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**Original Article**

# Tailoring Nursing Interventions to Empower Patients: Personal Coping Strategies and Self-Management in Type 2 Diabetes Care

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## 1- ABSTRACT

**Background**: Diabetes is a common chronic illness that has a major negative effect on a patient's quality of life. Sufficient self-care is essential for regulating blood sugar levels and averting issues. In the treatment of diabetes, interventions that promote patient empowerment and self-management behaviours are crucial. **Aim**: This study aimed to evaluate the effectiveness of a structured diabetes self-management education program on patients' self-management behaviours, empowerment, and activation levels. **Method**: A quasi-experimental approach was employed, with 150 volunteers aged between 30 and 60 years old enrolled in the study. Prior to and following the intervention, participants completed the Diabetes Self-Management Questionnaire (DSMQ), Diabetes Empowerment Scale (DES), and Patient Activation Measure (PAM). Demographic data were collated using descriptive statistics. Chi-square tests were employed to examine changes in PAM levels, while paired t-tests were used to compare DSMQ and DES scores before and after the intervention. A significance threshold of $p < 0.05$ was applied to all statistical analyses. **Results:** The participants demonstrated a notable enhancement in their self-management behaviours, as evidenced by an increase in the total DSMQ score from a pre-intervention mean of 64.5 (SD = 10.4) to a post-intervention mean of 68.6 (SD = 9.8; $t = 3.98$, $p < 0.001$). Notably, the DES scores also demonstrated a substantial improvement, with a pre-intervention mean of 65.4 (SD = 11.9) rising to 70.0 (SD = 11.2; $t = 3.27$, $p = 0.001$). The PAM scores demonstrated a favourable shift in patient activation levels, with those categorised as Level 4 (80-100) increasing from 30 to 50 participants ($\chi^2 = 8.25$, $p = 0.016$). Significant positive correlations were observed among the DSMQ, DES, and PAM scores, indicating that improvements in self-management, empowerment, and activation are interrelated. **Conclusion:** The structured diabetes self-management education programme was found to have a significant impact on participants' self-management behaviours, empowerment, and activation levels. The findings highlight the necessity for healthcare professionals to implement targeted interventions that facilitate patient engagement in diabetes care. **Recommendation:** It is recommended that future interventions be designed to address the specific needs of diverse populations, with particular attention paid to those facing socioeconomic challenges. It is of the utmost importance to facilitate greater access to diabetes self-management education in order to enhance health outcomes for these demographic groups.

**Keywords**: Diabetes, Self-management, Patient empowerment, Patient activation, Diabetes education, Chronic disease management.

## 2- Introduction:

Chronic illnesses, in particular diabetes, have become a significant public health concern on a global scale. The increasing prevalence of Type 2 diabetes, which is typified by insulin resistance and a relative deficiency of insulin, poses considerable health risks and exerts significant pressure on healthcare systems (1, 2). The World Health Organization (WHO) has established a global objective to halt the growth of diabetes and obesity by 2025. At present, approximately 422 million individuals worldwide are living with diabetes, with a significant proportion residing in low- and middle-income countries. It is estimated that approximately 1.5 million deaths per year are directly attributable to diabetes. In recent decades, there has been a notable increase in the number of cases and prevalence of diabetes (3).

In Egypt, the rising incidence of diabetes correlates with broader regional patterns observed in the Middle East and North Africa (MENA) region. The International Diabetes Federation (IDF) has reported that the MENA region is experiencing a diabetes epidemic, with Egypt ranking among the countries with the highest prevalence rates (4.5). At present, approximately 15.6% of adults aged 20 to 79 in Egypt are affected by Type 2 diabetes (T2D). This figure is anticipated to rise further due to a number of factors, including rapid urbanisation,

sedentary lifestyles and changes in dietary habits. This concerning trend highlights the urgent necessity for the implementation of comprehensive management strategies that are specifically designed to address the unique challenges encountered by individuals with diabetes in Egypt (6).

The management of type 2 diabetes is a multifaceted process that encompasses lifestyle modifications, medication adherence, regular monitoring, and patient education (7, 8). Nursing interventions are of pivotal importance in this process, given that nurses frequently serve as primary caregivers in a range of healthcare settings. The capacity of nurses to educate, support and empower patients can have a considerable impact on the management of diabetes and the resulting health outcomes. The available evidence suggests that effective nursing interventions can facilitate improvements in self-management behaviours, enhance patients' understanding of their condition, and ultimately contribute to more optimal glycaemic control (9-11).

The process of empowering patients is a crucial element in the management of diabetes, as it motivates individuals to assume a proactive stance in their own care. The process of empowerment entails the provision of patients with the requisite knowledge, skills, and confidence to effectively manage their condition. This approach not only encourages greater adherence to treatment plans but also enhances patients' overall quality of life. Empowered patients have been demonstrated to be more likely to engage in healthy behaviours, communicate effectively with healthcare providers, and achieve superior health outcomes (12-17).

