An Idea Health Journal
ISSN (Online) 2797-0604
Volume 5, Issue 02, July 2025

Optimizing Blood Sugar Control in Diabetes Mellitus: The Impact of Family Interventions :A Literature Review

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ARTICLE INFO

Article history :
Received :21-10-2024
Revised : 20-11-2024
Accepted :10-02-2025

Keywords : Diabetes Mellitus, Family Intervention, Glicemic Control

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ABSTRACT

Background: Diabetes Mellitus (DM) is a chronic disease that requires long-term management including optimal blood sugar control. Family support plays an important role in the successful management of diabetes by facilitating interventions that can improve adherence to healthy lifestyles and medical therapies. Objective: This study aimed to identify and analyze the role of family interventions blood glucose control in individuals with Diabetes Mellitus (DM). Design: A Literature Review was conducted. Data Sources: A systematic search ascross eight databases PubMed, ProQuest, Clinical Key Nursing, Science Direct, Cochrane, EBSCOhost, Wiley, and Gray Literature. Methods: The reviewed articles published between 2014 and 2019, examined the effects of family interventions on glycemic control and met the inclusion criteria. Articles addressing the role of family support in managing blood glucose levels in individuals with DM were included and critically appraised using the CASP tool. Results: Seven studies meeting the inclusion criteria were included in this review. The intervention type examined was the role of family interventions in individuals with DM. The literature review indicated a positive effect on glycemic control in individuals with DM following Family Intervention. Conclusions: This review included seven studies, all of which provided statistically significant results, and concluded that Family Intervention influences glycemic control in individuals with DM.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disorder that causes significant damage to the heart, blood vessels, eyes, kidneys, and nerves and is characterized by a persistent elevation in blood glucose (or blood sugar) levels (1). Type 2 diabetes is the most prevalent type of diabetes (2) While, Type 1 DM is more commonly diagnosed among adolescents (3). The global prevalence of diabetes has reached 830 million individuals by 2022, and this figure is projected to rapidly increase (4). Diabetes mellitus predominantly affects individuals in the low- and middle-income populations. The Rising rising incidence of DM is intrinsically associated with familial factors. The The effectiveness of family-provided care is directly correlated with the successful management of DM cases (5). Families equipped with adequate knowledge and caregiving capabilities are essential to fulfilling the necessary roles (6). Family functions encompass health care and maintenance responsibilities. Care is crucial for maintaining the health of family members and achieving high productivity (7).

According to Valencia (2023), family interventions comprise a model for engaging with families or individuals with diseases, including family counselling, psychoeducation, family support, family education, and assisting families in understanding and supporting their affected family members (4). The care provided by the family is significantly enhanced by the education received, as diabetes education must be sufficiently comprehensive to increase in-depth understanding of the importance of examination and follow-up. Education necessitates effective communication between individuals with diabetes and other healthcare professionals (2). Effective management is crucial to maintain blood glucose stability in individuals with diabetes. As the closest support system, Family members, play a vital role in caring for individuals with DM maintaining, caring for, and meeting their daily needs; therefore, the family's role is a critical factor in diabetes care (8). Families empowered through education can effectively control HbA1c levels and accelerate the healing of Diabetic Foot Ulcer (DFU) (9). Family involvement and support have been demonstrated to have a positive impact on diabetes mellitus control. Consequently, it is imperative to review family interventions to control blood glucose levels in individuals with diabetes mellitus. This study aimed to identify and analyze the role of family interventions in controlling blood glucose levels in individuals with Diabetes Mellitus (DM).

