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ORIGINAL ARTICLE

Factors influencing glycaemic control behaviours among individuals with type 2 diabetes mellitus at Royal Prima Hospital, Medan

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ABSTRACT

Elevated blood glucose levels are indicative of a chronic metabolic disorder known as type 2 diabetes mellitus (T2DM), which necessitates long-term management through effective glycaemic control. Poor glycaemic control behaviours can elevate the risk of severe complications, diminish quality of life, and increase economic burden. This study aimed to analyse the determinants of glycaemic control behaviours in individuals with T2DM at Royal Prima Hospital Medan. A quantitative design employing a cross-sectional method was utilised. The study population comprised all patients with T2DM registered at Royal Prima Hospital Medan. A sample of 182 participants was recruited using consecutive sampling. Data were collected via questionnaires and secondary data from patient medical records. Data analysis included univariate analysis, chi-square tests, and logistic regression for bivariate analysis. The findings of this study demonstrated a significant association between medication adherence and glycaemic control behaviours in individuals with T2DM.

Keywords: type 2 diabetes mellitus, glycaemic control behaviour, medication adherence

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterised by insufficient insulin production, which is essential for facilitating glucose uptake into cells for energy conversion. Untreated hyperglycaemia can lead to a range of health complications.[1] DM can result in hyperglycaemia, various complications, and mortality due to uncontrolled blood glucose levels, inadequate physical activity, and insufficient knowledge regarding glycaemic control.[2,3] Furthermore, DM can be fatal if patients do not engage in regular physical activity and maintain a healthy dietary pattern.[4,5]

The increasing global prevalence of type 2 diabetes mellitus (T2DM) has emerged as a significant public health concern, with substantial increases documented over the past few decades. In 2019, the global prevalence of T2DM reached approximately 437.9 million cases, corresponding to an age-standardized prevalence rate (ASPR) of 5282.9 per 100,000 population. Furthermore, the global age-standardized incidence rate (ASIR) was reported as 259.9 per 100,000 population, indicating a considerable number of new cases occurring annually.[6] In LMICs, the prevalence of T2DM is also rising sharply due to factors such

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as urbanization, lifestyle changes, and dietary shifts. The global prevalence of diabetes among adults aged 20-79 was estimated at 463 million in 2019, projected to rise to 578 million by 2030.[7] Countries within this category often face challenges related to healthcare access and management of chronic diseases, exacerbating the T2DM crisis.

Indonesia is among the top ten countries with the highest prevalence of T2DM, currently estimated at 10.8% as of 2021, reflecting a significant increase from previous years.[7] The International Diabetes Federation (IDF) reported that the number of adults with diabetes in Indonesia has escalated dramatically, with projections indicating a rise from 8.4 million in 2000 to approximately 21.3 million by 2030.[8] A study utilizing data from the Indonesian Family Life Survey indicated a 3.8% incidence of T2DM in 2014, which aligns with findings from the National Basic Health Research (Riskesdas) showing an increase from 1.1% in 2007 to 2.4% in 2013.[9] Furthermore, the DISCOVER study highlighted that over 40% of T2DM patients also presented with hypertension and/or hyperlipidemia, indicating a high burden of comorbidities.[7] Based on data from Riskesdas in 2018[10], the province with the highest prevalence of diabetes mellitus (DM) in Indonesia was DKI Jakarta, with a prevalence rate of 3.4% of its total population. East Kalimantan ranked second at 3.1% of its total population, followed by DI Yogyakarta, also at 3.1%. North Sumatra held the fourth position with 161,268 individuals affected by DM. Furthermore, data from the Medan City Health Office indicated that Medan is a city with a substantial number of Type II DM cases, reaching 12,575.[11]

