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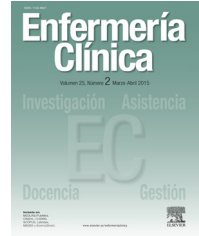
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ORIGINAL ARTICLE

The effect of family caregiver empowerment interventions on family caregiver capabilities in self-management of type 2 diabetes mellitus in Indonesia

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KEYWORDS

Type 2 diabetes mellitus;
Family caregiver;
Empowerment;
Self-management

Abstract

Objective: Empowering family caregivers is one of the strategies to increase the family caregiver's capability in T2DM self-management. The adequate capability of family caregivers in T2DM self-management can improve T2DM management, impacting people's health status with T2DM. This study aimed to examine the effect of family caregiver empowerment intervention on the family caregiver's T2DM self-management capability.

Methods: This study is an experimental study with a randomized control group pre-test post-test design. The sample size is 60 respondents by simple random sampling, which is divided into two groups randomly. The treatment group ($n = 30$) received 10-session intervention in 10 weeks (six education and training sessions and four mentoring sessions), and the control group ($n = 30$) received standard care. Data were collected using a questionnaire, twice, before and after the intervention (12 weeks after the last intervention session) and analysed descriptively and statistically (One way-ANOVA test, dependent t -test, and independent t -test).

Results: The empowerment intervention significantly increased the family caregiver's T2DM self-management capability, including diet management ($t = 4.070$; $p < .001$), physical activity management ($t = 9.493$; $p < .001$), medication management ($t = 4.021$; $p < .001$), self-monitoring blood glucose levels ($t = 2.789$; $p < .001$), and foot care skills ($t = 6.835$; $p < .001$).

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Conclusion: Family caregiver empowerment interventions can improve the capability of family caregivers in self-management of T2DM, including increasing the capability to manage diet, physical activity, medication, self-monitoring blood glucose levels, and foot care. Nurses can empower family members as family caregivers to improve self-management of T2DM.
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PALABRAS CLAVE

Diabetes mellitus tipo 2;
Cuidador familiar;
Empoderamiento;
Autogestión

Efecto de las intervenciones de empoderamiento de los cuidadores familiares sobre las capacidades de estos para gestionar la diabetes mellitus tipo 2 en Indonesia

Resumen

Objetivo: Empoderar a los cuidadores familiares es una de las estrategias para incrementar la capacidad de dichas personas en cuanto a autogestión de la DMT2. La capacidad adecuada de los cuidadores familiares en términos de autogestión de la DMT2 puede mejorar la gestión de esta, repercutiendo en el estatus sanitario de la persona. El objetivo de este estudio fue examinar el efecto de la intervención de empoderamiento del cuidador familiar sobre la capacidad de autogestión de la DMT2.

Métodos: Se trata de un estudio experimental con un diseño de grupo control aleatorio pretest posttest. El tamaño de la muestra es de 60 participantes por muestreo aleatorio simple, que se divide aleatoriamente en dos grupos. El grupo de tratamiento (n = 30) recibió una intervención de 10 sesiones en 10 semanas (seis sesiones educativas y formativas y cuatro sesiones de tutoría), y el grupo control (n = 30) recibió cuidados estándar. Los datos fueron recopilados utilizando un cuestionario, dos veces: antes y después de la intervención (12 semanas tras la última sesión de intervención), y fueron analizados descriptiva y estadísticamente (prueba ANOVA unidireccional, prueba t dependiente, y prueba t independiente).

Resultados: La intervención de empoderamiento incrementó significativamente la capacidad de autogestión de la DMT2 por parte del cuidador familiar, incluyendo la gestión de la dieta (t = 4,070; p < 0,001), gestión de la actividad física (t = 9,493; p < 0,001), gestión de la medicación (t = 4,021; p < 0,001), automonitorización de los niveles de glucosa (t = 2,789; p < 0,001), y técnicas sobre cuidados de los pies (t = 6,835; p < 0,001).