METHODS

This study involved four reviewers:Indra Junsen, Achmad Dhabi, Deliati, Jenita. Search strategy and review process: There were currently eight electronic databases used to identify relevant studies. These included PubMed, Proquest, Clinicalkey Nursing, Science Direct, Cochrane, Ebscohost, Willey, and Gray Literature. The search was conducted using the title of the medical subject, the keywords used in this search were "Diabetes Mellitus (Mesh Term)," "Family Intervention (Mesh Term)," and "GlicemicControl (Mesh Term)," and the free text words depending on the database; selected by CAST (Critical Appraisal Screening Test) and various terms related to caregivers are included in the first step; followed by the term on family-based intervention in the second step; and the term about Diabetes Mellitus in the third step. The search was limited to peer-reviewed research articles published between March 2014 and December 2019 and written in English. Studies were considered eligible for inclusion if they met the following criteria:

1. Research design focused on randomized controlled trials (RCTs) and quasi-experimental studies
2. All articles were published in English
3. Studies concentrated on family interventions for blood glucose control

Table 1. Table of PICOT

P	I	C	O	T
Family	Family Inerventions	-	Diabetes Mellitus, Blood Sugar Control	-

**P : Population, I :Intervention, C:Comparison, T: Times*

Table 2. Database

Keywords by PICOT	Pubmed	Proquest	Scince direct	Cochrane	Ebscohost	Willey	Clinicalkey Nursing	Gray Literature
"Diabetes Mellitus AND Family Interventions AND Blood Sugar Control'	31	164	12	21	36	156	208	4

**Keywords: DM, Family intervention, Blood sugar control*

RESULT AND DISCUSSION

RESULT

Selection Study

The results of eight search databases resulted in several research articles, including the PubMed database with advanced search keyword 1 "diabetes mellitus [MeSH Terms]" found 424675 articles, keyword 2 "Family Intervention [MeSH Terms]" found 20324, keyword 3 "Glycemic Control" [MeSH Terms] found 1 article and keyword 4 "Blood Sugar" [MeSH Terms] found 163801 articles. Furthermore, keywords 1,2,3, and 4 were combined, and 97 articles were obtained. After applying a five-year publication filter, 31 articles were obtained, filtered for full text, and 31 articles were obtained and filtered again according to the research topic obtained from two articles. In the Science Direct database, by entering the keyword "Diabetes Mellitus OR Type 1 Diabetes OR Type 2 Diabetes AND Family Intervention AND Glycemic Control", 18 articles were obtained and filtered specifically for research articles in the last 5 years, 12 articles were obtained, and according to the research question, 1 article was obtained.

In the Cochrane database, by entering the keywords "Diabetes Mellitus OR Type 1 Diabetes OR Type 2 Diabetes AND Family Intervention AND Glycemic Control", 243 articles were obtained and filtered publications within the last five years, 128 articles were obtained for the Journal of Nursing and Midwifery, 21 articles were obtained, and according to the research topic, one article was obtained. A search of the ClinicalKey Nursing database using the keywords "Diabetes Mellitus OR Type 1 Diabetes OR Type 2 Diabetes AND Family Intervention AND Glycemic Control" yielded 478 articles. After filtering for the last five years, 208 articles were obtained, which were filtered according to the research topic, and one article was obtained. In the Ebscohost database, 134 articles were obtained by entering the keywords "Diabetes Mellitus OR Type 1 Diabetes OR Type 2 Diabetes AND Family Intervention AND Glycemic Control", and then filtered for the last 5 years, 36 articles were obtained, then filtered according to the research topic, 1 article was obtained. Meanwhile, in the Willey database,

by entering the keyword "Diabetes Mellitus OR Type 1 Diabetes OR Type 2 Diabetes AND Family Intervention AND Glycemic Control" 1627 articles were obtained and then filtered in the Journal of Paediatric Diabetes, 156 articles were obtained, and then filtered according to the research topic, obtaining one article. The Proquest database with the keywords "Diabetes Mellitus OR Type 1 Diabetes OR Type 2 Diabetes AND Family Intervention AND Glycaemic Control yielded 164 articles, and after filtering, no articles were found that were following the research topic. In the Grey Literature database with the keywords "Diabetes Mellitus OR Type 1 Diabetes OR Type 2 Diabetes AND Family Intervention AND Glycemic Control, four articles were obtained, however, none were deemed relevant to the research topic. The process of searching for articles using keywords occasionally encounters obstacles, such as mismatched keywords, necessitating the use of alternative terms for a more targeted search. All identified articles were independently assessed for inclusion in this systematic review. A total of **seven** articles met the inclusion criteria and were critically appraised using the Critical Appraisal Skills Programme (CASP) framework