Glycaemic control behaviour plays a crucial role in the management of T2DM and is therefore a significant focus in patient care. Complications such as nerve damage, eye disorders, heart disease, kidney failure, and circulatory problems leading to amputation are more likely to occur in individuals with poor glycaemic control. Suboptimal glycaemic control can negatively impact patients' quality of life.[12] Uncontrolled glucose levels can cause fatigue, frequent urination, and excessive thirst, which interfere with daily activities. This can lead to stress, depression, and anxiety due to a perceived lack of control. Higher healthcare costs arise as a consequence of the increased use of expensive medications, more frequent medical visits, and prolonged hospitalisations for patients with poor glycaemic control.[13] In individuals with T2DM, poor glycaemic control behaviour can be attributed to various factors, including a lack of knowledge about DM, non-adherence to treatment, lifestyle modifications, and psychosocial factors.[13,14]

Glycaemic control assessment involves evaluating expected glucose levels, blood pressure, and nutritional status against target values.[15] A significant number of patients with T2DM have been identified as not achieving glycaemic control.[16] Studies identified risk factors for poor glycaemic control in DM patients, including disease duration, medication adherence, nutritional status, and distance from healthcare facilities. Identifying factors associated with poor glycaemic control is crucial for preventing DM complications.[17–20] Research findings indicate that patient non-adherence is a barrier to achieving blood glucose control, necessitating interventions to improve therapy adherence, such as pharmacist-led short message service (SMS) reminders, which can enhance medication adherence.[21] Furthermore, research suggests that frequent nocturnal urination in T2DM patients often disrupts sleep quality, and sleep quality is associated with glycaemic control.[22]

Based on preliminary survey data from 2021, there were 2,453 T2DM patients at Royal Prima Hospital. This number increased to 2,567 in 2022 and 2,637 in 2023. From January to April 2024, the number of T2DM patients at Royal Prima Hospital was 376. Interviews conducted by the author with eight T2DM patients revealed that five patients reported non-adherence to glycaemic control due to difficulties in avoiding sugary foods, while the other three routinely adhered to their glycaemic control regimen. This phenomenon highlights the need for research on the determinants of glycaemic control behaviour in type 2 diabetes mellitus.

Method

This research employed a quantitative approach with a cross-sectional study design. The study was conducted at a hospital in Medan. Data collection took place within a defined timeframe. The study population comprised all patients diagnosed with type 2 diabetes mellitus at the aforementioned hospital within a specific year. The study sample was drawn from a subset of this population using a non-probability sampling technique. Inclusion and exclusion criteria were established to select respondents who aligned with the research objectives.

Research data were collected through two methods: primary and secondary data collection. Primary data were obtained directly from respondents via questionnaires encompassing questions regarding various factors hypothesised to be associated with glycaemic control. In addition to the questionnaires, observation and interviews were also conducted to supplement the information provided by the respondents. Secondary data were retrieved from patient medical records and other relevant documents from the hospital administration to support this research.

The dependent variable in this study was the respondents' glycaemic control. The measurement of glycaemic control was based on the respondents' glycated haemoglobin (HbA1c) levels recorded in their medical documentation over a specific time period. Based on these HbA1c levels, the respondents' glycaemic control status was grouped into two categories. The independent variables in this study comprised knowledge, attitude, disease duration, medication adherence, dietary adherence, family support, and dietary patterns. Knowledge was assessed using a series of true/false statements, with the total number of correct responses yielding a knowledge score that was subsequently dichotomised. Attitude was evaluated via a Likert scale consisting of multiple response options, and the cumulative score derived from participants' responses determined their attitude category. Disease duration was determined by the length of time participants had lived with the condition and was categorised into two groups based on a predefined cut-off point. Medication and dietary adherence were both assessed using true/false statements, with the total number of correct answers indicating the respective levels of adherence. Family support was measured through a series of yes/no questions, and the total number of affirmative responses indicated the level of support received. Finally, dietary patterns were assessed using questions with response options detailing the frequency or regularity of food consumption, and the total score of these responses was used to classify participants' dietary pattern.

The data analysis techniques employed in this study involved univariate, bivariate, and multivariate analyses using SPSS. Univariate analysis was used to describe the characteristics of each research variable separately, including their frequency distributions. Bivariate analysis was applied to examine the relationships between each independent variable and the dependent variable, using appropriate statistical tests to determine the significance of the associations.

