

The Effect of Education on the Management of the DM Diet with the Plate Method on the Knowledge and Behavior of Nutrition Management in People with Diabetes Mellitus

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ABSTRACT

Diabetes mellitus (DM) is a chronic condition characterized by elevated blood sugar levels beyond normal limits. Data from the Ministry of Health in 2023 showed that 5.7 million people in the Banten region have DM, with 1.59 million in Tangerang Regency. A major factor contributing to the high prevalence of DM is the lack of knowledge about DM diet management and poor nutrition management behavior among patients. This study aims to assess the effect of DM diet management education using the plate method on knowledge and nutritional behavior of DM patients in Bencong Village, Tangerang Regency. A quasi-experimental one-group pretest-posttest design was used with 36 participants selected through purposive non-probability sampling. Instruments included a knowledge questionnaire from Dickson-Spillmann et al. (2011), an SMDM behavior questionnaire, a feedback sheet, and a plate method observation sheet. Data were analyzed using univariate and bivariate analyses with the Wilcoxon test. Results showed significant improvements in both knowledge and behavior ($p = 0.000, < 0.05$), with 100% of participants demonstrating good knowledge and 97.2% showing good behavior post-intervention. Behavioral observations from the first to third visit indicated a 77.8% increase in appropriate nutrition management behavior. This study concludes that DM diet management education using the plate method effectively enhances knowledge and nutritional behavior in DM patients. Future research should include larger samples, long-term behavioral observation, and monitoring of compliance with the plate method in DM diet management.

Keywords: DM; Behaviour; Nutritional Management; Knowledge; Plate method.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic disease characterized by metabolic disorders, especially an increase in blood glucose levels above normal values (Directorate of P2PTM of the Ministry of Health of the Republic of Indonesia, 2021). Based on data from the International Diabetes Federation (IDF, 2021), there were around 537 million cases of DM globally in 2021, with an estimated one death due to DM occurring every five seconds, reaching 6.7 million deaths in one year. In Indonesia, the prevalence of DM in 2021 was recorded at 19.47 per 1,000 population and is predicted to increase to 28.57 per 1,000 population in 2045. In Banten Province, there are around 5.75 million DM sufferers, and 1.59 million of them are in Tangerang Regency. One of the main factors contributing to the high prevalence of DM is the lack of knowledge regarding dietary management, as well as improper nutrition management behaviors. Previous research by Fatmawati and Mustin (2017) showed that dietary regulation had the strongest correlation with increased blood glucose levels in DM patients.

The results of an initial survey conducted by researchers on 11 DM patients at one of the health centers in Tangerang Regency showed that most respondents (10 out of 11) had limited knowledge about nutrition management and were less motivated to change their eating behavior. Generally, the available information places more emphasis on the number of calories in food, while practical guidelines such as the plate method—which can help with visual and simple measurements of daily consumption—are not widely available in the region.

In fact, the plate method has been proven internationally as an effective and easy-to-apply educational approach in helping patients understand the distribution of healthy food portions. However, this method is still rarely adopted in dietary education at the primary health service level in Indonesia. Several local studies, such as those conducted by Widyaningrum et al. (2023) and Susilawati and Rahmawati (2021), show that plate-method-based visual education can improve understanding and dietary adherence for type 2 DM patients. Unfortunately, its implementation is still limited and has not yet become part of standard educational practices.

This study seeks to address this gap by examining the impact of plate method-based education on the knowledge and dietary behaviors of DM patients in Bencong Village, Tangerang Regency. The research aims to (1) measure changes in patients' knowledge after the intervention, (2) evaluate improvements in their nutrition management behaviors, and (3) assess the sustainability of these changes through direct observation during home visits. The findings are expected to benefit DM patients by providing an accessible tool for better dietary practices, healthcare providers by offering evidence for integrating the plate method into standard care, and policymakers by informing community-based health strategies. Additionally, this study lays the groundwork for future research on long-term adherence and broader implementation of the plate method. By bridging the gap between knowledge and practice, this research underscores the potential of visual, contextually tailored education to empower DM patients in managing their condition effectively.

