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Research Article

Factors Associated with Glycemic Control Among Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study

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Abstract

Aims: Even though the prevalence of type 2 diabetes mellitus in Indonesia continues to increase, research data on glycemic management, which is the primary strategy for reducing complications of diabetes mellitus, is still limited. In this study, an evaluation of glycemic control status and related factors was conducted in adult patients with type 2 diabetes mellitus.

Methods: This research was a cross-sectional study with 115 type 2 diabetes adults who came to the Hospital in Kediri for treatment. Data was collected using the UK Diabetes and Diet Questionnaire (UKDDQ) questionnaire, which consists of 24 questions and the Godin Leisure-Time Exercise Questionnaire (GLTEQ), along with a blood glucose check between July and August 2023. The glycemic level was assessed using a random blood glucose level, and 'poor glycemic control' was defined when the blood glucose level was >200 mg/dL. SPSS was used for descriptive analyses and inferential statistics by chi-square test to analyze the relationship between patients glycemic control status and its relevant risk factors, including demographics, dietary control, and physical activity.

Results: Only 26.1% of type 2 diabetes mellitus patients at Aura-Syifa Kediri Hospital have good glycemic control. In bivariate analysis, gender, education, control status of diet, and physical activity (P values 0.05) were significantly correlated with glycemic control. Meanwhile, age, marital status, employment status, and duration of diabetes mellitus (p-value > 0.05) were not associated with glycemic control.

Conclusion: The prevalence of good glycemic control in type 2 diabetes patients remains low. Based on this research, we found that gender, education, diet control, and physical activity were influencing factors in this problem. Publicity and education regarding the importance of glycemic control should be developed for type 2 diabetes patients, and targeted interventions should be made for risk groups.

Keywords:

Cross-sectional, glycemic control, type 2 diabetes mellitus,

INTRODUCTION

Diabetes mellitus (DM) is characterized by hyperglycemia caused by insulin deficiency secretion, insulin impairment or both. Prolonged hyperglycemia due to diabetes can cause long-term permanent organ damage, including organ failure or

dysfunction, such as heart disease, blood vessels and nerves impairment, kidney failure, and eye dysfunction (1). Type 2 diabetes mellitus (T2DM) makes up about 85 to 95% of all cases of diabetes in high-income countries, with a higher percentage in low and middle-income countries due to rapid sociocultural changes, ageing

populations, growing urbanization, decreased physical activity and unhealthy lifestyles and behavioural patterns (2).

Diabetes is a massive and quickly expanding global health issue. The IDF estimates that 463 million people had diabetes in 2019, with 578 million expected by 2030 and 700 million by 2045 (3)(4). In 2013, Indonesia ranked seventh as the country with the highest number of diabetes cases, with 5.8% of cases or roughly 8.5 million cases, topped by women with 4.9 million cases and men with 3.6 million cases (5)(6). According to the Indonesian health profile, the prevalence of diabetes mellitus in East Java is 2.6%. East Java has the sixth-highest rate of diabetes mellitus in Indonesia (7). Nowadays, the prevalence of T2DM is rapidly increasing due to inactive lifestyles and the consumption of unhealthy foods (8). T2DM can cause various complications, such as retinopathy, kidney disease, neuropathy, skin ulcers, and atherosclerosis. These complications can significantly lower the quality of life, lead to premature death, and cause a substantial economic burden on both individuals and society (9). However, the management and regulation of T2DM in Indonesia are currently inadequate (10).

Good control of blood sugar levels is crucial for postponing the onset of T2DM and minimizing its related complications (11). Polyuria and polydipsia, two signs of hyperglycemia, as well as its direct complications (prolonged wound healing time, diabetic ketoacidosis, dehydration, hypertonic hyperglycemia syndrome, and coma due to diabetes), may result from inadequate glycemic management (12). Sustainable moderate glycemic control can decrease the incidence of microvascular and macrovascular problems (13). Another study found that financial difficulty, psychosocial issues, and educational attainment are additional factors that affect glycemic control, age, and sex (14). Other factors influencing blood glucose levels include disease duration, medication

adherence, dietary considerations, and physical activity (15)(10).

Therefore, adequate glycemic control in T2DM patients can prevent short-term complications, reduce the risk of long-term complications, and minimize resource use and healthcare costs (16). So, there is a need to pay attention to glycemic control. In its 2030 Sustainable Development Goals (SDG), the Indonesian government aims to reduce the premature death rate due to non-communicable diseases by one-third, focusing on four diseases, one of which is DM (17). This research aimed to identify factors related to glycemic control in Kediri type 2 diabetes patients. This will improve glycemic control and prevent diabetic complications in this population.

