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Model of Lifestyle Behaviour Improvement in Diabates Mellitus Patients in Pekanbaru City Health Centre Area

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ABSTRACT

Introduction: Diabetes mellitus is a chronic metabolic disease that can lead to serious complications, including damage to the eyes, kidneys, blood vessels, nerves and heart. A healthy lifestyle is important in the management of diabetes, but behaviour change is often difficult to achieve without appropriate intervention. Although Social Cognitive Theory has been shown to be effective in improving healthy behaviours, its application in diabetes management in Indonesia, especially considering local culture, is still limited.
Aim: This study aims to develop and test a model for improving lifestyle behaviour in diabetes mellitus patients based on Social Cognitive Theory.
Method: This study used descriptive and explanatory research approaches. The study population consisted of 326 diabetes mellitus patients registered at five health centres in Pekanbaru City. The sampling technique used was probability sampling with random sampling method. The instrument used was a questionnaire to measure variables of individual characteristics, personal factors, environmental factors, and lifestyle behaviour. Data analysis was carried out with descriptive analysis techniques and Partial Least Squares.
Results: The study showed a significant relationship between personal factors (self-efficacy) and improved lifestyle behaviour of diabetes mellitus patients (path coefficient = 0.302; t-statistic = 2.125). In addition, individual characteristics such as self-motivation and patient perceptions had a significant effect on personal factors and lifestyle behaviour (path coefficient = 0.272 and 0.195; t-statistic = 4.642 and 3.439). This model can explain most of the variation in lifestyle behaviour of diabetes mellitus patients ($R^2 = 0.102$). Goodness of fit test results ($Q^2 = 0.2995$) showed good predictive ability.
Conclusion: Individual characteristics and personal factors, especially self-efficacy, and self-regulation, significantly influence improvements in lifestyle behaviour. This model is effective and can be integrated into diabetes management programmes at the community health centre level. Promotional policies that encourage active social support are essential for sustainable healthy lifestyle changes.

KEYWORDS: Diabetes melitus, Social cognitive theory, Lifestyle behaviour, Self-efficacy, Self-regulation.

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INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease characterised by hyperglycaemia due to impaired insulin secretion, insulin resistance, or both. This condition can lead to serious complications such as damage to the eyes, kidneys, blood vessels, nerves, and heart. According to a 2016 WHO report, the number of people with diabetes has nearly quadrupled since 1980, reaching 422 million adults. This increase is largely due to a surge in cases of type 2 diabetes associated with factors such as overweight and obesity [1]. Data from the International Diabetes Federation (IDF) shows that in 2021, the global prevalence of diabetes among individuals aged 20 to 79 years was estimated at 10.5% (536.6 million people) and is projected to increase to 12.2% (783.2 million) by 2045. This prevalence is higher in urban areas (12.1%) compared to rural areas (8.3%), and higher in high-income countries (11.1%) compared to low-income countries (5.5%) [2].

Indonesia is also listed as a country with a high prevalence of diabetes, ranking fifth in the world with 19.5 million sufferers in 2021, and this number is predicted to increase to 28.6 million by 2045 [3]. In the province of Riau, particularly in the city of Pekanbaru, the number of diabetes patients in 2023 reached 18,044, with 10,094 cases recorded in 21 community health centres. This increase in the number of patients poses a significant challenge for local healthcare facilities in caring for DM patients, often leading to complications such as neuropathy and diabetic foot ulcers [4]. These complications increase the risk of infection and impaired motor function in patients [5], [6]. Therefore, proper and safe management of DM patients is essential to prevent such complications.

A number of factors have been identified as contributing significantly to the increase in cases of diabetes mellitus (DM). These include unhealthy lifestyle changes, such as the consumption of foods high in sugar and fat, low physical activity, smoking, and uncontrolled stress [7], [8], [9], [10]. Lifestyle not only affects physical condition, but also influences psychological aspects of individuals, which in the long term can worsen glycemic control [11]. Local cultural factors, such as social eating habits and the value placed on serving high-carbohydrate and sugary foods, also pose challenges in promoting healthy lifestyles, particularly in

Pekanbaru. Moreover, the roles of family and social environments frequently serve to reinforce the adoption of detrimental behaviours. These include the restriction of certain foods for individuals diagnosed with diabetes mellitus (DM), as well as the limitation of physical activity due to overprotective care.