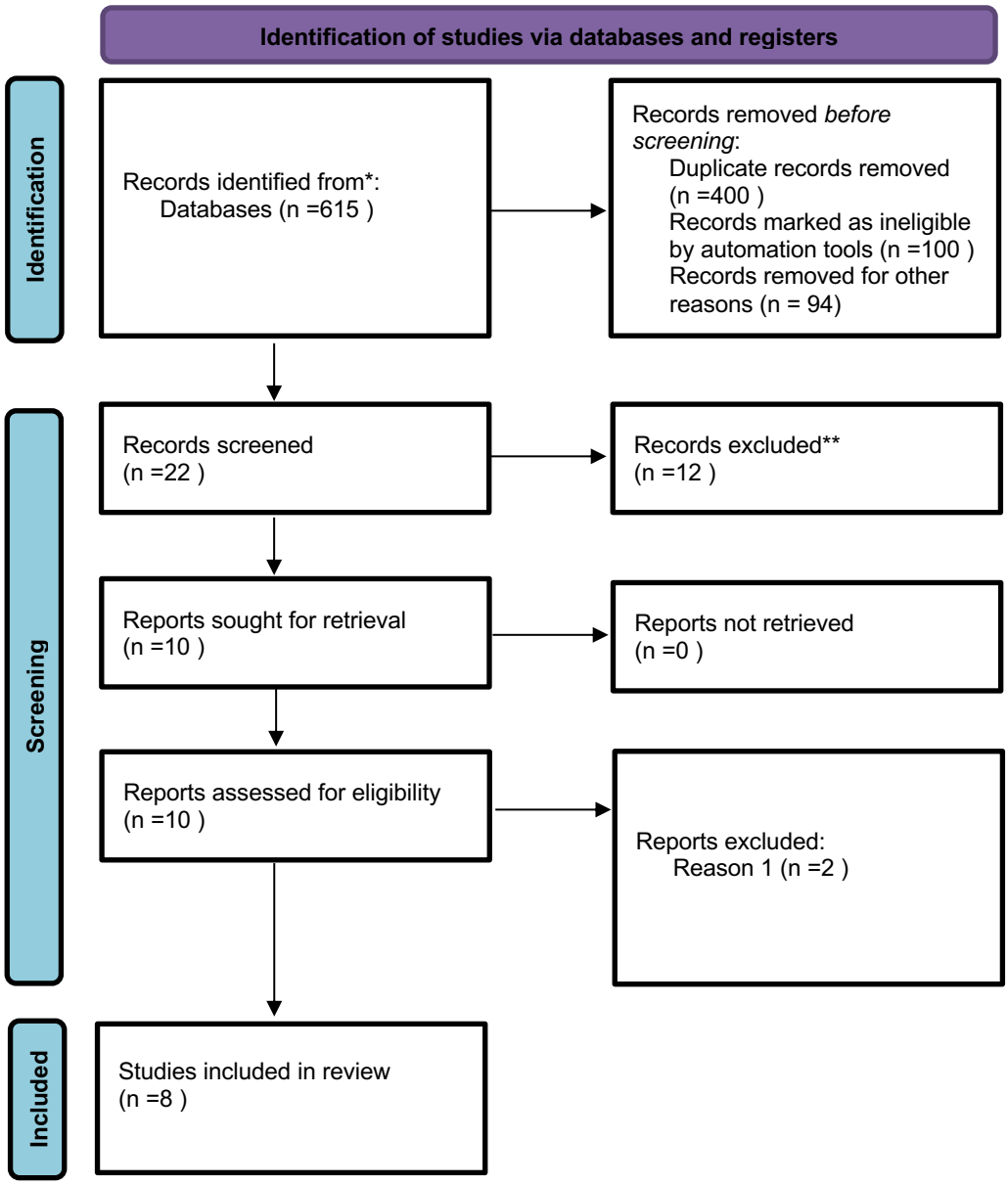

Figure 1 . Flowchart PRISMA

Table 3. Summary Study in Review

Tittle	Authors	Design	Participants	Family	Tujuan	Intervention	Outcomes	Result
Family-based psychoeducation and care ambassador intervention to improve glycemic control in youth with type 1 diabetes: a randomized trial	(3) Katz (2014)	RCT	153 respondents participated in this study	Schedule blood sugar checks and visits to doctors and dentists and get psychoeducation from health workers	Improving glycemic control with Care Ambassadors (CAs) and family-focused psychoeducational interventions.	Participants were randomised into two groups according to age (8 – 12 years or> 13 years) to one of three groups: Standard Care (SC), Care Ambassador Plus (CA+), or Care Ambassador Ultra (CA+Ultra). The participants provided demographic, clinical, and laboratory evaluations at each visit. SC participants received the usual pediatric diabetes subspecialty treatment, including coordination of primary care by the CA (to assist with scheduling quarterly clinic visits). CA+ participants received monthly outreach by CA via phone or email. Finally, CA+ Ultra participants received a psychoeducational intervention conducted at the quarterly study visit.	Parental involvement in diabetes management was measured using the DiaBetes Family Responsibility Questionnaire (DFRQ), family conflict was measured using the Diabetes Family Conflict Scale (DFCS), and quality of life was measured using the Generic Core Scale.	Of the 153 adolescents (56% female, median age 12.9 years) with type 1 diabetes (mean A1c 8.4 ± 1.4%). There was no significant difference between the A1c treatment groups. Among young people with a suboptimal initial A1c≥8%, however, in the psychoeducational group, this intervention was able to maintain or increase parental involvement in young people in the other two groups combined (77 vs. 52%, p = 0.03; 36 vs. 11%, p = 0.01, respectively).
