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Effectiveness of Diabetes Self-Management Education (DSME) in Supporting Self-Management Treatment of Clients with Diabetes Mellitus : A Systematic Review

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ABSTRACT

Diabetes mellitus (DM) is a chronic metabolic disorder with multiple etiologies. Diabetes Self-Management Education (DSME) is an intervention method related to increasing self-care knowledge and skills that was recommended for all individuals with diabetes. This systematic review is to determine the effectiveness of the application DSME on DM sufferers. A literature identification study by collecting research articles on the application of DSME interventions in individuals with diabetes. A systematic literature search process to collect English-language research articles for the last 5 years (2017 – 2021) from indexed electronic databases. Thirteen studies were eligible for literature review English articles were collected from electronic databases including PubMed, SpringerLink ScienceDirect, and Scopus. Diabetes Self-Management Education (DSME) in general can help people to maintain healthy living behavior with various forms of application methods. The DSME method encourages sufferers to obtain the information, abilities, and capacities needed for self-care. DSME strategy was effective to improved the self-management ability of diabetics during treatment, which can be continuously developed with various forms of intervention.

Keywords: Diabetes Mellitus; Diabetes Self Management Education (DSME); Self Care Management

1. INTRODUCTION

Diabetes mellitus (DM) is responsible for high rates of morbidity and mortality every year [1]. Anxiety and depression can appear frequently as a form of psychological complications that have an impact on daily life and psychosocial life and can worsen treatment [2]. Statistical data from the International Diabetes Federation from around the world in 2021, there are 537 million people in the age range of 20 to 79 years diagnosed with diabetes, or 1 in 10 people. This number is expected to increase to 643 million people with diabetes in 2030 and 784 million people in 2045. Diabetes causes 6.7 million deaths in 2021 with a ratio of 1 sufferer dying every 5 seconds. [3]. Diabetes sufferers increase often start from unhealthy lifestyles and habit pattern [4].

Diabetes Self Management Education (DSME) is an intervention method that is one of the options to increase information about diabetes [5]. A well-implemented DSME will

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facilitate self-care knowledge, attitudes, and abilities a form of prevention and empowerment of diabetics to be involved in maintaining lifestyle changes by increasing self-management abilities [6] [7]. The DSME method used needs to be adapted to the circumstances and culture of a particular local community [8]. The DSME media used needs to be tested to adapt to the conditions and characteristics of the community in a location that is the target of application [1]. Comprehensive educational interventions can increase the knowledge of DM patients on the level of glycemic control [9].

Clients with diabetes need holistic and complete care to control the risk of long-term complications and reduce acute complications. Diabetics are required to be able to take care independently for self-management in addition to continuous medical care [5]. An important component in managing diabetes is the client's ability to effectively control glycemic, adopt a healthy lifestyle, consume the right and correct diet, and adhere to taking medication as important factors in good glycemic control [10]. Diabetic patients need self-management education to make it easier to understand and manage their disease [11]. Diabetes education about managing health behavior which includes diet regulation, medication adherence, self-monitoring of blood glucose, and regular light physical activity, is important for successful diabetes management [12]. DSME is the right choice to train diabetes clients in self-management, but maintaining health behavior is also necessary for a sustainable self-management program [5].

2. METHODS

A systematic literature search process to collect English-language research articles for the last 5 years (2017 –2021) on the application of DSME interventions in individuals with diabetes from indexed electronic databases such as PubMed, SpringerLink ScienceDirect, and Scopus. Thirteen articles were selected and eligible for systematic review. Article search results are written following the protocol and checked using a checklist and using the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) diagram.

