Impact of Diabetes Self-Management Education on Glycemic Control and Self-Care Practices Among Type 2 Diabetic Patients in Tripoli, Libya

Khalid Milad[*] iD , **Shahir Ghiath** iD , **Mohmmed Sehaib** iD

Department of Anatomy, Faculty of Medicine, University of Tripoli, Tripoli, Libya
***Corresponding email.** kha.mohamed@uot.edu.ly*

A B S T R A C T

Diabetes self-management education (DSME) is a critical component of diabetes care, providing patients with essential knowledge and skills for effective self-care, crisis management, and lifestyle modifications. Despite its importance, research on DSME remains limited in Arabic-speaking countries, including Libya, highlighting the need for further evidence to improve implementation and outcomes. This study compared two groups of type 2 diabetes mellitus (T2DM) patients: those who regularly attended DSME workshops and those who did not, assessing differences in diabetes knowledge, dietary adherence, physical activity, blood glucose monitoring, emergency management, complication screening, psychological well-being, awareness dissemination, treatment adherence, and HbA1c levels. Using an interviewer-administered questionnaire (April 2019–January 2020; N=85), data were analyzed via SPSS version 20 with independent t-tests and chi-square tests (significance: $p<0.05$). Results showed that the DSME group achieved significantly better glycemic control (mean HbA1c 7.4% vs. 8.5%), higher treatment adherence (89.3% vs. 7%), and greater diabetes knowledge (85.7% vs. 59.5%). They also demonstrated more frequent glucose monitoring (5 vs. 2 days/week), healthier diets (4 vs. 1 day/week), increased physical activity (3.5 vs. 2.5 days/week), improved emergency management (78.6% vs. 53.2%), and more consistent complication screenings (4 vs. 2 days/week). Additionally, the DSME group reported better psychological well-being (82.1% vs. 64.9%). These findings underscore the significant benefits of DSME in enhancing diabetes self-management and clinical outcomes, suggesting that Libyan health authorities should prioritize expanding access to structured DSME programs. Further research should explore context-specific adaptations to optimize diabetes care in diverse settings.

INTRODUCTION

Diabetes Self-Management Education (DSME) is an evidence-based approach that equips patients with diabetes with essential knowledge and skills for effective disease management [1]. These structured programs address key components including medication adherence, blood glucose monitoring, nutrition planning, physical activity, and complication prevention [2]. Multiple studies demonstrate DSME's effectiveness in improving glycemic control (reducing HbA1c by 0.5-1.0%), decreasing diabetes-related complications, and enhancing quality of life [3,4]. The American Diabetes Association has established 10 standards for quality DSME implementation, emphasizing individualized care plans and ongoing support [5,6]. While proven cost-effective through reduced hospitalizations [7], access to formal DSME remains limited in many developing nations, including Libya where diabetes prevalence exceeds 12% [8]. This study evaluates the impact of DSME on glycemic control among Libyan patients with type 2 diabetes.

METHODS

Study Design

This study employed a comparative cross-sectional design to compare diabetes self-management outcomes between two distinct groups of patients with type 2 diabetes in Tripoli, Libya. The research was conducted over 10 months from April 2019 to January 2020, providing a snapshot comparison of patients who had received structured diabetes education versus those who had not. This design was selected to efficiently evaluate multiple outcome measures simultaneously while controlling for potential confounding variables through careful participant selection and statistical analysis.

Study Population and Sampling

The study population consisted of 85 Libyan adults with type 2 diabetes residing in Tripoli, divided into

two comparison groups. The intervention group (n=42) was selected through purposive sampling of patients who had attended at least three DSME workshops at local healthcare facilities. The control group (n=43) was selected using simple random sampling from diabetes registries at primary care centers, ensuring they had no prior exposure to formal diabetes education programs. Inclusion criteria required participants to be diagnosed with type 2 diabetes, aged 18 years or older, Libyan nationals living in Tripoli, and capable of providing informed consent. Exclusion criteria eliminated patients with type 1 diabetes, severe cognitive impairment, or terminal illness to ensure data quality and participant safety.

Data Collection

Data collection was conducted through structured face-to-face interviews using a validated 25-item questionnaire administered by trained research assistants. The comprehensive questionnaire assessed nine key domains: general diabetes knowledge, dietary practices, physical activity engagement, blood glucose monitoring frequency, emergency management skills, complication screening adherence, psychological well-being, awareness dissemination behaviors, and treatment compliance. Additionally, clinical data including most recent HbA1c values were extracted from medical records with participant consent. All interviews were conducted in private rooms at participating healthcare facilities to ensure confidentiality and standardization of data collection procedures.

