



Medication Adherence, Glycemic Control and Quality of Life in Patients with Type 2 Diabetes Mellitus: a cross-sectional study

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ABSTRACT: Medication adherence is important in controlling blood sugar levels (HbA1c) in patients with Diabetes Mellitus (DM). Studies on the relationship between medication adherence and blood sugar control on the quality of life (QoL) in Type 2 DM patients are limited in Indonesia. This study aims to assess the relation between medication adherence with blood sugar control and the quality of life of Type 2 DM patients. This study used a cross-sectional design conducted at Universitas Indonesia Hospital. Medication Adherence Questionnaires and EuroQoL 5D-5L is used to assess patients' medication adherence and quality of life. This study involved a total of 74 Type 2 DM patients with an average age of 57 ± 10.74 years. Medication adherence with good blood sugar control (HbA1c <7%) showed a significant relationship (p-value <0.05) with COR values of 3.74 (1.21- 11.6) compared to non-adherent patients. But not on the QoL Index and VAS (Visual Analog Scale) values, where the value is lower in patients with high adherence and good blood sugar control. Factor associated with blood sugar controlled were comorbidities and medication adherence while factor that associated with quality of life were comorbidities, ages, education and employment status.

Keywords: diabetes mellitus; medication adherence; HbA1c; quality of life (QoL);

Introduction

Diabetes Mellitus (DM) is a chronic disease and one of the top 10 causes of death in adults [1]. Referring to the International Diabetes Federation (IDF) in 2019, Indonesia is the 6th country with the highest number of DM patients reaching 10.3 million. IDF predicts the number of DM patients will increase to 13.7 million in 2030 [2]. Poor blood sugar control (HbA1c >7%) can increase the risk of microvascular and macrovascular complications. Microvascular complications that may occur cover blindness, end-stage renal disease (ESRD), and amputation. While the possible macrovascular risk is cardiovascular complications which are the main cause of increased morbidity and mortality in DM patients [3-6]. Thus, it is important to control blood sugar levels.

Previous studies revealed that blood sugar control was related to patients' medication adherence. High medication adherence shows a significant relationship with good blood sugar control (HbA1c < 7%) [7,8]. A study by Ho et.al (2006) on DM patients with low medication adherence showed an increase in HbA1c,

blood pressure, and LDL cholesterol levels and led to an increase in admission to hospital and even death [9]. Thus, it is important to evaluate the level of patients' medication adherence.

Evaluation of health-related quality of life (HRQoL) in DM patients has to be carried out as one of the goals of DM treatment besides preventing complications [10]. Previous studies on the association between quality of life and HbA1c showed that good blood sugar control affected the good quality of life [11], and high medication adherence improved the quality of life in patients [11,12]. On the other hand, other studies showed medication adherence did not show a significant association with quality of life in patient with DM type 2 [13]. Therefore, we do need to assess how does medication adherence could impact the quality of life in DM type 2 patient.

Studies on the association between medication adherence and blood sugar control on the quality of life of patients are limited in Indonesia. Thus, this study aims to assess the relation

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between medication adherence and blood sugar control on the quality of life of patients and the influencing factors.

Methods

Study Design and Population

This observational study used a cross-sectional design which was conducted in 2 months from September to October 2022 at the Secondary Care Setting, Universitas Indonesia Hospital, Depok. The inclusion criteria in this study were Type 2 DM patients, aged > 18 years, using antihyperglycemic drugs and willing to participate in the study. Patients who are pregnant/breastfeeding and undergoing hemodialysis were excluded from this study. The minimum sample in this study was 64 subjects to obtain a confidence interval (CI) of 95% assuming the prevalence of Type 2 DM patients who had high adherence was 0.209 [12]. This study was carried out after being approved by the Ethics Committee at Universitas Indonesia Hospital, Depok with the ethical approval number S-032/KETLIT/RSUI/VIII/2022

Data Collection

Patient who met inclusion criteria were invited to participate in this study. Patient who had consent were provide with questionnaire related to sociodemographic, clinical status, medication adherence and quality of life assessment.