Conclusión: Las intervenciones de empoderamiento de los cuidadores familiares pueden mejorar la capacidad de autogestión de la DMT2 por su parte, incluyendo el incremento de la capacidad para gestionar la dieta, la actividad física, la medicación, la automonitorización de los niveles de glucosa, y el cuidado de los pies. Las enfermeras pueden empoderar a los miembros de la familia como cuidadores familiares para mejorar la autogestión de la DMT2.

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What is known

The empowerment of the family caregiver in the self-management of DM Type 2 is an intervention that focuses on strengthening the fundamental values of family caregivers in the self-management of Type 2 DM. the ability of family caregivers in self-management of type 2 DM. Practically, the novelty of intervention to empower family caregivers in self-management of type 2 DM.

What it contributes

The results of this study can contribute to the development of nursing science, especially in nursing care for patients with Type 2 DM, and as a source of information, referrals, and reference material for empowering family members as family caregivers in the independent management of Type 2 DM. This study can use as a guideline for nurses in implementing empowerment programs for family caregivers in the self-management of Type 2 DM.

Introduction

Type 2 Diabetes Mellitus (T2DM) is a chronic disease, 90–95% of total diabetes cases, and that is currently a priority for treatment in the world.¹ Indonesia is one of the countries with the highest number of people with T2DM. In 2015, the number of people with T2DM was 10 million; in 2017, it was 10.3 million; in 2019, it was 9.3 million, and in 2030, it is predicted to increase to 10.2 million.² Sustainable self-management is needed as part of comprehensive T2DM management to prevent complications and enhance quality of life.² Families as primary care providers must act as family caregivers^{3,4}; therefore, they must have adequate abilities in T2DM self-management.⁵ The results of previous studies have shown that the family has a very important role in the management of diabetes.⁶ Family involvement in diabetes management is one of the strategies that can be done by health workers to get optimal diabetes management results.^{7,8} The results of several previous studies indicate that diabetes education interventions for families can develop healthy family behaviors, so that families can provide emotional and psychological support for patients with diabetes and promote diabetes self-management behavior,⁹ thereby improving health outcomes.^{10,11}

However, several studies showed that most families do not have yet adequate skills in the T2DM self-management.^{9–11} Only 46.82% of families had self-management in the good category.¹² Even the results of a preliminary study in Jember District showed most families (80%) could not carry out the T2DM self-management. Families' inability to perform diabetes management independently can lead to increased health problems and complications for people with T2DM. Other negative impacts are increasing need for care and treatment costs, decreased quality of life, reduced life expectancy, and increasing the risk of premature death and death due to diabetes.^{2,13}

Family empowerment is one of the strategies that nurses can do to increase the family's capability to manage diseases.^{14,15} To empower family caregivers can increase knowledge and skills,^{3,4} reduce distress, increase the sense of coherence and situation control, growth and development of personal abilities, and increase self-satisfaction.¹⁶ The empowerment of family caregivers can also increase mind and body positive control, foster positive feelings, increase proactive caregiving, and increase constructive relationships with the environment to increase the family caregiver's ability to manage disease independently.¹⁷ This study aimed to examine the effect of family caregiver empowerment intervention on the family caregiver's T2DM self-management capability.

Methods

Experimental study with a randomized control group pre-test post-test design conducted from June to October 2020 at Jember District. The sample inclusion criteria were: (1) a spouse or adult child of people with T2DM; (2) living together with people with T2DM; (3) Only one person with T2DM in the family; (4) patients diagnosed with T2DM ≥ 1 year; and (5) have health insurance. The sample size was estimated based

on the previous study regarding family caregiver capacity building.¹⁸ Based on the Federer formula, the minimum sample size for each group is 18 respondents. We enrolled 60 family caregivers (treatment $n=30$; control $n=30$) to obtain sufficient statistical power = 0.8; $\alpha=0.05$, randomly using simple random sampling. In this study, all respondents can follow the study procedure until the ends (Fig. 1).