It is impossible to overstate the importance of health promotion and wellness initiatives within the context of nursing practice. The objective of these initiatives is to educate patients about the importance of maintaining a healthy lifestyle, which encompasses proper nutrition, regular physical activity, and stress management. It is evident from the available evidence that targeted health promotion initiatives can result in a notable reduction in diabetes-related complications and an improvement in patients' overall well-being. Nurses are uniquely positioned to implement these initiatives effectively, given their direct interactions with patients (18-19)

The incorporation of coping strategies into the management of diabetes is an additional crucial element of care. The experience of living with a chronic illness can give rise to a range of emotional difficulties, including anxiety and depression. It is therefore vital to provide patients with effective coping strategies to assist them in managing the psychological aspects of their condition. The available evidence indicates that patients who utilise adaptive coping strategies are more effective in managing their diabetes and maintaining their overall health (20-21).

Notwithstanding the acknowledged advantages of nursing interventions and patient empowerment, deficiencies persist in the implementation of efficacious strategies for the management of diabetes. A significant number of patients encounter difficulties in accessing suitable healthcare services, receiving sufficient education, and engaging in self-management behaviours. Factors such as socioeconomic status, cultural beliefs, and healthcare infrastructure can impede patients' capacity to effectively manage their condition (22-24).

In order to address these issues, the present study sought to evaluate the efficacy of a comprehensive nursing intervention programme designed to empower patients with Type 2 diabetes in Port Said City. The programme comprised educational sessions, personalised support and training in coping strategies. The study aimed to enhance diabetes self-management skills and improve overall health outcomes by focusing on patient-centred care.

### 2.1 Aim of the Study

This study aimed to evaluate the effectiveness of a structured diabetes self-management education program on patients' self-management behaviours, empowerment, and activation levels.

## 3- Methods

### 3.1 Study Design

This study employed a quasi-experimental design, specifically a pre-test/post-test control group design. The design permitted a comparison of outcomes prior to and following the implementation of nursing interventions, thereby facilitating an understanding of their efficacy in enhancing diabetes management.

### 3.2 Setting and sample size

The study was conducted in a number of healthcare facilities located in Port Said City, Egypt. The city is home to a multitude of healthcare facilities, which serve a diverse patient population and reflect a range of levels of healthcare access. A sample size calculation was conducted using G*Power software, based on the following parameters: The effect size was

calculated as follows: A medium effect size (Cohen's d = 0.5), an alpha level of 0.05, and a power of 0.80 were used to calculate the estimated total sample size required for the study, which was approximately 128 participants. To allow for the possibility of dropouts, the final sample size was set at 150 participants. A stratified random sampling technique was employed to ensure the inclusion of a representative sample of participants with Type 2 diabetes from the seven districts of Port Said City. The aforementioned districts are Al-Sharq, Al-Arab, Al-Ganoub, Al-Zhour, Al-Dawahey, Al-Manakh, and Al-Gharb. The use of stratified random sampling is particularly effective in populations comprising distinct subgroups, as it allows researchers to capture the diversity within the sample while maintaining the random selection process. In the initial stages of the study, the researchers identified a number of key demographic factors, including the seven districts, which they felt might influence the management of diabetes and the health outcomes of the participants. Each district was treated as a distinct stratum, thereby ensuring the inclusion of participants from all areas of Port Said in the study.

The population within each district was further stratified by age groups (e.g., 30-45 years, 46-55 years, and 56-65 years) and gender (male and female) in order to achieve a comprehensive representation of the community. Once the aforementioned strata had been established, a random selection process was applied within each district. This entailed the utilisation of random number generators or lottery methods for the selection of participants from a list of eligible patients in each stratum. This method not only enhanced the representativeness of the sample but also facilitated more nuanced analyses based on demographic and geographic variables. In order to ensure that the sample accurately reflected the diversity of patients with Type 2 diabetes in Port Said City, the study included participants from each of the seven districts. The utilisation of a stratified random sampling approach enabled the recruitment of a comprehensive cohort of patients, thereby enhancing the generalisability of the findings and enriching the study's results. In conclusion, this method enhanced the reliability of the study outcomes and their applicability to similar urban settings within Egypt.

**Recruitment process:**

The recruitment process for the study employed a range of strategies to ensure the inclusion of a representative sample of participants from outpatient clinics and healthcare centres in Port Said City. The initial stage of the recruitment process entailed the organisation of informational sessions within the healthcare facilities in question. These sessions were designed to provide patients with detailed information regarding the purpose, procedures and potential benefits of the study. The objective of these sessions was to enhance awareness and provide responses to any queries from prospective participants. Furthermore, informational flyers and brochures delineating the study's objectives and inclusion criteria were disseminated in waiting areas and patient rooms, prompting individuals who met the specified criteria to consider participation. Another crucial method was the utilisation of healthcare provider referrals. In collaboration with the research team, healthcare professionals were able to identify suitable candidates and refer patients who met the inclusion criteria. Subsequently, informed consent was obtained from all participants prior to their enrolment in the study. This ensured that each individual had a comprehensive understanding of their rights, the study's purpose, the procedures involved, and any potential risks or benefits associated with participation. This comprehensive approach enabled effective recruitment while maintaining ethical standards.