In recent years, Social Cognitive Theory (SCT), developed by Albert Bandura, has been widely used to design interventions aimed at improving healthy behaviour in patients with diabetes mellitus (DM). SCT emphasises that behavioural change occurs through dynamic interactions between personal, environmental, and behavioural factors. Numerous studies have demonstrated the effectiveness of SCT in improving the health of diabetes patients, such as increased physical activity and healthier dietary patterns [12], [13]. Despite its widespread application, the integration of SCT within the local cultural context in Indonesia remains limited. For example, a study in Ponorogo, East Java, showed that factors such as motivation, knowledge, and self-efficacy play a significant role in improving secondary prevention behaviour among DM patients [14]. Additionally, technology-based SCT applications, such as mHealth in Japan, have successfully increased physical activity among type 2 diabetes patients [15]. However, despite these promising results, the implementation of SCT in the social and cultural context of Indonesia requires further research.

Existing interventions frequently fail to consider demographic variations, including age, educational attainment, and initial health status, which can influence the efficacy of SCT-based interventions. It is evident that by adapting interventions to align more closely with these factors, more favourable outcomes can be attained [16]. Additionally, there is significant potential to improve patient adherence by aligning lifestyle changes with individual preferences and leveraging financial and non-financial incentives as additional motivators [17].

Although SCT has been widely applied to diabetic patients in various countries, most studies have been conducted outside Indonesia, so the integration of SCT in the local cultural context of Indonesia, especially in managing healthy lifestyles in areas such as Pekanbaru, is still very limited. This study offers a new approach by applying SCT in the context of local Indonesian culture, specifically to improve healthy lifestyle behaviour among diabetes patients in Pekanbaru City. By considering local cultural factors, this study has the potential to contribute significantly to the development of more effective and easily accepted intervention models, thereby increasing the likelihood of success in promoting healthy lifestyle changes among diabetes mellitus patients. This study aims to develop and test a model for improving lifestyle behaviour in diabetes mellitus patients based on Social Cognitive Theory (SCT) in the Pekanbaru City Health Centre area. This study integrates the SCT approach to enhance personal, environmental, and behavioural factors in healthy lifestyle management for diabetes patients, while considering the local cultural values present in Pekanbaru.

METHOD

Study Design and Location

This study utilised a non-experimental quantitative method with a descriptive analysis approach and explanatory research. Explanatory research aims to explain the relationship between independent and dependent variables. This study was conducted in the Pekanbaru City Health Centre area, focusing on five health centres with the highest number of diabetes mellitus cases among 21 health centres in Pekanbaru City, namely Garuda Health Centre, RI Tenayan Raya Health Centre, RI Simpang Tiga Health Centre, Karya Wanita Health Centre, and Payung Sekaki Health Centre. These health centres were selected to obtain a representative sample, with the hope of providing a comprehensive overview of the factors influencing the lifestyle behaviour of diabetes mellitus patients in Pekanbaru City. This study was conducted from August to September 2024.

Population and Study Sample

The population in this study consisted of diabetes mellitus (DM) patients registered at five community health centres with the highest number of DM cases in Pekanbaru City, namely Garuda Community Health Centre, RI Tenayan Raya Community Health Centre, RI Simpang Tiga Community Health Centre, Karya Wanita Community Health Centre, and Payung Sekaki Community Health Centre, with a total population of 4,282 patients from January to December 2023. The sampling technique used was probability sampling with a random sampling method, where samples were randomly selected from the registered patients at the five health centres. The sample proportion was divided based on the population size at each health centre to ensure balanced representation in the study.

Sample Criteria

The sample criteria in this study were divided into inclusion and exclusion criteria. The inclusion criteria included patients who were willing to be respondents, aged between 19 and 65 years, had a fasting blood sugar level of more than 200 mg/dL, were diabetes mellitus patients who were treated at the Community Health Centre, and had a minimum education level of elementary school graduate. Exclusion criteria include patients currently hospitalised at the selected Community Health Centre, patients with cognitive impairments that may affect their ability to understand instructions or complete the questionnaire, and patients who were absent during the study.