The Effect of Family-centered Care on Management of Blood Glucose Levels in Adolescents with Diabetes	(4) Cheraghi (2016)	Quasi Experimental	Forty adolescents aged 10–14 years and their families were selected using a random sampling method.	Providing blood sugar monitoring interventions, managing food diets, and motivating physical activity	Identifying the effects of family-centered care such as blood glucose level management in adolescents with type 1 DM	The researcher explained the purpose of the research to the participants and then chose the time and location of the training. Four educational training sessions were conducted for each group, comprising 16 sessions. Each session lasts 30-40 minutes. and at the end of the session, participants were given an educational booklet.	Family behaviour was measured using SBC questionnaires, adolescent management behaviour was measured using the (MBA), and blood sugar levels (HbA1C) were recorded before the intervention and three months after.	The results of the paired t-test showed significant results on adolescent management behaviour towards insulin therapy, blood glucose testing, diet, physical activity (P < 0.001), and family supervision (P < 0.001). The blood glucose levels after the intervention had a P value of < 0.001.
A Family-Based, Culturally Tailored Diabetes Intervention for	(5) Hu (2016)	Quasi Experimental	186 participants with type 2 DM	Providing support in medication compliance, providing support in	To test the effectiveness of culturally appropriate family-based interventions for	The intervention was administered in eight group sessions for participants and families with type 2 DM and two sessions for families for data collection. The control group	Blood sugar levels were measured using capillary blood samples with the HbA1c and glycated hemoglobin test. Knowledge was	The mean SKILLD diabetes knowledge score was 8.6 (out of a possible 10) for the intervention group compared to the control at the post-intervention (P <0.001). Meanwhile, in family support, the