The study variables consisted of family caregiver empowerment interventions as an independent variable and family caregivers' T2DM self-management capability as dependent variables. The treatment group received an intervention while the control group received standard care, namely health education from health workers conducted once a month, with a duration of about 60 min. The intervention was carried out in 10 sessions in 10 weeks, namely six education and training sessions (home visit, ± 120 min, each session) and four mentoring sessions (one home visit, ± 120 min; and telephone calls three times, ± 60 min, each session). Education and training are conducted with contextual and adult learning using interactive learning media (modules, audiovisuals, and teaching aids). Mentoring are conducted to correct improper self-management, provide support and access to resources, and ensure continuity of quality care (Table 1).

Data were collected using a sociodemographic and the T2DM self-management questionnaire. The sociodemographic questionnaire contains questions about age, gender, marital status, education and income level, ethnicity, and kinship. T2DM self-management questionnaire was adapted from the Diabetes Management Self Efficacy Scale.¹⁹ This questionnaire consists of 20 items with a Likert scale of 1–5. It is, contains questions about diet management (10 items), physical activity management (3 items), medication management (3 items), SMBG management (3 items), and foot care skills (1 item). The validity was 0.425–0.839, and the reliability was 0.752.

Researchers carried out data collection by measuring before and after the intervention (12 weeks after intervention). Descriptive analysis was conducted to describe the characteristics of respondents and variables. The variable of family caregiver capability was categorized based on the normal distribution model using theoretical mean (μ) and standard deviation (σ). Self-management capability was categorized into 3 categories (low = <46.67 ; medium = $46.67-73.32$, high = ≥ 73.33). Diet management (low = <23.33 ; medium = $23.33-36.66$; high = ≥ 36.67). Physical activity, medication, and SMBG management (low = <7 ; medium = $7-10.99$; high = ≥ 11), and foot care skills (low = <2.33 ; medium = $2.33-3.66$; high = ≥ 3.67). One way-ANOVA test was used to determine family caregivers' T2DM self-management capability based on sociodemographic characteristics. Meanwhile, to determine the effect of empowerment interventions using the dependent and independent t-test. All study procedures were approved by the ethics committee of the Faculty of Nursing Universitas Airlangga. In addition, before conducting the study, the researcher informed the respondents about the objectives, benefits, time, procedures, dangers, and compensation obtained by the respondents. Family caregivers who are willing to become respondents are then asked to sign the study consent form.

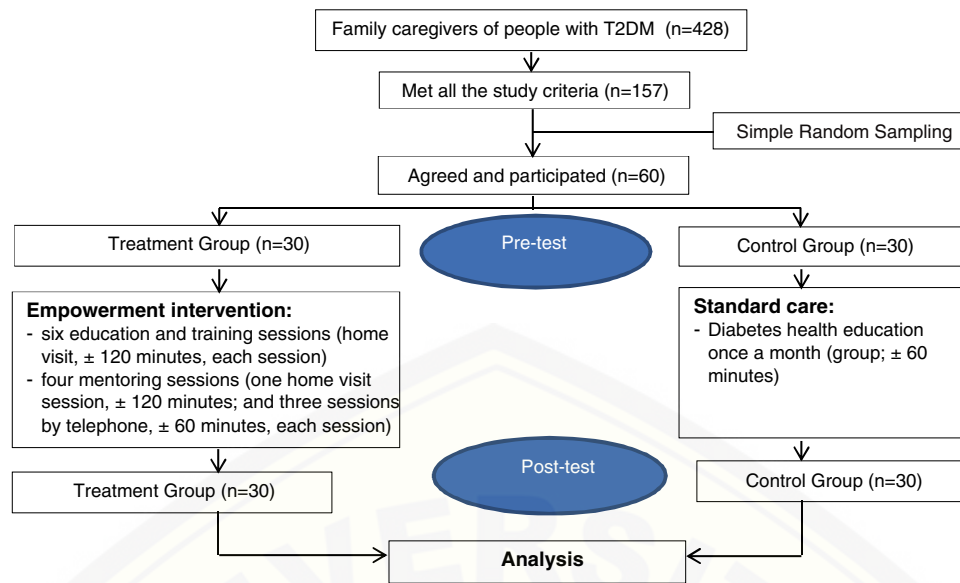


Figure 1 Flow chart of procedure.