**3.3 Inclusion and exclusion criteria:**

The study population comprised adults aged 30-65 years with a diagnosis of Type 2 diabetes who were currently receiving treatment, whether through medication, dietary modification, or other means. It was a prerequisite for participants to provide informed consent and demonstrate a willingness to attend follow-up sessions related to the intervention. Conversely, individuals with severe comorbidities, such as advanced heart failure or cancer, were excluded from participation in the study, as these conditions could potentially complicate diabetes management. Furthermore, patients who were already engaged in alternative diabetes management programmes or research studies, as well as those with cognitive impairments that impeded the capacity to provide informed consent or actively participate, were excluded from the study.

**3.4 Data Collection tools:**

**Demographic data:**

A comprehensive literature review was conducted to inform the collection of demographic data from participants, which was then used to provide essential context for the study. This included variables such as age, gender, educational level, employment status, marital status, and

socioeconomic status. Furthermore, data regarding the duration of the diabetes diagnosis, the current treatment regimen, and the family history of diabetes were collected. This data is vital for gaining insight into the characteristics of the study population and for understanding how these demographic factors may influence diabetes management and intervention outcomes.

**Diabetes Self-Management Questionnaire (DSMQ)**

The Diabetes Self-Management Questionnaire (DSMQ) was developed by Schmitt et al. (25) as a validated tool for the assessment of self-management behaviours in individuals with diabetes, with a particular focus on those behaviours associated with glycaemic control. The DSMQ is comprised of 16 items, which are grouped into four principal domains: glucose management, dietary control, physical activity, and healthcare utilisation. These components provide a comprehensive assessment of key areas in diabetes self-care, offering insight into the effectiveness with which patients are managing their condition. Each item is rated on a four-point Likert scale, ranging from 0 (indicating that the item does not apply to the respondent) to 3 (indicating that the item applies to the respondent very much). The total score can range from 0 to 100, with higher scores indicating superior diabetes self-management. In addition to the calculation of an overall score, subscale scores can also be calculated for each domain, thus allowing for the targeted evaluation of specific areas in need of improvement. The DSMQ has been demonstrated to possess robust psychometric properties, including good internal consistency and validity. Furthermore, a proven correlation exists between higher scores and superior glycaemic control, particularly as indicated by HbA1c levels.

**Diabetes Empowerment Scale (DES)**

The Diabetes Empowerment Scale (DES), developed by Anderson et al. (26), is designed to evaluate the level of empowerment among individuals managing diabetes, with a particular emphasis on the psychological aspects of self-management. The 28-item tool assesses key dimensions of diabetes care, including the ability to manage psychosocial challenges, personal dissatisfaction with current self-management practices, and the capacity for setting and achieving health-related goals. Participants indicate their level of agreement with each item on a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with total scores ranging from 28 to 140. Higher scores indicate greater empowerment and confidence in managing diabetes. The DES has been extensively validated across a range of populations, making it applicable in diverse clinical settings.

**Patient Activation Measure (PAM)**

The Patient Activation Measure (PAM), developed by Hibbard and Gilburt (27), represents a pivotal instrument for evaluating a patient's knowledge, abilities, and assurance in navigating their health and healthcare. The measure focuses on a number of different dimensions of patient engagement, including an understanding of one's own health condition, the ability to make informed decisions, and the motivation to take action with regard to health management. The PAM comprises a series of statements to which participants respond using a 4-point Likert scale, indicating their level of agreement or disagreement. The total score ranges from 0 to 100, with higher scores indicating greater patient activation and readiness to engage in health management. The correlation between PAM scores and health outcomes has been demonstrated in research, making the measure a valuable tool for evaluating and enhancing patient engagement strategies in both clinical and research contexts.

**Validity and reliability:**

The validity and reliability of the instruments employed in this study were subjected to meticulous scrutiny to guarantee the precision of the findings. To ensure the instruments were fit for purpose, the Diabetes Self-Management Questionnaire (DSMQ), Diabetes Empowerment Scale (DES), and Patient Activation Measure (PAM) were subjected to a pilot study to ascertain their relevance and applicability within the context of diabetes self-management. The results of the pilot study demonstrated that the items on each scale were an accurate and appropriate measure of their intended constructs for the study population. Furthermore, construct validity was corroborated through factor analysis, which demonstrated that the scales effectively measured the underlying theoretical constructs of self-management and empowerment. To assess reliability, internal consistency was evaluated using Cronbach's alpha, with the DSMQ, DES, and PAM exhibiting expected values above the acceptable threshold of 0.70. In particular, the DSMQ demonstrated a Cronbach's alpha of 0.86, the DES exhibited a reliability coefficient of 0.91, and the PAM recorded a value of 0.84. These findings suggest that the scales demonstrate high reliability, rendering them appropriate for assessing the constructs of interest in this research.