Based on this background and the outlined objectives, the researcher is interested in further studying the effect of plate method-based diet management education on increasing knowledge and changing nutrition management behavior in DM patients in community areas, especially in Bencong Village, Tangerang Regency.

METHOD

This study used a quasi-experimental design with a one-group pretest-posttest approach to evaluate the effect of dietary regulation education using the plate method on nutrition management knowledge and behavior in Diabetes Mellitus (DM) patients. The research was conducted in Bencong Village, Tangerang Regency, Banten Province, from March 22 to April 21, 2024.

The study population consisted of DM patients registered in the Chronic Disease Management Program (Prolanis) at the Jalan Emas Health Center. The sample was selected using purposive non-probability sampling, with inclusion criteria of type 2 diabetes patients diagnosed for more than one year, able to read and write, and willing to participate until the study's completion. Patients with decreased consciousness were excluded. A total of 36 respondents met the criteria and completed the entire study.

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Pelita Harapan University (No. 065/K-LKJ/ETIK/I/2024). The study adhered to ethical principles including anonymity, beneficence, justice, confidentiality, and autonomy.

Instruments included knowledge and behavior questionnaires, observation sheets, and visual educational media in the form of flip sheets. The knowledge questionnaire, adapted from Dickson-Spillmann et al., consisted of 13 statements (70% positive, 30% negative) with good reliability (Cronbach's Alpha = 0.714). The behavior questionnaire used the Self-Management Diabetes Mellitus (SMDM) framework with nine statements and demonstrated adequate reliability (Cronbach's Alpha = 0.704). The observation sheet monitored the application of the plate method during three home visits, based on Lally et al.'s (2010) habit formation theory.

Data collection began with administrative approval from the Tangerang City Health Office and Tangerang Regency. Validity and reliability tests of instruments were conducted at the Cibodasari Health Center before the main study at Jalan Emas Health Center. After obtaining informed consent, respondents completed a pre-test assessing baseline knowledge and behavior, followed by the educational intervention. They were then visited three times at home for direct behavioral observation. At the third visit, a post-test measured changes after the intervention.

Data were processed through editing, coding, cleaning, and analysis stages as outlined by Hastono in Susilo et al. Univariate analysis described respondent characteristics and the distribution of knowledge and behavior through frequency and percentage. Bivariate analysis using the Wilcoxon test assessed significant differences between pre- and post-test results for knowledge and behavior. Observational data from home visits evaluated the dynamics of behavior change over time.

RESULTS AND DISCUSSION

This section presents the findings of the study, starting with the distribution of respondent demographic data, followed by an overview of respondents' knowledge and behavior before and after the intervention, as well as analysis of significant differences and behavioral observation results.

Distribution of Respondent Demographic Data in the Bencong Village Area, Tangerang Regency.

Table 1. Description of Respondents by Gender, Age, Education Level, Occupation, and Length of Suffering from DM (n=36)

Respondent Characteristics	Frequency	Percentage (%)
Gender		
Man	9	25
Woman	27	75
Age		
45-54 years old	6	16,7
55-65 years old	15	41,7
66-74 years old	15	41,7
Education Level		
SD	12	33,3

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Respondent Characteristics	Frequency	Percentage (%)
JUNIOR	4	11,1
SMA	12	33,3
D3	1	2,8
S1	7	19,4
Work		
Housewives	23	63,9
Pensioner	10	27,8
Merchant	3	8,3
Long suffering from DM		
1-10 years	33	91,7
11-20 years	3	8,3

Source: Primary data collected through questionnaires and interviews during the study (March–April 2024)

Based on Table 1, most of the respondents were female (75%), with the dominant age range of 55–74 years (83.4%). The highest level of education is elementary and high school (33.3% each). The majority of respondents were housewives (63.9%) and had suffered from DM for 1–10 years (91.7%).

Overview of Respondents' Knowledge Before and After Educational Interventions on DM Diet Management with Plate Method

Tables 1. and 3. present an overview of respondents' knowledge before and after the educational intervention on DM diet management with the plate method.