Sample Size

The research sample was calculated using the Lemeshow formula (1997) because the population size was unknown or unlimited, with a confidence level of 95%, a maximum proportion estimate of 0.9, and a sampling error margin of 5%. Based on these calculations, the minimum sample size required is 326 respondents. This sample is divided proportionally based on the population size of each health centre, with the following sample allocation: Garuda Community Health Centre has the largest sample size, with 98 respondents, followed by RI Tenayan Raya Community Health Centre (82 respondents), RI Simpang Tiga Community

Health Centre (81 respondents), Karya Wanita Community Health Centre (54 respondents), and Payung Sekaki Community Health Centre (51 respondents).

Sampling Procedure and Data Collection

The data collection technique used in this study was a questionnaire designed to observe improvements in lifestyle behaviour among patients with diabetes mellitus (DM). The questionnaire used to measure the dependent variable, namely lifestyle improvement, was adapted from the Rikesdas (2013) questionnaire, which consists of 15 negative questions. For independent variables, the questionnaires used include those designed to measure lifestyle motivation in DM patients, consisting of 14 questions that include both positive and negative statements. Perception of the disease was measured using a questionnaire modified from the Illness Perception Questionnaire-Revised (IPQ-R) by Rona Moss-Morris, consisting of 9 items with positive statements on items 4 and 8, and negative statements on the remaining items [18]. Environmental factors were measured using the Multidimensional Scale of Perceived Social Support (MSPSS) questionnaire, which focuses on social support, particularly from health workers, with 15 positive questions (Stewart et al., 2014). Personal factors were measured using a questionnaire covering various scales, such as the Smoking Cessation Self-Regulation, Eating Behaviour Self-Regulation Questionnaire (SREBQ), and Self-Regulation Exercise Questionnaire. The questionnaire to measure self-efficacy uses a modified tool from the Self-Efficacy Behavioral Smoking, Self-Efficacy Exercise, and Dietary Eating Self-Efficacy scales, which contain positive statements. All questionnaires used have undergone validity and reliability testing to ensure the data obtained are accurate and reliable [19], [20].

Research Variables

The variables in this study consist of dependent and independent variables. The dependent variable, namely an increase in lifestyle behaviour, was measured using a questionnaire that assessed whether patients engaged in appropriate activities, maintained a healthy diet, and avoided smoking, using an ordinal scale. Independent variables include several aspects of individual characteristics, such as age, gender, education, socioeconomic status, body mass index (BMI), perception of disease, occupation, history of diabetes mellitus, and number of children. All these variables are measured using questionnaires adapted to nominal or ordinal scales, depending on the type of data. Environmental factors, including family support, friends, and healthcare providers, are also measured using questionnaires with an ordinal scale. Additionally, personal factors, such as self-efficacy and self-regulation, are assessed using questionnaires based on validated and reliable instruments. All these variables are designed to provide a comprehensive overview of the factors influencing the lifestyle of diabetes mellitus patients.

Statistical Analysis

Data analysis was performed using Partial Least Squares (PLS), a statistical method that is effective for addressing problems in data, such as abnormal distribution, missing values, and multicollinearity. PLS does not require normal distribution assumptions and can be used with small samples. The first step was to evaluate the outer model by measuring the validity of the indicators through loading factors (values above 0.5 were considered valid) and Average Variance Extracted (AVE) for discriminant validity. Reliability was tested using composite reliability and Cronbach's alpha (values > 0.6 and 0.7 indicate high reliability). Next, the inner model is tested by examining the R-square value to assess model quality, with criteria of 0.75 (strong), 0.50 (moderate), and 0.25 (weak). The Q-square evaluation is used to assess the predictive relevance of the model. For hypothesis testing, path coefficients are used to test the direct effects between variables, with p-values < 0.05 indicating significant relationships.

RESULTS

Table 1. Characteristics of Diabetes Mellitus Patients in Pekanbaru City (n=326)

Patients Characteristics	Frequency (n)	Percentage (%)
Age		
19–25 year old	11	3,4
26–35 year old	14	4,3
36–45 year old	23	7,1
46–55 year old	76	23,3
56–65 year old	202	62,0
Gender		
Female	227	69,6
Male	99	30,4
Education		
Elementary School	68	20,9
Junior High School	37	11,3
Senior High School	183	56,1
Higher/Tertiary Education	38	11,7
Occupation		
Housewife	31	9,5
Farmer	76	23,3
Private employee	205	62,9
Teacher	14	4,3

