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Original Research

Effect of Family Caregiver Empowerment on Binge Eating Behavior in Type 2 Diabetes Patients

Rondhianto Rondhianto[1*], Baskoro Setioputro[1], Agil Agustin[1]

[1] Faculty of Nursing, Universitas Jember, Indonesia

ABSTRACT

Background: *Improper diet arrangements in type 2 diabetes (T2D) patients can cause eating patterns to be disturbed in the form of binge eating behavior. The family can play a helping role in improving diabetes management. One of the interventions that can be given to empower families is the Family Caregiver Empowerment Model (FCEM). This study aimed to analyze the effect of FCEM on binge eating in T2D patients.*

Methods: *This study was a randomized control group pre-test and post-test design with a total sample of 85 respondents taken by cluster random sampling, divided randomly (treatment = 41; control = 44). The independent variable is FCEM, while the dependent variable is binge eating behavior. Data was collected using the Indonesian version of the Binge Eating Scale questionnaire and analyzed used the Wilcoxon sign rank test and independent T-test.*

Results: *There were differences in binge eating behavior in the treatment group before and after intervention (Z= -5.347; p=0.001), whereas in the control group, there was no difference in pre-test and post-test scores (Z= -0.599; p= 0.549). The study result showed that there was a significant difference in the average value between the treatment and control groups (t =5.017; p=0.001).*

Conclusion: *FCEM intervention can reduce binge eating behavior to increase adherence to the diabetes diet program. Nurses can use FCEM intervention to empower family caregiver to help T2D patients improve and maintain eating habits to improve diabetes self-care behaviors.*

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CONTACT
Rondhianto
✉
rondhianto@unej.ac.id
Faculty of Nursing, Universitas Jember. Jl. Kalimantan Tegalboto No.37, Jember, Jawa Timur, Indonesia.

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INTRODUCTION

Type 2 diabetes (T2D) is the most common type of diabetes worldwide (90 – 95% of all diabetes cases). T2D occurs when the body's cells fail to fully respond to insulin (insulin resistance), triggering increased insulin production. Over time, this can lead to inadequate insulin production due to pancreatic beta cells failing to meet demand,

resulting in elevated blood glucose levels (International Diabetes Federation, 2021; World Health Organization, 2024).

Globally, the prevalence of type 2 diabetes continues to increase in people under 40 years of age across all regions of the world. In 2021, there were 536.6 million people with diabetes globally, with a mortality rate of 6.7 million. The number of people with diabetes is expected to continue to increase to 642.7 million in 2030 and 783.2 million in 2045, a 46% increase. (International Diabetes Federation, 2021; World Health Organization, 2024).

Indonesia is one of the Southeast Asian countries ranked among the top 10 nations worldwide with the highest number of diabetes cases, with 10.7 million. Indonesia also holds third in diabetes prevalence, with a prevalence rate of 11.3% (International Diabetes Federation, 2021). T2D is one of the leading causes of death, and the 8th leading cause of disease burden globally, and is expected to become the second leading cause by 2050 (Institute for Health Metrics and Evaluation (IHME), 2024).

T2D patients must be able to manage their diabetes independently, including diet management. Good diet management can support better blood glucose control, thus preventing the risk of disease complications and premature death (American Diabetes Association, 2023a, 2023b; World Health Organization, 2024). However, many T2D patients are still unable to manage their diets, often encountering problems and making mistakes in managing their diets. Several studies have shown that T2D is associated with an increased risk of inappropriate eating behaviors, including binge eating (Dziewa et al., 2023; Harris et al., 2021; Lindekilde et al., 2022; Shakeri et al., 2022; Yahya et al., 2022).

Binge eating behavior is characterized by recurrent episodes of consuming large amounts of food (often rapidly and to the point of discomfort), feeling a loss of control while eating, and experiencing shame, distress, or guilt after eating (Dziewa et al., 2023; Harris et al., 2021; Shakeri et al., 2022). The estimated prevalence of binge eating disorders in T2D patients varies, but several studies indicated that 7 – 21% T2D patients had binge eating disorder (Dziewa et al., 2023; Harris et al., 2021; Lindekilde et al., 2022; Salvia et al., 2022). If binge eating behavior persists, it can worsen T2D and increase the risk of complications and mortality among T2D patients (Dziewa et al., 2023; Shakeri et al., 2022; Yahya et al., 2022).

Managing a patient's diabetes diet can involve the family, the smallest structural unit, the patient's closest environment. Families play a significant role in influencing health behaviors, providing care, facilitating recovery from illness, and serving as the primary source of emotional support and nurturing. This demonstrates the advantages of having family caregivers in improving patients' health status and enhancing their quality of life (Thongduang et al., 2022).

Families' support is needed for people with T2D, as DM requires long-term care and regular monitoring; hence, people with T2D will not experience fatigue, and diabetes self-management will remain sustained (Suyanto & Astuti, 2022). A previous study on family empowerment showed that only 48.18% family caregivers had adequate capability in T2D management (Rondhianto et al., 2020). The inability of the family, specifically the family caregiver, to manage diabetes can result in ineffective management of the patient's diabetes. Therefore, special interventions for family caregivers are needed to improve their diabetes management skills.

The family caregiver empowerment model (FCEM) is an intervention that can increase family caregivers' capacity to manage type 2 diabetes (Rondhianto, Nursalam,

et al., 2022). The primary principle of the FCEM intervention is to empower family members who act as caregivers and independently manage diabetes at home. This is achieved by strengthening fundamental family values, including internal factors such as knowledge, motivation, coping skills, and family relationships, as well as external factors involving the patient, the caregiver, and the situation.

