalence (20 – 79 years) of people living with diabetes, which was 12.3% in 2021. Insulin therapy is more commonly used in DM patients and good adherence to insulin therapy makes it easy for a diabetic individual to have good treatment outcomes. This research aims to assess adherence to insulin therapy and glycaemic control among patients with diabetes.

**Method:** A cross-sectional study was conducted through convenience selection of 150 diabetic patients at Bugando Medical Centre from 2nd April to 28th April, 2024. Data was collected using questionnaires. Data was entered and cleaned using Microsoft Excel then analysed using STATA version 15. Logistics regression was used to obtain how the predictor variables were associated with non- adherence to insulin therapy and glycaemic control.

**Results:** Among 150 diabetic patients who were recruited into this study, the median age of the participants was 60[IQR: 47-67] years and most of the participants were female, 84(56.00%). Majority, 82.00% of the participants had low adherence to insulin therapy. Male gender and poor glycaemic control ( $p<0.05$ ) were significantly associated with non-adherence to insulin therapy. Low adherence to insulin therapy had a significant association with poor glycaemic control ( $p<0.05$ )

**Conclusion:** The findings from this study showed low level of adherence among the majority of the study participants. Male patients and those with poor glycaemic control had significant non-adherence to insulin therapy in this study. Patients with low adherence to insulin therapy were more likely to have poor glycaemic control.

---

## Keywords

Insulin adherence, Glycaemic control, Diabetes Mellitus.

## Background

Diabetes mellitus (DM) is one of the utmost public health problems of which currently, it is estimated to affect over 537 million people worldwide and in the absence of sufficient initiative to address the situation, it is anticipated 643 million people to have diabetes by 2030 [1]. If current trends pursue, the figure is to spring to a staggering 783 million by 2045 [1].

In Africa, diabetes affects 1 in 22 adults, totalling 24 million. This number is expected to increase by 129% to 55 million by 2045, the highest increase among all International Diabetes Federation regions [1]. Tanzania is the leading country in Sub Saharan Africa for age – adjusted prevalence (20 – 79 years) of people living with diabetes which was 12.3% in 2021 and the number of people living with diabetes being 2.9 million [1]. Over 90% of cases of diabetes in Sub-Saharan Africa are type 2, making it the most prevailing kind of disease [1]. Insulin therapy is more commonly used in patients with type 1 diabetes, as this form of diabetes is characterized by a lack of insulin production by the pancreas. In contrast, patients with type 2 diabetes may initially be treated with lifestyle modifications and oral hypoglycaemic agents, with insulin therapy reserved for those who do not achieve adequate glucose control with these interventions.

According to the World Health Organization (WHO), Adherence to treatment refers to how closely the patient's record of using therapeutic medication aligns with the advocated treatment [2]. Aside from physicians choosing insulin regimen inappropriately and delaying treatment intensification (including dose, frequency or insulin type), if patients fail to adhere to their treatment plan, it can result in inadequate glycaemic control and potentially cause severe long – term harm [3].

Insulin adherence is crucial for managing blood glucose in diabetic patients but frequently low [4]. Non-adherence is a significant challenge to the success and safety of many therapies, particularly in chronic conditions [5]. It is a widespread issue that leads to high global costs [6], with low adherence often hindering the achievement of target outcomes in long-term treatments [7].

Adherence is influenced by multiple factors across five dimensions: social and economic, therapy-related, disease-related, patient-related, and health care system-related. These factors impact both intentional non-adherence (e.g., skipping medication due to high costs) and unintentional non-adherence (e.g., forgetfulness due to mental health issues). In Tanzania, there is a lack of sufficient studies on insulin adherence and glycaemic control among diabetic patients. This gap limits healthcare workers' ability to counsel patients effectively. This research aimed to assess patient's adherence to insulin therapy and their glycaemic control.