Family History		
None	287	88
Yes	**39**	**12**
BMI		
Thin	144	44,2
Normal	122	37,4
Fat	48	14,7
Obese	12	3,7
Socioeconomic		
Low	81	24,8
Middle	107	32,8
High	138	42,3
Number of children		
High parity	183	56,1
Low parity	143	43,9
Self Motivation		
Low	164	50,3
High	162	49,7
Patient Perception		
Negative	177	54,3
Positive	149	45,7
Total	**326**	**100**

Table 1 shows that most patients are in the 56–65 age range (62.0%) and the majority are female (69.6%). In terms of education, most patients have a high school education (56.1%). The majority of patients work in the private sector (62.9%). Additionally, more than half of the patients have high parity (56.1%), low self-motivation (50.3%), and negative perceptions of their health condition (54.3%).

Table 2. Frequency Distribution of Personal and Environmental Factors on Lifestyle Behaviour

Variable	Frequency (n)	Percentage (%)
Self-Efficacy		
Low	172	52,8
High	154	47,2
Total	326	100
Self-Regulation		
Low	182	55,8
High	144	44,2
Family Support		
Low	112	34,4
High	214	65,6
Peer Support		
Low	125	38,3
High	201	61,7
Health Worker Support		
Low	170	52,1
High	156	47,9
Total	**326**	**100**

Table 2 presents the frequency distribution of personal and environmental factors that influence respondents' lifestyle behaviours. The majority of respondents exhibited low levels of self-efficacy (52.8%) and self-regulation (55.8%). The data indicates that levels of support from family and friends are relatively high, with 65.6% and 61.7% of respondents reporting high levels of support from these sources, respectively. Conversely, levels of support from health professionals are slightly lower, with 52.1% of respondents reporting a low level of support from health professionals.

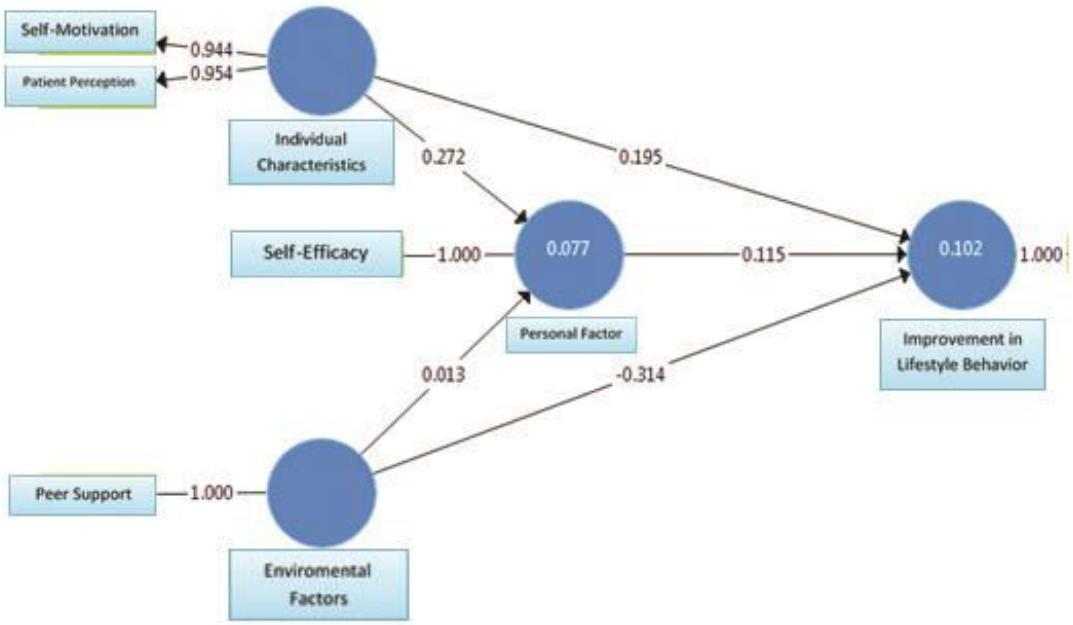

Figure 1. Results of *outer loading* test Improvement in *lifestyle* behaviour of patients with diabetes mellitus

As illustrated in Figure 1, the outcomes of the outer loading test for the model of enhancing lifestyle behaviour in patients with diabetes mellitus are demonstrated. In this model, patient lifestyle behaviour is influenced by three factors: individual characteristics, self-efficacy, and environmental factors (peer support). The relationship between self-efficacy and personal factors shows a loading value of 0.077, while the relationship between personal factors and lifestyle behaviour has a loading value of 0.302. Peer support has a negative influence on personal factors with a value of -0.314. Self-motivation and patient perception have a significant influence on individual characteristics with values of 0.944 and 0.954, respectively.