Through successful empowerment, family caregivers experience reduced dependence on healthcare professionals, increased participation in disease management, improved disease management, and enhanced collaboration with healthcare providers (Rondhianto et al., 2020). In addition, this intervention can also reduce distress (Anastasya et al., 2024) and burnout in family caregivers (Wardani et al., 2021). In addition, previous research found that FCEM intervention can increase patient self-efficacy (Rondhianto et al., 2025) and reduce hypoglycemia-related fear in T2D patients (Rondhianto, Kushariyadi, et al., 2024).

Interventions aimed at promoting lifestyle changes can improve long-term survival in patients with T2D. Making health-promoting dietary changes can improve post-meal glycemic fluctuations, lower HbA1c, reduce diabetes-related morbidity and mortality, and improve quality of life for T2D patients (Salvia & Quatromoni, 2023; Wang et al., 2024; Ye et al., 2023). Therefore, the study aimed to analyze the effect of aimedM on Binge Eating Behavior in T2D patients.

MATERIALS AND METHODS

The randomized controlled group with pre-test and post-test design was conducted at Banjarsengon Public Health Center, Jember Regency, from March 26 to July 2, 2023. The sample T2D patients living in the Banjarsengon Public Health Center working area who met the research criteria, namely: (1) aged 20 – 79 years old, (2) living together with a family caregiver, and (3) there is only one person with diabetes in the family. Meanwhile, the exclusion criteria were: (1) hospitalization for more than one week and (2) having disabilities (blindness, deafness, speech impairment, etc.).

The number of T2D patients in Banjarsengon PHC, based on medical record data, is 613 people; however, only 300 prospective respondents who meet the research criteria are detailed as follows: Banjarsengon (39), Jumerto (18), Slawu (85), Bintoro (75), and Baratan (83). The sample size is calculated using the Federer formula $((n - 1)(t - 1) \geq 15)$. The sample results indicate 16 respondents per group, so the minimum sample size is 32. In this study, the researcher set the sample size at 90 respondents, accounting for potential drop-out, and to meet the criteria for normal sample distribution, respondents were selected using a cluster random sampling technique, carried out in stages by dividing respondents proportionally across villages (clusters).

Based on the cluster fraction sampling formula, the number of respondents per cluster was: Banjarsengon (n = 12), Baratan (n = 24), Bintoro (n = 22), Jumerto (n = 6), and Slawu (n = 26). The researcher then randomized (single-blind) each cluster (village) into two groups (intervention vs. control), with 45 respondents per group. At the end of the study, 5 respondents dropped out. Four respondents dropped out of the treatment group due to being hospitalized (1 respondent). They refused to continue the intervention (3 respondents)—one respondent dropped out of the control group due to death. The total number of respondents in this study was 85 (Figure 1).

The independent variable in this study is the FCEM intervention, while the dependent variable is Binge Eating Behavior. The FCEM intervention consists of education, training, and mentoring. The researcher conducted the intervention for ten

sessions within ten weeks. Sessions 1 to 6 focus on education and training and are run through home visits, lasting approximately ±120 minutes per session. Session 7 involves monitoring and evaluation through a home visit of about ±120 minutes. Finally, sessions 8 to 10 consist of mentoring sessions (approximately 60 minutes via telephone per session) (Rondhianto, Nursalam, et al., 2022). More details on the FCEM intervention are shown in Table 1.