Results

Respondent characteristics

In this study, there were no respondents who resigned or drop out so that all respondents could follow the study procedures until this research ended (treatment group $n=30$; control group $n=30$). The study results showed that the respondents' characteristics in the treatment and control groups were almost the same and homogeneous ($p > \alpha = 0.05$) (Table 2).

Family caregiver's T2DM self-management capability

In the pre-test, most of the family caregivers in the treatment and control groups had T2DM Self-Management Capability in the medium category (73.30% vs. 66.70%). Family Caregiver's T2DM self-management both groups was increased in post-test. However, the treatment group was higher than the control group (18.40 vs. 6.57). It causes all respondents in the treatment group to have T2DM self-management in the high category (100%), while the control group is mostly still in the medium category (56.7%) (Table 3). Based on the one-way ANOVA test results (Table 4), there is a difference in the family caregiver's T2DM self-management capability before intervention based on education level ($p = 0.008$). Family caregiver with a higher level of education have better T2DM self-management capability, namely diet ($p = 0.032$), physical activity ($p = 0.031$), medication ($p = 0.003$), SMBG ($p = 0.038$), and foot care ($p = 0.029$).

The effect of family caregiver empowerment intervention

Based on the results of the dependent t -test (Table 5), there is a significant difference in T2DM self-management

between the pre-test and post-test in both groups ($p < \alpha = 0.05$). However, based on the independent t -test, there is a significant difference between treatment and control groups ($t = 8.886$; $p = 0.001 < \alpha = 0.05$). Specifically for each component, namely diet, physical activity, medication, SMBG, and foot care ($t = 4.070$; $t = 9.493$; $t = 4.021$; $t = 2.789$; $t = 6.835$; $p = 0.001 < \alpha = 0.05$). The results of the independent t -test were strengthened by the results of One way-ANOVA test which showed that after intervention, there was a significant difference in T2DM self-management between the two groups, generally and for each component ($p < \alpha = 0.05$). This study indicates that the family caregiver empowerment intervention increases T2DM self-management capability significantly.

Discussion

The family is the primary care provider for people with T2DM, so they must act as family caregivers.^{3,4} Ignorance of disease management causes the family to be unable to perform the role as family caregiver.⁷ Before the intervention most of the respondents had T2DM self-management capability in the medium category (Table 2), and influenced by education level. The higher the education level, which means the better the knowledge, the better their abilities. The results of this study are consistent with the previous study, which state that knowledge is one-factor affecting T2DM self-management capability.²⁰ Nurses can improve the ability of family caregivers by empowerment,¹⁴ to increase the ability to manage T2DM independently.²¹ Empowerment enables families to adjust their roles to assist family members in disease management.^{15,22} Some actions in empowerment are providing information about disease management, training technical and problem-solving skills, assistance and consultation during the period of continuous care and follow-up, and providing support.²³

The study results showed that the family caregiver empowerment intervention significantly affected T2DM

Table 1 Summary of family caregiver empowerment interventions.

