Original Article

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Effectiveness of Self-care Management Program on Glycaemic Control, Level of Knowledge and Anxiety among Adolescents with Type I Diabetes Mellitus: A Quasi-experimental Study

Paediatrics Section

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ABSTRACT

Introduction: Type 1 Diabetes Mellitus (T1DM) is an autoimmune disease that leads to the destruction of insulin-producing pancreatic beta cells. Managing diabetes is a multidisciplinary task that involves keeping the affected person under the care of a comprehensive healthcare system. A self-care management program increases their knowledge and lessens their anxiety. However, there is a research gap, as limited studies focus on self-care management programs regarding glycaemic control, knowledge level and anxiety level among adolescents with type 1 diabetes in India.

Aim: To evaluate the effectiveness of a self-care management program on glycaemic control, knowledge level and anxiety among adolescents with T1DM.

Materials and Methods: This pretest-post-test quasi-experimental study was conducted from July 2023 to December 2023 at the Diabetology Outpatient Department of Government Rajaji Hospital in Madurai, Tamil Nadu, India. The researchers employed a probability systematic sampling technique to allocate samples to both groups for the study. The control and experimental groups each consisted of 105 samples. In the pretest, Glycosylated Haemoglobin (HbA1C) levels, diabetic knowledge scores and anxiety levels were assessed. Adolescents underwent self-care management training sessions weekly through lectures, video tutorials and informational booklets for a duration of 12 weeks. After the intervention, post-tests were conducted.

Results: After the intervention, the experimental group showed significant improvement in glycaemic levels (p-value <0.001), improved knowledge scores (p-value <0.001), decreased anxiety levels (p-value <0.001) and decreased depression levels (p-value <0.001). However, there was no significant difference in the control group regarding HbA1C levels, knowledge scores, anxiety scores, and depression scores (p-value=0.686, p-value=0.043, p-value=0.611, and p-value=0.832, respectively).

Conclusion: The diabetic self-care management program implemented in this study successfully controlled glycaemic levels, enhanced diabetic knowledge and decreased anxiety and depression levels among adolescents diagnosed with type 1 diabetes.

Keywords: Depression, Diabetes education, Glycosylated haemoglobin, Self-management intervention

INTRODUCTION

Worldwide, 15 per 1,00,000 children have type 1 diabetes. Every three to six years, the prevalence and incidence increase by about 2 to 5% globally. T1DM is a chronic disease that creates a high demand for and responsibility in patient self-care. Evidence suggests that diabetes self-management education improves short-term glycaemic control and reduces diabetes complications [1]. In 2009, it was estimated that 285 million people had diabetes (both type 1 and type 2 combined), increasing to 366 million in 2011, 382 million in 2013, 415 million in 2015, and 425 million in 2017 [2]. Type 1 diabetes is rising in India; however, the lack of a nationwide registry makes accurate estimates challenging. The Diabetes Atlas 2017 reported 1,28,800 children and adolescents with diabetes in India. Globally, the increase is linked to environmental and lifestyle factors, including rising obesity, poor neonatal feeding practices, and reduced infection rates, rather than genetic factors [3].

Symptoms of anxiety and depression are common among adolescents with type 1 diabetes. These symptoms are linked to higher HbA1c levels, worse self-management and coping behaviours, depressive symptoms, fear of hypoglycaemia, and decreased blood glucose monitoring frequency [4]. Younger adolescents with type 1 diabetes are at a higher risk of significant depressive symptoms and require regular screening. Newly diagnosed adolescents may experience greater anxiety compared to those with a longer disease duration [5]. Various internal and environmental factors influence blood glucose levels, but it is well acknowledged that efficient self-care helps people with type 1 diabetes avoid problems. They must actively manage their illness to achieve the best blood glucose results [6]. Glycaemic management, as measured by HbA1c levels, is a key predictor of long-term health outcomes in people with T1DM [7].