Medication adherence was assessed using Medication Adherence Questionnaire and patient's quality of life was assessed using the EuroQoL EQ-5D-5L and EQ-VAS. The EQ-5D-5L questionnaire consisted of 5 domains including the ability to walk (mobility), self-care, usual activities, pain/discomfort, and anxiety/depression (sadness) in which each domain covered 5 levels from no problem (1) to problem (2-5). The utility value was obtained using the Indonesian value set, where a utility

with a value of 1 is the best health and 0 is the worst health [14].

Data Analysis

The distribution of patient characteristics was analyzed using univariate analysis. The association between categorical variables with medical adherence and blood sugar control analyzed with Chi-Square and Logistic Regression. Mann-Whitney analysis was performed to see the differences QoL Index on medication adherence and blood sugar control. Kruskal-Wallis analysis was used to determine the differences QoL Index and variables consisting of 3 or more categories. The significance level was $\alpha = 0.05$. All of data were analyzed using IBM SPSS Statistics v22.

Result and Discussion

This study involved a total of 74 patients with Type 2 DM with an average age of 57.74 ± 10.74 (mean \pm SD) years consisting of 54.1% male and 45.9% female. Body mass index (BMI) median was 26.64 in which 60.8% of patients were overweight or obese. Patients with higher education have a greater proportion, namely 63.5%. The average QoL index in Type 2 DM patients was 0.79 ± 0.29 with an average VAS value of 78.19 ± 10.81 . In this study, it was found that the QoL index of patients with Type 2 DM was higher than the previous study by Arifin et.al using the same Indonesian value set with utility index score was 0.77 [15]. This can be due to possible comorbidities and other factors that may influence. Assessments related to medication adherence showed that 37.8% of patients had a high level of medication adherence, while patients with medium and low medication adherence were 31.1% of each. Data related to the patient's sociodemographic and clinical status are presented in [Table.1](#).

Table 1. Characteristics of the study participants

Variable	Category	N	%
Age	Mean (SD)	57.74 (10.74)	
	<60 years	40	54.1
	≥ 60 years	34	45.9
Gender	Male	40	54.1
	Female	34	45.9
BMI	Median, Min-Max	26.64 (18.82- 44.29)	
	<25 Kg/m ²	29	39.2
	≥ 25 Kg/m ²	45	60.8

Variable	Category	N	%
Employment status	Employed	34	45.9
	Unemployed	40	54.1
Education	SD- SMA	27	36.5
	University	47	63.5
Family history of DM	No	32	43.2
	Yes	42	56.8
Exercise	Yes	54	73.0
	No	20	27.0
Smoking	No	66	89.2
	Yes	8	10.8
Comorbidity	≤ 3	49	66.2
	>3	25	33.8
Number of drugs	≤ 3	16	21.6
	4-5	23	31.1
	>5	35	47.3
Type of DM drugs	OHA	55	74.3
	Insulin	4	5.4
	OHA + Insulin	15	20.3
Duration of DM	≤ 2	23	31.1
	3-10	33	44.6
	>10	18	24.3
HbA1c	Mean (SD)		7.49 (1.95)
	Controlled	31	41.9
	Uncontrolled	43	58.1
Medication Adherence	Low	23	31.1
	Medium	23	31.1
	High	28	37.8
QoL Index	Mean. SD		0.79 (0.29)
QoL VAS	Mean. SD		78.19 (10.81)

The association between medication compliance and patient blood sugar control, a score with a total of below 6 was grouped as non-adherent and a score ≥ 6 was grouped as adherent. Based on the results of bivariate analysis, medication adherence had a significant association (p -Value < 0.05) with blood sugar control with an OR value of 3.74 (1.21 - 11.6) (Table 2). Patients who had good adherence are 3.74 times more likely to achieve an HbA1c $< 7\%$. Thus, it can be said that medication compliance can assess the therapeutic success of the hypoglycemia drugs used on the clinical outcome (HbA1c) of Type 2 DM patients. This study was in line as studies by Tominaga,

et.al (2018), where is one-point difference in score equates to an approximately 0.13% change of HbA1c [16]. In other studies where patient with high adherence had a significantly lower HbA1c than those with low adherence [17].