Sessions/time	Learning outcome (family caregiver able to)	Material	Method	Strategy
Session 1 (120')	Explain basic concepts of T2DM, self-management, illness management in the family, and situational factors in T2DM self-management	T2DM concepts Self-management concepts Illness management in the family Situational factors in self-management	Lectures, discussions, 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 T2DM self-management
Session 2 (120')	Explain the role of nurses, filial values, and empowerment in T2DM self-management	The role of nurses Filial values concepts Empowerment concepts		
Session 3 (120')	Demonstrate the diet management	Diet management	Lectures, discussions, demonstrations, and counseling	1. Assess ability 2. Provide information 3. Strengthen the capability 4. Encourage active participation 5. Designing strategies for implementing self-management
Session 4 (120')	Demonstrate the physical activity management	Physical activity management		
Session 5 (120')	Demonstrate medication, SMBG, and foot care management	Medication, SMBG, and foot care management		
Session 6 (120')	Design T2DM self-management plan	T2DM self-management planning		
Session 7 (120')	Face challenges in T2DM self-management	Discussion and about implementation: obstacles, strengths, resources and strategies to face challenges	Discussions and counseling	1. Encourage action 2. Help solve problems 3. Strengthen the ability 4. Provide information and choice of sources
Session 8–10 (60')	Demonstrate T2DM self-management independently	Evaluation of T2DM self-management skills and strategies to overcome problems		1. Evaluate capability 2. Monitoring and support 3. Recognition of the role and competence

self-management capability. The empowerment intervention was given to the treatment group adjusted to the family caregiver and family's conditions and abilities and gradually provided education, training, and mentoring. Education and training with adults and contextual learning were conducted to increase knowledge about disease and skill disease management. While mentoring is conducted by monitoring and evaluating. Monitoring and evaluation are carried out to correct improper self-management, provide support and access to resources to increase self-confidence and competence, and ensure quality care for people with T2DM. These study results are consistent with previous studies, which state that empowerment interventions can increase the family caregiver's ability to manage disease.¹⁸ Empowerment by providing education combined with technical skills training and mentoring can increase knowledge and skills and foster sustainable positive attitudes and behaviors in

disease management.^{15,24} Empowerment interventions can increase knowledge, motivation, spirituality, coping, family coherence, and family support to strengthen the family caregiver's filial values. Strengthening filial values will make family caregivers able to pass empowerment stages and improve T2DM self-management capability.²⁰ Empowerment interventions for the family can increase knowledge, motivation, self-confidence, coping that can reduce negative stressors, improve technical skills and self-care monitoring, improve T2DM self-management capability.^{9–11}

The study results showed that the family caregiver empowerment intervention could improve the family caregiver's ability to manage diabetes diet, physical activity, medication, SMBG, and foot care. The results of this study are consistent with the previous study, which state that education can improve the family's ability to manage diabetes diet,^{9,11} improve the family's ability to manage physical

Table 2 Respondents characteristics.

No	Characteristics	Treatment group (n = 30)	Control group (n = 30)	Total (n = 60)	Homogeneity of variance test (p-value)
		Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	
1	Age	46.47 ± 12.13	46.50 ± 9.85	46.48 ± 10.99	0.991
2	Gender				0.792
	Female	18 (60%)	19 (63.30%)	37 (61.67%)	
	Male	12 (40%)	11 (36.70%)	23 (38.33%)	
3	Education				0.527
	No	2 (6.67%)	1 (3.33%)	3 (5%)	
	Basic	19 (63.33%)	19 (63.33%)	38 (63.33%)	
	Middle	3 (10%)	2 (6.67%)	5 (8.33%)	
	High	6 (20%)	8 (26.67%)	14 (23.33%)	
4	Income				1.000
	<District Minimum Wage	20 (66.70%)	20 (66.70%)	40 (66.67%)	
	≥District Minimum Wage	10 (33.30%)	10 (33.30%)	20 (33.33%)	
5	Marital status				0.557
	Married	29 (96.70%)	28 (93.30%)	57 (95%)	
	Unmarried	1 (3.30%)	2 (6.70%)	3 (5%)	
6	Ethnicity				0.608
	Javanese	15 (50%)	13 (43.30%)	28 (46.67%)	
	Madurese	15 (50%)	17 (56.70%)	32 (53.33%)	
7	Kinship				0.163
	Child	13 (43.33%)	12 (40%)	25 (41.67%)	
	Spouse	17 (56.67%)	18 (60%)	35 (58.33%)	