## Methodology

Endocrinol Metab Nutr, 2024

## Study Setting and Design

The study utilized a cross sectional design conducted from April 2 to April 28 2024, at Bugando Medical Centre (BMC) in Mwanza, Tanzania. BMC is a tertiary referral hospital with 900 beds, serving over 800 in-patients and 1,500 out-patients daily. Mwanza, with a population of approximately 3.69 million, is primarily inhabited by the Sukuma people, who engage in livestock rearing, farming, and fishing. The hospital conducts two diabetic clinics weekly, attending to about fifty patients per visit (BMC medical records, 2023).

## Study Population

Participants for the study were recruited from the diabetic clinic at BMC hospital, focusing on individuals with diabetes, both type 1 and type 2, who were receiving insulin therapy. The study included patients attending the diabetic clinic at BMC throughout the study period who were willing to participate. Individuals who were newly diagnosed with diabetes, those with severe mental illness, in-patients, and critically ill patients were excluded from the study.

## Sample Size and Sampling Technique

The required sample size for this study was 150 diabetes patients, determined using Yamane Taro. To achieve this, participants were recruited serially until the required sample size was reached. Participants were selected based on accessibility and willingness to participate rather than through random selection.

## Data Collection

Patients' fasting blood glucose (FBG) was taken from results recorded by clinicians during the period of study, whereby blood glucose levels of FBG values of 70 mg/dl – 130 mg/dl was categorized as good glycaemic control and having FBG values less than 70 mg/dl and greater than 130 mg/dl was categorized as poor glycaemic control. Additionally, questionnaires adapted from the previous studies conducted in north western Ethiopia, available in both English and Swahili, were utilized to collect information about socio – demographic characteristics (age, sex, BMI, level of education), the level of adherence to insulin treatment using the General Medication Adherence Scale which consisted of 10 items with a maximum score of 30, where if the scale score was less than 24, the study participant was considered to be non-adherent and greater than 24 was considered adherent, and also factors associated with non – adherence to insulin treatment among patients with diabetes as well as their medication profile. Prior to gathering actual data, the questionnaire underwent a preliminary test with 5% of patients with diabetes who were on insulin treatment at Sekou Toure Regional Referral Hospital to guarantee the thoroughness and uniformity of the data collection instrument.

## Data Analysis

The collected data underwent cleaning in Microsoft Excel (2013) before being analysed using STATA version 15. Socio – demographic information was summarized using proportions and median for age. To facilitate the presentation of results, visual representations such as frequency tables, graphs and charts were employed. Associations of variables were assessed using logistic regression.

## Ethics Approval and Consent to Participate

Volume 3 | Issue 1 | 2 of 7

Ethical clearance for this study was sought and obtained from joint BMC/CUHAS Ethics and Review Committee with the certificate number 2844/2024. Before commencing the study, approval was obtained from the management of BMC through the Director General. Participants received a comprehensive written consent form, were briefed on the study's objectives and then asked for their consent.

## Results

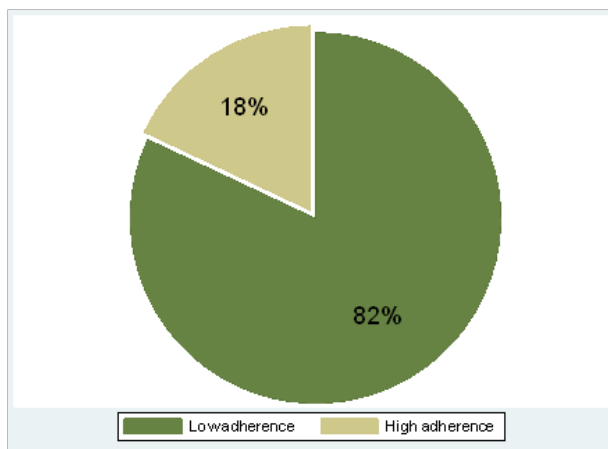
A total of 150 diabetic patients on insulin therapy were enrolled and participated in this study, achieving a 100% response rate. The median age of the participants was 60[IQR: 47-67] years; majority, 90 (60.0%) having the age greater than or equal to 56 years. Most of the participants were female, 84 (56.0%) and a significant number, 84 (56.0%) had primary education. Majority, 98 (65.3%) were married, and about 33% were retirees. On the other hand, 93 (62.0%) lived in rural areas and 136 (90.7%) were of Christian religion as shown Table 1. Among 150 participants, 56 (37.3%) had DM between 11 and 20 years. And among those with Type 2 DM, 54 (42.2%) have had the disease for that period. Regarding the duration of insulin therapy, most, 83 (55.3%) have been on the therapy for less than 5 years.