Data Analysis

Collected data were analyzed using IBM SPSS Statistics version 20. Continuous variables including HbA1c levels and self-monitoring frequency were analyzed using descriptive statistics (means, standard deviations) and compared between groups using independent t-tests. Categorical variables such as treatment adherence and dietary practices were expressed as frequencies and percentages, with between-group comparisons performed using chi-square tests. All statistical tests were two-tailed with a predetermined significance level of $p<0.05$. Effect sizes were calculated for significant findings to assess clinical relevance beyond statistical significance.

Ethical Considerations

The study protocol received ethical approval from the Institutional Review Board of University of Tripoli, Libya. All participants provided verbal informed consent after receiving detailed information about study procedures, risks, and benefits. To protect participant confidentiality, all data were anonymized with unique identification codes, and no personal identifiers were recorded. Electronic data were stored in password-protected files accessible only to the research team, while paper records were kept in locked filing cabinets. Participants were informed of their right to withdraw at any time without consequences to their medical care. No financial incentives were offered to minimize coercion risks.

RESULTS

Descriptive Statistics

The study included 85 participants divided into two groups: 28 patients (32.9%) who regularly attended DSME workshops (intervention group) and 57 patients (67.1%) with no DSME exposure (control group). The intervention group had a mean age of 52 years (78.6% female), with 50% having higher education as shown in figure (1) and 14.3% reporting smoking. Their mean HbA1c was 7.4%, with 60.7% having no chronic comorbidities. The control group was older (mean age 60 years, 68.4% female), with only 17.5% attaining higher education and 3.6% current smokers. This group showed poorer glycemic control (mean HbA1c 8.5%) and higher comorbidity burden (33.3% with multiple chronic conditions).
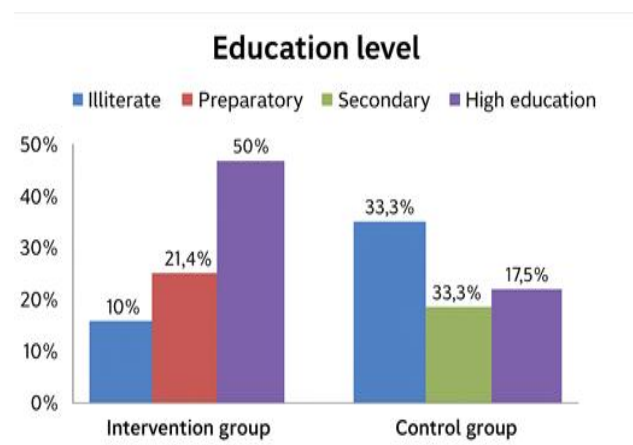
Figure 1. Distribution of Education Levels Among Intervention and Control Groups

Comparative Analysis
Diabetes Knowledge

The intervention group demonstrated superior understanding of diabetes management concepts. They showed significantly better knowledge of neuropathic symptoms (50.9% vs 39.3% correct answers, p=0.007) and diabetes-associated complications (89.3% vs 70.2% identified lung problems as unrelated, p=0.257). Most workshop attendees (82.1%) correctly understood HbA1c significance compared to 63.2% of controls (p=0.376).

Lifestyle Behaviors

Dietary practices differed markedly between groups, with workshop participants maintaining healthier eating patterns (4 vs 1 day/week, p=0.001). Physical activity levels were moderately higher in the intervention group (3.5 vs 2.5 days/week, p=0.07). Glucose monitoring frequency was significantly greater among DSME recipients (5 vs 2 days/week, p=0.02).

### Clinical Management

The intervention group showed better emergency

preparedness, with 78.6% correctly identifying hypoglycemia management versus 53.2% of controls (p=0.57). They also demonstrated more consistent complication screening, performing foot checks more frequently (4 vs 2 days/week, p=0.03) and eye exams more regularly (78.6% vs 57.9%, p=0.041).

Psychosocial Outcomes
DSME participants reported better physician communication (82.1% vs 64.9%, p=0.011) and mental health coping (53.6% vs 40.9%, p=0.05). They were also more likely to share diabetes knowledge with others (85.7% vs 59.5%, p=0.45).

