
A Study to Assess the Effectiveness of a Structured Teaching Program on Self-Monitoring of Blood Glucose Levels and Self Administration of Insulin in Terms of Knowledge and Practice in Children with Diabetes Mellitus in Selected Hospital at Jaipur, Rajasthan

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Abstract

Diabetes mellitus is a chronic metabolic disorder affecting both adults and children. Among pediatric populations, Type 1 diabetes is particularly challenging as its management relies heavily on self-care practices such as blood glucose monitoring and insulin administration. The present study aimed to assess the effectiveness of a structured teaching program on improving knowledge and self-care practices related to blood glucose monitoring and insulin administration in children diagnosed with diabetes mellitus at a selected hospital in Jaipur, Rajasthan.

A pre-experimental one-group pre-test post-test research design was utilized. Forty children diagnosed with diabetes mellitus participated in the study. A structured teaching program focusing on self-monitoring of blood glucose and proper insulin administration techniques was developed and implemented. Data collection was performed using a structured knowledge questionnaire and practice checklist administered before and after the intervention.

Findings revealed a significant improvement in knowledge and practice post-intervention. The mean pre-test knowledge score was 18.6, while the mean post-test score increased to 27.6. Similarly, practice scores improved significantly, indicating a better understanding and application of self-care techniques. Standard deviation analysis confirmed consistent improvement among participants. Chi-square tests showed no statistically significant association between post-test knowledge scores and demographic variables such as age, gender, religion, income, birth order, illness duration, and prior health education.

The study concludes that structured teaching interventions are highly effective in improving self-care behaviors among children with diabetes. By enhancing knowledge and practice, such programs contribute to better glycemic control and overall quality of life. The study recommends the integration of structured education into routine care settings to empower children and families to manage diabetes confidently and effectively.

Keywords: Type 1 Diabetes Mellitus, Self-Monitoring of Blood Glucose, Insulin Administration, Pediatric Diabetes, Structured Teaching Program, Diabetes Education.

Introduction

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Among its various types, Type 1 diabetes mellitus (T1DM) is an autoimmune disorder that accounts for 5-10% of all diabetes cases globally. It is particularly prevalent among children and adolescents, posing significant health and socio-economic challenges.

The earliest known descriptions of symptoms resembling diabetes can be traced back to ancient civilizations. Egyptian manuscripts from 1500 BCE describe excessive urination and weight loss, common symptoms of diabetes. The term “diabetes” was introduced by the Greek physician Aetius of Cappadocia (81-133 AD), who described the disease as excessive urination and dehydration. In 1675, British physician Thomas Willis added the term “mellitus,” derived from Latin meaning “honey-sweet,” based on the observation of sweet-tasting urine in affected individuals. Later, in 1776, Dr. Matthew Dobson confirmed that the sweetness was due to excess glucose in the blood and urine.

A critical turning point in understanding diabetes came in the 19th century when Claude Bernard identified the role of the liver in glucose metabolism, establishing that diabetes is caused by an imbalance in glucose production and utilization. The discovery of insulin by Banting and Best in 1921 revolutionized the treatment of T1DM, saving countless lives. However, managing diabetes requires ongoing self-care, particularly for children who must learn to monitor glucose levels and administer insulin.

Type 1 diabetes presents unique challenges because its management largely depends on the patients themselves or their caregivers rather than healthcare providers. Parents often face immense stress after diagnosis, which disrupts family routines and finances. The monthly cost of treatment, including insulin, glucometers, test strips, and hospital visits, ranges from Rs. 3,000 to Rs. 4,000 in India. Families with lower socio-economic status find it difficult to sustain treatment, resulting in poor adherence and increased complications.

In developed countries, insulin pumps are commonly used, offering better glycemic control but at a higher cost — a one-time investment of Rs. 2.5 lakhs and running costs of Rs. 8,000 to 9,000 per month. Such expenses are prohibitive for many families, underscoring the need for cost-effective

interventions like education programs that can enhance self-management skills without additional financial burden.

Globally, over 21 million children live with Type 1 diabetes, with more than 60% developing the condition before age 20. Presentations vary but commonly include osmotic symptoms such as polyuria, polydipsia, and weight loss. Additionally, diabetic ketoacidosis is a frequent and severe presentation that necessitates immediate medical intervention.