Hispanics and Their Family Members				physical activity.	Hispanics with type 2 DMs and their family members	receive the same amount of time and dose but was only provided with general health and diabetes care information.	assessed using the Spoken Knowledge of Diabetes in Low Literacy Patients (SKILLD) questionnaire. Family support was evaluated using the Chronic Illness Resources Survey (CIRS). Self-confidence was measured with the Stanford Diabetes Self-Efficacy (DSE) Scale. Self-management was assessed using the Revised Summary of Diabetes Self-Care Activities (SDSCA). Physical activity levels were measured using the Short International Physical Activity Questionnaire (IPAQ).	value (CIRS) was not significant with a value (P = 0.028), in self-confidence, insignificant results were obtained also with a value of P = 0.007, in physical activities, no significant results were found with a value of P = 0.096. Self-management (SDSCA) showed insignificant results for medication adherence (P = 0.946), blood sugar testing (P = 0.286), foot care (p = 0.083), and diet (p = 0.061).
Effects of a Family-based Diabetes Intervention on Behavioral and Biological Outcomes for Mexican American Adults	(7) McEwen (2017)	Quasi Experimental	157 participants and their families were involved in this study	Managing low-sugar eating, encouraging physical activity, managing stress management	To evaluate the effects of family-based self-management support interventions for adults with type 2 diabetes mellitus (T2DM).	The intervention group received treatment for 12 weeks. Interventions, such as education and support for activities such as diabetes management, are delivered successively. Meanwhile, the control group received only two hours of education sessions every week for three weeks.	Knowledge of DM was measured using The Diabetes Knowledge Questionnaire (DKQ), self-efficacy and stress were measured using questionnaires, and physical activity was measured using the International Physical Activity Questionnaire (IPAQ). A1C was measured using a finger stick and a DCA machine (DCA 2000).	Dietary management was significantly different from the control group (p = 0.043). Stress management also had a significant value in the control group (P = 0.032).
Randomized controlled trial of a family-oriented self-management	(10) Wichit (2017)	RCT	A total of 140 participants with type 2 DM.	Preparing healthy meals, encouraging adherence to medical and	To assess the effectiveness of family-oriented interventions in enhancing self-	Each Participant was asked to record all their daily activities, including health care practices, which were then recorded by their caregiver. Adherence to the	Primary outcome: Self-management is measured using the Summary of Diabetes Self Care Activities	In the intervention group, regarding self-efficacy, self-management, quality of life, and diabetes knowledge, increased results were obtained with a P

program to improve self-efficacy, glycemic control and quality of life among Thai individuals with Type 2 diabetes				exercise routines, and facilitating access to healthcare services for individuals with diabetes mellitus (DM).	efficacy, glycemic control, self-management, and quality of life among individuals with type 2 diabetes mellitus (T2DM).	program and review of potential issues to be evaluated during home visits at week 3. The intervention group received routine care and participated in the study, while the control group received routine clinical care, such as blood tests, medical physical examinations, and follow-up treatment.	(SDSCA) Secondary Outcome: Self Efficacy was measured using the Diabetes Management Self Efficacy Scale (DMSES) and Perceived Therapeutic Efficacy Scale (PTES). Quality of life was measured using the Short Form Health Survey (SF-12).	value of <0.05 for each outcome, and vice versa, no difference was found in the control group regarding self-efficacy, self-management, quality of life, and diabetes knowledge. With a P value of >0.05.
Contribution of family social support to the metabolic control of people with diabetes mellitus: A randomized controlled clinical trial	(8) Gomes (2017)	RCT	A total of 190 participants were divided into 2 groups, namely the intervention group and the control group	Caring for DM patients such as DM care, providing social support to their families suffering from DM.	Evaluate the contribution of family social support in people with type 2 diabetes to their clinical control.	In the intervention group, family caregivers who were considered caregivers of patients were included in the DM education program. Subsequently, it was controlled through telephone contact. In total, 17 phone calls were made to all patient caregivers, lasting 8 min each, with a frequency of 10-30 days. The control group only received phone calls at the beginning and end of the study.	The Education Program for DM patients was measured using the Diabetes Conversation Maps (DCM) educational tool which consists of four main maps: How the Body and Diabetes Work, Healthy Food and Physical Activity, Mediation Treatment and Blood Glucose Monitoring, Achieving Goals with Insulin.	The participants in this study consisted of adults and the elderly with an average age of 60.43 (SD=8.38) years. Using insulin and oral antidiabetics, 68.3% reported doing physical activity (55.5%) and following a diet (71.9%). The average age of the participating caregivers was 47.01 years (SD=13.52), of which 82.9% were women. The clinical variables between the groups showed that the educational interventions contributed to the variables that had been carried out.
Family-based intervention by pharmacists for type 2diabetes: A randomised controlled trial	(1) Withid panyaw ong (2019)	RCT	170 individuals with Type 2 DM, divided into 85 intervention and 85 control participants	Providing care such as medication adherence, diet, and encouraging physical activity.	Identifying the effectiveness of family interventions with type 2 DM and examining predictors of glycemic control	The intervention group of the participants' families received health education provided by a pharmacist during four visits over nine months. Each intervention lasted 40-50 hours and was conducted in a private room. Meanwhile, the control group received DM services provided by doctors, operandis, and pharmacists during outpatient visits every three months.	Participants' knowledge was measured using a questionnaire translated into Thai, medication adherence was measured using the Morisky Medication Adherence Scale (MMAS), and physical activity was measured using the DM self-management activity questionnaire.	For 9 months, the intervention group showed good results in glycaemic control with an HbA1C P value of < 0.001. Changes in blood pressure differed significantly, with a P-value of < 0.05. For DM knowledge, the intervention group obtained significant results compared to the control group (P value of < 0.001).