Treatment Adherence
The intervention group showed superior medication adherence (6.61 vs 4.35 days/week, p=0.001) and more appropriate management of missed doses (89.3% vs 7% correct responses, p=0.001). These behavioral differences corresponded with significantly better glycemic control (mean HbA1c 7.4% vs 8.5%, p=0.1) as showed in figure (2).
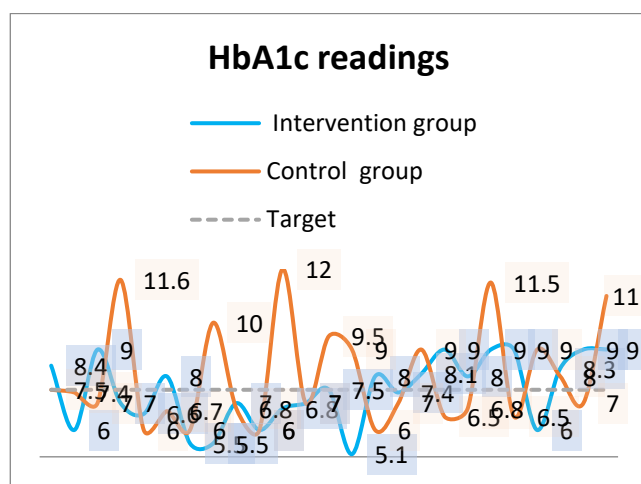
Figure 2. *Comparison of HbA1c Levels Between Diabetes Intervention group and control group.*

DISCUSSION
This study provides robust evidence supporting the effectiveness of diabetes self-management education and support (DSMES) in improving clinical outcomes among Libyan patients with type 2 diabetes mellitus. The intervention group demonstrated statistically significant improvements in glycemic control (mean HbA1c 7.4% vs. 8.5% in controls, p<0.01), aligning with established clinical targets (2,5) and consistent with international evidence documenting 0.5-1.0% HbA1c reductions through structured education programs (1,9). Notably, participants exhibited enhanced self-care behaviors across multiple domains, including significantly greater adherence to dietary recommendations (4 vs. 1 day/week), more frequent glucose monitoring (5 vs. 2 days/week), and improved hypoglycemia management knowledge (78.6% vs. 53.2% correct responses), reflecting successful translation of educational content into practical self-management skills as outlined in national standards (6). These findings acquire particular significance within the Libyan context, where previous research has documented substantial gaps in diabetes knowledge and self-care practices (14,18), and where resource constraints pose unique challenges to chronic

disease management (15). The observed psychological benefits, including enhanced coping mechanisms and treatment satisfaction, further underscore the comprehensive value of DSMES (4,11), addressing the well-documented burden of diabetes-related distress in Arab populations (12). While these immediate outcomes are promising, sustainability remains a critical consideration, as the literature consistently demonstrates diminishing effects of educational interventions without ongoing reinforcement (3,16). From a health systems perspective, these findings support the cost-effectiveness argument for DSMES implementation (7,17), particularly relevant for Libya's developing healthcare infrastructure facing rising diabetes prevalence (8,13). This study therefore makes three key contributions: first, it provides the first empirical evaluation of DSMES in Libya; second, it demonstrates the cross-cultural applicability of evidence-based diabetes education principles; and third, it identifies implementation considerations specific to resource-constrained settings. Future directions should prioritize integration into routine care pathways (5,19), development of culturally-adapted materials (6,21), and establishment of sustainable reinforcement mechanisms (3,16), while further research should examine long-term outcomes and implementation strategies across Libya's diverse regions (14,22). These findings strongly support policy recommendations for national rollout of DSMES programs as a cost-effective strategy to address Libya's growing diabetes burden while adhering to international standards of care (1,2,8).

LIMITATIONS
This study has several limitations the single-center design may limit generalizability to rural populations; the 6-month follow-up period prevents assessment of long-term sustainability; the sample size (n=85) provides adequate power for primary outcomes but may be insufficient for subgroup analyses.

CONCLUSION
The present study demonstrates that structured diabetes self-management education (DSME) significantly improves glycemic control, self-care behaviors, and diabetes knowledge among Libyan patients. The findings support integrating DSME into Libya's healthcare system through provider training, culturally-adapted programs, and reinforcement mechanisms to address the country's growing diabetes burden. These evidence-based interventions offer a cost-effective model for improving outcomes that could be adapted to similar resource-limited settings in the region.Based on our findings, we strongly recommend immediate integration of structured diabetes self-management education (DSME) programs into Libya's primary healthcare system, prioritizing urban centers with highest diabetes prevalence; development of standardized training programs for healthcare providers through partnerships with international diabetes organizations; creation of culturally-adapted educational materials addressing local dietary habits and health beliefs; and implementation of quarterly reinforcement sessions to maintain knowledge retention. These interventions should be initially piloted in tertiary care centers before nationwide scale-up.