Recent findings indicate a decline in glycaemic control among US adults, from 57.4% during 2007-2010 to 50.5% in the period from 2015-2018 [8]. Effective health education can lead to improved knowledge, attitudes and practices among patients, which are essential for managing diabetes and preventing complications. However, barriers such as illiteracy, lack of knowledge and insufficient health literacy significantly challenge the effectiveness of diabetes education [9]. Gamlath G et al., conducted a study on self-care management for diabetes. He concluded that the self-care management intervention enhanced self-care behaviour and revealed gaps in physical health, diet and medications. By addressing these gaps, it improved diabetic management and prevented complications [10]. Adolescents with T1DM often face challenges in maintaining glycaemic control, leading to anxiety and an increased risk of short-term complications, such as hypoglycaemia and hyperglycaemia, as well as long-term complications, including cardiovascular disease, kidney disease, and neuropathy [11].

Implementing self-care management programs can improve glycaemic control, enhance diabetes knowledge and reduce

anxiety by equipping adolescents with tools to monitor their health and manage stress. Healthcare professionals trained in these programs can also guide patients to improve their quality of life. A similar pilot study was conducted by the authors on a self-care management program addressing glycaemic control and levels of depression among adolescents with T1DM [12]. Based on the literature above, only a few studies [9-11] have focused on self-care management programs aimed at improving glycaemic control, diabetes knowledge and reducing anxiety among adolescents with T1DM. Therefore, this study aimed to evaluate the effectiveness of a self-care management program in improving glycaemic control, increasing knowledge and reducing anxiety among adolescents with T1DM.

MATERIALS AND METHODS

This pretest-post-test quasi-experimental study was conducted from July 2023 to December 2023 at the Diabetology OP, Govt. Rajaji Hospital, Madurai, Tamil Nadu, India. The researchers employed a probability systematic sampling technique to allocate samples to both groups for the study. The SMCH Institutional Ethics Committee (IEC) approved the study, under number 003/08/2022/IEC/SMCH, dated 01.08.2022. The researchers secured prior permission from the hospital authorities in adherence to applicable research ethics regulations. The appropriate authority approved the study. The researchers provided participants with comprehensive information regarding their rights to participate, decline, or withdraw at any point, and obtained formal consent from each participant. They treated all gathered data with the utmost confidentiality and ensured that participation in the study had no adverse effects on the wellbeing of the adolescent participants.

Inclusion criteria: Adolescents aged 12 to 18 years with T1DM receiving regular insulin injections were included in the study.

Exclusion criteria: Adolescents with type 1 diabetes who declined to participate were excluded from the study.

Sample size calculation: The sample size was calculated using formula $n=\{2\times(Z\alpha+Z\beta)^2 \times P(1-P)\}/(P1-P2)^2$ [13], in this formula, n represented the sample size required per group. Zα denoted the significance level, while Zβ indicated the power of the study. P referred to the pooled proportion, calculated as the average of P1 and P2 using the formula P=P1+P2. The term P(1–P) represented the variance of the pooled proportion. P1 and P2 were the proportions in the experimental and control groups. Finally, (P1–P2)2 represented the squared difference between the two proportions, which was used to determine the effect size where Zα=1.96(95% CI), Zβ=0.84 and P1=0.75 and P2=0.56. Total study sample was 210.

The control group consisted of 105 samples, and the experimental group consisted of 105 samples. The experimental group received a self-care management program through lectures, demonstrations, videos and booklets, along with regular treatment, while the control group received regular treatment as usual. They also received the self-care management program through lectures, demonstrations, videos, and booklets after the data collection procedure.

Study tools: Diabetic knowledge was evaluated using a self-structured questionnaire developed by the investigator. The questionnaire was designed to assess the level of knowledge regarding T1DM. It consisted of four parts: Part A - General aspects of DM; Part B - Diet and exercise; Part C - Knowledge of insulin injection; Part D - Prevention of complications. Each part contained 10 questions, resulting in a total of 40 questions. Validity and reliability were determined using the test-retest method, with an obtained correlation coefficient (r) value of 0.92. Responses were scored as 1 point for a correct answer and 0 points for an incorrect answer. Anxiety and depression levels were assessed using the Hospital Anxiety and Depression Scale (HADS), which utilises a 4-point Likert scale (0, 1, 2, 3). It consists of 14 items, split into two subscales: Anxiety, which includes 7 items focused on measuring the symptoms of anxiety, and depression, which includes 7 items that assess symptoms of depression [14].

Data collection procedure: After obtaining informed written consent from each participant and from the parents of adolescents under 18 years old, demographic and clinical variables were collected. The researcher assessed glycaemic control by measuring HbA1c levels and diabetic knowledge using a self-structured knowledge questionnaire. Anxiety levels were evaluated using the HADS.