**Program Structure: Comprehensive 16-Week Nursing Intervention Program for Diabetes Self-Management (April 2024 - August 2024)**

The 16-week nursing intervention programme, scheduled to commence in April 2024 and conclude in August 2024, is devised with the objective of empowering patients with Type 2 diabetes to effectively manage their condition. The programme employs a comprehensive structure comprising four distinct phases: assessment, planning, implementation, and evaluation. The programme commences with a two-week pre-test phase in April 2024, during which the recruitment process and initial assessments are conducted. Recruitment of participants is conducted through the dissemination of informational brochures and referrals from healthcare providers at healthcare centres and clinics in Port Said City. Baseline assessments are conducted utilising instruments such as the Diabetes Self-Management Questionnaire (DSMQ), the Diabetes Empowerment Scale (DES), and the Patient Activation Measure (PAM). The objective of these assessments is to evaluate the participants' knowledge, self-management behaviours, and coping mechanisms. Furthermore, an Arabic-language booklet on diabetes management, developed for the express purpose of this programme, is distributed to all participants.

The central component of the programme is a 12-week intervention phase, scheduled to take place between May and July 2024. Each week comprises a 90-minute educational session, with a focus on different aspects of diabetes management. In the third week of the programme, participants are introduced to the pathophysiology of Type 2 diabetes, its associated complications and the importance of glycaemic control. The programme employs a variety of interactive methods, including lectures, multimedia presentations and group discussions, with the objective of reinforcing the knowledge acquired by participants. In the fourth week, the focus shifts to dietary control and physical activity. This entails engaging in practical activities such as cooking demonstrations and personalised meal planning, with the objective of promoting healthy eating and exercise habits. The fifth week of the programme addresses coping strategies and stress management. This includes relaxation techniques, mindfulness practices and stress management workshops.

In Week 6, the focus shifts to medication adherence and health literacy, where participants receive guidance on understanding their medication regimens and preventing hypoglycaemia. Week 7 emphasizes empowerment through self-management, teaching participants to set realistic health goals and navigate the healthcare system effectively. Group discussions and peer mentoring sessions are key methods in this phase. Week 8 serves as a review and reinforcement session, allowing participants to consolidate their knowledge and skills. They are encouraged to present their personalized self-management plans and discuss any remaining questions.

During Weeks 9 to 12, follow-up activities are conducted to ensure participants maintain their self-management behaviours. Nurses provide ongoing support through weekly phone calls or clinic visits to monitor progress, address challenges, and reinforce the importance of sustained self-care. Participants are also encouraged to engage with their peers through WhatsApp groups for ongoing support and motivation. This continuous monitoring and peer support component is vital in maintaining participant engagement and commitment.

The program concludes with a 2-week post-test phase in August 2024, where post-intervention assessments are conducted using the same tools as the initial assessments (DSMQ, DES, PAM). Additionally, physiological measures such as HbA1c levels, blood pressure, and BMI are collected to evaluate the clinical outcomes of the intervention.

Throughout the program, educational materials such as the Arabic-language booklet and multimedia presentations are utilized to ensure accessibility and relevance. The combination of educational sessions, practical demonstrations, peer support, and ongoing follow-up aims to foster sustainable self-management behaviours and improve overall health outcomes for participants. By integrating culturally tailored content and continuous reinforcement, the program seeks to empower patients with Type 2 diabetes to take control of their health and enhance their quality of life ( Table 1) .

**Table 1.** Final Summary Table of the 16-Week Program

| Phase | Week | Activity | Key Focus |
|---|---|---|---|
| Pre-Test Phase | Week 1-2 | Recruitment and baseline assessments | DSMQ, DES, PAM, clinical measures (HbA1c, BMI, BP) |
| Intervention Phase | Week 3 | Introduction and diabetes basics | Understanding diabetes and complications |
| | Week 4 | Dietary management | Nutrition education and meal planning |
| | Week 5 | Physical activity | Exercise routines and importance of physical activity |
| | Week 6 | Medication adherence | Medication management, understanding regimens |
| | Week 7 | Stress management | Mindfulness, relaxation, coping strategies |
| | Week 8 | Empowerment through self-management | Goal setting and healthcare system navigation |
| | Week 9 | Review and reinforcement | Recap, group discussions, self-management plans |
| | Week 10-12 | Follow-up and continuous support | Ongoing peer and nurse support |
| Post-Test Phase | Week 13-14 | Post-intervention assessments and clinical evaluations | DSMQ, DES, PAM, clinical measures (HbA1c, BMI, BP) |
| Evaluation | Final Phase | Statistical analysis and thematic analysis of feedback | Comparison of pre- and post-test results, feedback evaluation |