In India, rising urbanization, changes in lifestyle, and delayed diagnosis have contributed to an increasing prevalence of Type 1 diabetes among children. Despite awareness campaigns, misconceptions about the disease and its treatment persist, leading to neglect and poor management. Educating children and families plays a pivotal role in controlling blood glucose levels and preventing long-term complications such as neuropathy, retinopathy, and cardiovascular diseases.

This study aims to assess the impact of a structured teaching program designed to improve knowledge and practical skills related to diabetes management among children attending a hospital clinic in Jaipur, Rajasthan. By empowering children and caregivers with appropriate knowledge and techniques, it is possible to enhance adherence, reduce complications, and improve the overall quality of life.

Methods

The present study employed a quantitative, pre-experimental research approach to determine the effectiveness of a structured teaching program on self-monitoring of blood glucose levels and self-administration of insulin among children with diabetes mellitus. This approach was chosen to allow systematic measurement of changes in knowledge and practice resulting from the intervention.

A one-group pre-test post-test design was utilized for this purpose. In this design, the same group of participants was assessed before and after the structured educational intervention. This method was deemed appropriate as it enabled the researchers to evaluate the direct impact of the teaching program on the participants' knowledge and self-care practices.

The study considered both dependent and independent variables. The dependent variables included the children's knowledge and practical skills related to blood glucose monitoring and insulin administration. The independent variables comprised demographic and health-related factors such as age, gender, religion, family income, birth order, duration of illness, and prior exposure to health education. These factors were included to explore whether they influenced the participants' learning outcomes.

The research was conducted at the diabetic clinic of Narayana Multispecialty Hospital, Jaipur, Rajasthan. This setting was chosen because it provided access to a diverse group of children with diabetes, ensuring that the sample was representative of the broader pediatric diabetic population. The

hospital's infrastructure and availability of healthcare professionals also facilitated effective implementation of the teaching intervention.

The study population included all children diagnosed with diabetes mellitus who were attending the diabetic clinic. A sample of 40 children was selected using purposive sampling based on specific inclusion and exclusion criteria. Children between the ages of 10 and 18 years, diagnosed with Type 1 diabetes for at least six months, and capable of understanding and following instructions were included in the study. Those with cognitive impairments or those receiving advanced medical interventions such as insulin pumps were excluded to ensure uniformity in the sample and to minimize confounding factors.

A structured teaching module was carefully developed through an extensive review of relevant literature and discussions with healthcare professionals specializing in diabetes care. The content of the module covered key aspects of diabetes management, including the importance of self-monitoring of blood glucose, proper techniques for using glucometers, the significance of insulin therapy, steps for correct self-administration of insulin, and managing complications such as hypoglycemia and hyperglycemia. Additionally, diet management and lifestyle modifications were emphasized to support long-term health. Teaching aids such as charts, videos, demonstration kits, and printed reference materials were used to enhance understanding and engagement among participants.

Data collection was carried out using two main tools. The first tool, a structured knowledge questionnaire, consisted of 25 multiple-choice questions designed to assess the children's understanding of diabetes, blood glucose monitoring, and insulin administration. Each correct answer was awarded one point, allowing for objective scoring. The second tool, a practice observation checklist, evaluated the participants' ability to perform essential tasks such as using a glucometer and administering insulin, through direct observation of the demonstration steps.

The procedure began with a pre-test, where participants were briefed about the study objectives and process. Written informed consent was obtained from both parents and the children. The structured knowledge questionnaire and practice checklist were then administered to record the baseline data on their knowledge and skills. Following this, the structured teaching program was implemented over two days, with each session lasting approximately 60 minutes. These sessions included interactive discussions, demonstrations, and hands-on practice to ensure thorough understanding and skill acquisition. A post-test was conducted seven days after the intervention using the same tools to measure improvements in knowledge and practice.

The collected data were analyzed using both descriptive and inferential statistical methods. The mean, median, and standard deviation were calculated for knowledge and practice scores to describe the distribution and central tendency of the data. Chi-square tests were used to examine possible associations between demographic variables and post-test scores, with a significance level set at $p < 0.05$.