DISCUSSION

The number of participants in this study ranged from 40 to 190, with each person with DM had a family member involved in providing the interventions. In this case, the family had a dominant role in lowering blood sugar levels. Each family receives various activities, such as training and health education, which then provides intervention to people with diabetes. According to Teli (2023), some family-oriented values can affect diabetes self-management and vice versa, and DM control can affect the health and well-being of all family members (11). The welfare of the family members in question, such as increased treatment costs and short-term and long-term complications, can cause serious problems in the lives of children and other family members. Vascular changes in patients with diabetes mellitus occur within 3 years if not properly controlled (12). Therefore, the family's role is to manage various activities to control blood sugar levels (13). Based on several studies, there are several family interventions used to control blood sugar levels in people with diabetes, such as: Education and social support: Modifying risk factors can prevent and delay DM occurrence. After developing DM, many cases can prevent or minimize the increase in blood sugar levels (14). Both individuals and their families share the responsibility for diabetes management, making health education a fundamental aspect of DM care (15). Providing health education and social support has a positive effect on every patient. According to Katz (2014), education is effective in maintaining glycemic control and increasing family involvement in people with diabetes (3). Likewise with social support, according to Gomes (2017), families are strongly advised to motivate people with diabetes to engage in self-care (8). Social support has an important influence in controlling blood sugar levels in people with diabetes, as individuals with diabetes often seek continuous assistance from their family members.. This is in line with research conducted by Onyango (2022), which explains that family involv is important evidence for protective factors in DM compliance and glycemic control (16). This is because social support can improve self-care in individuals with diabetes. Family involvement has a better correlation with glycemic control and medication adherence (17).

Physical activity

Physical activity is a viable intervention for individuals with diabetes, potentially exerting a positive influence on their blood glucose levels. Engaging in short-duration, high-frequency physical activity may yield greater benefits than infrequent, prolonged exercise. For individuals with diabetes classified as obese, 30 min of low- or moderate-intensity aerobic exercise appears to be particularly advantageous. This regimen should be repeated as frequently as possible daily basis (18). Numerous studies have demonstrated the efficacy of exercise and physical activity in reducing blood glucose levels. Cheraghi (2016) reported a decrease in the mean blood glucose level recorded following physical activity (4). Consequently, family-centered interventions may contribute to a reduction in blood glucose levels in individuals with type 1 diabetes. A subsequent study conducted by Wichit (2017) indicated that family-oriented physical activity can enhance self-efficacy and self-management in individuals with disabilities, ultimately leading to lower blood glucose levels (10). Yamaguchi (2023) elucidated that family involvement in the self-management of individuals with DM, including physical activity, can improve DM outcomes (19). Furthermore, Hu (2016) demonstrated that family interventions can enhance glycemic control (5).