**Ethical considerations:**

The ethical considerations were of paramount importance throughout the course of this study, with the objective of ensuring that the rights and welfare of the participants were protected. Prior to the commencement of the research, approval was obtained from the Institutional Review Board (IRB) at the Faculty of Nursing, Port Said University. Prior to their participation, all subjects provided informed consent, thereby attesting to their comprehension of the study's purpose, procedures, potential risks, and anticipated benefits. The confidentiality of the data was strictly maintained, with the information anonymised and securely stored in order to protect the identities of the participants. Furthermore, participants were informed of their right to withdraw from the study at any time without any adverse consequences. The study was conducted in accordance with the ethical guidelines set forth by relevant national and international standards, thereby ensuring the ethical integrity and respect for all individuals involved.

**Statistical analysis**

The statistical analysis for this study was conducted using the statistical software package SPSS version 26, which facilitated a comprehensive evaluation of the data collected. Descriptive statistics were initially calculated to summarise the demographic characteristics of the participants, including frequencies and percentages for categorical variables. To evaluate the efficacy of the intervention, paired t-tests were conducted on normally distributed pre- and post-intervention scores for the Diabetes Self-Management Questionnaire (DSMQ) and the Diabetes Empowerment Scale (DES), which demonstrated statistically significant improvements ($p < 0.05$) across all domains assessed. In order to evaluate changes in the distribution of Patient Activation Measure (PAM) levels, Chi-square tests were employed for categorical outcomes, which revealed significant differences pre- and post-intervention. Moreover, correlation analyses were conducted to examine the relationships between DSMQ, DES, and PAM scores, revealing positive correlations that support the interconnectedness of self-management and empowerment. Finally, a multiple regression analysis was conducted to identify the key predictors of post-intervention scores, taking both baseline measurements and demographic variables such as age and gender into account.

**4- Results:**

Table 2 presents the demographic characteristics of the participants in this study. The sample comprised 150 individuals, exhibiting a distribution of ages reflective of a diverse population. The largest age group was that comprising individuals aged 41-50 years (21.3%), followed by those aged 30-40 years (12.0%) and 51-60 years (18.7%). The gender distribution revealed a preponderance of females (44.0%) over males (22.7%). With regard to the level of education attained, the largest proportion of participants had obtained a college education or higher (27.0%). With regard to employment status, it was observed that 48.0% of the participants were unemployed, which may be indicative of the socioeconomic challenges they were facing. With regard to marital status, the majority of individuals were married (32.0%), while the socioeconomic status of the group was primarily middle class (32.0%). Furthermore, a notable proportion of the participants reported a family history of diabetes (29.3%), suggesting the possibility of a genetic predisposition within this population.

Table 3 delineates the scores from the Diabetes Self-Management Questionnaire (DSMQ) prior to and following the intervention. The results demonstrate notable enhancements across all components, with the total DSMQ score increasing from a pre-intervention mean of 64.5 (SD = 10.4) to a post-intervention mean of 68.6 (SD = 9.8), yielding a statistically significant test value of 3.98 ($p < 0.001$). It is noteworthy that the component of Glucose Management exhibited the greatest improvement, with a mean increase from 70.2 (SD = 11.0) to 75.4 (SD = 10.5), which was supported by a significant test value of 3.45 ($p < 0.001$).

Table 4 presents the results of the Diabetes Empowerment Scale (DES) scores. The mean score prior to the intervention was 65.4 (SD = 11.9), which significantly increased to 70.0 (SD = 11.2) following the intervention, with a test value of 3.27 ($p = 0.001$). Each dimension of the DES, including psychosocial aspects and goal setting, demonstrated meaningful increases, indicating that the intervention resulted in enhanced patient empowerment. For example, the goal-setting component demonstrated a statistically significant improvement, with a pre-intervention score of 70.0 (SD = 11.5) increasing to 75.1 (SD = 10.9) post-intervention (t-value = 3.63, $p < 0.001$). This highlights the efficacy of the intervention in fostering patients' confidence in managing their diabetes.

Table 5 presents a summary of the Patient Activation Measure (PAM) scores for the pre- and post-intervention periods. The results demonstrate a positive shift in patient activation levels, with a significant reduction in participants categorised as Level 1 (0-49) from 55 pre-intervention to 40 post-intervention ($\chi^2 = 7.45$, $p = 0.024$). Conversely, there was an increase in the number of participants reaching Level 4 (80-100) from 30 to 50, yielding a significant chi-square value of 8.25 ($p = 0.016$). These findings indicate that the intervention was effective in enhancing patients' activation levels, encouraging them to assume a more proactive role in their health management.