Most, 131 (87.3%) acquired insulin through health insurance, followed by 12 (8.0%) who acquired insulin via Tanzania Diabetes Association (TDA). Commonly reported diabetic complication were neuropathy and retinopathy among 81 (54.0%) and 17 (11.3%) participants, respectively. Mixtard insulin was used by most, 115 (76.7%) of the participants, majority, 106 (82.8%) being those with Type 2 DM. The presentation of medication format was mainly through vial among 126 (84%) participants and majority, 141 (94%) administered insulin twice daily (Table 2).

### Level of Adherence of Patients to Insulin Therapy

The overall adherence levels to insulin therapy of the study participants were grouped into high and low. Majority, 123 (82.0%) of the participants had low adherence to insulin therapy, whereas the remaining, 27 (18.0%) had high adherence as seen in Figure 1.

**Figure 1:** The level of Adherence to Insulin Therapy among DM



Patients, N=150.

**Table 1:** Socio-Demographic Information and Health Profile of Participants, N=150.

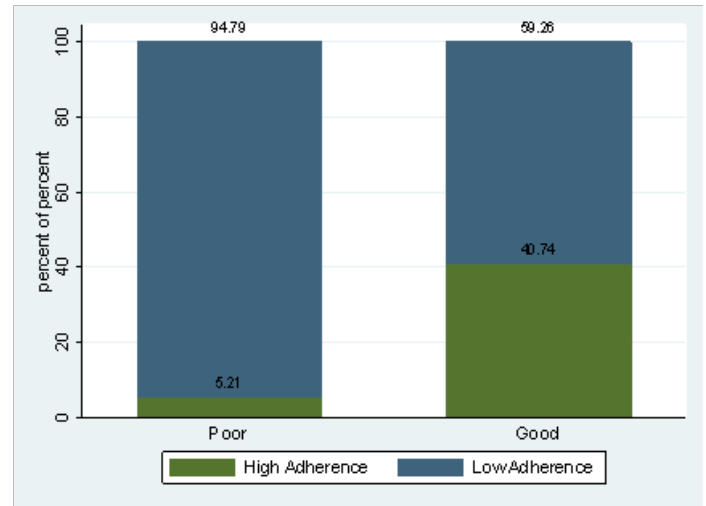
Variables	Categories	Freq (%)	Type 1 DM	Type 2 DM
Gender	Female	84 (56.0%)	8 (36.4%)	76 (59.4%)
	Male	66 (44.0%)	14 (63.6%)	52 (40.6%)
Age (years)	<30	18 (12.0%)	16 (72.7%)	2 (1.5%)
	31-55	42 (28.0%)	4 (18.2%)	38 (29.7%)
	≥56	90 (60.0%)	2 (9.1%)	88 (68.8%)
Level of Education	Certificate	1 (0.6%)	1 (4.5%)	0 (0.0%)
	Degree	13 (8.7%)	2 (9.1%)	11 (8.6%)
	Diploma	10 (6.7%)	0 (0.0%)	10 (7.8%)
	Illiterate	1 (0.7%)	0 (0.0%)	1 (0.8%)
	Post graduate	2 (1.3%)	0 (0.0%)	2 (1.6%)
	Primary	84 (56.0%)	15 (68.2%)	69 (53.9%)
	Secondary	39 (26.0%)	4 (18.2%)	35 (27.3%)
Marital Status	Divorced	2 (1.3%)	1 (4.5%)	1 (0.8%)