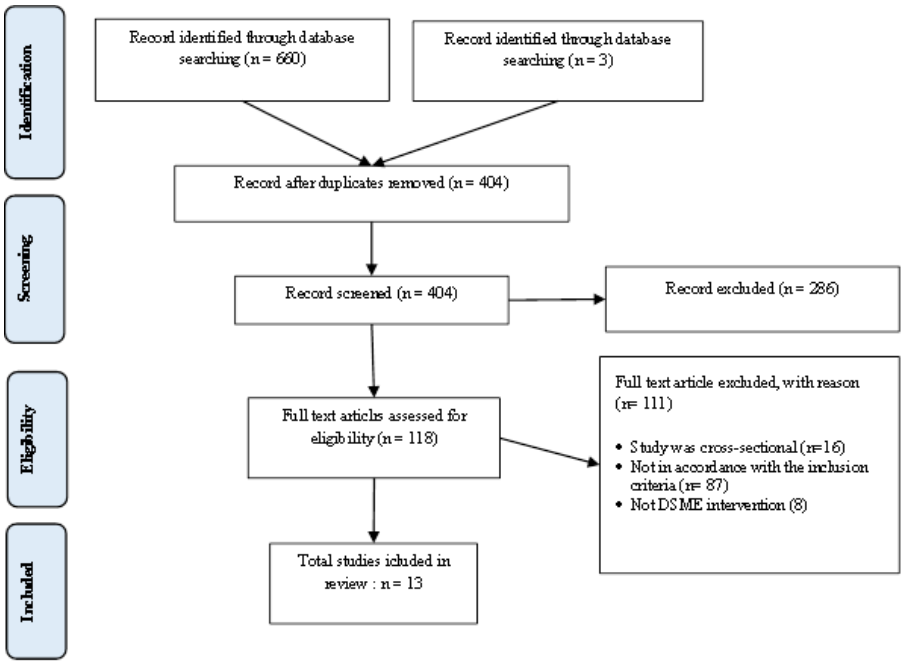

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Figure 1 *PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart*

Literature article searches were conducted from April to July 2022. Article searches used the PICOS framework strategy shown in table 1. Article identification using the keywords "Diabetes Self Management Education (DSME) AND Self Care Management AND Self-Efficacy AND Patient with Diabetes Mellitus" by limiting the range of article years from 2010 to 2021 for English articles and full-text articles, to obtain relevant articles.

Table 1. The PICOS format of this study

Criteria	Inclusion	Exclusion
Population	People with Diabetes Mellitus (DM)	The article is not full text, does not focus on DM sufferers
Intervensi	Diabetes Self-Management Education (DSME)	Not following the given intervention
Outcome	Self-care management	-
Time	2017 - 2021	Less than the specified time limit
Study design	RCT, experimental, systematic review, and meta-analysis	-
Language	English	Other than English

In this study, the inclusion criteria for the articles used were Diabetes Self Management Education (DSME) intervention articles in supporting diabetes self-care management. Articles were retrieved using RCT, experimental, systematic review, and meta-analytical studies. The purpose of this literature study is to test the effectiveness of the DSME method in supporting the self-care management of people with diabetes mellitus from various research sources that have been conducted. The search results showed that 13 articles were selected out of 663 articles found in the database that matched the inclusion criteria.

A total of 663 articles were identified, then duplication was removed and the remaining 404 articles were then reviewed for feasibility, this process is illustrated in Figure 1. Articles were reviewed based on title identification and obtained as many as 118 full-text articles and the results of the due diligence then left 13 research articles for further study. shown in table 2.

3. RESULT

Diabetes Self Management Education (DSME) in general can help people to maintain healthy living behavior with various forms of application methods. Diabetics obtain the information, self-management skills, and self-care capacities needed by applying

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the DSME method [13]. The results of the analysis of the systematic review of the articles show that the DSME program is effectively applied to patients with diabetes, including glycemic control, lowering HbA1c levels of patients, and involving peer and family support can increase behavioral perceptions, and increase self-efficacy [14].

The active involvement of nurses in the implementation of DSME interventions is a good motivation for diabetics and improves self-management skills in the process of self-care in diabetics [15]. DSME with group-based was effective at improving aspects of diabetes care at 6 months [16], but support and the role of family participation in helping diabetes care are also needed [17].