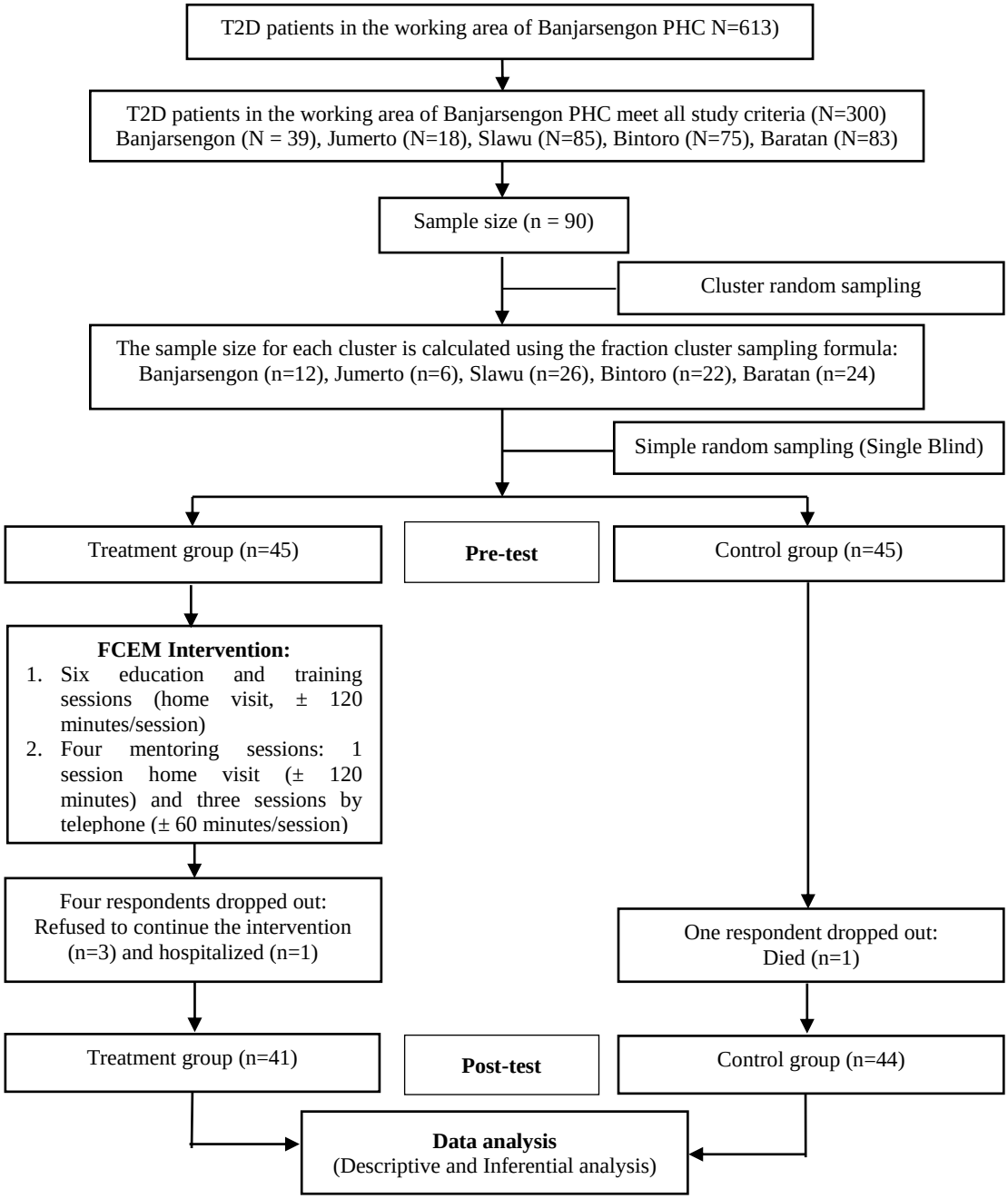


Figure 1. Flowchart study procedure

Table 1. Summary of the family caregiver empowerment model intervention

Session/ Duration	Learning outcomes (Family caregiver able to)	Topic	Learning Method	Strategy
First Session (±120')	Explain T2D basic concepts, self-management, illness management in the family context, and situational factors in T2D self-management	The basic concepts and self-management of T2D, management of illness in the family, and situational factors in T2D self-management	Lecture, discussion, and counseling	1. Build relationship 2. Provide complete and accurate information 3. Guide the assessment of support and resources 4. Help determine needs 5. Provide support in setting goals in the T2D self-management
Second Session (±120')	Explain the nurse role, filial values, and empowerment in T2D self-management	Nurse role, and empowering family caregivers in self-management of T2D		
Third Session (±120')	Demonstrate diet management	Diet management: Concept and strategy	Lecture, discussion, demonstrations, and counseling	1. Assess ability 2. Provide information 3. Strengthen the capability 4. Encourage active participation 5. Designing a strategy for implementing self-management
Fourth Session (±120')	Demonstrate physical activity management	Physical activity management: Concept and strategy		
Fifth Session (±120')	Demonstrate medication, SMBG, and foot care management	Medication, self-monitoring blood glucose, and foot care: Concept and strategy		
Six Session (±120')	Design T2D self-management plan	T2D self-management plans and prevention of complications		
Seventh Session (±120')	Face challenges in T2D	Follow-up and support for resource access (This activity is carried out so that family caregivers can carry out diabetes self-management according to the target)	Mentoring, discussion, and counseling	1. Encourage action 2. Help solve problems 3. Strengthen the ability 4. Provide information and choice of sources
Eight to Teen (± 60')	Demonstrate T2D self-management independently	Monitoring and evaluation that includes support and assistance for the continuity of quality care		1. Evaluate capability 2. Monitoring and support 3. Recognition of the role and competence

The instrument used in this study was the Indonesian version of the Binge Eating Scale (BES) questionnaire. This questionnaire was initially developed in English (Gormally et al., 1982) and has been adapted and translated into Indonesian, with validity and reliability established (r = 0.600–0.710; Cronbach's alpha = 0.980) (Audah, 2019). This questionnaire consists of 16 items on a Likert scale from 0–3 (0 = no overeating problem; 3 = severe overeating problem), divided into two domains: feelings/cognitions (8 items) and behaviors (8 items).

This questionnaire measures binge eating behavior, including discomfort, guilt, and shame after overeating, as well as behaviors related to uncontrolled overeating. The

score range is 0-48, which is categorized descriptively into none or mild problem (≤ 17), moderate (18-26), and severe (≥ 27). Before using this questionnaire, researchers conducted validity and reliability tests on 30 respondents at Patrang PHC, who had the same characteristics as those at the research location, and found the questionnaire to be valid and reliable (r = 0.465-0.748; Cronbach's alpha = 0.899; n = 30).

The researcher collected data through face-to-face, door-to-door interviews with respondents. Before collecting the data, the researcher provided a general overview of the study, its purpose, benefits, procedures, and potential risks to prospective respondents. Those who understood and agreed to participate in the study were asked to sign an informed consent form. Data were collected twice: a pre-test and a post-test. The pre-test was conducted before the FCEM intervention, and the post-test was conducted two weeks after the intervention.

The two-week post-test timeframe to measure binge eating behavior was based on several previous studies. A previous study suggests that behavioral changes in T2D patients can be evaluated at least 2 weeks after the intervention to assess the immediate reaction to the intervention, as reflected in initial behavior change (Wen et al., 2025). Behavioral compliance changes in type 2 patients can be assessed after 2 weeks of intervention (Shahabi et al., 2024). Another study suggests that a two-week post-intervention evaluation is an effective way to assess the initial success of an intervention. Two weeks post-intervention provides time for participants to demonstrate new insights and implement learned behaviors, including dietary modifications (Phudphad et al., 2024).