	Married	98 (65.3%)	4 (18.2%)	94 (73.4%)
	Single	28 (18.7%)	17 (77.3%)	11 (8.6%)
	Widowed	22 (14.7%)	0 (0.0%)	22 (17.2%)
Religion	Christian	136 (90.7%)	19 (86.4%)	117 (91.4%)
	Muslim	14 (9.3%)	3 (13.6%)	11 (8.6%)
Employment Status	Employed	35 (23.3%)	3 (13.6%)	32 (25.0%)
	Retired	50 (33.3%)	1 (4.6%)	49 (38.3%)
	Self employed	31 (20.7%)	3 (13.6%)	28 (21.9%)
	Unemployed	34 (22.7%)	15 (68.2%)	19 (14.8%)
Residence	Rural	93 (62.0%)	16 (72.7%)	77 (60.2%)
	Urban	57 (38.0%)	6 (27.3%)	51 (39.8%)
Duration of Disease (years)	<1	2 (1.3%)	2 (9.1%)	0 (0.0%)
	01-May	25 (16.6%)	9 (40.9%)	16 (12.5%)
	06-Oct	35 (23.3%)	6 (27.3%)	29 (22.7%)
	Nov-20	56 (37.3%)	2 (9.1%)	54 (42.2%)
	≥20	32 (21.3%)	3 (13.6%)	29 (22.6%)
Duration of Insulin Therapy (years)	<5	83 (55.3%)	13 (59.1%)	70 (54.7%)
	05-Oct	23 (15.4%)	3 (13.6%)	20 (15.6%)
	Oct-15	23 (15.3%)	5 (22.7%)	18 (14.1%)
	≥15	21 (14.0%)	1 (4.6%)	20 (15.6%)
Acquisition of Insulin	Cash	7 (4.7%)	3 (13.6%)	4 (3.1%)
	Insurance	131 (87.3%)	7 (31.8%)	124 (96.9%)
	TDA	12 (8.0%)	12 (54.6%)	0 (0.0%)
Diabetic Complications	Neuropathy	81 (54.0%)	6 (27.3%)	75 (58.6%)
	Retinopathy	17 (11.3%)	2 (9.1%)	15 (11.7%)
	Ketoacidosis	2 (1.3%)	1 (4.5%)	1 (0.8%)
	Nephropathy	11 (7.4%)	1 (4.5%)	10 (7.8%)
	Radiculopathy	2 (1.3%)	0 (0.0%)	2 (1.6%)
	None	52 (34.7%)	14 (63.6%)	38 (29.7%)
Type of Insulin	Mixtard	115 (76.7%)	9 (40.9%)	106 (82.8%)
	Mixtard and soluble	2 (1.3%)	1 (4.5%)	1 (0.8%)
	Soluble and Lente	33 (22.0%)	12 (54.6%)	21 (16.4%)
Insulin package	Pen	24 (16.0%)	13 (59.1%)	11 (8.6%)
	Vial	126 (84.0%)	9 (40.9%)	117 (91.4%)
Frequency of Administration	Three times daily	9 (6.0%)	6 (27.3%)	3 (2.3%)
	Twice daily	141 (94.0%)	16 (72.7%)	125 (97.7%)

