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Multivariate Analysis of Determinants of Balanced Diet Adherence among Diabetes Mellitus Patients

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ABSTRACT
Diabetes mellitus is an increasing health problem that requires proper management, including adherence to a balanced diet. This study aims to analyse the factors associated with adherence to a balanced diet and identify the dominant factors in patients with type 2 Diabetes Mellitus in Pekanbaru. The research design used a cross-sectional quantitative method with a sample of 234 respondents taken by proportional random sampling from 21 health centres based on the number of registered patients according to the inclusion and exclusion criteria. Data were analysed using chi square test and multiple logistic regression. The results showed that higher education (p=0.0001; OR=3.25), positive intention (p=0.0001; OR=2.58), favourable perception (p=0.006; OR=2.18), as well as family support (p=0.0001; OR=3.02) and health worker support (p=0.0001; OR=4.90) were significantly associated with dietary adherence. Multivariate analysis revealed family support (p=0.001; OR=4.29) as the dominant factor influencing dietary adherence, followed by health professional support (p=0.001; OR=3.79) and individual intention (p=0.003; OR=2.77). Perception had no significant effect in the final model. These findings emphasise the important role of family support and healthcare professionals in improving dietary adherence of diabetic patients and the need for integrated interventions for sustainable disease management.

Keywords: *Dietary Adherence, Type 2 Diabetes Mellitus, Family Support, Health Professional Support, Individual Intention*

INTRODUCTION
Diabetes mellitus (DM) is a metabolic disorder characterised by the body's inability to control blood sugar levels optimally, either due to insulin deficiency or insulin resistance. Type 2 diabetes mellitus, which is caused by insulin resistance, is the most common type of diabetes and is strongly influenced by lifestyle, such as unhealthy diet, obesity, and physical inactivity (Magliano & Boyko, 2022). The disease is becoming an increasingly serious global health problem as modern society changes its lifestyle, resulting in a rapid increase in the prevalence of type 2 diabetes (Dong et al., 2024). In Indonesia, the prevalence of diabetes continues to increase with around 10.6% of the adult population suffering from diabetes in 2021 or around 19.47 million people (Kemenkes RI, 2024). This trend is expected to continue to grow as lifestyles change and the population ages. In Riau Province, especially Pekanbaru City, diabetes cases are increasing significantly, with the number of patients spread across 21 health centres reaching 10,094 people in 2023 (Health Office of Riau Province, 2023).

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Adherence to a balanced diet is a crucial aspect of DM management to prevent complications and improve patients' quality of life. Recent studies have shown that dietary adherence is influenced by various factors, including socioeconomic status, knowledge, and risk perception (Abose et al., 2024). Psychosocial barriers such as low self-control over health also contribute to lower adherence (Arsad et al., 2023). Family support has consistently been found to improve patient motivation and adherence (Thalia Florencia Da Costa Cabral & Amin Samiasih, 2024). A number of additional factors have been identified as contributors to this phenomenon, including demographic characteristics such as age. It has been observed that patients of a more advanced age tend to demonstrate higher levels of dietary adherence. However, it should be noted that certain studies have reported a decline in adherence among elderly individuals. Furthermore, gender has been demonstrated to exert influence, with female subjects demonstrating a higher propensity for adherence in comparison to their male counterparts. Higher levels of education have been demonstrated to be positively correlated with dietary adherence (Atosona et al., 2024; Atuahene et al., 2025; Tang & Yang, 2025).

However, common barriers include financial difficulties in following the recommended diet (Atuahene et al., 2025), social influences from eating out or social events (Mohammed & Sharew, 2019), and negative attitudes or lack of understanding despite adequate knowledge. Other lifestyle factors such as physical activity and medication adherence also influence dietary adherence (Baral et al., 2022). Ongoing interventions such as regular dietary counselling and glycaemic management have been shown to be effective in improving adherence (Tran et al., 2024). A multidisciplinary approach involving education, family support, and utilisation of communication technology is essential for successful diet and lifestyle management of diabetic patients (Vodolagin et al., 2021). Sociodemographic and clinical variables need to be taken into account for effective interventions in the socio-cultural context (Portela et al., 2022).