Data were analyzed descriptively and inferentially using SPSS version 16 software. Descriptive statistics were used to present the data for easy understanding, with measures of central tendency and dispersion presented in a frequency distribution table. Meanwhile, inferential statistics were used to draw conclusions, estimate, and predict the characteristics of a broader population from sample data. The inferential analyses used were the Wilcoxon signed-rank test (for paired-sample tests; non-normally distributed data) and the independent t-test (for independent-sample mean-difference tests; normally distributed data, namely delta binge eating behavior data for the intervention group and delta binge eating behavior for the control group). This research was conducted in accordance with the ethics of human research, namely respect for persons, beneficence, non-maleficence, and justice, and has received approval and been declared ethically suitable by the Health Research Ethics Committee, Faculty of Nursing, Universitas Jember, with number 077/UN25.1.14/KEPK/2023.

RESULTS

The results of respondents' characteristics are shown in Table 2. The number of respondents was 85. Most of the respondents were aged 46–55 years (early elderly; 43.5%), female (80%), elementary school (55.3%), unemployed or housewives (56.5%), married (83.5%), and had diabetes for less than 5 years (90.6%).

Table 2. Characteristics of the respondents

Characteristics	Treatment group (n=41)		Control group (n =44)		Total (n=85)	
	n	%	n	%	n	%
Age						
< 25 years (late adolescent)	0	0	0	0	0	0

Characteristics	Treatment group (n=41)		Control group (n =44)		Total (n=85)	
	n	%	n	%	n	%
26 – 35 years (early adulthood)	1	2.4	1	2.3	2	2.4
36 – 45 years (late adulthood)	4	9.8	6	13.6	10	11.8
46 – 55 years (early elderly)	16	39	21	47.7	37	43.5
56 – 65 years (late elderly)	13	31.7	9	20.5	22	25.9
> 65 years (old)	7	17.1	7	15.9	14	16.5
Sex						
Male	6	14.6	11	25	17	20
Female	35	85.4	33	75	68	80
Education						
No education	6	14.6	10	22.7	16	18.8
Elementary school	20	48.8	27	61.4	47	55.3
Junior high school	7	17.1	3	6.8	10	11.8
Senior high school	7	17.1	4	9.1	11	12.9
College	1	2.4	0	0	1	1.2
Occupation						
Unemployed/Housewives	24	58.5	24	54.5	48	56.5
Civil servant/Army/Police	1	2.4	1	2.3	2	2.4
Laborer	0	0	1	2.3	1	1.2
Farmer	4	9.8	4	9.1	8	9.4
Self-employed	3	7.3	7	15.9	10	11.8
Etc.	9	22	7	15.9	16	18.8
Marital status						
Unmarried	0	0	0	0	0	0
Married	31	75.6	40	90.9	71	83.5
Widow/widower	10	24.4	4	9.1	14	16.5
Diabetes duration						
< 5 years	37	90.2	40	90.9	77	90.6
> 5 years	4	9.8	4	9.1	8	9.4

Table 3. Binge Eating Behavior Category in The Treatment and Control Group

Binge eating behavior category	Treatment Group		Control Group	
	Pre-test n (%)	Post test n (%)	Pre-test n (%)	Post-test n (%)
None or mild	30 (73.2)	41 (100)	38 (86.4)	37 (84.1)
Moderate	8 (19.5)	0 (0)	6 (13.6)	7 (15.9)
Severe	3 (7.3)	0 (0)	0 (0)	0 (0)
Total	41 (100)	41 (100)	44 (100)	44 (100)

Table 3 shows that, before intervention (pre-test), respondents in the treatment group were still experiencing binge eating behavior in the moderate and severe categories (19.5%; 7.3%). In the intervention (post-test), none of the respondents experienced moderate or severe binge eating behavior (all respondents experienced binge eating behavior in the none or mild category). Table 3 also shows that in the pre-test, 13,6% respondents in the control group experienced binge eating behavior in the moderate category, which increased to 15.9% in the post-test.

Table 4. Result of Statistical Analysis

Group	Test	Normality test (p)	Mean±SD	*Wilcoxon Signed Rank Test*		*Independent t-test*	
				Z	**p**	**t**	**p**
Treatment	Pre-test	0.015	13.05±7.311	-5.347	0.001		
	Post-test	0.001	8.61±5.253				
Control	Pre-test	0.019	11.64±5.221	-0.599	0.549		
	Post-test	0.007	11.27±5.178				
Difference (Δ) of each group	Treatment group	0.125	4.44±3.225			5.017	0.001
	Control group	0.087	0.36±4.166				

The results of the Wilcoxon signed-rank test, as listed in Table 4, show a significant difference in binge eating behavior in the treatment group ($Z = -5.347$; $p = 0.001 < \alpha = 0.05$). A negative Z value indicates a significant decrease in binge eating behavior in T2D patients after the intervention. Meanwhile, in the control group, there was no difference in binge eating behavior scores between the post-test and the pre-test ($Z = -0.599$; $p = 0.549 > \alpha = 0.05$).

The results of the independent t-test indicate a significant difference in changes in binge eating behavior between the treatment and control groups ($t = -5.017$; $p\ 0.001 < \alpha = 0.05$). A positive t-value indicates that the average change in the treatment group was higher than in the control group. This difference indicates that the FCEM intervention significantly decreases binge eating behavior in T2D patients.