Results

The provided table presents the characteristics of 182 patients diagnosed with Type 2 Diabetes Mellitus (T2DM). The data is categorized into several variables, including age, education level, occupation, family history of diabetes, medication adherence, and glycaemic control behaviour, with the number (n) and percentage (%) of patients falling into each category.

Regarding age, the distribution of patients across different age groups shows a wide range. The smallest group is the youngest, with only 4 patients (2.2%) aged between 26 and 35 years. The largest age groups are those aged 36-45 and 46-55, comprising 46 patients (25.3%) and 48 patients (26.4%), respectively. Following these, there are 41 patients (22.5%) in the 56-65 age range, and a slightly larger group of 43 patients (23.6%) are older than 65 years. This indicates that T2DM in this cohort is prevalent across middle-aged and older adults, with a relatively small representation in the younger age bracket.

In terms of education level, the majority of the patients (135, or 74.2%) had completed Senior High School or Vocational training. A smaller proportion had attained a Diploma, Bachelor's, or Master's degree (29 patients, 15.9%). Notably, a very small number of patients had no schooling or only primary school education, with 1 patient (0.5%) in each of these categories. This suggests a generally moderate level of educational attainment within the study population.

Looking at occupation, the two largest categories were housewives (56 patients, 30.8%) and self-employed individuals (63 patients, 34.6%). Civil servants constituted another significant group with 36 patients (19.8%), while farmers made up 27 patients (14.8%). This distribution reflects a variety of occupational backgrounds among the T2DM patients in this study.

Concerning family history of diabetes, a substantial majority of the patients (149, or 81.9%) reported a negative family history, meaning they did not have any close relatives with the condition. Conversely, 33 patients (18.1%) indicated a positive family history of diabetes, suggesting a potential genetic predisposition in a smaller subset of the cohort.

Table 1. T2DM patient characteristics (n=182)

Variable	n	%
Age (years)		
26-35	4	2,2
36-45	46	25,3
46-55	48	26,4
56-65	41	22,5
> 65	43	23,6
Education level		
No schooling	1	0,5
Primary School	1	0,5
Junior High School	16	8,8
Senior High/Vocational	135	74,2
Diploma/Bachelor/Master	29	15,9
Occupation		
Housewive	56	30,8
Self-Employed	63	34,6
Farmer	27	14,8
Civil Servant	36	19,8
Family history		
Positive Family History	33	18,1
Negative Family History	149	81,9
Medication Adherence		
Non-Adherent	98	53,8
Adherent	84	46,2
Glycaemic Control Behaviour		
Poor (HbA1c >7%)	105	57,7
Good (HbA1c <7%)	77	42,3

Regarding medication adherence, the data reveals that slightly more than half of the patients (98, or 53.8%) were classified as non-adherent to their medication regimen. In contrast, 84 patients (46.2%) demonstrated adherence to their prescribed medications. This highlights a significant challenge in managing T2DM within this population, as non-adherence can negatively impact treatment outcomes.

Finally, when examining glycaemic control behaviour, the majority of patients (105, or 57.7%) exhibited poor glycaemic control, defined as having a HbA1c level greater than 7%. A smaller proportion, 77 patients (42.3%), demonstrated good glycaemic control with HbA1c levels below 7%. This finding underscores the need for improved strategies to help patients achieve and maintain adequate blood sugar levels in this T2DM population.

Table 2. Relationship between medication adherence and glycaemic control

Variable	Glycaemic Control Behaviour				Total		*p-value*	OR
	Poor (HbA1c >7%)		Good (HbA1c <7%)					
	n	%	n	%	n	%		
Medication Adherence								
Non-Adherent	71	72,4	27	27,6	98	100	0,549	1,790 (1,344-2,384)
Adherent	34	40,5	50	59,5	84	100		

Regarding medication adherence among individuals with poor glycaemic control, out of 98 participants, 71 (72.4%) were classified as non-adherent to their medication, while 27 (27.6%) were adherent. Conversely, among the 84 participants with good glycaemic control, a smaller proportion, 34 (40.5%), were non-adherent, and a larger proportion, 50 (59.5%), were adherent to their medication.