Table 3. Results of Inner Model Test for Improving Lifestyle Behaviour of Diabetes Mellitus Patients

Relationship	*Original sample*	*Sample mean*	*Standard deviation*	*T statistics*	Desc
Environmental factors > Personal factors	0,013	0.013	0,057	0,230	tdk sig
Environmental factors > Lifestyle behaviour	-0,314	-0,311	0,055	5,761	sig
Personal factors > Lifestyle behaviour	0,115	0,114	0,054	2,125	sig
Individual Characteristics > Personal factors	0,272	0,277	0,059	4,642	sig
Individual Characteristics > Lifestyle behaviour	0,195	0,193	0,057	3,439	sig

Table 3 shows the results of the inner model test for improving lifestyle behaviour of diabetes mellitus patients. The test results show that environmental factors have a significant influence on personal factors (T statistic value 0.230) but with a very small influence (0.013). In contrast, environmental factors showed a significant negative influence on lifestyle behaviour (T statistic 5.761, value -0.314). Personal factors have a significant positive influence on lifestyle behaviour (T statistic 2.125, value 0.115). Individual characteristics have a significant influence on personal factors (T statistic 4.642, value 0.272), and also positively and significantly influence lifestyle behaviour (T statistic 3.439, value 0.195).

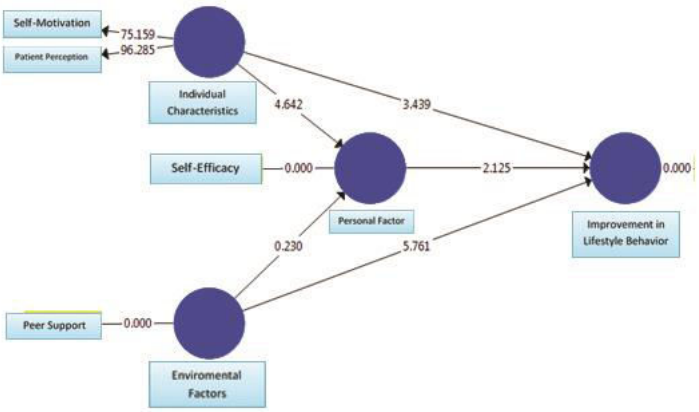

Figure 2. Results of Structural Model Analysis of Lifestyle Behaviour Improvement in Diabetes Mellitus Patients

Figure 2 shows the results of the structural model analysis for improving lifestyle behaviour in patients with diabetes mellitus. The analysis shows that individual characteristics have a significant effect on personal factors (path coefficient = 0.272, t-statistic = 4.642) and lifestyle behaviour (path coefficient = 0.195, t-statistic = 3.439). Self-efficacy has a significant effect on personal factors (path coefficient = 0.077, t-statistic = 3.349) and lifestyle behaviour (path coefficient = 0.302, t-statistic = 2.125). Friend support had a negative effect on personal factors (path coefficient = -0.314, t-statistic = 5.761), but showed no direct effect on lifestyle behaviour. All relationships in this model showed high significance, with t-statistics greater than the required threshold value, indicating that this model is valid in explaining the improvement of lifestyle behaviours in patients with diabetes mellitus.

Table 4. R Square Model of Improving Lifestyle Behaviour in Diabetes Mellitus Patients

Variable	*R square*
Personal Factors	0,068
Lifestyle Behaviour	0,102

Table 4 shows the R-square values for two variables, namely Personal Factors and Lifestyle Behaviour. The R-square value for personal factors is 0.068, while that for lifestyle behaviour is 0.102. The lower R-square value for personal factors indicates a small contribution to the variability of lifestyle behaviour, while the R-square value for lifestyle behaviour is higher, but still shows a relatively small influence. Furthermore, the Goodness of Fit of this model is measured using Q-square predictive relevance. Q-square calculation with the formula:

$Q^2 = 1-(1-R_1^2)(1-R_2^2)$
$Q^2 = 1-(1-0,068)^2(1-0,102)^2$
$Q^2 = 1-0,7004$
$Q^2 = 0,2995$

The Q-square calculation result of 0.2995 shows that this model has good predictive relevance, because the Q-square is greater than zero. This means that the model of improving the lifestyle behaviour of patients with diabetes mellitus can be used to improve the lifestyle behaviour of patients with diabetes mellitus with good predictive relevance.