The researcher conducted a pretest assessment before the interventions. Participants received a self-care management program, which included education on diabetes, a demonstration of insulin administration, and a 24-hour dietary history for nutrient evaluation. They also received personalised nutritional advice. Additionally, they participated in yoga practices such as Surya Namaskar (3 cycles for 10 minutes), Super Brain Yoga (3 minutes), Deep Relaxation in Shavasana pose (7 minutes), Pranayama (Breathing Practices) (10 minutes), Bhastrika (Inhalation and Exhalation), Anuloma-Viloma (Alternate Nostril Breathing), and Bhramari (Honeybee sound during expiration). They also practiced Udgeeth and meditation for five minutes. Participants attended weekly self-care management sessions that consisted of lectures, video tutorials, and informational booklets over a 12-week period. Upon completion of the intervention, a post-test assessment of HbA1c levels, knowledge scores and anxiety levels was conducted using a self-structured knowledge questionnaire and the HADS.

STATISTICAL ANALYSIS

The researchers analysed the data using descriptive and inferential statistics. They used Statistical Package for the Social Sciences (SPSS) version 27.0 software for data analysis. They conducted a paired t-test to compare the pre- and post-test results within the groups and an unpaired t-test to compare between the groups. In the study, they considered a p-value of <0.05 at a confidence interval of 95% to be significant.

RESULTS

[Table/Fig-1] shows that the experimental group had more participants aged over 16 years (40, 38.1%) and females (68, 64.8%), while the control group has more participants aged under 14 years (40, 38.1%). However, there was a significant difference in gender distribution between the groups (p-value=0.018). The control group had a significantly greater number of participants with a family history of T1DM than the experimental group (p-value=0.016).

S. No.	Variable	Category	Control group N (%)	Experimental group N (%)	p-value
1	Age (years)	<14	40 (38.1)	33 (31.4)	0.264
		14-16	36 (34.3)	32 (30.5)	
		>16	29 (27.6)	40 (38.1)	
2	Gender	Male	55 (52.4)	37 (35.2)	0.018
		Female	50 (47.6)	68 (64.8)	
3	Birth order	First	42 (40.0)	56 (53.3)	0.081
		Second	53 (50.5)	37 (35.2)	
		Third and above	10 (9.5)	12 (11.4)	
4	Residence	Rural	16 (15.2)	33 (31.4)	0.021
		Semi-urban	34 (32.4)	27 (25.7)	
		Urban	55 (52.4)	45 (42.9)	
5	Family history of type1 DM	No	84 (80.0)	97 (92.4)	0.016
		Yes	21 (20.0)	8 (7.6)	
6	Family history of type 2 DM	No	74 (70.5)	78 (74.3)	0.643
		Yes	31 (29.5)	27 (25.7)	

7	History of mother with GDM	No	86 (81.9)	99 (94.3)	0.592
		Yes	9 (8.1)	6 (5.7)	

[Table/Fig-1]: Comparison of demographic variables of control and experimental groups for homogeneity.
Con: Control; Exp: Experimental; n=105 each

The experimental group showed a significant improvement in diabetic knowledge, with mean scores increasing from 14.97 to 34.19 (p-value <0.001), indicating the effectiveness of the intervention. In contrast, the control group showed a slight decline in mean scores from 12.61 to 11.95 (p-value=0.043), reflecting no meaningful improvement. These results underscore the intervention's impact on enhancing diabetic knowledge in the experimental group [Table/Fig-2].

Within group		Mean±SD	t-value	p-value
Experimental group (n=105)	Pretest	14.97±4.14	66.140	<0.001**
	Post-test	34.19±2.51		
Control group (n=105)	Pretest	12.61±2.72	2.461	0.043
	Post-test	11.95±2.79		
Between group				
Experimental group (n=105)	Pretest	14.97±4.14	43.016	<0.001**
Control group (n=105)		12.61±2.72		
Experimental group (n=105)	Post-test	34.19±2.51	44.675	<0.001**
Control group (n=105)		11.95±2.79		

[Table/Fig-2]: Comparison of the mean score of diabetic knowledge score in type 1 diabetics.
SD: Standard deviation

The experimental group exhibited a decrease in the mean value of HbA1c. The difference in HbA1c was 1.65 (p-value <0.001), indicating the beneficial effect of the intervention. Conversely, the control group did not show substantial changes (p-value=0.686) [Table/Fig-3].