METHODS

This cross-sectional study was conducted on diabetic patients at the Hospital at Kediri-East Java in July and August 2023. In this study, demographic characteristics, duration of DM, diet, physical activity, and blood glucose levels were observed. Data collection used a questionnaire given to respondents who came to Aura Syifa Hospital, Kediri. At the beginning of the survey, we describe the purpose of this study and the details of informed consent. Participants who agreed to participate were asked to complete a consent form.

Respondents of this research were 37–70 years old with T2DM, did not have dementia or mental disorders, and were willing to become respondents. Respondents who did not complete the questionnaire were excluded. We got 115 respondents by G-Power application with an α error probability of 0.05 and a power of 0.95 and taken by convenience sampling.

There are four sections on the questionnaire: demographics, diabetes diet, physical activity, and glycemic control. Demographics include sex, gender, level of education, marital status, occupation, and duration of diabetes mellitus. Diabetes diet

was measured using the UK Diabetes and Diet Questionnaire (UKDDQ) questionnaire, which consists of 24 questions. The measurement results will be divided into two criteria: a controlled diet if you eat more than twice a week and eat well, and an uncontrolled diet if you eat more than once a week and eating is not good (18). In this research, the Cronbach alpha value for UKDDQ was 0.765. Physical activity (PA) level was assessed by a modified questionnaire of the Godin Leisure-Time Exercise Questionnaire (GLTEQ) and the Advisory Committee for Americans. We calculated patients' metabolic equivalent of task (MET)-h/week by those instruments. Subjects with a total MET-h/week score \geq 7.5 MET-h/week are defined as active physical activity, while insufficient physical activity is $<$ 7.5 MET-h/week (19). Blood glucose levels in peripheral blood were measured using a glucometer with good glycemic control ($<$ 200 mg/dl) and uncontrolled blood sugar (\geq 200 mg/dl) criteria.

Statistical analysis was performed using SPSS. Demographic characteristics were

represented using frequency distributions. Bivariate analysis determined the correlation between the independent and the dependent variables. The Chi-square test was performed to evaluate the glycemic control states of T2DM patients with demographics, diabetes duration, diet, and physical activity. The statistically significant variables had a p-value $<$ 0.05. The Strada Indonesia Institute of Health Sciences Research Ethics Committee has approved this study.

RESULTS

This research was conducted in July–August 2023. This study involved 115 patients, 56.52% of whom were women. Demographic data for the qualitative variables is presented in Table 1. The majority of patients were $>$ 50 years old, had Less than a Bachelor's degree, were married, worked, and had had diabetes for \geq 5 years. Uncontrolled diet frequency: 86 (74.78%), physical activity (MET-h/week): $<$ 7.5 (80%), poorly controlled glycemic index: 85 (74%).

Table 1. Clinical and demographic characteristics of patients with T2DM

Variable category	Characteristics	N	%
Sex	Male	50	43.48
	Female	65	56.52
Age (yr)	\leq 50	40	34.78
	$>$ 50	75	65.22
Education	Less than Bachelor's degree	91	79
	Bachelor's degree or more	24	21
Marital status	Married	103	89.56
	Divorce, widow/er	12	10.43
Occupation	Jobless/ Retirement	48	41.74
	Work	67	58.26
Duration of diabetes	$<$ 5 years	65	41.52
	\geq 5 years	50	43.48
Diet control status	Uncontrolled	86	74.78
	Controlled	29	25.22

Physical activity (MET-h/week)			
	<7.5	92	80
	≥7.5	23	20
Glycemic control			
	<200	30	26
	≥200	85	74

Most of the uncontrolled glycemic status are female: 56 (48.7%), age > 50 years 54 (47%), less than Bachelor's degree 74 (64.3%), married status 77 (67%), working 45 (29.6%), duration of diabetes <5 years 51 (44.3%), uncontrolled diet 76 (66%), and physical activity <7.5 (MET-h/week) 77 (67%). In Table 2, glycemic control status has a significant relationship with sex ($p = 0.001$), education ($p = 0.001$), diet control ($p = 0.001$), and physical activity ($p = 0.02$). However, glycemic control status did not have a significant relationship with sex, marital status, occupation, or duration of diabetes ($p > 0.05$).