The analysis of 13 articles that meet the feasibility of the review is in accordance with table 2 below:

Table 2. Review of articles on Diabetes Self-Management Education (DSME)

Title, Year, Author	Methode	Result
Comparative Effectiveness and Maintenance of Diabetes Self- Management Education Interventions for Marshallese Patients With Type 2 Diabetes: A Randomized Controlled Trial (2019) Pearl A. McElfish, Christopher R. Long, Peter O. Kohler, Karen H.K. Yeary, Zoran Bursac, Marie-Rachelle Narcisse, Holly C. Felix, Brett Rowland, Jonell S. Hudson, Peter A. Goulden	• Randomized controlled trial • A sample of 221 people was divided into two groups, comparing the two DSME models: 1) 111 respondents were given the DSME standard model 2) 110 respondents in the DSME family adaptation model • Outcomes were measured at baseline, immediately after the intervention, at 6 months, and 12 months after the intervention. • Data were analyzed by mixed linear regression	• In The group that intervened with the DSME family adaptation model, participants experienced a significant decrease in the average HbA1c: 1) Early to immediately after intervention (21.18% [95% CI21.55,20.81]), 2) Up to 6 months (20.67% [95% CI21.06,20.28]) 3) Up to 12 months (20.87% [95% CI21.28,20.46]) ($P < 0.001$ for all). • Participants who received DSME adapted in the family model showed a significantly greater reduction in mean HbA1c immediately after and 12 months after the intervention than the reduction among those receiving standard DSME. • This study demonstrates the potential effectiveness of a culturally adapted DSME that includes members of the participant's family to be more effective in its implementation and helps build self-management in sufferers.
DM-calendar app as a diabetes self-management education on adult type 2 diabetes mellitus: a randomized controlled trial (2019) Kusnanto, Komang Agus Jerry Widyanata, Suprajitno, Hidayat Arifin	• Randomized controlled trial • Respondents were 30 people who were divided into two groups and one of them was given an Android-based DSME Calendar	• DSME with Android-based DM calendar affected self-efficacy ($p < 0.001$), HbA1c levels ($p = 0.005$), cholesterol ($p = 0.009$), triglycerides ($p = 0.000$), HDL-c ($p = 0.048$), LDL-c ($p = 0.048$), c ($p = 0.010$), and insulin ($p = 0.000$) compared to the control group. • Education with electronic media has increased the perception of self-efficacy and improved self-management behavior that can be seen from

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Title, Year, Author	Methode	Result
	Application intervention • The instrument uses a diabetes management self-efficacy scale and standard operating procedures for blood sampling	changes in controlled HbA1c levels, and lipid and insulin profiles. • Conclusion The results of this study can be used as a reference to provide experimental education that is adapted and adapted to patients with Type 2 Diabetes Mellitus (DMT2) to train the patient's independence in self-care.
The effect of diabetes self-management education on HbA1c and quality of life in African-Americans: a systematic review and meta-analysis (2018) Amy T. Cunningham, Denine R. Crittendon, Neva White, Geoffrey D. Mills, Victor Diaz, Marianna D. La Noue	• Systematic review and meta-analysis • 14 studies were eligible for systematic review and 8 for meta-analysis. Systematic review and meta-analysis of selected articles	• The difference in weighted mean HbA1c between intervention and usual care participants was not significant: 0.08%[− 0.40–0.23]; 2 = 84.79 (p < .001), I2 = 92%, (n = 1630). Four of the five studies measuring QoL reported significant improvements for intervention participants. • The results of the meta-analysis showed a non-significant effect of DSME on HbA1c in African Americans. The QoL did show improvement and is an important DSME result to measure in future trials. More research is needed to understand the effectiveness of DSME in this population.
The effect of peer support in diabetes self-management education on glycemic control in patients with type 2 diabetes: a systematic review and meta-analysis (2021) Akhmad Azmiardi, Bhisma Murti, Ratih Puspita Febrinasari, Didik Gunawan Tamtomo	• Systematic review and meta-analysis • Journals collected from PubMed, Cochrane Library, ProQuest, SpringerLink, ScienceDirect, Scopus, and Google Scholar • Range 2005 - 2020 Cochrane Collaboration's Risk of Bias	• Twelve studies were included in this study. DSME integrated with peer support effectively reduced levels of glycated hemoglobin A1c (HbA1c), with a statistically significant effect (SMD, -0.41; 95% confidence interval [CI], -0.69 to -0.13; p <0.001). • Program with sample size <100 (SMD, -0.45; 95% CI, -0.79 to -0.11; p=0.009), intervention duration 6 months (SMD, -0.52; 95% CI, -0.96 to -0.07; p=0.020, baseline HbA1c <8.5% (SMD, -0.42; 95% CI, -0.77 to -0.07; p=0.020), delivery by group (SMD, -0.28; 95% CI, -0.51 to -0.06; p=0.010), and high contact frequency (SMD, -0.29; 95% CI, -0.48 up to -0.10; p=0.003) had a statistically significant effect in lowering HbA1c levels in patients with type 2 diabetes. • Integrated DSME with peer support effectively improves glycemic control in patients with type 2 diabetes in maintaining self-care. • Programs with smaller participant groups, shorter interventions, weekly meetings, and closer group sessions improve glycemic control in patients with type 2 diabetes.
The effect of diabetes education and short message	• Pre-test and post-test control group	• At the third and sixth-month evaluation, statistically significant differences were found