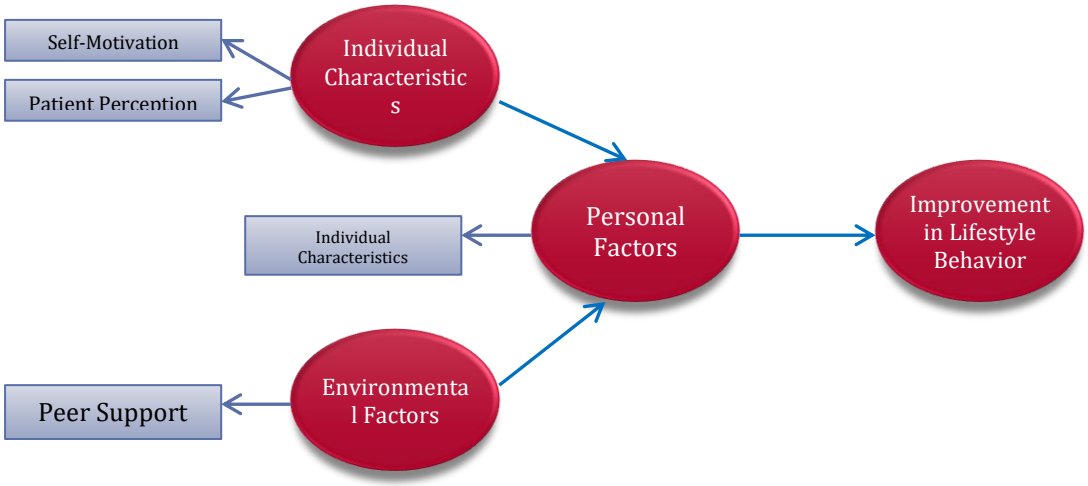

Figure 3. Conceptual Model for Improving Lifestyle Behaviour in Diabetes Mellitus Patients

Figure 3 shows the conceptual model of improving lifestyle behaviour in patients with diabetes mellitus. This model illustrates the relationship between factors that influence lifestyle behaviour, including individual characteristics, self-efficacy, and environmental factors. Self-motivation and patient perceptions influence individual characteristics, which in turn influence personal factors. Personal factors are also influenced by peer support, while environmental factors have a direct effect on improving patients' lifestyle behaviours. This model reflects the interaction between personal and social factors in shaping the lifestyle behaviour of patients with diabetes mellitus.

DISCUSSIONS

The results of this study indicate a significant relationship between individual characteristics and personal factors (self-efficacy) in patients with diabetes mellitus. Valid indicators as individual characteristics include self-motivation and self-perception, while age, gender, education, body mass index (BMI), occupation, family history, socioeconomic status, and number of children did not show validity as indicators of individual characteristics. These findings are consistent with studies showing that increased self-efficacy is associated with better diabetes management [21]. Self-efficacy is a strong predictor of diabetes self-management behaviour, and higher levels of self-efficacy are associated with better adherence to self-management practices [22], [23], [24]. Another study in Saudi Arabia also found that self-efficacy-based interventions can improve self-management and quality of life in patients with diabetes [25].

The formation of self-efficacy is also influenced by environmental factors, including support from family members, friends, and

health professionals. As demonstrated by other studies in this field, the existence of supportive social interactions has been shown to have a positive effect on the strengthening of self-efficacy [24], [26]. However, the present study found that support from health workers was considered to be low. The development of self-efficacy is theorised to occur through experience and social interaction, thus individuals with greater life experience are hypothesised to exhibit higher levels of self-efficacy. These findings lend further support to the notion that motivation and self-perception play a pivotal role in the development of self-efficacy. Local cultural factors, such as *Gotong Royong* or mutual cooperation in Pekanbaru, have also been demonstrated to influence perceptions and lifestyle decisions [27].