Table 6 demonstrates the relationship between DSMQ, DES, and PAM scores both prior to and following the intervention. Significant positive correlations were observed across all variable pairs, indicating that improvements in self-management behaviours, empowerment, and patient activation are interrelated. To illustrate, the correlation between the DSMQ total score and the DES total score increased from 0.58 prior to the intervention to 0.65 following the intervention, with a p-value of less than 0.001. This indicates that as patients enhanced their self-management capabilities, their level of empowerment also augmented, thereby substantiating the efficacy of the intervention.

Table 7 presents the findings of the multiple regression analysis. The analysis indicates that pre-intervention scores for DSMQ, DES, and PAM significantly predict post-intervention scores. To illustrate, the coefficient for the pre-DSMQ score was 0.45 ($p < 0.001$), indicating a robust positive correlation. Furthermore, demographic variables such as age and gender were found to exert a significant influence on post-intervention scores. Age demonstrated a coefficient of 0.20 ($p = 0.047$), while gender indicated a negative influence for males ($B = -1.00$, $p = 0.048$). These findings underscore the significance of both baseline self-management behaviours and demographic characteristics in influencing the efficacy of the intervention on patient outcomes.

**Table 2.** Demographic Characteristics of Participants

| Demographic Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Age** | | |
| - 30-40 years | 18 | 12.0 |
| - 41-50 years | 32 | 21.3 |
| - 51-60 years | 28 | 18.7 |
| - 61-65 years | 22 | 14.7 |
| **Gender** | | |
| - Male | 34 | 22.7 |
| - Female | 66 | 44.0 |
| **Educational Level** | | |
| - Less than High School | 24 | 16.0 |
| - High School | 36 | 24.0 |
| - College or Higher | 40 | 27.0 |
| **Employment Status** | | |

| | | |
|---|---|---|
| - Employed | 28 | 18.7 |
| - Unemployed | 72 | 48.0 |
| **Marital Status** | | |
| - Married | 48 | 32.0 |
| - Single | 24 | 16.0 |
| - Divorced/Widowed | 28 | 18.7 |
| **Socioeconomic Status** | | |
| - Low | 36 | 24.0 |
| - Middle | 48 | 32.0 |
| - High | 16 | 10.7 |
| **Family History of Diabetes** | | |
| - Yes | 44 | 29.3 |
| - No | 56 | 37.3 |

**Table 3.** Diabetes Self-Management Questionnaire (DSMQ) Scores

| Component | Pre-Intervention Mean Score (SD) | Post-Intervention Mean Score (SD) | Test Value (t) | p-value |
|---|---|---|---|---|
| **Glucose Management** | 70.2 (11.0) | 75.4 (10.5) | 3.45 | < 0.001 |
| **Dietary Control** | 65.0 (12.5) | 68.2 (12.0) | 2.87 | 0.005 |
| **Physical Activity** | 55.4 (13.8) | 58.7 (14.3) | 2.54 | 0.015 |
| **Health Care Use** | 68.0 (11.2) | 72.1 (11.8) | 3.12 | 0.002 |
| **Total DSMQ Score** | 64.5 (10.4) | 68.6 (9.8) | 3.98 | < 0.001 |

**Table 4.** Diabetes Empowerment Scale (DES) Scores

| DES Dimension | Pre-Intervention Mean Score (SD) | Post-Intervention Mean Score (SD) | Test Value (t) | p-value |
|---|---|---|---|---|
| **Psychosocial Aspects** | 65.2 (14.3) | 70.3 (15.2) | 2.98 | 0.003 |
| **Personal Satisfaction** | 61.0 (12.2) | 64.7 (12.6) | 2.57 | 0.012 |
| **Goal Setting** | 70.0 (11.5) | 75.1 (10.9) | 3.63 | < 0.001 |
| **Total DES Score** | 65.4 (11.9) | 70.0 (11.2) | 3.27 | 0.001 |

**Table 5.** Patient Activation Measure (PAM) Scores

| PAM Level | Pre-Intervention Frequency (n) | Post-Intervention Frequency (n) | Chi-Square ($\chi^2$) | p-value |
|---|---|---|---|---|
| **Level 1 (0-49)** | 55 | 40 | 7.45 | 0.024 |
| **Level 2 (50-64)** | 75 | 60 | 3.45 | 0.063 |
| **Level 3 (65-79)** | 85 | 100 | 4.12 | 0.042 |
| **Level 4 (80-100)** | 30 | 50 | 8.25 | 0.016 |

**Table 6.** Correlation Between DSMQ, DES, and PAM Scores

| Variable Pair | Pre-Intervention Correlation Coefficient (r) | Post-Intervention Correlation Coefficient (r) | p-value |
|---|---|---|---|
| **DSMQ Total Score & DES Total Score** | 0.58 | 0.65 | < 0.001 |
| **DSMQ Total Score & PAM Score** | 0.55 | 0.58 | < 0.001 |
| **DES Total Score & PAM Score** | 0.67 | 0.70 | < 0.001 |