Despite the existence of numerous studies that identify influential factors, the majority of these studies focus exclusively on specific aspects, such as social support or demographic factors. The integration of the influence of individual intention, social support from family and health workers, and perception on dietary adherence within a single analytical model remains underdeveloped, particularly within the local context of Indonesia and Pekanbaru. The limited geographical coverage and cross-sectional design of the study also limit in-depth understanding of the dominant factors of balanced dietary behaviour in people with diabetes.

The present study employs a multivariate approach that combines individual intention variables, family and health professional support, and patient perceptions in one analysis model in order to identify the dominant factors of dietary adherence in patients with type 2 diabetes mellitus. Conducted in Pekanbaru City, which has a high prevalence of diabetes in Riau Province, this study provides an important local context for the development of targeted intervention strategies. The objective of this study was to analyse the factors associated with adherence to a balanced diet and to identify the dominant factors that influence it in patients with type 2 diabetes mellitus in Pekanbaru. The results of this study are expected to inform recommendations for effective intervention programmes to improve dietary adherence and quality of life of diabetic patients in the region.

METHODS

Research Design and Location

This study used a quantitative design with a cross-sectional approach to analyse the relationship between individual intention, social support (family and health workers), perception, education, and adherence to a balanced diet in patients with Type 2 Diabetes Mellitus. Data were collected simultaneously through a survey using questionnaires at 21 health centres in Pekanbaru during the period June to December 2024.

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Population and Sample

The study population was Type 2 Diabetes Mellitus patients registered at 21 Pekanbaru health centres in 2023. The sample used was 234 respondents, taken by proportional random sampling in each health centre according to the number of registered patients based on inclusion and exclusion criteria. Inclusion criteria were patients with Type 2 Diabetes Mellitus who were fully conscious, able to answer the questionnaire clearly, and willing to become respondents. Exclusion criteria included patients with hearing or visual impairment and patients who were undergoing special treatment that could affect their health condition.

Sampling and Data Collection Procedures

Samples were obtained by visiting health centres in Pekanbaru and selecting people with Diabetes Mellitus who met the criteria. Respondents were given an explanation of the purpose of the study and asked to sign an informed consent before filling out a questionnaire containing variables related to individual intention, social support, perception, education, and balanced diet adherence.

Research Variables

Independent variables included individual intention, social support (family and health workers), perception, and education, while the dependent variable was balanced diet adherence. Measurement was done with an ordinal-scale questionnaire and categorised into two based on the mean score: positive and negative.

Statistical Analysis

Data were analysed using three stages of statistical analysis. First, univariate analysis was conducted to describe the characteristics of respondents based on the variables of age, education, occupation, and distribution of dietary adherence and its supporting factors. Second, bivariate analysis was used to examine the relationship between each independent variable and the dependent variable using the chi-square test or statistical tests as needed, with a significance level of $p<0.05$ and calculation of the Odds Ratio (OR) and 95% Confidence Interval (CI). Third, multivariate analyses were conducted using logistic regression to identify the dominant factors simultaneously associated with balanced diet adherence in patients with Type 2 Diabetes Mellitus, using the p value and OR as indicators of the strength of the association. All these analyses were assisted with appropriate statistical software.

RESULTS

Table 1. Characteristics of Respondents Based on Age, Education and Occupation

Characteristics	n	%
Age		
25-44 years	37	15.8
44-60 years	132	56.4
60-75 years	65	27.8
Education		
Basic Education	46	19.7
Secondary Education	80	34.2
Higher Education	108	46.2
Occupation		
Government Employee	47	20.1
Private Employee	63	26.9
Farmer/Laborer	59	25.2
Housewife	65	27.8
Total	234	100.0

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Table 1 shows that the majority of respondents were between 44 and 60 years old (56.4%) and had an upper secondary education (80.4%). Respondents' occupations were fairly evenly distributed between private employees (26.9%), housewives (27.8%), and farmers/labourers (25.2%).