Dietary Considerations

Nutritional requirements for individuals with diabetes are crucial for supporting their dietary intake. It is important to note that several low-sugar foods are essential for consumption by individuals with diabetes. Research conducted by Neyman (2023) indicates that maintaining a healthy diet, low-calorie diet, and low-carbohydrate diet can help prevent elevated sugar levels and assist in managing diabetes mellitus (DM) (20). Consequently, family interventions in managing dietary habits are of significant importance for controlling blood sugar levels. According to Cheraghi (2016), there is a significant correlation between glycemic control in individuals with diabetes and family interventions provided in terms of managing a low-sugar diet before and after the intervention is implemented (4). The study further elucidated that self-management of dietary habits had a more substantial positive impact and resulted in more favorable changes compared to the pre-intervention period.

Medication Compliance

One of the family interventions that can be implemented for individuals with diabetes is monitoring medication adherence. Some individuals with diabetes require family assistance to remind them of their medication

schedule and ensure consistent adherence. According to Stewart (2023), treatment adherence is notably low because of factors such as treatment costs, forgetfulness, limited access to treatment, and depression. Consequently, family assistance is crucial for medication compliance (21). Research conducted by Hu (2016) indicated that self-care activities of individuals with diabetes regarding medication adherence did not yield significant results, attributing this to the severity of the disease and complications of diabetes exacerbated by socioeconomic status (5). In contrast, a study conducted by Withidpanyawong (2019) demonstrated that family members in the intervention group exhibited a significant increase in medication adherence compared with the control group (1).

Blood Sugar Monitoring

Family interventions in blood sugar monitoring have been shown a positive impact on the elevation of blood glucose levels in individuals with DM. Multiple studies examining these interventions strongly advocate blood sugar monitoring in individuals with DM. However, among the five studies that addressed the intervention, one yielded inconclusive result. This outcome can be attributed to various factors, including disease severity and complications, in patients with DM. These findings align with research conducted by Appil (2020), which indicates that inadequate blood sugar monitoring correlates with increased HbA1c levels, whereas effective blood sugar monitoring exhibits a positive influence on HbA1c levels in individuals with DM (22).

Stress Management

Stress is a significant factor influencing blood glucose levels in individuals with diabetes. McEwen (2017) reported that family-based stress management interventions have a beneficial effect on individuals with DM (6). Moreover, Woods (2019) indicated that group stress management programs are particularly effective for individuals with type 2 diabetes in clinical settings (23). This finding is further corroborated by Alavijeh et al. (2018), who demonstrated that theory-based stress management techniques contribute to a reduction in glycosylated hemoglobin levels in diabetic patients (24).

Insulin therapy

Several factors must be considered to increase the use of insulin therapy in patients with diabetes, including cost and safety concern. Research conducted by Cheraghi (2016) demonstrated that family intervention in the administration of insulin therapy was effective in reducing blood sugar levels in individuals with DM (4). This finding is consistent with the research conducted by Natalansyah (2021), which indicated that multiple trials yielded results wherein the use of insulin can achieve the desired glycemic goal, despite insulin not having dose limitations (25).

CONCLUSION

Various family interventions can be employed to support family members with diabetes mellitus (DM). Family interventions have a positive influence on improving glycemic control in individuals with DM. This approach is particularly significant in community settings given the annual increase in the prevalence of diabetes. Family interventions represent a potential therapeutic approach that can be implemented in both hospital and community settings. These interventions have been demonstrated to be effective in reducing elevated blood glucose levels, while also being safe, cost-effective, and applicable across diverse populations.

ACKNOWLEDGMENTS

We acknowledge the valuabe contributions of the authors in facilitating the development of this scientific paper for publication..

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