DISCUSSION

This study found that the family caregiver empowerment model intervention significantly reduced binge eating behavior in T2D patients. There were significant differences in binge eating behavior between the pre- and post-intervention periods in the treatment group. Meanwhile, the control group did not experience significant changes. In addition, results showed that the treatment group experienced a significant decrease in binge eating behavior compared to the control group. Previous research has shown that empowering family members who serve as family caregivers can improve their ability to manage diabetes, thereby increasing their active participation in the care of patients with diabetes (Rondhianto, Nursalam, et al., 2022).

Another study showed that a family-centered dietary intervention in patients with diabetes led to significant reductions in weight, HbA1c levels, food intake, and BMI, as well as increased physical activity, compared with the control group (Shahabi et al., 2024). These results highlight the importance of a family-centered approach in managing T2D and addressing binge eating behaviors (American Diabetes Association, 2023a; Mokhtari et al., 2023). In line with the study's findings, previous research has also shown increased patient and family awareness of the diabetic diet, along with family support, which contributes to better daily food intake among individuals with diabetes. As a result, family-centered interventions can raise awareness and promote family involvement in preparing healthier meals for people with diabetes, ultimately leading to improved diet and food intake (Horikawa et al., 2020).

In this study, most respondents were over 45 years old, placing them in the elderly category and indicating a low level of education. The sample for this study was collected in the Banjarsengon work area, which is geographically categorized as a rural

area. Individuals in this category often have difficulty managing their diabetes, especially in the context of diet management.

Previous studies have suggested that older age is associated with difficulties in managing diet, which contribute to poor control (Dey et al., 2022). Educational factors and family type are also among the main components that influence the dietary behavior of diabetic patients (Rondhianto, Ridla, et al., 2024). Low levels of education are often associated with poor dietary behavior. So, efforts to provide health education are urgent to improve dietary behavior in diabetes management.

In this study, in addition to being elderly, most of the respondents were women. Based on previous studies, people with diabetes tend to experience obstacles in managing their condition; therefore, family involvement in disease management is crucial. Previous studies show that healthy lifestyle education interventions grounded in a family-centered empowerment model can improve the lifestyles of patients with diabetes and enhance metabolic control (Someia et al., 2020). Support from a partner as a family member plays an important role in helping individuals develop a healthy lifestyle, including engaging in regular exercise and adopting healthy eating habits.

Supportive relationships are essential for improving eating disorders, such as binge eating behaviors. In marriage, couples tend to accept each other for who they are, including body image, and being overweight can result from overeating behavior. Partners also support each other in adopting a healthy lifestyle, including diabetes management and a healthy diet (Birmingham et al., 2021). However, to manage binge eating, a holistic, targeted intervention guided by each patient's needs is needed (Yahya et al., 2022). Therefore, the family's involvement as the primary source of support can be optimized to prevent and/or reduce binge eating behaviors.

The family caregiver empowerment model is one of the empowerment methods that focuses on increasing the capacity of family members who act as caregivers for diabetic patients through education and training, mentoring, and monitoring and evaluation. This intervention has been shown to increase family caregivers' capacity and capabilities to manage diabetes (Rondhianto, Nursalam, et al., 2022). Families who understand the disease and its management will find it easier to increase their capacity and capabilities, and to be involved in diabetes management and collaborate with healthcare providers in managing patients' conditions.

Good collaboration with the patient's health goals is not only beneficial for the patient. Still, it can also reduce distress and burnout, which are often experienced by families caring for diabetic patients (Anastasya et al., 2024; Wardani et al., 2021). Family caregivers who do not experience psychological problems can show a more optimal role in managing patients' diabetes so that because they can carry out family health tasks (recognizing health problems, making informed decisions, caring for sick family members, modifying the environment to support patient care, and utilizing health facilities) (Rondhianto et al., 2020) well in the management and prevention of complications of diabetes (Rondhianto, Siswoyo, et al., 2022).

Family involvement in diet management is significant in diabetes management; adequate knowledge and skills possessed by caregivers have been proven to reduce the fear of failure in disease management, such as reducing the fear of hypoglycemia (Rondhianto, Kushariyadi, et al., 2024) and also increase patient self-efficacy (Rondhianto et al., 2025; Shahabi et al., 2024). Based on social cognitive theory (SCT), family involvement can increase self-efficacy, thereby acting as a barrier to the prevention of adverse psychological effects. A person with high self-efficacy can think

logically, effectively improve, increase motivation, and selectively choose appropriate actions for himself (Alshaikh et al., 2024).

So that it can improve self-care, compliance, and quality of life for T2D patients (Olagbemide et al., 2021; Thongduang et al., 2022). In the context of diet management and the prevention of binge eating behavior. In addition to providing direct support to patients to improve self-care. Families can also serve as cue actions that provide proper dietary information, assess what can and cannot be done in relation to diet management, and provide direction and assistance in managing diet (Diriba et al., 2023; Gorrell et al., 2019; Someia et al., 2020). Specific actions taken by family members of diabetic patients, both verbal and nonverbal, are interpreted by patients as an attempt to control their health.

Depending on the situation, these actions may or may not help with independent diabetes management. Patients may appreciate this behavior because it makes them feel cared for. Sometimes, however, such actions can be perceived as too restrictive, causing stress for the patient (Chevinsky et al., 2020; Dziewa et al., 2023; Yahya et al., 2022). As a result, patients may respond by overeating and consuming large amounts of food. It is related to the cycle of overeating behavior, in which one predisposing factor is a person's psychological state under stress, which they seek to overcome by turning to overeating (Chevinsky et al., 2020; Harris et al., 2021; Yahya et al., 2022).