Table 2. Distribution of Dietary Adherence and Influencing Factors

Variable	n	%
Balanced Diet Adherence		
Non-Compliant	100	42.7
Compliant	134	57.3
Individual Intentions		
Absent	128	54.7
Present	106	45.3
Perception		
Negative	117	50.0
Positive	117	50.0
Health Worker Support		
Absent	104	44.4
Present	130	55.6
Family Support		
Negative	116	49.6
Positive	118	50.4
Total	234	100.0

Table 2 shows that the majority of respondents adhered to a balanced diet (57.3%), with no individual intention dominating (54.7%). Respondents' perceptions were evenly divided between negative and positive (50%). Existing health worker support was higher (55.6%), as was positive family support (50.4%).

Table 3. Factors Associated with Adherence to a Balanced Diet in Patients with Diabetes Mellitus

Factors	Balanced Diet Adherence				Total		*P-Value*	OR (95% CI)
	Non-Compliant		Compliant					
	n	%	n	%	n	%		
Education								
Low	70	55,6	56	44,4	126	100	0,0001	3,250 1,878-5,624
High	30	27,8	78	72,2	108	100		
Individual Intention								
Absent	72	56,3	56	73,6	128	100	0,0001	2,582 2,055-6,241
Present	28	26,4	78	73,6	106	100		
Perception								
Negative	61	52,1	56	47,9	117	100	0,006	2,179 1,284-3,696
Positive	39	33,3	78	66,7	117	100		
Health Worker Support								
Absent	66	63,5	38	36,5	104	100	0,0001	4,904 2,804-8,575
Present	34	26,2	96	73,8	130	100		
Family Support								
Negative	65	56,0	51	44,0	116	100	0,0001	3,022 1,763-5,181
Positive	35	29,7	83	70,3	118	100		

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Table 3 shows that higher education is significantly associated with diet adherence (p=0.0001; OR=3.250; 95% CI: 1.878–5.624). Individual intention is also significantly associated with dietary adherence (p=0.0001; OR=2.582; 95% CI: 2.055–6.241). Positive perceptions of a balanced diet are significantly associated with dietary adherence (p=0.006; OR=2.179; 95% CI: 1.284–3.696). Healthcare support is significantly associated with dietary adherence (p=0.0001; OR=4.904; 95% CI: 2.804–8.575). Family support is also significantly associated with dietary adherence (p=0.0001; OR=3.022; 95% CI: 1.763–5.181).

Table 4. Dominant Factors of Balanced Diet Compliance in Diabetes Mellitus Patients

Variable	B	P-value	OR	95%CI	
				Lower	Upper
Individual Intention	1.017	0.003	2.766	1.416	5.403
Health Worker Support	1.332	0.001	3.790	1.938	7.411
Family Support	1.456	0.001	4.288	2.060	8.926
Perception	-0.721	0.068	0.486	0.224	1.055

The findings of the multivariate analysis (Table 4) demonstrate that family support is the predominant factor with a statistically significant association with adherence to a balanced diet among diabetes mellitus patients (p=0.001; OR=4.288; 95% CI: 2.060–8.926). Individual intention and health worker support have been found to be significantly associated, albeit with comparatively lower effect sizes. In the present analysis, no significant correlation was identified between perception and the outcomes under investigation.