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Title, Year, Author	Methode	Result
service reminders on metabolic control and disease management in patients with type 2 diabetes mellitus (2020) Türkan Akyol Güner dan Gülhan Cosansu	• Sample 101 was divided into two groups: 1) N=50 intervention group 2) N=51 control group • Variable test with Chi-squared, Friedman test group differences, and comparison with Wilcoxon test. • DSME Group-based education module is provided in two intervention sessions and SMS reminder for 6 months	between the intervention and control groups in terms of HbA1c, fasting blood sugar, lipid values (except triglycerides), blood pressure, and body mass index. and weighing results ($p < 0.001$). • Diabetes education and SMS reminders sent for six months are effective in improving metabolic control and self-care management of patients with type 2 diabetes mellitus.
Effect of a Nurse-Led Diabetes Self-Management Education Program on Glycosylated Hemoglobin among Adults with Type 2 Diabetes (2018) Golnaz Azami, Kim Lam Soh, Shariff Ghazali Sazlina, Md. Said Salmiah, Sanaz Aazami, Mosayeb Mozafari, Hamid Taghinejad.	• Randomized controlled trial • Sample of 142 people divided into 2 groups • The control group was given the usual diabetes care • The intervention group provided usual care and was given a DSME intervention led by a nurse.	• Secondary outcomes were changes in blood pressure, weight, lipid profile, self-efficacy, improvement in self-management behavior, QoL, social support, and depression. • The intervention group showed significant improvements in HbA1c, blood pressure, body weight, progress expectations, outcome expectations, and improved self-management behaviors. • The beneficial effects of nurse-led interventions continue to increase and result in continuous improvement in clinical conditions, lifestyle, and psychosocial outcomes that represent good self-care.
Effectiveness of diabetes self-management education programs for US Latinos at improving emotional distress: A systematic review (2020) Angela P. Gutierrez, M.S., Addie L. Fortmann, Ph.D., Kimberly Savin, B.A., Taylor L. Clark, B.S., Linda C. Gallo, Ph.D.	• Systematic reviews • Using the PRISMA procedure • 15 articles entered into the criteria and then analyzed	• Fifteen studies were included in the review. Six of the 8 studies examining depressive symptoms reported significant reductions in symptoms. Of the 10 studies examining health-specific emotional distress, 6 reported significant symptom reduction. • Effect sizes range from 0.20 to 3.85. The null finding was easier to find among studies with small sample sizes ($n < 30$), and among studies testing interventions without specific psychosocial content, with little cultural adjustment, with less frequent intervention sessions, and with no support sessions. Having concurrent diabetes education.