Within the group		Mean±SD	t-value	p-value
Experimental group (n=105)	Pretest	11.60±1.60	17.708	<0.001**
	Post-test	9.95±1.78		
Control group (n=105)	Pretest	10.91±1.70	1.205	0.686
	Post-test	11.01±1.49		
Between the group				
Experimental group (n=105)	Pretest	11.60±1.60	3.040	0.003
Control group (n=105)		10.91±1.70		
Experimental group (n=105)	Post-test	9.95±1.78	4.643	<0.001**
Control group (n=105)		11.01±1.49		

[Table/Fig-3]: Comparison of the Glycosylated Haemoglobin (HbA1c) levels in type 1 diabetics.
SD: Standard deviation

The anxiety score significantly decreased (p-value=0.001) in the experimental group (from 16.51 to 11.41) postintervention when compared to the control group (from 15.74 to 15.93), indicating the beneficial effect of the intervention [Table/Fig-4]. Similarly, the depression score in the experimental group (from 15.87 to 11.16) also showed a significant decrease postintervention (p-value <0.001) when compared to the control group (from 14.85 to 15.05), indicating the beneficial effect of the intervention [Table/Fig-5].

DISCUSSION

This study aimed to assess the effectiveness of a self-care management program on glycaemic control, knowledge levels and anxiety among adolescents with T1DM. The experimental group showed a significant improvement in diabetic knowledge (p-value <0.001). The findings of this study are consistent with existing literature, emphasising the effectiveness of self-care management programs and psychological interventions in improving outcomes

Within the group		Mean±SD	t-value	p-value
Experimental group (n=105)	Pretest	16.51±1.99	31.916	<0.001**
	Post-test	11.41±2.48		
Control group (n=105)	Pretest	15.74±1.77	1.273	0.611
	Post-test	15.93±1.51		
Between the group				
Experimental group (n=105)	Pretest	16.51±1.99	9.271	<0.001**
Control group (n=105)		15.74±1.77		
Experimental group (n=105)	Post-test	11.41±2.48	21.497	<0.001**
Control group (n=105)		15.93±1.51		

[Table/Fig-4]: Comparison of the anxiety score levels in type 1 diabetics.
SD: Standard deviation

Within the group		Mean±SD	t-value	p-value
Experimental group (n=105)	Pretest	15.87±2.07	24.128	<0.001**
	Post-test	11.16±2.38		
Control group (n=105)	Pretest	14.85±1.80	1.088	0.832
	Post-test	15.05±1.68		
Between the group				
Experimental group (n=105)	Pretest	15.87±2.07	7.954	0.001**
Control group (n=105)		14.85±1.80		
Experimental group (n=105)	Post-test	11.16±2.38	16.162	0.001**
Control group (n=105)		15.05±1.68		

[Table/Fig-5]: Comparison of the depression score levels in type 1 diabetics.
SD: Standard deviation

for individuals with diabetes. The results of the study by Salahshouri A et al., demonstrated significant improvements in susceptibility, severity, perceived benefits and self-management behaviours among the intervention group [15]. Additionally, barriers to self-management were substantially reduced. These findings highlight the importance of targeted interventions in empowering individuals to manage their condition effectively, echoing the outcomes of this study, where improved diabetic knowledge was observed in adolescents with T2DM following a self-care management program.

Similarly, Jalilian F et al., provided robust evidence of the clinical benefits of an intervention program, as seen in the significant reduction in diabetic neuropathy symptoms, fasting blood sugar and HbA1c levels in the trial group [16]. These outcomes complement the findings of the present study, where improvements in glycaemic control were achieved through a structured self-care management program. The reduction in anxiety among adolescents can also be attributed to better knowledge and control over their condition, as demonstrated by the outcomes of the intervention. Overall, the combined findings underscore the importance of integrative interventions that address both psychological and physiological aspects to improve health outcomes in chronic diseases like diabetes. These results highlight the necessity of designing multifaceted approaches that leverage behavioural and clinical insights to optimise patient care. This indicates that the educational intervention was effective in enhancing the participants' understanding of diabetes and its management. The present findings align with the study by Ahrary Z et al., which demonstrates the significant clinical benefits of targeted interventions [17]. Reductions in diabetic neuropathy symptoms, fasting blood sugar, and HbA1c levels in the trial group underscore the effectiveness of structured diabetes management programs. These results validate the potential of focused interventions to achieve meaningful physiological improvements, emphasising the importance of addressing both the symptoms and underlying health markers of diabetes.