activity,¹¹ reduce stressors and increase the ability to manage medications,^{10,11} improve family knowledge and skills in monitoring blood glucose levels,^{9,11} and improve the family's ability to do foot care to people with T2DM.^{10,11} Empowerment interventions regarding diet management are given according to the family caregivers and family conditions. They are carried out in stages, covering basic dietary knowledge, goals and benefits, dietary principles and dietary composition of diabetes diet, calorie needs, diabetes diet choices, and a list of the ingredients to replace the diabetes diet. The family caregiver also trained by demonstrating how to calculate calorie needs and selecting menus tailored to people with T2DM. So that the family can regulate the diet as expected. Providing education and guidance adjusted to family conditions can increase knowledge, skills, and compliance in carrying out a diabetes diet program.^{8,25} The family support will increase people with T2DM's compliance in physical activity programs.²⁶ Family caregivers received education about benefits, types, principles, and procedures of physical activity. They also receive training adjusted to the people with T2DM condition. Increased knowledge, skills and support from health worker will increase family caregivers' motivation, coping, and positive attitudes in helping people with T2DM. Education is arranged according to the needs and conditions of people with T2DM, and interactive discussions can increase skills and compliance in carrying out physical exercise programs.²⁷

Non-adherence to medication is an essential factor that causes failure in diabetes management.²⁷ The ability and family support greatly influenced people with T2DM adherence to undergo medication programs.²⁶ Providing proper education to family caregivers will make them understand medication goals, use the right drugs, monitor treatment results, and make treatment adjustments to increase their ability to manage medication.⁸ Regular SMBG is useful for knowing the impact of management and strengthening the behavior of proper diabetes management.⁸ Families' inability to monitor blood sugar levels can impact people's health status with T2DM.²⁷ Therefore, health workers' education and support are needed so that family caregivers. Education and training related to basic concepts, strategies, principles, and procedures for SMBG can increase family caregivers' knowledge and skills in monitoring blood sugar levels. This study's results are consistent with previous studies that state education on blood glucose level monitoring designed in a structured and therapeutic can facilitate increasing SMBG capability.⁸ The results showed that empowering family caregivers can improve the ability to care for diabetic feet. The increase in foot care skills in the treatment group was due to empowerment interventions. Family caregivers were received an education, training skills, mentoring about foot care. The family caregiver will understand the risk of diabetic ulcers and take diabetic foot prevention. Besides, family caregivers

Table 3 Family caregiver's T2DM self-management capability.