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Title, Year, Author	Methode	Result
A structured, group-based diabetes self-management education (DSME) programme for people, families and whanau with type 2 diabetes (T2DM) in New Zealand: An observational study (2013) J.D. Krebs, A. Parry-Strong, E. Gamble, L. McBain, L.J. Bingham, E.S. Dutton, S. Tapu Ta'ala, J. Howells, H. Metekingi, R.B.W. Smith, K.J. Coppell	• Observational study • Seventeen groups of six education sessions were run • Clinical data were collected from primary care at baseline, 3, 6 and 9 months • Completed a self-administered questionnaire on diabetes knowledge, and self-management behaviours	• 107 participants, mean age 56.7±11.3 years and mean duration of diabetes 7.5±7 years (NZ European (44%), Maori (24%), Pacific (16%) and Indian (16%)), were enrolled. • Confidence in self-managing diabetes, regular examination of feet, physical activity levels and smoking rates all improved. • Glycaemic control improved between baseline and 6 months (HbA1C 64.9±20.0 mmol/mol to 59.9±13.9 mmol/mol ($p < 0.05$) (baseline 8.07%±1.80, 6 months 7.62%±1.25)), but was no different to baseline at 9 months. • Systolic BP reduced from 131.9±16.4 to 127.4±18.2mmHg ($p < 0.05$) at 6 months, but increased to baseline levels by 9 months. • Diastolic BP, triglycerides and urine microalbumin: creatinine ratio were significantly reduced at 3, 6 and 9 months.
Effectiveness-implementation trial comparing a family model of diabetes self-management education and support with a standard model (2022) Lindsay S. Mayberry, Holly C. Felix, Jonell Hudson, Geoffrey M. Curran, Christopher R. Long, James P. Selig, Ayoola Carleton, Arshiya Baig, Hope Warshaw, Mark Peyrot, Pearl A. McElfish.	• Hybrid Type 1 effective-ness implementation design • Participants are ≥18 years old with type 2 diabetes mellitus • Participants recruited from rural and urban primary care clinics • randomly assigned to Family or Standard DSMES, delivered in a small-group format via telehealth. • Data are collected at baseline, immediately post-intervention, and 6, 12, and 18 months post-intervention.	• Recruitment for the study started in January 2021, and we anticipate enrollment will continue until early 2023. • Results will fill knowledge gaps about which type of DSMES may be most effective and guide Family- DSMES implementation efforts.
Structured diabetes self-management education and its association with perceived diabetes knowledge, information, and disease distress: Results of a	• The cross-sectional and nationwide survey • The data stemmed from two combined survey parts based on computer assisted telephone interviews.	• DSME-participants showed a higher level of diabetes knowledge compared to never-DSME participants, particularly in aspects concerning diabetes in general (odds ratio 2.53; 95% confidence intervals 1.48–4.33), treatment (2.41; 1.36–4.26), acute complications (1.91; 1.07–3.41) and diabetes in everyday life (1.83; 1.04–3.22).

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Title, Year, Author	Methode	Result
nationwide population-based study (2022) M. Heise, C. Heidemann, J. Baumert , Y. Du, T. Frese, M. Avetisyan , S. Weise	• Randomly selected sample of the German-speaking population aged 18 years and over. • Dual-frame sample, which comprised 1216 partici-pants with a self-reported diabetes diagnosis	• DSME-participants showed higher information needs regarding late complications (1.51; 1.04–2.18) and acute complications (1.71; 1.71–2.48) than DSME never participants. • DSME-participants more frequently consulted diabetologists (5.54; 3.56–8.60) and diabetes care specialists (5.62; 3.61–8.75) as information sources. • DSME participation was not associated with disease distress.
Knowledge, attitudes and practices of persons with type 2 diabetes in a rural community: Phase I of the community-based Diabetes Self-Management Education (DSME) Program in San Juan, Batangas, Philippines (2010) Gregory Joseph Ryan A. Ardena, Elizabeth Paz-Pacheco, Cecilia A. Jimeno, Frances Lina Lantion-Ang, Elizabeth Paterno, Noel Juban	• Cross-sectional analytic study • Participants were selected using stratified cluster sampling (n=35) • Data were collected using two main methods: use of investigator-administered questionnaires and focus group discussions (FGDs)	• 156 diabetic residents were included. • The overall mean percentage score on knowledge was 43%. • Less than half of the respondents strongly believed in the need for patient autonomy (38%). • 35 respondents were included in the FGDs. • Only 4 out of 35 diabetic respondents owned a glucose meter while only 16 out of the 35 consult their doctors on a regular basis. • The study comprises Phase I of the proposed 5-year community-based DSME Program in the Philippines. It highlights the importance of evaluating knowledge, attitudes and practices as crucial means to understand observed behaviors and guide behavioral change
Effect of diabetes self-management education (DSME) on glycated hemoglobin (HbA1c) level among patients with T2DM: Systematic review and meta-analysis of randomized controlled trials (2021) Bayu Begashaw Bekele, Samuel Negash, Biruk Bogale, Melkamsew Tesfaye, Dawit Getachew, Fekede Weldekidan, Behailu Balcha.	• This SRMA was made according to preferred reporting Items for systematic review and Metaanalysis (PRISMA) guidelines • The relevant articles were searched from four databases: Cochrane Library, MEDLINE (EBSCOhost), MEDLINE / PubMed and SCOPUS • Quality assessment was carried out • Subgroup analysis was conducted for assessing	• A total of 1312 studies were identified from databases. • Among these 25 studies met inclusion criteria. • From these 20 were included in the meta-analysis. • In meta-analysis a pooled standard mean difference in HbA1c was _0.604 (95% confidence interval ¼ _0.854 -0.353, I2 ¼ 90.3, p < 0.001). • In subgroup analysis a significant reduction was seen among studies with less than four months, upper middle followed by lower middle income countries (LMICs), Western Pacific (WP) followed by Middle Eastern and Northern African (MENA) regions with moderate to substantial heterogeneity.