Positive relationships between patients and their families have been shown to increase adherence to dietary recommendations and motivation in managing diabetes. In addition, family support, by empowering family members to provide practical assistance, has increased patients' self-efficacy, fostering positive attitudes towards treatment and support, including praise and encouragement from family members (Horikawa et al., 2020; Olagbemide et al., 2021). Therefore, family members play an important role in educating individuals with diabetes about their dietary intake and in offering unwavering support.

Family participation can significantly improve patient self-efficacy, encourage positive approaches to treatment, and promote healthy living behaviors (Diriba et al., 2023). Based on the findings of this study, it is emphasized that to improve or reduce binge eating behavior, restoring a regular diet and focusing on the patient's nutritional health while maintaining a balanced diet are important considerations. Family involvement and support can significantly help patients and their family members understand symptoms and provide optimal care (Amodeo et al., 2019; Harris et al., 2021).

Empowering families through this support can reduce the triggers of binge eating behaviors and positively affect patients' self-perception. The family empowerment approach can increase patient understanding and awareness of the importance of maintaining an optimal diet in managing diabetes. Family empowerment is a practical, family-oriented approach to improving patient independence and adherence to dietary guidelines (Nizar et al., 2021).

This study has several limitations, including the relatively small sample size. However, the sample calculation meets the minimum sample size criteria. Further research can use larger sample sizes to improve accuracy by reducing the risk of error, reducing sampling error, increasing statistical power, and improving the estimation of results in line with population conditions. The following limitation is the use of self-report questionnaires, which can introduce bias, such as social desirability, recall bias, response bias, acquiescence bias, and misunderstanding.

Although the researcher in this study has stated that they will maintain confidentiality and anonymity, the potential for social desirability bias remains. In further research, if using a self-report questionnaire like this, randomizing the question order and inserting reverse-scored items may help reduce bias. This study also has limitations, including a short follow-up period. The post-test time after the intervention is 2 weeks, which only measures the immediate reaction to the intervention, which is the initial behavior change. Further studies may use more extended follow-up periods, such as 3 and 6 months, to better understand behavioral changes in T2D patients.

CONCLUSION

This study concludes that the family caregiver empowerment model is an effective intervention for reducing binge eating behavior in T2D patients. The results showed a significant decrease in binge eating behavior in the treatment group following the FCEM intervention. Theoretically, this study can serve as a reference and strengthen the evidence base for the family caregiver empowerment model, particularly in T2D patients. Practically, nurses or other health workers can use FCEM interventions to empower families to prevent overeating behaviors in people with T2D.

Family plays an important role in caring for people with T2D because they are the closest people to them and are always present. FCEM helps families provide proper patient care and teaches them how to take action if problems arise in disease management. This intervention has been shown to improve patient adherence to a diabetic diet and prevent deterioration in binge-eating behavior. Further research can be conducted with a larger sample size, thereby increasing data accuracy and improving generalizability.

In addition, it can be used to measure intervention outcomes, not just to compare baseline and 2 weeks post-intervention. However, periodic post-intervention measurements can be made. Time series analysis was conducted, such as 1 month post-intervention (2nd follow-up), 3 months post-intervention (3rd follow-up), 6 months post-intervention (4th follow-up), and 1 year post-intervention (5th follow-up), to find out more about how the tendency of behavior change occurs post-intervention so that the effectiveness of the intervention can be assessed more comprehensively.

REFERENCES

Alshaikh, A. A., Al-Qahtani, F. S., Alqahtani, S. A. M., AlFarhan, A. A., Al Nuwayhidh, A. M., Madkhali, A. M., AlQahtani, R. S., AlAsmari, A. F., Alserhani, A. S., Alqubaisi, H. A., Saeed Aldawh, Z. S., Al Bin Ahmad, A. K., & Ghazy, R. M. (2024). Exploring the self-efficacy of patients with diabetes: its role as a predictor of diabetes management and well-being. *Frontiers in Endocrinology*, *15*, 1347396. https://doi.org/10.3389/fendo.2024.1347396

American Diabetes Association. (2023a). 5. Facilitating positive health behaviors and well-being to improve health outcomes: Standards of Care in Diabetes—2023. *Diabetes Care*, *46*(Supp. 1), S68–S96. https://doi.org/10.2337/dc23-S005

American Diabetes Association. (2023b). 8. Obesity and weight management for the prevention and treatment of type 2 diabetes: Standards of Care in Diabetes—2023. *Diabetes Care*, *46*(Supp. 1), S128–S139. https://doi.org/10.2337/dc23-S008

Amodeo, G., Cuomo, A., Bolognesi, S., Goracci, A., Trusso, M. A., Piccinni, A., Neal, S. M., Baldini, I., Federico, E., Taddeucci, C., & Fagiolini, A. (2019). Pharmacotherapeutic strategies for treating binge eating disorder. Evidence from clinical trials and implications for clinical practice. *Expert Opinion on Pharmacotherapy*, *20*(6), 679–690. https://doi.org/10.1080/14656566.2019.1571041

Anastasya, I., Rondhianto, R., & A'la, M. Z. (2024). Effect of FCEM intervention on distress in caregivers of type 2 diabetes mellitus patients. *NurseLine Journal*, *9*(2), 124–131. https://doi.org/10.19184/nlj.v9i2.51742

Audah, N. (2019). Uji Validitas Konstruk Pada Instrumen The Binge Eating Scale Dengan Metode Confirmatory Factor Analysis (CFA). *Jurnal Pengukuran Psikologi Dan Pendidikan Indonesia (JP3I)*, *7*(2), 71–77. https://doi.org/10.15408/jp3i.v7i2.12098