**Table 2:** Level of Adherence According to Patients' Demographic and Health Profiles.

Variables	Categories	Adherence Level	
		Low	High
Gender	Female	65 (52.8%)	19 (70.4%)
	Male	58 (47.2%)	8 (29.6%)
Age (years)	<30	14 (11.4%)	4 (14.8%)
	31-55	36 (29.3%)	6 (22.2%)
	≥56	73 (59.3%)	17 (63.0%)
Level of Education	Certificate	1 (0.8%)	0 (0.0%)
	Degree	9 (7.3%)	4 (14.8%)
	Diploma	7 (5.7%)	3 (11.1%)
	Illiterate	1 (0.8%)	0 (0.0%)
	Post graduate	2 (1.6%)	0 (0.0%)
	Primary	80 (65.0%)	4 (14.8%)
	Secondary	23 (18.7%)	16 (59.3%)
Marital Status	Divorced	1 (0.8%)	1 (3.7%)
	Married	83 (67.5%)	15 (55.6%)
	Single	21 (17.1%)	7 (25.9%)
	Widowed	18 (14.6%)	4 (14.8%)
Employment Status	Employed	30 (24.4%)	5 (18.5%)
	Retired	40 (32.5%)	10 (37.0%)
	Self employed	26 (21.1%)	5 (18.5%)
	Unemployed	27 (22.0%)	7 (26.0%)
Residence	Rural	80 (65.0%)	13 (48.2%)
	Urban	43 (35.0%)	14 (51.8%)
Type of Diabetes	1	18 (14.6%)	4 (14.8%)
	2	105 (85.4%)	23 (85.2%)
Duration of Disease (years)	<1	1 (0.8%)	1 (3.7%)
	1-5	22 (17.9%)	3 (11.1%)
	6-10	30 (24.4%)	5 (18.5%)
	11-20	48 (39.0%)	8 (29.6%)
	≥20	22 (17.9%)	10 (37.1%)
Duration of Insulin Therapy (years)	<5	76 (61.8%)	7 (25.9%)
	5-10	19 (15.5%)	4 (14.8%)
	10-15	17 (13.8%)	6 (22.2%)
	≥15	11 (8.9%)	10 (37.1%)
Acquisition of Insulin	Cash	6 (4.9%)	1 (3.7%)
	Insurance	109 (88.6%)	22 (81.5%)
	TDA	8 (6.5%)	4 (14.8%)
Type of Insulin	Mixtard	95 (77.2%)	20 (74.1%)
	Mixtard and soluble	1 (0.8%)	1 (3.7%)
	Soluble and Lente	27 (22.0%)	6 (22.2%)
Administration of Insulin	Pen	18 (14.6%)	6 (22.2%)
	Vial	105 (85.4%)	21 (77.8%)
Frequency of Administration	Three times daily	7 (5.7%)	2 (7.4%)
	Twice daily	116 (94.3%)	25 (92.6%)

For those with low level of adherence, majority were female, 65 (52.8%), those aged ≥ 56 years, 73 (59.3%), those with primary education, 80 (65.0%), married participants, 83 (67.5%), rural residents, 80 (65.0%), Type 2 DM patients, 105 (85.4%), acquiring insulin via insurance, 109 (88.6%), used vial to administer insulin, 105 (85.4%) and administering insulin twice daily, 116 (94.3%), as seen in Table 3.

The overall status of glycaemic control among participants was grouped into good and poor. Majority, 96 (64.0%) had poor glycaemic control and 54 (36.0%) had good glycaemic control. Among those with poor glycaemic control, 91 (94.8%) had low adherence while 5 (5.2%) had high adherence and among those with good glycaemic control, 22 (40.7%) had high adherence while 32 (59.3%) had low adherence to insulin therapy as shown in Figure 2.



**Figure 2:** The Proportion of Level of Adherence to Glycaemic Control Status.

Using multivariate logistic regression to determine the association between glycaemic control and other factors, patients with low level of adherence to insulin therapy were more likely to have poor glycaemic control than those with high level of adherence (AOR=19.156, 95%CI=4.975-73.760, p=0.000), as seen in Table 3.

In multivariate logistic regression, two factors were found to be predictors of non-adherence to insulin therapy with 95% CI and significant levels of p <0.05. Being male and having poor glycaemic control had significant association with non-adherence. Male patients were more likely to have low adherence compared to their female counterparts (AOR=7.716, 95%CI=1.598-37.306, p=0.011). On the other hand; patients with poor glycaemic control (AOR=38.127, 95%CI=5.953-244.202, p=0.000) were about 38 times more likely not to adhere to insulin therapy compared to those with good glycaemic control as shown Table 4.