No	Variable	Treatment group			Control group			Difference between treatment and control group					
		Pre-test (n = 30)		Post-test (n = 30)		Pre-test (n = 30)		Post-test (n = 30)		Pre-test (n = 30)		Post-test (n = 30)	
		Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	Mean ± SD or n (%)	p-Value	CI 95%	p-Value	CI 95%
1	<i>Diet</i>	33.43 ± 5.79	41.03 ± 2.43	33.27 ± 4.14	37.00 ± 3.92	0.898	-2.439	2.348-2.769	0.001				
	Low	2 (6.70%)	0 (0%)	0 (0%)	0 (0%)		to						
	Medium High	18 (60%) 10 (33.30%)	0 (0%) 30 (100%)	21 (70%) 9 (30%)	17 (56.70%) 13 (43.30%)			2.769					
2	<i>Physical activity</i>	9.57 ± 1.96	13.20 ± 1.13	10.67 ± 1.63	10.97 ± 1.56	0.051	-2.030	1.529-2.938	0.001				
	Low	2 (6.70%)	0 (0%)	0 (0%)	0 (0%)		to						
	Medium High	16 (53.30%) 12 (40%)	0 (0%) 30 (100%)	15 (50%) 15 (50%)	14 (46.70%) 16 (53.30%)			-0.169					
3	<i>Medication</i>	10.60 ± 2.72	12.70 ± 1.26	10.23 ± 1.85	10.60 ± 1.81	0.544	-0.836	1.293-2.907	0.001				
	Low	3 (10%)	0 (0%)	1 (3.30%)	1 (3.30%)		to						
	Medium High	11 (36.70%) 16 (53.30%)	0 (0%) 30 (100%)	14 (46.70%) 15 (50%)	11 (36.70%) 18 (60%)			1.570					
4	<i>SMBG</i>	8.80 ± 2.34	11.93 ± 1.20	7.73 ± 2.39	9.63 ± 2.04	0.086	-0.156	1.434-3.165	0.001				
	Low	6 (20%)	0 (0%)	9 (30%)	3 (10%)		to						
	Medium High	16 (53.30%) 8 (26.70%)	0 (0%) 30 (100%)	18 (60%) 3 (10%)	17 (56.70%) 10 (33.30%)			2.289					
5	<i>Foot care</i>	2.33 ± 1.16	4.27 ± 0.79	2.60 ± 1.48	2.87 ± 1.48	0.493	-0.951	0.788-2.012	0.001				
	Low	18 (60%)	0 (0%)	17 (56.70%)	14 (46.70%)		to						
	Medium High	5 (16.70%) 7 (23.30%)	6 (20%) 24 (80%)	4 (13.30%) 9 (30%)	5 (16.70%) 11 (36.70%)			0.418					
6	<i>DSM capability</i>	64.73 ± 10.23	83.13 ± 5.26	64.50 ± 10.02	71.07 ± 8.75	0.929	-5.000	8.334-15.799	0.001				
	Low	2 (6.70%)	0 (0%)	1 (3.30%)	0 (0%)		to						
	Medium High	22 (73.30%) 6 (20%)	0 (0%) 30 (100%)	20 (66.70%) 9 (30%)	17 (56.70%) 13 (43.30%)			5.467					

Table 4 Family caregiver's T2DM capability before intervention based on sociodemographic.

No	Variable	Mean ± SD	Age p-Value	Gender p-Value	Education p-Value	Income p-Value	Marital p-Value	Ethnicity p-Value	Kinship p-Value
1	<i>Diet</i>								
	Treatment	33.43 ± 5.79	0.753	0.607	0.030	0.528	0.789	0.202	0.681
	Control	33.27 ± 4.14	0.141	0.054	0.014	0.283	0.260	0.499	0.313
	Both of group	33.35 ± 4.99	0.380	0.248	0.032	0.732	0.180	0.407	0.390
2	<i>Physical activity</i>								
	Treatment	9.57 ± 1.96	0.732	0.434	0.034	0.949	0.426	0.217	0.607
	Control	10.67 ± 1.63	0.231	0.150	0.029	0.699	0.233	0.213	0.204
	Both of group	10.12 ± 1.87	0.215	0.511	0.031	0.847	0.251	0.233	0.335
3	<i>Medication</i>								
	Treatment	10.60 ± 2.72	0.096	0.437	0.045	0.328	0.379	0.896	0.504
	Control	10.23 ± 1.85	0.121	0.123	0.001	0.081	0.325	0.851	0.090
	Both of group	10.42 ± 2.32	0.884	0.858	0.003	0.876	0.228	0.971	0.988
4	<i>SMBG</i>								
	Treatment	8.80 ± 2.34	0.116	0.382	0.041	0.329	0.121	0.761	0.400
	Control	7.73 ± 2.39	0.053	0.054	0.050	0.492	0.169	0.704	0.228
	Both of group	8.27 ± 2.41	0.076	0.058	0.038	0.243	0.122	0.713	0.164
5	<i>Foot care</i>								
	Treatment	2.33 ± 1.16	0.579	0.528	0.048	0.913	0.145	0.758	0.511
	Control	2.60 ± 1.48	0.380	0.244	0.005	0.117	0.114	0.592	0.108
	Both of group	2.47 ± 1.32	0.503	0.587	0.029	0.192	0.102	0.857	0.079
6	<i>DSM capability</i>								
	Treatment	64.73 ± 10.23	0.401	0.949	0.027	0.694	0.366	0.192	0.996
	Control	64.50 ± 10.02	0.141	0.261	0.003	0.222	0.093	0.844	0.216
	Both of group	64.62 ± 10.04	0.505	0.246	0.008	0.565	0.057	0.280	0.237

Table 5 The effect of family caregiver empowerment intervention on family caregiver's TZDM self-management capability.