Similarly, the present study findings align with the study by Cai C and Hu J, which highlights the value of family-based interventions grounded in self-efficacy theory [18]. Participants with T2DM in the intervention group experienced significant improvements in HbA1C

levels, body mass index, diabetes knowledge, self-care activities and health-related quality of life compared to the control group. Additionally, family members in the intervention group also showed increased diabetes knowledge and quality of life. These findings underscore the importance of engaging family members to create a supportive environment that reinforces lifestyle changes and self-care practices. Rochmah N et al., demonstrated a significant improvement in diabetes mellitus knowledge among high school students in Indonesia following an educational intervention [19]. The marked increase in pre- and post-test scores underscores the effectiveness of targeted education in enhancing awareness of diabetes, its signs and symptoms and management strategies. This study emphasises the need for early diabetes education, particularly in younger populations, to promote long-term awareness and prevention.

Collectively, these studies illustrate the necessity of combining cultural sensitivity, clinical focus and family involvement to enhance diabetes management outcomes. Tailoring interventions to specific cultural and community contexts, while incorporating evidence-based behavioural theories, is critical for achieving sustained improvements in glycaemic control, self-care efficacy and overall quality of life. Furthermore, in the present study, HbA1c levels decreased by 1.65 (p-value <0.001) in the experimental group, suggesting improved glycaemic control. The findings of the current study align with those of Yuan C et al., which revealed that Diabetes Self-Management Education (DSME) interventions led to significant reductions in HbA1c levels and body weight in patients with T2DM [20]. The reduction in HbA1c and body weight further supports the effectiveness of structured educational initiatives in improving both metabolic control and overall health.

Similarly, the findings of the present study are consistent with those of the study by Rishi P et al., which demonstrated that combining educational interventions with non educational methods, such as support groups, psychiatric consultations and phone consultations, enhances medical adherence in patients with diabetes [21]. Overall, these studies emphasise the necessity of integrating educational strategies with supplementary non educational support to address the multifaceted challenges of diabetes management. Early education, tailored DSME programs, and holistic approaches that combine behavioural and psychological support are critical for promoting knowledge, improving clinical outcomes and increasing medical adherence across various populations.

Additionally, the study reported a significant reduction in anxiety scores from 16.51 to 11.41 in the experimental group, while the control group showed minimal change (from 15.74 to 15.93). Similarly, there was a significant reduction in depression scores in the experimental group, from 15.87 to 11.16, while the control group showed minimal change (from 14.85 to 15.05), indicating the beneficial effect of the intervention. The findings suggest that the educational intervention was effective in reducing anxiety and improving the participants' psychological wellbeing. The present findings align with the study by Winkley K et al., which underscores the significant impact of psychological and educational interventions on improving health outcomes in patients with diabetes [22]. The results revealed that patients in the intervention group exhibited higher scores in nutritional perceptions and beliefs while experiencing notable decreases in fears, concerns, discomforts and exaggerated beliefs compared to the control group. This highlights the importance of addressing psychological factors as part of a comprehensive diabetes management strategy.

Limitation(s)

The present study had several limitations. It was conducted in a single-institution setting, which may restrict the applicability of the results. The duration of the intervention was limited and longer-term effects on glycaemic control, knowledge and anxiety were not assessed. The self-reported nature of the data collection regarding knowledge and anxiety may introduce response bias, affecting the accuracy of the results. Additionally, both groups differed significantly before the intervention for all study parameters.

CONCLUSION(S)

The present study demonstrated the effectiveness of a structured educational intervention in enhancing diabetic knowledge, improving glycaemic control and reducing anxiety in individuals with T2DM. These findings highlight the importance of comprehensive, evidence-based diabetes education programs in improving the overall management and wellbeing of individuals with T2DM. Future research should examine the long-term impact of structured educational interventions, their effectiveness in diverse populations, and the potential integration of technology-based approaches to enhance accessibility and outcomes.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Oct 10, 2024
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- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

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