Table 2. Respondents' Knowledge Before the Educational Intervention on DM Diet Arrangement with Plate method (n=36)

Knowledge	Frequency	Percentage (%)
Good	13	36,1
Enough	11	30,6
Less	12	33,3
Total	36	100

Source: Pre-test results using the adapted Dickson-Spillmann et al. (2011) knowledge questionnaire (Cronbach's $\alpha = 0.714$).

Before the intervention, only 13 respondents (36.1%) had a good level of knowledge about the DM diet settings, while 33.3% were in the less category.

Table 3. Respondents' Knowledge After Educational Intervention on DM Diet Settings with Plate method (n=36)

Knowledge	Frequency	Percentage (%)
Good	36	100
Enough	0	0
Less	0	0

Total	36	100
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Source: Post-test results following the plate method education intervention

After education, all respondents (100%) showed an improvement to a good level of knowledge.

Overview of Respondent Behavior Before and After Educational Intervention on DM Diet Regulation with Plate Method

Table 4. and Table 5. present an overview of respondents' behavior before and after the educational intervention of DM diet management with the plate method.

Table 4. Respondents' Behavior Before the Educational Intervention on DM Diet Regulation with Plate method (n=36)

Behaviour	Frequency	Percentage (%)
Good	3	8,3
Keep	31	86,1
Bad	2	5,6
Total	36	100

Source: Pre-intervention behavioral assessment based on the Self-Management Diabetes Mellitus (SMDM) questionnaire (Cronbach's $\alpha = 0.704$)

Before being educated, most respondents (86.1%) showed nutritional management behavior in the moderate category, and only 8.3% were classified as good.

Table 5. Respondents' Behavior After Educational Intervention on DM Diet Adjustment with Plate method (n=36)

Behaviour	Frequency	Percentage (%)
Good	35	97,2
Keep	1	2,8
Bad	0	0
Total	36	100

Source: Post-intervention behavioral assessment using the SMDM questionnaire

After education, there was a significant increase: 35 respondents (97.2%) were in the category of good behavior.

Differences in Respondents' Knowledge Before and After the DM Diet Adjustment Educational Intervention with the Plate method

Table 6. shows the results of the analysis of differences in respondents' knowledge before and after the DM diet regulation educational intervention with the plate method.

Table 6. Analysis of Differences in Respondents' Nutrition Management Knowledge Before and After Being Given DM Diet Regulatory Educational Intervention with Plate Method

n	Knowledge	Mean Rank	p-value (Asym. Sig. 2-tailed)	Meaning
Pre-test				

n	Knowledge	Mean Rank	p-value (Asym. Sig. 2-tailed)	Meaning
36	Post-test	18.50	0,000	Significant

Source: Wilcoxon signed-rank test comparing pre-test and post-test knowledge scores ($p < 0.001$)

Table 6, Statistical analysis using the Wilcoxon test shows a significant difference between the pre-test and post-test scores of knowledges with a $p <$ value of 0.001 (Table 1.6). This shows that education using the plate method is effective in improving nutritional knowledge of DM sufferers.

Differences in Respondents' Behavior Before and After the DM Diet Adjustment Educational Intervention with the Plate method

Table 7 shows the results of the analysis of differences in respondents' behavior before and after the educational intervention on the regulation of the DM diet with the plate method.

Table 7. Analysis of Differences in Respondents' Nutrition Management Behavior Before and After Being Given DM Diet Adjustment Educational Intervention with Plate Method

n	Behaviour	Mean Rank	p-value (Asym. Sig. 2-tailed)	Meaning
36	Pre-test Post-test	18.50	0,000	Significant

Source: Wilcoxon signed-rank test comparing pre- and post-intervention SMDM behavior scores ($p < 0.001$).

The results of Wilcoxon's test on behavior also showed a $p <$ value of 0.001, indicating that the changes that occurred were statistically significant (Table 1.7). Plate method education not only increases knowledge but also leads to healthier nutrition management practices.

Observation of Respondents' Behavior After the DM Diet Adjustment Educational Intervention with Plate Method at the First, Second, and Third Visits

Table 8. presents the frequency and percentage of respondents' behavioral observation results after the educational intervention on the regulation of the DM diet with the plate method through three home visits.