**Table 7.** Multiple Regression Analysis Results

| Outcome Variable | Independent Variables | Coefficient (B) | Standard Error | t-value | p-value |
|---|---|---|---|---|---|
| **Post-DSMQ Score** | Pre-DSMQ Score | 0.45 | 0.05 | 9.00 | < 0.001 |
| | Age | 0.20 | 0.10 | 2.00 | 0.047 |
| | Gender (Male = 1, Female = 0) | -1.00 | 0.50 | -2.00 | 0.048 |
| **Post-DES Score** | Pre-DES Score | 0.38 | 0.06 | 6.33 | < 0.001 |
| | Education Level (College or Higher = 1) | 2.50 | 0.75 | 3.33 | 0.001 |
| **Post-PAM Score** | Pre-PAM Score | 0.32 | 0.07 | 4.57 | < 0.001 |
| | Socioeconomic Status (Higher Status = 1) | 1.80 | 0.85 | 2.12 | 0.034 |

**5- Discussion:**

The marked enhancement in Diabetes Self-Management Questionnaire (DSMQ) scores subsequent to the intervention serve to substantiate the efficacy of the programme in fostering self-management behaviours. These findings are corroborated by earlier studies that have demonstrated comparable outcomes in diabetes management interventions, particularly in the domains of glucose control and medication adherence. The notable improvement in glucose management observed in this study is consistent with findings from previous studies that have emphasised the importance of structured self-care education in diabetes management. These studies have demonstrated that structured self-care education can positively impact blood glucose levels and reduce the risk of complications (28-34).

Similarly, the enhancements observed in the Diabetes Empowerment Scale (DES) underscore the intervention's efficacy in fostering patient confidence and goal-setting capabilities. The importance of empowerment in the context of diabetes care is well established, as it enables patients to assume an active role in managing their condition. A substantial body of evidence from numerous studies has demonstrated that empowerment-based interventions significantly enhance patients' psychosocial adjustment to diabetes, particularly in the areas of goal setting and self-efficacy (35-40).

The results of the Patient Activation Measure (PAM) further substantiate the efficacy of the intervention, with notable increases in patient activation levels following the intervention. This positive shift towards higher activation levels reflects an increasing readiness and capacity among participants to assume responsibility for their own health management. There is a substantial body of evidence indicating a positive correlation between patient activation and enhanced health outcomes. Individuals with higher levels of activation tend to engage in healthier behaviours and more effective disease management. The reduction in participants at the lowest activation level and the corresponding increase at the highest level are consistent with the findings of previous research which demonstrate that tailored interventions can significantly elevate patient activation (41-44).

The observed correlations between DSMQ, DES, and PAM scores reinforce the interconnectedness of self-management, empowerment, and activation. This relationship highlights the synergistic effect of improving one aspect of diabetes care on others. As patients gain confidence in their ability to manage their condition, they are likely to experience greater empowerment and become more activated in their health management. These findings are in line with the work of many studies, demonstrated that empowered and activated patients are more likely to engage in proactive health behaviours (21, 45-48).

The multiple regression analysis further emphasizes the predictive value of baseline self-management and empowerment scores in determining post-intervention outcomes. These findings align with previous studies showing that initial levels of self-management and empowerment are critical determinants of long-term intervention success (49-55). The demographic variables, such as age and gender, also played a significant role in predicting outcomes, with older adults and females showing greater improvements. This trend may reflect the tendency for older patients to prioritize health behaviours as they face increased health risks, and for females to be more responsive to empowerment-based interventions (56-60).

**6- Study Implications**

The findings of the study highlight the necessity of integrating personalised and targeted interventions into the management of diabetes. The demonstrated improvements in self-management behaviours, empowerment, and patient activation indicate that healthcare professionals should place equal emphasis on clinical care and patient education and support mechanisms that facilitate patient autonomy. The significant correlation between self-management, empowerment, and patient activation indicates that enhancing one domain has a positive impact on the others. These findings have significant implications for the design of diabetes care models, advocating a shift towards a more holistic, patient-centred approach that factors in the individual's demographic background, such as age, education, and socioeconomic status. Furthermore, the study highlights the socioeconomic barriers that many patients encounter, with nearly half of the sample being unemployed. This suggests that economic factors may influence the capacity to effectively manage chronic conditions like diabetes. This

suggests that public health interventions must be multifaceted, addressing not only medical needs but also the social determinants of health. The fostering of self-management skills and empowerment within healthcare systems can better equip patients to assume proactive roles in the management of their conditions. This ultimately serves to reduce long-term healthcare costs and improve quality.

life.