## Discussion

### Level of Adherence to Insulin Therapy

This study confirmed low levels of adherence to insulin among 82% of the participants. This magnitude was considerably higher compared to the studies which were conducted in Tukur hospital in Ethiopia and Felege hospital in Ethiopia with a magnitude of about 33% and 41% respectively [8,9]. These differences could be due to lifestyle, sample size and differences in economic standards of study participants.

**Table 3:** Association between Adherence Level to Insulin Therapy and Glycaemic Control using Multivariate Logistic Regression Model.

Variables	Categories	Glycaemic Control Status		95% CI	p-value
		Good	Poor	AOR	
Gender	Female	32 (59.3%)	52 (54.2%)	1	1
	Male	22 (40.7%)	44 (45.8%)	0.791 (0.334-1.874)	0.595
Age (years)	<30	5 (9.3%)	13 (13.5%)	2.691 (0.435-16.461)	0.287
	31-55	16 (29.6%)	26 (27.1%)	1	1
	≥56	33 (61.1%)	57 (59.4%)	1.737 (0.678-4.451)	0.250
Residence	Rural	21 (38.9%)	72 (75.0%)	1	1
	Urban	33 (61.1%)	24 (25.0%)	0.198 (0.084-0.465)	0.000***
Duration of Insulin Therapy (years)	<5	23 (42.6%)	60 (62.5%)	2.643 (0.795-8.792)	0.113
	5-10	8 (14.8%)	15 (15.6%)	2.846 (0.605-13.384)	0.185
	10-15	12 (22.2%)	11 (11.5%)	1	1
	≥15	11 (20.4%)	10 (10.4%)	2.833 (0.564-14.239)	0.206
Administration of Insulin	Pen	10 (18.5%)	14 (14.6%)	1	1
	Vial	44 (81.5%)	82 (85.4%)	2.320 (0.591-9.109)	0.228
Frequency of Administration	Three times daily	1 (1.8%)	8 (8.3%)	1	1
	Twice daily	53 (98.2%)	88 (91.7%)	0.087 (0.005-1.547)	0.096
Level of Adherence	Low	32 (59.3%)	91 (94.8%)	19.156 (4.975-73.760)	0.000***
	High	22 (40.7%)	5 (5.2%)	1	1

**Table 4:** Predictors of Level of Non-Adherence using Multivariate Logistic Regression Model.

Variables	Categories	Adherence Level		95% CI	p-value
		Low	High	AOR	
Gender	Female	65 (52.8%)	19 (70.4%)	1	1
	Male	58 (47.2%)	8 (29.6%)	7.716 (1.596-37.306)	0.011***
Residence	Rural	80 (65.0%)	13 (48.2%)	1	1
	Urban	43 (35.0%)	14 (51.8%)	0.876 (0.215-3.572)	0.853
Duration of Insulin Therapy (years)	<5	76 (61.8%)	7 (25.9%)	3.755 (0.473-29.802)	0.211
	5-10	19 (15.5%)	4 (14.8%)	0.481 (0.037-6.211)	0.575
	10-15	17 (13.8%)	6 (22.2%)	1	1
	≥15	11 (8.9%)	10 (37.0%)	0.201 (0.022-1.805)	0.152
Administration of Insulin	Pen	18 (14.6%)	6 (22.2%)	1	1
	Vial	105 (85.4%)	21 (77.8%)	1.667 (0.207-13.405)	0.631
Frequency of Administration	Three times daily	7 (5.7%)	2 (7.4%)	1	1
	Twice daily	116 (94.3%)	25 (92.6%)	40.928 (0.266-1322.843)	0.063
Glycaemic Control Status	Good	32 (26.0%)	22 (81.5%)	1	1
	Poor	91 (74.0%)	5 (18.5%)	38.127 (5.953-244.202)	0.000***