Factors that also affect in controlling blood sugar other than compliance to drug in this study covering the number of co-morbidities and the type of DM medication (p -Value < 0.05). This finding was in line as studies by Ibrahim, et.al that Type 2 DM patients with comorbidities use more drugs and need a high level of adherence to achieve good glycemic control [17]. On other study state

Table 2. Factors associated with blood sugar control (HbA1c < 7)

Variable	Blood sugar control		COR (95% CI)	P-Value
	Good	Poor		
Age				
<60 years	16 (40)	24 (60)	0.84 (0.33- 2.13)	0.815
≥ 60 years	15 (44.1)	19 (55.9)		
Gender				
Male	18 (45)	22 (55)	1.32 (0.52- 3.35)	0.639
Female	13 (38.2)	21 (61.8)		
BMI				
<25 Kg/m ²	11 (37.9)	18 (62.1)	0.76 (0.29- 1.98)	0.635
≥ 25 Kg/m ²	20 (44.4)	25 (55.6)		
Employment status				
Employed	12 (35.3)	22 (64.7)	0.6 (0.24- 1.54)	0.348
Unemployed	19 (47.5)	21 (52.5)		
Education				
SD- SMA	9 (33.3)	18 (66.7)	0.57 (0.21- 1.52)	0.33
University	22 (46.8)	25 (53.2)		
Family history of DM				
No	15 (46.9)	17 (53.1)	1.43 (0.56- 3.64)	0.484
Yes	16 (38.1)	26 (61.9)		
Exercises				
Yes	25 (46.3)	29 (53.7)	2.01 (0.67- 6.01)	0.29
No	6 (30)	14 (70)		
Smoking				
No	29 (43.9)	37 (56.1)	2.35 (0.44- 12.52)	0.455
Yes	2 (25)	6 (75)		
Comorbidity				
≤ 3	16 (32.7)	33 (67.3)	0.32 (0.12- 0.88)	0.028
>3	15 (60)	10 (40)		
Number of drugs				
≤ 3	5 (31.3)	11 (68.8)	1.3 (0.37- 4.58)	0.683
4-5	13 (56.5)	10 (43.5)	0.45 (0.16- 1.33)	0.15
>5	13 (37.1)	22 (62.9)	Ref	
Types of DM drugs				
OHA	27 (49.1)	28 (50.9)	0.16 (0.03- 0.72)	0.023
Insulin	2 (50)	2 (50)	0.15 (0.13-1.80)	0.136
OHA + Insulin	2 (13.3)	13 (86.7)	Ref	
Duration of DM				
≤ 2	13 (56.5)	10 (43.5)	Ref	
3-10	11 (33.3)	22 (66.7)	0.49 (0.14-1.71)	0.265
>10	7 (38.9)	11 (61.1)	1.3 (0.39- 4.19)	0.69
Medication adherence				
Adherent	26 (51)	25 (49)	3.74 (1.21- 11.6)	0.023
Non-adherent	5 (21.7)	18 (78.3)		

that patients who is being diagnosed with comorbidities reported to be more adherent. This suggests that patients are become better at medication adherence to prevent additional comorbidities or other complications [18]. It shows that the comorbidity of the disease makes patients aware of the importance of medication adherence.

This study also found that patients who used monotherapy Oral Hypoglycemic Agent (OHA) or insulin showed better blood sugar control (Table 2). In line with the previous study were showed patient with monotherapy were likely to have good blood sugar control [19]. This found could be explained as the combination of oral diabetes drugs and insulin is commonly given because of worsening blood sugar level.

Factor related to Quality of life showed significant association with age, employment status, education, and comorbidity but not with medication adherence (Table 3). Patients aged <60 years have higher QoL score than those aged >60-years. Its in line with previous studies by Chantzaras and Yfantopoulos (2022) where patient DM age >60-year reported with lower QoL index (0.73) and

VAS score (70.61). It could be associated where older patient likely to have mobility and selfcare problem than those ages <60 years [20].

Medication adherence and blood sugar control with quality of life in patients did not show a significant mean difference. Quality of life on medication adherence and blood sugar control showed lower valued in patients whose had good medication adherence and good blood sugar control, which is contradictory to previous studies. Dhillon et.al report that patients with controlled blood sugar have higher QoL scores than those with uncontrolled blood sugar [11]. This found could be explained by the comorbidities that patient have. Where this study conducted in secondary health care, where is patient who has worse cases are generally referred from primary to secondary health care this will explain the lower score of index utility and VAS QoL. As report from previous study that patient DM Type 2 with complication and comorbidities are likely to experienced problem on self-care and usual activity [15].