No	Variable	Mean ± SD		Dependent t-test		Independent t-test		One way-ANOVA test (p-Value)		
		Pre-test	Post-test	Δ	t	p-Value	t	p-Value	Pre-test	Post-test
1	<i>Diet</i>									
	Treatment	33.43 ± 5.79	41.03 ± 2.43	7.60 ± 4.39	-9.463	0.001	4.070	0.001	0.202	0.025
	Control	33.27 ± 4.14	37.00 ± 3.92	3.73 ± 2.78	-7.360	0.001				
2	<i>Physical activity</i>									
	Treatment	9.57 ± 1.96	13.20 ± 1.13	3.63 ± 1.75	-11.363	0.001	9.493	0.001	0.195	0.047
	Control	10.67 ± 1.63	10.97 ± 1.56	0.30 ± 0.75	-2.068	0.048				
3	<i>Medication</i>									
	Treatment	10.60 ± 2.72	12.70 ± 1.26	2.10 ± 2.23	-5.149	0.001	4.021	0.001	0.160	0.017
	Control	10.23 ± 1.85	10.60 ± 1.81	0.37 ± 0.77	-2.626	0.014				

Table 5 (Continued)

No	Variable	Mean ± SD		Dependent t-test		Independent t-test		One way-ANOVA test (p-Value)		
		Pre-test	Post-test	Δ	t	p-Value	t	p-Value	Pre-test	Post-test
4	SMBG									
	Treatment	8.80 ± 2.34	11.93 ± 1.20	3.13 ± 1.91	-8.999	0.001	2.789	0.001	0.634	0.007
	Control	7.73 ± 2.39	9.63 ± 2.04	1.90 ± 1.49	-6.967	0.001				
5	Foot care									
	Treatment	2.33 ± 1.16	4.27 ± 0.78	1.93 ± 1.14	-9.267	0.001	6.835	0.001	0.088	0.001
	Control	2.60 ± 1.48	2.87 ± 1.48	0.27 ± 0.69	-2.112	0.043				
6	DSM capability									
	Treatment	64.73 ± 10.23	83.13 ± 5.26	18.40 ± 6.82	-14.786	0.001	8.856	0.001	0.929	0.013
	Control	64.50 ± 10.02	71.07 ± 8.75	6.57 ± 3.25	-11.084	0.001				

also understand the importance of conducting foot examinations. The study result is consistent with previous studies, that education can increase knowledge and self-efficacy in foot care in diabetes management, which can improve ability in self-management of T2DM.²⁸

This study has several limitations, including small sample size, the sampling technique even though it uses randomization but only uses simple random sampling. In addition, the measurement after the intervention was only carried out once. Although statistically, there is no difference in T2DM self-management based on age, sex, income level, marital status, ethnicity, and kinship. However, in implementing empowerment interventions, special attention may be needed relating to these differences. Nurses should strive for family caregivers to stay focused and participate actively in the learning process. Further research can be carried out using a larger sample size using multistage or cluster random sampling and repeated measurements so that the research findings are more valid.

Conclusions and suggestions

Family caregiver's empowerment intervention can improve the family caregiver's T2DM self-management, including diet management, physical activity management, medication management, self-monitoring of blood glucose levels, and foot care skills. The intervention can be used as a guideline for nurses to empower family caregivers in diabetes management to improve people's health status with T2DM.

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