\*\*\*bio-statistically significant at 95% Confidence Interval

In this study, married individuals had high level of adherence to insulin therapy (about 56%) compared to other groups of individuals. These findings reflect the findings from other studies that revealed the diabetic's partner, on daily basis, may be able to provide the emotional and psychosocial support needed to improve commitment and insulin adherence [10]. This study also revealed that those participants with type 2 DM had low adherence to insulin therapy to about 85% as compared to those respondents with type 1 DM as shown in table 3. This finding is consistent with studies conducted in Iran and Tikur Hospital in Ethiopia that type 2 DM patients were more likely to be non-adherent than those participants with type 1 DM [11]. This may be due to the reason that type 1 diabetic patients are younger in age, thus, minimizes their chances to forgetfulness. As a matter of fact, those individuals with type 2 DM are subjected to multiple drug therapies which make their treatment regimens more complex, hence finding it hard to adhere to insulin therapy.

### Association Between Level of Adherence to Insulin Therapy and Glycaemic Control

In this study it was found that 64% of the diabetic patients had poor glycaemic control. These were nearly similar to a study done in Dar-es-Salaam, which reported 66.1% diabetic patients to have poor glycaemic control [12]. But these results were lower compared to a study by Mansour et al., where 86.2% of diabetic patients were found to have poor glycaemic control [13]. These differences could be due to the different glucose measurements used and cut-off points used in determining glycaemic control status.

From this study, low level of adherence to insulin therapy was significantly associated with poor glycaemic control among diabetic patients (p=0.000). Patients with low level of adherence to insulin therapy were more likely to have poor glycaemic control, compared to those with high level of adherence (OR=19.156). A

study done in USA also, found a concomitant increase in poor glycaemic control with non-adherence to insulin therapy [14].

### Predictors of Non-Adherence to Insulin Therapy

Findings from this study revealed that, being a male decreased the odds of having high level of adherence to insulin therapy by seven folds compared to the female gender. These results were different from those reported by Weerakoon et al. where female patients were more likely not to adhere to insulin therapy compared to their male counterparts [15]. These differences could be attributed to the fact that, most families in this setting depend on male for economic needs and family matters. The study revealed that, participants who had poor glycaemic control had more non-adherence to insulin therapy by about 38 folds as compared to those who had good glycaemic control. This finding was similar to a study done in some public hospitals of Tigray, that having good glycaemic control, increases adherence level to 2.81 times more as compared to its counterpart [16]. This might be because of the fact that patients who have glucometers at home are expected to monitor their blood sugars regularly, and for them to take actions to control their blood glucose levels. In this study, participants who had poor glycaemic control, especially less than normal range, did not inject their insulin at recommended dosage. As a matter of fact, there was non-adherence to that group of individuals.

### Study Limitations

The study depended on participants reporting their own experiences, which could be influenced by memory or a desire to present themselves in a favourable light, possibly may impact the precision of the findings. The research also was solely focused on evaluating how well diabetic patients followed their insulin treatment and their blood sugar control. As a result, the data collected did not account for other factors related to Glycaemic control.

### Policy Implications

The findings underscore the need for targeted interventions to improve insulin adherence, particularly among male patients and those with poor glycaemic control. Health policies should prioritize gender-specific strategies and enhanced patient education on the importance of adherence to insulin therapy. Additionally, regular monitoring of glycaemic control should be emphasized as a critical component of diabetes management, with tailored support for patients showing signs of non-adherence. Implementing these measures could significantly improve treatment outcomes and reduce the burden of diabetes-related complications. Despite the above measures, further studies should be done to find out more predictors of adherence to insulin therapy such as the injection techniques and injection sites, economic status of individuals, number of medications used by individuals and so forth.

### Conclusion

The findings from this study showed low level of adherence among the majority of the study participants. Factors such as male gender and poor glycaemic control were significantly identified as the predictors of non-adherence to insulin therapy in this study

( $p < 0.05$ ). Male patients were more likely not to adhere to insulin therapy compared to female (OR= 7.716). Also, having poor glycaemic control (less than normal range) increased the odds of non-adherence to the insulin therapy. The level of adherence was found to be significantly associated with glycaemic control status of the patients ( $p = 0.000$ ). Patients with low level of adherence (non-adherence) were more likely to have poor glycaemic control (OR= 19.156). These findings will help healthcare professionals to provide the appropriate counselling to patients with diabetes who are on insulin therapy according to the characteristics and nature of these patients in this specific setting.