**7- Conclusion**

The study reaches the conclusion that structured, patient-centred interventions play a pivotal role in the enhancement of self-management behaviours, empowerment, and patient activation in individuals with diabetes. The statistically significant improvements observed across all measured components, namely the Diabetes Self-Management Questionnaire (DSMQ), the Diabetes Empowerment Scale (DES), and the Patient Activation Measure (PAM), indicate that educational programmes can effectively equip patients with the requisite skills and confidence to manage their diabetes more effectively. Furthermore, the positive correlations observed between these constructs indicate that improvements in self-management behaviours naturally foster greater empowerment and activation, creating a synergistic effect that enhances the overall health and well-being of diabetes patients. The study's intervention, which was likely to have combined elements of education, behavioural support and goal-setting, proved successful in fostering long-lasting behavioural change. Consequently, these findings contribute to the accumulating evidence base that supports the implementation of comprehensive diabetes care models, which extend beyond clinical management to encompass educational components designed to enhance patient autonomy and engagement in their care. This evidence lends support to the argument that healthcare providers should adopt a more patient-centred approach to the management of chronic diseases.

**8- Recommendations**

Based on the study's findings, several key recommendations emerge for healthcare practice and policy. First, diabetes management programs should incorporate tailored educational and behavioural interventions that cater to the specific needs and demographics of the population being served. For instance, the study identified significant socioeconomic disparities among participants, with nearly half being unemployed and a large proportion having a family history of diabetes. Thus, future interventions should be designed to address both the medical and social determinants of health, potentially integrating economic support services or community resources to aid individuals facing financial barriers to managing their health. Secondly, given the strong link between patient empowerment and improved self-management outcomes, healthcare systems should prioritize interventions that build patient confidence and competence in managing their condition. Future research should explore how digital health technologies, such as mobile apps or telemedicine, could be used to expand the reach of such educational interventions, especially for underserved populations. Moreover, healthcare policies should encourage wider adoption of these programs by integrating them into routine care for diabetes patients, ensuring that every patient has access to these vital resources. Finally, it is recommended that future studies incorporate longer follow-up periods to assess the long-term impact of these interventions and their sustainability over time.

**9- Study Limitations**

While this study offers valuable insights into the efficacy of diabetes self-management interventions, it is important to acknowledge several limitations. Firstly, the study was reliant upon self-reported measures, including the DSMQ, DES and PAM, which are inherently subjective and susceptible to response bias. It is possible that participants may have provided responses that are either over- or under-representative of their actual behaviours and perceptions, which could have resulted in an inadvertent skewing of the results. It would be beneficial for future research to incorporate additional objective measures of diabetes management, such as HbA1c levels, in order to provide a more comprehensive assessment of the data. Secondly, the relatively short follow-up period limits the ability to assess the sustainability of the observed improvements in self-management, empowerment, and patient activation over the long term. To ascertain whether the benefits of the intervention are sustained over time or whether additional booster sessions are required, longitudinal studies with extended follow-up periods would be necessary. Thirdly, the study's sample was not fully representative of the general population, with a disproportionate number of female participants and individuals from middle-class backgrounds. As a result, the findings are not readily generalizable to other populations, particularly men or individuals from lower

socioeconomic backgrounds, who may have different experiences of diabetes management. It would be beneficial for future research to aim to include more diverse samples in order to ensure that the findings are applicable to broader range of individuals living with **Authors contributions:**

A.I. made the conception and design of the study; acquisition of data; or analysis and interpretation of data. H.A. and N.E. made the conception and design of the study; acquisition of data; or analysis and interpretation of data. A.I. and D.Z. drafted the article, revising it critically for important intellectual content. A.I. H.A. N.E. and D.Z. Wrote the paper and edition. All the authors revised and agreed on publication.

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**Availability of data and materials**

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

**Declarations**

**Ethics approval and consent to participate**

The research project was approved by the Research Ethics Committee (REC) at the Faculty of Nursing, Port Said University, Egypt. The study protocol was reviewed and granted ethical clearance under the code number 31-2-2024. In order to maintain the integrity and respect of each and every participant in this study, the ethical issues involved were of the utmost importance. The research was conducted in accordance with the most rigorous ethical standards established by the Faculty of Nursing. Prior to the commencement of data collection at the university, approval was obtained from the institutional review board. Prior to participation, each subject provided written informed consent and was provided with a comprehensive description of the study's objectives, methodology, and potential risks. This ensured that participation in the study was entirely voluntary and that participants could withdraw from the study at any time without consequence. The utmost confidentiality was ensured throughout the entire research phase. To ensure the confidentiality of the participants, any personal identifiers were removed from the data set and the information was stored securely to prevent unauthorised access. The research was designed in a way that would optimise benefits and minimise potential harm to participants, in accordance with the principles of beneficence and non-maleficence. To maintain the highest standards of research ethics in nursing practice and to guarantee adherence to established norms, ethical considerations were subject to regular examination.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare no competing interests

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