Statistical analysis of this association yielded a p-value of 0.549. This p-value, exceeding the conventional significance level of 0.05, indicates that there was no statistically significant association between medication adherence and glycaemic control in this specific sample. In other words, based on these data, we cannot conclude that there is a significant difference in medication adherence levels between individuals with poor and good glycaemic control.

The odds ratio (OR) was reported as 0.549 with a 95% confidence interval (CI) of (1,344-2,384). However, this confidence interval appears implausibly wide and inconsistent with a typical odds ratio. It is highly probable that there is an error in the reporting of this confidence interval. Assuming the reported OR of 0.549 is accurate, it would suggest that individuals who are non-adherent to their medication have

approximately 0.549 times the odds of exhibiting poor glycaemic control compared to those who are adherent. Nevertheless, given the non-significant p-value, this observed odds ratio may be attributable to chance.

In summary, while the descriptive data indicate a higher percentage of non-adherent individuals within the poor glycaemic control group and a higher percentage of adherent individuals within the good glycaemic control group, the statistical analysis (p-value = 0.549) demonstrates that this association was not statistically significant in this sample. The reported confidence interval for the odds ratio is likely erroneous and should be interpreted with caution. Therefore, based on this analysis, a definitive conclusion regarding a significant relationship between medication adherence and glycaemic control cannot be drawn.

Discussion

The findings of this study demonstrate a significant association between medication adherence and glycaemic control behaviour in patients with T2DM at Royal Prima Hospital, Medan. These results indicate that adherence to medication is closely linked to patients' ability to manage their blood glucose levels. Medication adherence in this context encompasses not only the act of taking medication as prescribed but also reflects broader glycaemic control behaviours. Patients who adhere to their treatment regimen tend to exhibit greater discipline and awareness in managing their condition. This is likely influenced by adequate knowledge about their disease, high motivation to maintain their health, and an understanding of the importance of blood glucose control and regular check-ups.[23] Conversely, non-adherence to medication presents a major challenge in the management of T2DM. Various forms of non-adherence, such as irregular medication intake, discontinuing treatment without consultation, reducing dosage without advice, or neglecting medication schedules, can impede the achievement of optimal glycaemic control.

The Information–Motivation–Behavioral Skills (IMB) model demonstrates that adequate knowledge about diabetes, motivation to maintain health, and behavioral skills directly influence medication adherence. These factors also contribute to improved glycaemic control outcomes, emphasizing the importance of understanding the disease and treatment regimen.[24] Non-adherence to prescribed medications, including irregular intake, discontinuation without consultation, or neglecting schedules, is a major barrier to effective diabetes management. It has been associated with elevated HbA1c levels and poor glycaemic control, underscoring the need for strategies to address barriers such as financial constraints, side effects, and complex regimens.[25,26]These studies consistently reinforce the notion that greater patient adherence to treatment is associated with better blood glucose control outcomes. One factor that can influence medication non-adherence is the chronic nature of T2DM, which necessitates long-term, often lifelong, treatment. This condition can lead to feelings of weariness, boredom, and a desire to discontinue or neglect treatment.[27]

The implications of medication non-adherence are serious. A study found that poor medication adherence is associated with higher rates of morbidity and mortality among T2DM patients, emphasizing the critical role of adherence in achieving good glycemic control and preventing complications.[28] Furthermore, evidence suggests that non-adherence contributes to treatment failure and increases the likelihood of hospitalizations, which further exacerbates the condition and leads to higher healthcare costs.[26] Additionally, a systematic review highlighted that achieving therapeutic success in diabetes management is heavily reliant on patient adherence to prescribed medication regimens, reinforcing the connection between adherence and improved blood glucose levels.[29,30]

Conclusion

This study indicate that the majority of T2DM patients within this study cohort were middle-aged and older adults. The predominant level of educational attainment was upper secondary or vocational schooling, with diverse occupations, primarily homemakers and self-employed individuals. A majority of patients reported no family history of diabetes. Over half of the patients reported non-adherence to their medication regimen, and the majority exhibited poor glycaemic control. Although descriptive analysis suggested a difference in medication adherence between the groups with good and poor glycaemic control, statistical analysis did not reveal a significant association between medication adherence and glycaemic control within this study cohort.

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