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Title, Year, Author	Methode	Result
	heterogeneity among the studies	
Formative research to develop diabetes self-management education and support (DSMES) program for adults with Type 1 Diabetes (2021) Lovely Gupta, Priti Rishi Lal, Yashdeep Gupta, Alpesh Goyal, Aparna Khanna, Nikhil Tandon	• A qualitative formative research was conducted including indepth interviews (IDIs) following informal interview style • The interview questionnaire comprised of several openended, semistructured, pre-designed questions • T1DM management, and strategies to optimize medical nutrition therapy (MNT) and improve diabetes self management education (DSME). • A purposive sampling approach was used to select the study sites and participants	• In total, 28 in-depth interviews were conducted, 18 with health care professionals and 10 with adult individuals with T1DM. • The results demonstrated deficiencies in the implementation of a structured self-management program for diabetes owing to several patient and healthcare system-related factors. • A detailed nutritional counseling was provided at all sites by a qualified dietitian, however, carbohydrate counting was not routinely practiced. • The interviews of this formative research revolved around: a) evaluation of the existing usual care and gaps in implementation of a structured DSMES program, b) development of themes that will help in formulation of an intervention package and its effective delivery to the participants.

4. DISCUSSION

Diabetes Self Management Education (DSME) is one of the most effective strategies to improve the self-management skills of diabetics while undergoing treatment [18]. The DSME strategy can continue to be developed with various forms of intervention that are adapted to the circumstances of the community in assisting and motivating the process of self-care in achieving a better degree of health [17] [19] . The DSME method needs to be better developed and adapted to various aspects of diabetes care [20].

Diabetics need to be stimulated to gain better knowledge about diabetes and self-care using the right methods [21]. The application of appropriate educational methods can increase the information achievement goals in improving self-care abilities [8]. The increase in the number of DM sufferers indirectly becomes a demand that must be balanced by controlling and managing better diabetes care to improve the quality of serving diabetics [11].

The introduction of DM to sufferers at an early stage provides convenience in the future in the management of self-management and care independently by the sufferer himself [22]. The information provided on an ongoing basis using the DSME method needs

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to be improved. This will facilitate health services in controlling patients. It should also be remembered that DSME is still limited in its development, it needs innovative management by involving everything and the individuals around the sufferer in planning the DSME program [23] [24].

Failures may occur in the DSME implementation process. The initial planning process needs to be considered carefully, especially in determining the DSME that suits the needs of diabetics. Planning done systematically can reduce the impact on processes and results. The evaluation at the end of the DSME implementation is a benchmark that needs to be studied in implementing the program on an ongoing basis for sufferers [16] [21]. The results of the application and modification of various forms of application of DSME to date have shown positive and effective results as a promotive and preventive form of diabetes management [25].

5. CONCLUSION

Diabetes Self Management Education (DSME) can be implemented better with the form of innovation adopted by researchers. It is hoped that in the future DSME can be implemented in a sustainable manner as an intervention in the care of diabetics to help patients adapt to changes in health status and motivation to improve self-management.

6. ACKNOWLEDGMENTS

This paper is structured as a form of learning and more in-depth evidence of the results applying DSME method in the diabetes care process and an ongoing step to empower diabetics to practice independent self-care.

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