Ethical considerations were integral to the study's design and implementation. Ethical approval was obtained from the hospital's ethics committee prior to conducting the research. Written informed consent was secured from parents and participants, ensuring that participation was voluntary and that participants were fully informed about the study. Confidentiality was strictly maintained throughout the study, and participants' identities were protected in all reports and publications.

Results

Demographic Profile:

The demographic characteristics of the sample population are presented in Table 1.

Table 1: Distribution of Participants by Demographic Variables

Demographic Variable	Frequency	Percentage
Age (15–16 years)	14	35%
Gender – Female	21	53%
Religion – Hindu	19	47%
Monthly Income >30,000	19	47%
Birth Order – Second	19	47%
Illness Duration 2–3 years	19	47%
Prior Health Education	21	53%

Knowledge Scores:

The mean pre-test knowledge score was 18.6 ± 3.22 , while the mean post-test score increased to 27.6 ± 2.5 , indicating a statistically significant improvement in knowledge levels. The median score for the pre-test was 18 and for the post-test was 27, both aligning closely with the respective mean values, suggesting consistency in performance improvements.

Practice Scores:

Improvements were also observed in practice scores. The proportion of participants able to perform all steps of insulin administration correctly rose from 25% in the pre-test to 80% in the post-test. Similarly, correct use of glucometers increased from 35% to 85%.

Association with Demographic Variables :

Chi-square analysis indicated that there was no significant association between post-test knowledge scores and demographic factors such as age ($\chi^2 = 3.74$), gender ($\chi^2 = 0.53$), religion ($\chi^2 = 3.25$), family income ($\chi^2 = 3.25$), birth order ($\chi^2 = 6.01$), illness duration ($\chi^2 = 1.37$), and exposure to prior health education ($\chi^2 = 2.03$), all at $p < 0.05$.

Interpretation:

These findings suggest that structured teaching programs can effectively enhance knowledge and practice among children with diabetes, irrespective of socio-demographic differences. This indicates that educational interventions can be universally beneficial across different segments of the population.

Discussion

The results of this study support the hypothesis that structured teaching programs significantly improve knowledge and practice regarding diabetes management in children. The considerable increase in mean post-test scores reflects the effectiveness of targeted education in improving the understanding of critical self-care tasks.

The lack of significant association between demographic variables and outcomes suggests that structured education can transcend socio-economic barriers, making it an accessible tool for improving pediatric diabetes care. These findings are consistent with earlier studies that reported positive outcomes from educational interventions in chronic disease management.

Moreover, the use of interactive teaching strategies, including demonstrations and hands-on practice, contributed to participants' retention and confidence. Children are more likely to engage in health-promoting behaviors when they understand the rationale behind interventions, which is evident from the improved post-test practice scores.

The results also underline the need for integrating structured teaching into routine care protocols. Given the financial and emotional burden faced by families managing pediatric diabetes, empowering children with self-care skills can enhance their independence and reduce reliance on healthcare providers. Educational programs should be tailored to include practical demonstrations, simple language, and culturally relevant examples to improve understanding and adherence.

Although the study's findings are promising, it has limitations. The use of a one-group design without a control group may limit the ability to attribute improvements solely to the intervention. Additionally, the sample size of 40 participants may restrict generalizability, and the short duration between pre-test and post-test may not account for long-term retention.

Future research should consider randomized controlled trials with larger sample sizes and longer follow-up periods to evaluate sustained benefits. Collaboration between healthcare providers, schools, and community organizations can also expand access to educational resources.

In conclusion, structured teaching programs are a practical and cost-effective approach to improving self-monitoring and insulin administration among children with diabetes. Healthcare providers should advocate for integrating educational interventions into treatment protocols to ensure that children are equipped with the knowledge and skills necessary to lead healthier lives.

Conclusion

The present study demonstrates that structured teaching programs are highly effective in enhancing the knowledge and practical skills of children with diabetes regarding blood glucose monitoring and insulin administration. The significant improvements in post-test scores reflect increased understanding and confidence in managing the disease, irrespective of demographic variables.

The findings highlight that such programs can serve as an empowering tool, improving both disease control and quality of life while reducing healthcare costs. Pediatric diabetes requires continuous management, and equipping children with knowledge is critical to long-term health outcomes.

Healthcare systems, especially in resource-limited settings, should integrate structured education into standard care practices. Further research with broader populations and extended timelines is recommended to validate these results and explore long-term impacts.

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