### Acknowledgments

I sincerely thank the BMC administrator for granting permission to conduct this study, as well as the medical records department and the diabetic clinic nurses at BMC for their support during data collection.

### References

1. IDF Diabetes Atlas [Internet]. [cited 13th June 2024]. Available from: <https://diabetesatlas.org/>.
2. Organization WH. Adherence to long-term therapies: evidence for action: World Health Organization. 2003.
3. Brown MT, Bussell JK. Medication adherence: WHO cares? *Mayo Clin Proc.* 2011; 86: 304-314.
4. Krass I, Schieback P, Dhippayom T. Adherence to diabetes medication: a systematic review. *Diabet Med.* 2015; 32: 725-737.
5. Martin-Ruiz E, Oly-de-Labry-Lima A, Ocaña-Riola R, et al. Systematic review of the effect of adherence to statin treatment on critical cardiovascular events and mortality in primary prevention. *J Cardiovasc Pharmacol Ther.* 2018; 23: 200-215.
6. Cutler RL, Fernandez-Llimos F, Frommer M, et al. Economic impact of medication non-adherence by disease groups: a systematic review. *BMJ open.* 2018; 8: e016982.
7. Bitton A, Choudhry NK, Matlin OS, et al. The impact of medication adherence on coronary artery disease costs and outcomes: a systematic review. *Am J Med.* 2013; 126: 357.e7-357.e27.
8. Tewabe T, Kindie S. Level of insulin adherence among diabetes mellitus patients in Felege Hiwot Referral Hospital, Bahir Dar, Northwest Ethiopia, 2017: a cross-sectional study. *BMC Res Notes.* 2018; 11: 295.
9. Gerada Y, Mengistu Z, Demessie A, et al. Adherence to insulin self administration and associated factors among diabetes mellitus patients at Tikur Anbessa specialized hospital. *J Diabetes Metab Disord.* 2017; 16: 1-6.
10. Kalra S, Jena BN, Yeravdekar R. Emotional and psychological needs of people with diabetes. *Indian J Endocrinol Metab.* 2018; 22: 696-704.
11. Demoz GT, Berha AB, Alebachew Woldu M, et al. Drug therapy problems, medication adherence and treatment satisfaction among diabetic patients on follow-up care at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. *PLoS one.* 2019; 14: e0222985.

- 
12. Yahaya JJ, Doya IF, Morgan ED, et al. Poor glycaemic control and associated factors among patients with type 2 diabetes mellitus: A cross-sectional study. *Scientific Reports*. 2023; 13: 9673.
  13. Mansour AA, Alibrahim NT, Alidrisi HA, et al. Prevalence and correlation of glycaemic control achievement in patients with type 2 diabetes in Iraq: A retrospective analysis of a tertiary care database over a 9-year period. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2020; 14: 265-272.
  14. DiBonaventura M, Wintfeld N, Huang J, et al. The association between nonadherence and glycosylated hemoglobin among type 2 diabetes patients using basal insulin analogs. *Patient Preference Adherence*. 2014; 19: 873-882.
  15. Weerakoon LN, Amarasekara TD, Jayasekara R. Factors Affecting Adherence to Insulin Therapy among Patients with Type 2 Diabetes Mellitus in a Selected Teaching Hospital, Sri Lanka. *J Sci Tech Res*. 2020; 30: 23608-14.
  16. Mariye T, Girmay A, Birhanu T, et al. Adherence to insulin therapy and associated factors among patients with diabetes mellitus in public hospitals of Central Zone of Tigray, Ethiopia, 2018: a cross-sectional study. *Pan Afr Med J*. 2019; 33: 309.