The study also found a significant relationship between individual characteristics and self-regulation. Just like self-efficacy, only self-motivation and self-perception were valid indicators, while other variables were not significant. This is in line with the study of Uly et al. (2025) which highlighted the importance of perception and motivation in shaping self-regulation. Other studies have also revealed that better glycaemic control correlates with higher levels of self-regulation [28] and environmental influences such as work pressures and social habits in Pekanbaru also become obstacles [29]. Lack of support from health workers is one of the obstacles in this process.

In addition, a significant relationship was also found between individual characteristics and lifestyle behaviours of diabetic patients. Motivation and perception again emerged as dominant factors, while other demographic variables were not significant. Previous studies have suggested that lifestyle behaviour patterns are more influenced by social and environmental interactions than demographic factors alone [30], [31], [32]. In Pekanbaru, the habit of consuming foods high in sugar and low physical activity reflects a weak culture of healthy living. Community-based intervention strategies that consider local social norms are important [33].

With regard to the relationship between environmental and personal factors, the results of this study indicate an absence of a significant relationship. This phenomenon is evidenced by the minimal support received from healthcare professionals and family members, despite the substantial support received from friends. Research by Ji et al. (2020) and Habibi Soola et al. (2022) demonstrates that the type of support has a divergent influence on the formation of self-efficacy and self-regulation, contingent on the context and form of support provided [34], [35]. Support from friends in Pekanbaru proved to be more dominant in influencing self-regulation than support from health workers. However, high family support has the potential to be negative if it is not accompanied by an appropriate educational approach [36], [37].

Furthermore, the relationship between environmental factors and lifestyle behaviours showed significant results. Friend support plays an important role in supporting a healthy lifestyle, particularly in encouraging patients to avoid unhealthy eating habits and smoking. This finding is consistent with the results of a US study that linked friend support with increased physical activity post-diagnosis of diabetes [38], [39]. Unfortunately, support from health workers is considered not optimal, in contrast to studies in other countries that show that support from health workers can encourage significant lifestyle changes [40], [41].

Finally, this study confirms the relationship between personal factors (self-efficacy and self-regulation) and increased lifestyle behaviours. A Transtheoretical Model (TTM)-based approach was found to be effective in improving self-efficacy and self-management in diabetic patients [42], [43], [44]. Low self-control and confidence in maintaining a healthy lifestyle is evident in smoking behaviour, consumption of foods high in sugar, and lack of exercise. This suggests the importance of interventions that target improving motivation and self-regulation skills [45]. This finding extends the application of social cognitive theory in a local cultural context and reinforces the importance of community-based approaches in diabetes management. The present study also provides practical contributions to the development of educational and health promotion programmes that consider peer support and local cultural values such as *gotong royong*. The policy implications of this research indicate the need for active involvement of health workers in sustainable support programmes, self-regulation skills training for patients, and community-based health promotion campaigns that strengthen the local social and cultural network.

The present study is subject to several limitations. Firstly, the non-experimental quantitative design employed, which is of an explanatory nature, precludes the drawing of direct causal conclusions between variables. Secondly, data were collected through self-administered questionnaires; therefore, it is not possible to avoid response bias, particularly in the form of social desirability bias. Thirdly, the study was conducted on a limited population in five community health centres in Pekanbaru City; therefore, the results cannot be generalised to the wider population of diabetes patients in other areas. Fourthly, despite the utilisation of standardised instruments, certain indicators within the model proved to be invalid and necessitate further evaluation through subsequent studies. Consequently, it is recommended that future research employs a longitudinal design and incorporates greater geographical context variation to enhance the generalisability and external validity of the study results.

CONCLUSION

Individual characteristics, particularly self-motivation and perceptions of illness have been shown to significantly contribute to the formation of personal factors and improvements in the lifestyle behaviour of diabetes mellitus patients. Environmental factors, especially peer support, have a strong influence on behavioural change, while the roles of healthcare professionals and family members remain suboptimal. Personal factors such as self-efficacy and self-regulation also play a crucial role in supporting healthy lifestyles, reinforcing the relevance of social cognitive theory in the local cultural context. These findings indicate that psychosocial dimensions have a greater influence than demographic factors on the success of diabetes management. Healthcare providers need to enhance their consistent and empathy-based educational roles, while policymakers are advised to design promotive policies that encourage the formation of active social support at the primary level. Interventions targeting improved

self-regulation and patient motivation should be integrated into diabetes management programmes to ensure sustainable lifestyle changes.

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