Table 2. Univariate analysis of factors associated with glycemic control

Factors	Characteristics	Good n %	Uncontrolled n %	*P-value
Sex	Male	21 (18.3)	29 (25.2)	0.001
	Female	9 (7.8)	56 (48.7)	
Age (yr)	≤50	9 (7.8)	31 (27)	0.522
	>50	21 (18.2)	54 (47)	
Education	Less than Bachelor's degree	17 (14.8)	74 (64.3)	0.001
	Bachelor's degree or more	13 (11.3)	11 (9.6)	
Marital status	Married	26 (22.6)	77 (67)	0.546
	Divorce, widow/er	4 (3.4)	8 (7)	
Occupation	Not working/ retiring	8 (7)	40 (34.8)	0.052
	Work	22 (19.1)	45 (39.1)	
Duration of diabetes	<5 years	14 (12.2)	51 (44.3)	0.205
	≥5 years	16 (13.9)	34 (29.6)	
Diet control status	Uncontrolled	10 (8.7)	76 (66)	0.001
	Controlled	20 (17.4)	9 (7.9)	
Physical activity (MET-h/week)	<7.5	15 (13)	77 (67)	0.002
	≥7.5	15 (13)	8 (7)	

*Chi-square test

DISCUSSION

In this cross-sectional study, we assessed the glycemic control status and related factors with type 2 diabetes at Aura Syifa Hospital in Kediri. The findings revealed that the majority of them were female. These findings differ from past studies, which concluded that 62% (20), 52.3% (21) and 52% (2) of respondents were male. The majority of respondents are older than 50, married, and working. The findings of this study were consistent with prior studies, which found that 66.5% were above the age of 51, 81.2% were married, and 74.3% were working (20). More than half of the respondents suffered from T2DM for five years. The majority of respondents had less than a bachelor's degree. The findings of this study were consistent with prior research, which found that 87% had less education than a bachelor's degree (22).

The results of this study were comparable to previous studies, which reported that 50.4% of respondents had DM <5 years (23) but were different from previous studies in that 58.9% of respondents >7 years had T2DM (24). Longer diabetes duration has been linked to poor glycemic control, probably due to gradually reduced insulin production over time due to β -cell failure, making dietary changes or oral medicines ineffective at managing glycemic control (25). The majority of research results show uncontrolled diets and insufficient physical activity. These results were different from previous studies, which presented 226 (71%) controlled diets and 208 (73%) active physical activity (26). The results of this study indicate that most T2DM patients have poor glycemic control. These findings were consistent with previous research, which indicated that 70.9% (16), 65% (27), and 65% (4) of respondents had poor glycemic control. These results indicate the need for more effective work on diabetes management, as maintaining adequate glycemic control is the main therapeutic goal for all diabetic patients (21).

According to the outcome of this study, there was a relationship between gender, nutrition control, and physical activity. No relationship was revealed between age, marital status, occupation, and duration of type 2 diabetes. The results presented coincided with previous research that reported a control diet (p-value = 0.024) and physical activity (p-value = 0.010) (28). Other studies report that diabetic patients who are physically active and manage their diet well will have better glycemic control abilities (29). Previous analyses also found a significant correlation between low levels of physical activity and poor glycemic control because poor glycemic control was less common among individuals who engaged in regular physical exercise than those who engaged in regular activity (30). According to other research findings, there was a significant relationship between poor glycemic control in T2DM patients who develop secondary medical issues and gender (female), age, diabetes duration, and type of treatment (31).

The reasons for poor glycemic control are difficult to determine. This might be due to a lack of complete diabetes treatment, such as dietary habits, physical activity, and diabetes mellitus knowledge, or it can be linked to the disease process. Furthermore, because of their low socioeconomic level, this group of at-risk people has prioritized treatment as a second priority after family requirements. We must raise public awareness and educate the public on the importance of controlling glycemic levels for the health of T2DM patients, particularly those who live in rural areas with limited access to health care. At the same time, T2DM patients' awareness of glycemic control and self-management should be increased.

This research had limitations, ruling out the association between potential risk factors and outcomes, and had a relatively short study duration. This made it impossible to assess all possible risk factors. Nonetheless, we believe this study is novel in that its

findings reflect the increasing prevalence of poor glycemic control in individuals with type 2 diabetes.

CONCLUSION

Only a few T2DM Patients at Aura Syifa Hospital had Good Glycemic Control. This research found that gender, education, diet control, and physical activity were associated with glycemic control of Type 2 Diabetes Mellitus patients. Meanwhile, age, marital status, employment status, and duration of diabetes mellitus were not. T2DM patients' awareness and knowledge of the importance of glycemic management need to be increased to manage T2DM patients' healthiness, especially those with low education or central obesity in the early stages of their disease. Healthcare providers need greater efforts to help more patients achieve good glycemic control.

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