Birmingham, W. C., Cavallini, A. Q., & Sgro, J. (2021). Spousal influence: A study of women with eating and body image concerns. *Journal of Health Psychology*, *26*(9), 1339–1352. https://doi.org/10.1177/1359105319873946

Chevinsky, J. D., Wadden, T. A., & Chao, A. M. (2020). Binge eating disorder in patients with type 2 diabetes: Diagnostic and management challenges. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *13*, 1117–1131. https://doi.org/10.2147/DMSO.S213379

Dey, S., Mukherjee, A., Pati, M. K., Kar, A., Ramanaik, S., Pujar, A., Malve, V., Mohan, H. L., Jayanna, K., & N, S. (2022). Socio-demographic, behavioural and clinical factors influencing control of diabetes and hypertension in urban Mysore, South India: A mixed-method study conducted in 2018. *Archives of Public Health*, *80*, 234. https://doi.org/10.1186/s13690-022-00996-y

Diriba, D. C., Leung, D. Y. P., & Suen, L. K. P. (2023). Effects of family-based diabetes self-management education and support programme on support behaviour amongst adults with type 2 diabetes in Western Ethiopia. *Scientific Reports*, *13*(1), 20867. https://doi.org/10.1038/s41598-023-48049-w

Dziewa, M., Bańka, B., Herbet, M., & Piątkowska-Chmiel, I. (2023). Eating disorders and diabetes: Facing the dual challenge. *Nutrients*, *15*, 3955. https://doi.org/10.3390/nu15183955

Gormally, J., Black, S., Daston, S., & Rardin, D. (1982). The assessment of binge eating severity among obese persons. *Addictive Behaviors*, *7*(1), 47–55. https://doi.org/10.1016/0306-4603(82)90024-7

Gorrell, S., Loeb, K. L., & Le Grange, D. (2019). Family-based treatment of eating disorders: A narrative review. *The Psychiatric Clinics of North America*, *42*(2), 193–204. https://doi.org/10.1016/j.psc.2019.01.004

Harris, S. R., Carrillo, M., & Fujioka, K. (2021). Binge eating disorder and type 2 diabetes: A review. *Endocrine Practice*, *27*(2), 158–164. https://doi.org/10.1016/j.eprac.2020.10.005

Horikawa, C., Hatta, M., Morikawa, S. Y., Takeda, Y., Takeuchi, M., Fujihara, K., Kato, N., Yokoyama, H., Kurihara, Y., Iwasaki, K., Tanaka, S., Maegawa, H., & Sone, H. (2020). Family support for medical nutritional therapy and dietary intake among japanese with type 2 diabetes (Jddm 56). *Nutrients*, *12*(9), 1–15. https://doi.org/10.3390/nu12092649

Institute for Health Metrics and Evaluation (IHME). (2024). *GBD Foresight Visualization*. IHME, University of Washington. https://vizhub.healthdata.org/gbd-foresight

International Diabetes Federation. (2021). *IDF Diabetes Atlas* (10th ed.). International Diabetes Federation. www.diabetesatlas.org

Komite Etik Penelitian dan Pengembangan Kesehatan Nasional Kementerian Kesehatan RI. (2021). *Pedoman dan standar etik penelitian dan pengembangan kesehatan nasional*. Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan. https://repository.badankebijakan.kemkes.go.id/id/eprint/4214

Lindekilde, N., Scheuer, S. H., Rutters, F., Knudsen, L., Lasgaard, M., Rubin, K. H., Henriksen, J. E., Kivimäki, M., Andersen, G. S., & Pouwer, F. (2022). Prevalence of type 2 diabetes in psychiatric disorders: An umbrella review with meta-analysis of 245 observational studies from 32 systematic reviews. *Diabetologia*, *65*(3), 440–456. https://doi.org/10.1007/s00125-021-05609-x

Mokhtari, Z., Mokhtari, S., Afrasiabifar, A., & Hosseini, N. (2023). The effect of family-centered intervention on key indicators of diabetes management and control in patients with type-2 diabetes. *International Journal of Preventive Medicine*, *8*(5), 1–7. https://doi.org/10.4103/ijpvm.IJPVM

Nizar, A. M. N., Kusnanto, & Lilik Herawati. (2021). Effectiveness of Family Empowerment towards Diet Compliance and Family Independence in Caring for Family Members with Diabetes Mellitus: A Systematic Review. *Poltekita : Jurnal Ilmu Kesehatan*, *15*(1), 9–19. https://doi.org/10.33860/jik.v15i1.435

Olagbemide, O. J., Omosanya, O. E., Ayodapo, A. O., Agboola, S. M., Adeagbo, A. O., & Olukokun, T. A. (2021). Family support and medication adherence among adult type 2 diabetes: Any meeting point? *Annals of African Medicine*, *20*(4), 282–287. https://doi.org/10.4103/aam.aam_62_20

Phudphad, T., Teravecharoenchai, S., Khemtong, P., & Suksatan, W. (2024). Examining the impact of a behavior modification program on disease prevention behaviors among individuals at risk of diabetes: A quasi-experimental investigation. *European Journal of Investigation in Health, Psychology and Education*, *14*, 1969–1980. https://doi.org/10.3390/ejihpe14070131

Rondhianto, Nursalam, Kusnanto, & Melaniani, S. (2022). The effect of family caregiver empowerment interventions on family caregiver capabilities in self-management of type 2 diabetes mellitus in Indonesia. *Enfermeria Clinica*, *32*(6), 385–395. https://doi.org/10.1016/j.enfcle.2022.01.005