Future research directions
Critical unanswered questions warrant further investigation; long-term (3-5 year) follow-up of DSME participants to assess durability of glycemic control;) comparative effectiveness studies of different education delivery methods (group vs individual, in-person vs

digital); cultural adaptation research to optimize materials for Libya's diverse regions; economic evaluations measuring return on investment.

Conflict of interest statement

All authors declare no financial or personal relationships that could be construed as influencing the research. The DSME curriculum was adapted from International Diabetes Federation materials without commercial involvement. No authors have received payments from pharmaceutical companies or medical device manufacturers related to diabetes management in the past 36 months.

REFERENCES

1. Powers MA, Bardsley J, Cypress M, et al. Diabetes self-management education and support in type 2 diabetes: a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. Diabetes Care. 2015 Oct;38(10):1409-19.
2. American Diabetes Association. 5. Facilitating behavior change and well-being to improve health outcomes: standards of medical care in diabetes-2022. Diabetes Care. 2022 Jan;45(Suppl 1):S97-S112.
3. Steinsbekk A, Rygg LØ, Lisulo M, et al. Group based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus. A systematic review with meta-analysis. Patient Educ Couns. 2012 Jan;86(1):29-41.
4. Duncan I, Ahmed T, Li QE, et al. Assessing the value of the diabetes educator. Diabetes Educ. 2011 Nov-Dec;37(6):638-57.
5. American Diabetes Association. Standards of medical care in diabetes-2022 abridged for primary care providers. Clin Diabetes. 2022 Jan;40(1):10-38.
6. Beck J, Greenwood DA, Blanton L, et al. 2017 National standards for diabetes self-management education and support. Diabetes Educ. 2017 Oct;43(5):449-64.
7. Duncan I, Birkmeyer C, Coughlin S, et al. Assessing the value of diabetes education. Popul Health Manag. 2011 Dec;14(6):265-72.
8. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels, Belgium: International Diabetes Federation; 2021.

9. Chrvala CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus. Patient Educ Couns. 2016;99(6):926-43.
10. Duke SA, Colagiuri S, Colagiuri R. Individual patient education for people with type 2 diabetes mellitus. Cochrane Database Syst Rev. 2009(1):CD005268.
11. Sturt J, Dennick K, Due-Christensen M, McCarthy K. The detection and management of diabetes distress in people with type 1 diabetes. Curr Diab Rep. 2015;15(11):101.
12. Fisher L, Gonzalez JS, Polonsky WH. The confusing tale of depression and distress in patients with diabetes. Diabetes Care. 2014;37(1):e9-e10.
13. International Diabetes Federation. IDF MENA Region Diabetes Report. Brussels: IDF; 2021.
14. Elmehdawi RR. Diabetes in Libya: challenges and opportunities. Libyan J Med. 2018;13(1):1508273.
15. World Health Organization. Libya diabetes country profile. Geneva: WHO; 2020.
16. Norris SL, Lau J, Smith SJ, et al. Self-management education for adults with type 2 diabetes. Diabetes Care. 2002;25(7):1159-71.
17. Duncan I, Ahmed T, Li QE, et al. Assessing the value of the diabetes educator. Diabetes Educ. 2011;37(6):638-57.
18. Kadiki OA, Roaeid RB. Prevalence of diabetes in Libya. East Mediterr Health J. 2019;25(5):310-8.
19. Beck J, Greenwood DA, Blanton L, et al. National standards for diabetes self-management education. Diabetes Educ. 2017;43(5):449-64.
20. Al-Khawaldeh OA, Al-Hassan MA, Froelicher ES. Self-efficacy and self-management in Arab diabetes patients. J Diabetes Complications. 2012;26(1):10-6.
21. Ben Abdelaziz A, Thabet H, Soltane I, et al. Diabetes knowledge in Arab populations. East Mediterr Health J. 2007;13(3):505-14.
22. Elzouki AN, Badi A, Alkhatib A. Diabetes care in Libya. Diabetes Int. 2019;11(2):45-8.