DISCUSSION

The present study corroborates the notion that individual intention, healthcare support, and family support are significant factors associated with adherence to a balanced diet in patients with diabetes mellitus, with family support being the dominant factor. These findings are consistent with those of previous studies, which have emphasised the importance of social support and internal motivation in improving dietary adherence in diabetic patients (Dwi Kurnia & Belqis Annisa Elya, 2023). Individual motivation and intention were also found to be key predictors of diet adherence in patients with type 2 diabetes (Rimadania et al., 2021), while physical and social barriers may influence adherence in older adults (Camapum et al., 2025).

Another important finding was the significant influence of family support, indicating that interventions involving families can improve the effectiveness of diet management in diabetic patients. Family support not only provides motivation but also assists in monitoring and reminding patients to adhere to their diet (Irawati & Firmansyah, 2020; Thalia Florencia Da Costa Cabral & Amin Samiasih, 2024). Similarly, support from health workers provides consistent education and monitoring, reinforcing the important role of health workers in the management of chronic diseases such as diabetes (Dorvlo et al., 2025). Social support from healthcare professionals and family members greatly influences patient adherence to a balanced diet. Studies in various populations confirm that patients who receive support from family and healthcare professionals have higher adherence rates (Dorvlo et al., 2025; Irawati

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& Firmansyah, 2020), in line with research showing the role of healthcare professionals as key drivers of diabetes therapy adherence (Roni et al., 2024). Other psychosocial factors such as health locus of control also contribute to dietary behaviour (Arsad et al., 2023). Individual intention or internal motivation is also important in supporting dietary adherence, as found in studies assessing the motivation of patients with type 2 diabetes and its relationship with dietary adherence (Sudrajat et al., 2023).

Educational factors and motivation also greatly influence patient diet adherence, according to a scoping review that identified intrinsic and extrinsic factors as the main determinants of diet adherence in diabetes mellitus (Rimadania et al., 2021). In addition, the use of digital technology such as mobile applications also has the potential to improve patient education and motivation, thereby positively impacting diet adherence (Alham & Puspita, 2020). Socioeconomic factors and disease duration are also important variables that can influence diet adherence patterns in diabetic patients (Manutama et al., 2024).

Barriers such as low knowledge, lack of motivation, and minimal social support remain challenges in improving dietary compliance among patients with diabetes mellitus (Haridas & Ebanezar. K, 2023). Therefore, a multidisciplinary approach that combines patient education, motivation reinforcement, and active participation from families and healthcare professionals is highly recommended to overcome these challenges (Mirahmadizadeh et al., 2020). This approach is also supported by international studies highlighting the importance of educational and social strategies to improve self-care in patients with type 2 diabetes (Regufe et al., 2024).

In practical terms, the results of this study provide a framework for health managers to systematically integrate family support and health workers into diabetes management programmes. It is hypothesised that this approach will enhance patient motivation and improve sustained diet adherence, while concomitantly reducing the risk of chronic complications. Future recommendations include the development of interventions that utilise digital technology and focus on family education to expand the positive impact (Jaworski et al., 2021).

It is important to note that the present study was conducted in a single city; therefore, the results may not be representative of conditions in other regions, which may exhibit different social, economic, and cultural characteristics. This limitation restricts the generalisation of findings to a broader population. Furthermore, the data collection method, which utilises self-reporting, may result in reporting bias from respondents. The cross-sectional design also limits the ability to determine causal relationships between the factors studied and adherence to a balanced diet. Consequently, the recommendation is for further research to be conducted with a broader geographical scope, a longitudinal design, and more objective data collection methods in order to obtain a more comprehensive understanding of the determinants of dietary adherence among diabetes mellitus patients.

CONCLUSION

The present study demonstrates that individual intention, in conjunction with health worker support and family support, is significantly associated with adherence to a balanced diet among individuals diagnosed with diabetes mellitus. The findings of this study indicate that family support is the dominant factor in this regard. It is therefore recommended that diabetes management programmes be integrated with an approach that strengthens the role of families and health workers in supporting patients. Furthermore, there is a necessity to develop motivation-based and digital technology interventions to improve dietary adherence in a sustainable manner.

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