Rondhianto, R., Hakam, M., & Al Alawi, R. I. (2025). Effect of the family caregiver empowerment model intervention on the self-efficacy of people with type 2 diabetes mellitus. *Jurnal Keperawatan Soedirman*, *20*(1), 7–15. https://doi.org/10.20884/1.jks.2025.20.1.9388

Rondhianto, R., Kushariyadi, K., & Rahmatullah, M. N. (2024). The effect of family caregiver empowerment model intervention on fear of hypoglycemia in people with type-2 diabetes mellitus. *Nurse Media Journal of Nursing*, *14*(2), 267–278. https://doi.org/10.14710/nmjn.v14i2.56893

Rondhianto, R., Nursalam, N., Kusnanto, K., & Melaniani, S. (2020). Development of family caregiver empowerment model (FCEM) to improve family caregiver capability on type 2 diabetes self-management. *Systematic Reviews in Pharmacy*, *11*(6), 1042–1051. https://doi.org/10.31838/srp.2020.6.149

Rondhianto, R., Ridla, A. Z., & Hasan, H. (2024). Sociodemographic factors affecting diabetic dietary behavior in people with type 2 diabetes mellitus. *Jurnal Kesehatan Masyarakat*, *19*(3), 429–437. https://doi.org/10.15294/kemas.v19i3.37856

Rondhianto, R., Siswoyo, S., & Fathoni, A. (2022). Effectiveness of empowerment-based diabetes education on diabetes complication prevention: A systematic review. *Jurnal Aisyah : Jurnal Ilmu Kesehatan*, *7*(4), 1123–1130. https://doi.org/10.30604/jika.v7i4.1308

Salvia, M. G., & Quatromoni, P. A. (2023). Behavioral approaches to nutrition and eating patterns for managing type 2 diabetes: A review. *American Journal of Medicine Open*, *9*, 100034. https://doi.org/https://doi.org/10.1016/j.ajmo.2023.100034

Salvia, M. G., Ritholz, M. D., Craigen, K. L. E., Care, W. B., & Quatromoni, P. A. (2022). *Managing Type 2 Diabetes and Binge Eating Disorder: A Qualitative Study of Patients' Perceptions and Lived Experiences*. *10*(2), 1–18.

Shahabi, N., Javdan, G., Hosseini, Z., Aghamolaei, T., Ghanbarnejad, A., & Behzad, A. (2024). A health promotion model-based intervention to enhance treatment adherence in patients with type 2 diabetes. *BMC Public Health*, *24*(1), 1943. https://doi.org/10.1186/s12889-024-19452-3

Shakeri, Z., Mardali, F., Farahani, M. A., Alemrajabi, M., & Mottaghi, A. (2022). Comparison of eating disorders and eating behaviors in adults with and without type 2 diabetes prior to bariatric surgery. *Journal of Eating Disorders*, *10*(107). https://doi.org/10.1186/s40337-022-00623-9

Someia, N., Atri, S., Areshtanab, H., Salehi-Pourmehr, H., & Farshbaf-Khalili, A. (2020). Effectiveness of education based on family-centered empowerment model on health-promoting behaviors and some metabolic biomarkers in elderly women: A stratified randomized clinical trial. *Journal of Education and Health Promotion*, *9*(1), 331. https://doi.org/10.4103/jehp.jehp_520_20

Suyanto, S., & Astuti, S. L. D. (2022). Differences In Level Of Spiritual Well-Being Of Patients With Type 2 Diabetes Mellitus In Urban And Rural Areas. *JKG (Jurnal Keperawatan Global)*, *7*(1), 10–18. https://doi.org/10.37341/jkg.v0i0.404

Thongduang, K., Boonchieng, W., Chautrakarn, S., & Ong-Artborirak, P. (2022). The influence of family caregiver knowledge and behavior on elderly diabetic patients' quality of life in Northern Thailand. *International Journal of Environmental Research and Public Health*, *19*(10216), 1–14. https://doi.org/10.3390/ijerph191610216

Wang, B., Fu, Y., Tan, X., Wang, N., Qi, L., & Lu, Y. (2024). Assessing the impact of type 2 diabetes on mortality and life expectancy according to the number of risk factor targets achieved: An observational study. *BMC Medicine*, *22*(144). https://doi.org/10.1186/s12916-024-03343-w

Wardani, N. P. E., Rondhianto, & Ridla, A. Z. (2021). Effect of family caregiver empowerment on burnout in caregiver type 2 diabetes. *Jurnal Ilmu Kesehatan*, *8*(2), 83–91. https://doi.org/10.33006/jikes.v8i2.798

Wen, A., Wu, K., & Ji, M. (2025). Behaviour change techniques used in the dietary management of patients with type 2 diabetes: A systematic review and meta-analysis. *Journal of Clinical Nursing*, *34*(8), 3101–3118. https://doi.org/https://doi.org/10.1111/jocn.17782

World Health Organization. (2024). *Diabetes*. https://www.who.int/news-room/fact-sheets/detail/diabetes

Yahya, A. S., Khawaja, S., Williams, P. S., & Naguib, M. (2022). Binge eating disorder and type 2 diabetes: epidemiology and treatment approaches. *Progress in Neurology and Psychiatry*, *26*(2), 33–37. https://doi.org/https://doi.org/10.1002/pnp.749

Ye, J., Wu, Y., Yang, S., & Zhu, D. (2023). The global, regional and national burden of type 2 diabetes mellitus in the past, present and future: A systematic analysis of the Global Burden of Disease Study 2019. *Frontiers in Endocrinology*, *14*(1192629). https://doi.org/10.3389/fendo.2023.1192629