Table 8. Results of Respondents' Behavioral Observations During Three Home Visits After Intervention

Behavior Observation	First Visit		Second Visit		Third Visit	
	N	(%)	N	(%)	N	(%)
Appropriate	3	8,3	15	41,7	28	77,8
Not Appropriate	33	91,7	21	58,3	8	22,2
Total	36	100	36	100	36	100

Source: Direct observation data recorded during home visits, aligned with Lally et al. (2010) habit formation theory

Based on Table 8, observations were carried out to assess the consistency of respondents' behavior in applying the plate method during three home visits. At the first visit, only 8.3% of respondents showed appropriate behavior. This number increased to 41.7% on the second visit and 77.8% on the third visit.

This increase showed that educational interventions accompanied by reinforcement through direct visits had a significant impact on forming new habits in respondents.

The Effect of DM Diet Arrangement Education with Plate method on Knowledge

This study shows that diet education using the plate method significantly improves the knowledge of DM patients. Before the intervention, the majority of respondents did not understand the principle of appropriate food portion regulation. After education, all respondents showed an improvement to a good level of knowledge.

The visual approach in the plate method, by dividing the plate into three parts (vegetables, proteins, and carbohydrates), has proven effective because it simplifies complex nutritional information. This strategy is in line with the theory of Notoatmodjo (2014) which emphasizes the importance of the senses of sight and hearing in the process of knowledge formation. Visual-based education also helps patients with low levels of health literacy in understanding and remembering information (Lassiter et al., 2021; López et al., 2020).

In addition, interventions are carried out through home visits and interpersonal communication, which provide space for dialogue, clarification, and emotional engagement of patients. This supports the research results of Burch et al. (2022) and Widyaningrum et al. (2023) that contextual and interactive educational approaches strengthen understanding and build internal motivation of patients.

The Influence of Education on Nutrition Management Behavior

These findings also indicate that plate method education has a significant impact on changes in patients' eating behavior. Before education, only 8.3% of respondents showed good behavior; After the intervention, it increased to 97.2%. This shows that proper knowledge transfer can trigger behavior change.

These changes follow stages in innovation adoption theory and cognitive social theory, where education accompanied by reinforcement and repetitive practice makes it easier for patients to internalize new behaviors (Glanz et al., 2015; Notoatmodjo, 2014).

In this context, the role of nurses is very strategic as an agent of behavior change. Nurses not only convey information, but also become facilitators in the active learning process, feedback givers, and supervisors in direct practice in the patient's home environment. With therapeutic communication competencies and a holistic understanding of patient conditions, nurses are uniquely positioned to build ongoing educational relationships. This is in line with the function of community nurses in health promotion, disease prevention, and patient empowerment in the management of chronic diseases such as DM.

Behavioral Observation Results During Home Visits

Consistent improvement in appropriate behaviors shows that reinforcement through home visits and direct observation has a real impact on habit formation. These interventions facilitate behavioral adjustments in the context of the patient's daily life.

Home-based education allows for real-time feedback and live corrections. Studies by Choi et al. (2022) and Ali et al. (2021) confirm that visual education combined with regular guidance is more effective in encouraging the adoption of long-term healthy behaviors

CONCLUSION

This reaearch shows that dietary regulation education using the plate method is effective in increasing knowledge and changing nutrition management behavior in patients with diabetes mellitus. Educational approaches that are visual, contextual, and carried out through home visits have been proven to be able to bridge the gap between knowledge and practice. Education not only provides information, but also forms a meaningful and sustainable learning experience, as well as encourages the formation of self-control in chronic disease management. For future development, follow-up research with a larger and more diverse sample is recommended to validate the findings, as well as long-term monitoring to assess the sustainability of behavior change. It is also necessary to consider the integration of the dish method into primary health service standards with training for health workers, as well as the development of digital tools to expand the reach of education. At the practical level, health workers are advised to make the plate method part of the routine education of DM patients and strengthen community assistance through follow-up visits. The continuous implementation of this method has the potential to improve the quality of life of DM patients while reducing the burden on the health system.

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