Table 3. Factor associated with quality of life

Variable	QoL Index (Mean,SD)	P-Value	VAS value (Mean, SD)	P-Value
Age				
<60 years	0.86 (0.14)	0.065	81.4 (10.73)	0.003
≥ 60 years	0.71 (0.38)		74.4 (9.75)	
Gender				
Male	0.85 (0.16)	0.077	77.28 (9.87)	0.339
Female	0.71 (0.37)		79.26 (11.88)	
BMI				
<25 Kg/m2	0.77 (0.29)	0.47	77.38 (12.37)	0.516
≥ 25 Kg/m2	0.79 (0.28)		78.71 (9.78)	
Employment status				
Employed	0.88 (0.12)	0.008	80.18 (11.57)	0.143
Unemployed	0.71 (0.36)		76.5 (9.94)	
Education				
SD- SMA	0.66 (0.39)	0.004	74.26 (11.07)	0.018
University	0.86 (0.16)		80.45 (10.09)	
Family history of DM				
No	0.78 (0.27)	0.399	75.47 (10.73)	0.07
Yes	0.79 (0.29)		80.26 (10.52)	
Exercises				
Yes	0.87 (0.12)	<0.001	79.28 (11.09)	0.107
No	0.56 (0.44)		75.25 (9.66)	

Variable	QoL Index (Mean,SD)	P-Value	VAS value (Mean, SD)	P-Value
Smoking				
No	0.78 (0.29)	0.561	77.59 (10.89)	0.227
Yes	0.87 (0.12)		83.13 (9.23)	
Comorbidity				
≤ 3	0.85 (0.17)	0.009	78.72 (11.87)	0.114
>3	0.67 (0.41)		76.96 (8.43)	
Number of drugs				
≤ 3	0.86 (0.11)	0.416	81.25 (9.22)	0.505
4-5	0.80 (0.31)		77.83 (11.06)	
>5	0.75 (0.32)		77 (11.33)	
Types of DM drugs				
OHA	0.78 (0.31)	0.772	78.38 (11.22)	0.963
Insulin	0.77 (0.18)		78.75 (10.31)	
OHA + Insulin	0.81 (0.22)		77.33 (9.98)	
Duration of DM				
≤ 2	0.81 (0.31)	0.338	78.56 (13.08)	0.773
3-10	0.80 (0.19)		78.45 (11.01)	
>10	0.72 (0.28)		77.22 (7.12)	
Medication adherence				
Adherent	0.78 (0.33)	0.402	77.73 (10.88)	0.743
Non-adherent	0.80 (0.16)		79.22 (10.81)	
Blood Sugar Controlled				
Good	0.73 (0.39)	0.603	75.64 (10.54)	0.126
Poor	0.83 (0.18)		80.02 (10.74)	

Patients with chronic diseases such as diabetes and hypertension are twice as likely to report or rate their physical health as less than optimal, or to have moderate to severe emotional problems, and limitations in sociability, and tend to have poor health than patients without chronic diseases [21]. In this study, patients with >3 comorbidities have higher medication adherence and outcomes (HbA1c). However, in assessing the quality of life, patients with >3 comorbidities have lower index QoL and VAS QOL values compared to patients with ≤3 comorbidities (p-value <0.05). This is because patients with comorbidities have higher anxiety regarding the complications of their disease [13]. This indicates that patients with comorbidities assess their quality of life as lower than those without or with less comorbidities (<3).

Education level and employment status have a significant mean difference in quality-of-life value. Patients with university education levels and who are working have an average QoL Index and VAS score higher. Higher education and having a job allow patients to have better

social support, and understanding regarding treatment, disease conditions, and DM type 2 related complication [21].

This study has some limitations such as the use of instruments that cannot be assessed objectively and the possibility of recall bias, the small number of samples so that the association between certain variables do not exist as the sample size that represents the category is small. Thus, it is necessary to carry out further studies in larger populations.

Conclusions

Medication adherence is associated with good blood sugar control but not with the patient's quality of life. Co-morbidities are one of the variables affecting the low quality of life values in patients, but it does have significant association to good blood sugar control. Factors affecting blood sugar control cover the number of comorbidities, and the type of hypoglycemic drug used. Meanwhile,

variables affecting the value of quality of life are age, education, employment status, and comorbidities.

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