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Effectiveness of a Community-based Diabetes Prevention Program on Knowledge, Self-Reported Practices, and Clinical Risk Indicators among High-Risk Schoolchildren: A Quasi-Experimental Study

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ABSTRACT:

Background: The increasing prevalence of unhealthy dietary behaviours, physical inactivity, overweight and obesity among children and adolescents has increased their future risk of type 2 diabetes mellitus. School- and community-based health promotion interventions may provide an opportunity to identify high-risk children and promote healthy lifestyle behaviours at an early age.

Objective: To evaluate the effectiveness of a community-based diabetes prevention program on knowledge, self-reported preventive practices and selected clinical risk indicators among high-risk school children.

Methods: A quantitative quasi-experimental pre-test–post-test control-group design was adopted. The study included 200 high-risk school children, with 100 participants in the experimental group and 100 in the control group. Participants were selected using purposive sampling. Data were collected using a sociodemographic questionnaire, a structured 30-item knowledge questionnaire and a self-reported practice checklist. Clinical risk indicators included body mass index (BMI), waist circumference and random blood

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sugar. The intervention included diabetes-prevention education, promotion of physical activity, dietary modification and family involvement. Knowledge and practice were assessed at baseline and at 2, 4 and 8 weeks after the intervention. Data were analysed using descriptive and inferential statistics.

Results: At baseline, 45% of participants had average knowledge and 42% had poor knowledge; only 13% demonstrated good knowledge. Similarly, 46% reported poor preventive practices, 42% average practices and 12% good practices. In the experimental group, mean knowledge scores increased from 13.24 ± 4.10 at pre-test to 18.67 ± 3.82, 22.45 ± 3.36 and 25.92 ± 2.84 at 2, 4 and 8 weeks, respectively ($F=286.4$, $p<0.001$). Mean practice scores increased from 11.82 ± 3.54 to 15.73 ± 3.18, 19.86 ± 2.74 and 23.44 ± 2.36, respectively ($F=258.7$, $p<0.001$). BMI, waist circumference and random blood sugar decreased significantly from 25.8 ± 2.4 to 24.6 ± 2.2 kg/m², 82.4 ± 4.8 to 79.3 ± 4.1 cm, and 110.6 ± 8.7 to 101.8 ± 7.5 mg/dL, respectively (all $p<0.001$). Knowledge was positively correlated with preventive practices ($r=0.78$, $p<0.001$).

Conclusion: The community-based diabetes prevention program was associated with significant improvements in diabetes-prevention knowledge and self-reported practices and favorable changes in selected clinical risk indicators among high-risk school children. Integrating structured diabetes prevention and lifestyle promotion into school health services may strengthen early prevention of diabetes-related risk.

INTRODUCTION

Diabetes mellitus is an important public health problem, and the emergence of diabetes-related risk factors during childhood and adolescence has increased concern regarding prevention at an early age. Childhood and adolescence are critical periods for establishing dietary, physical activity and other lifestyle behaviours that may persist into adulthood. Excess body weight, central adiposity, physical inactivity, unhealthy dietary patterns and a family history of diabetes can contribute to increased future metabolic risk[1].

Schools represent an important setting for health promotion because they provide access to large groups of children and allow health education to be combined with behavioral and environmental interventions. School-based interventions that promote healthy eating and physical activity have demonstrated potential for improving obesity-related outcomes and health behaviours. The prevention of type 2 diabetes therefore requires an approach that moves beyond disease treatment and focuses on early identification of risk and modification of preventable lifestyle factors.

Nurses, particularly community and school health nurses, have an important role in health education, screening, lifestyle counselling, family involvement and follow-up. A comprehensive community-based program incorporating education, physical activity, dietary modification and family participation may improve children's understanding of diabetes prevention and facilitate healthier behaviours[2-5].

The present study was conducted among high-risk school children in Sangli City to evaluate whether a structured community-based diabetes prevention program could improve knowledge and preventive practices and produce favorable changes in selected clinical risk indicators[6].

METHODS

Study design and setting

A quantitative quasi-experimental research approach was adopted. A pre-test–post-test control-group design was used. Participants were not individually randomized to experimental and control groups, although community settings were assigned randomly. The study was conducted among school children in selected schools in Sangli City, Maharashtra, India.

PARTICIPANTS AND SAMPLE SIZE

The target population consisted of school children studying in selected schools. Eligible participants were children aged 10–15 years who were studying in selected schools, willing to participate and available during data collection. Children absent during data collection or previously diagnosed with diabetes were excluded.

The sample-size calculation was performed using G*Power. The final study sample consisted of **200 school children**, with **100 participants in the experimental group and 100 in the control group**. Purposive sampling was used.

Data collection instruments

Three major instruments were used:

1. **Sociodemographic questionnaire:** age, gender, class, family history of diabetes, dietary history, physical activity and socioeconomic characteristics.
2. **Structured knowledge questionnaire:** 30 items covering the meaning of diabetes, risk factors, signs and symptoms, healthy diet, physical activity and prevention. Scores ranged from 0–30; scores of 0–10, 11–20 and 21–30 represented poor, average and good knowledge, respectively.
3. **Self-reported practice checklist:** assessed healthy eating, physical activity, limitation of sugary foods and drinks and weight-management behaviours. Higher scores represented better preventive practices.

Content validity was assessed by experts and the reported content validity index was 0.98. Reliability testing using the split-half method among 30 school children yielded a Spearman correlation coefficient of 0.86.

Intervention

The community diabetes prevention program consisted of four interrelated components:

- **Health education:** interactive sessions covering diabetes, risk factors, healthy diet, physical activity and sedentary behavior, supported by posters, videos, quizzes and peer discussion.
- **Physical activity promotion:** school-based sports, games and aerobic activities, together with encouragement of regular walking or cycling.
- **Dietary modification:** education regarding fruits, vegetables, whole grains and healthier food choices, with promotion of healthier school and home food options.
- **Family involvement:** parent education and family-based activities intended to reinforce healthy dietary and physical activity behaviours at home.

The control group did not receive the intervention during the study period.

Data collection and statistical analysis

Data were collected using a self-administered method. Written parental consent was obtained, and school permissions were secured. Data were collected in English/Marathi versions of the instruments.

Data were analysed using **SPSS version 21**. Descriptive statistics were used to describe participant characteristics and outcome measures. Repeated-measures analysis was used to examine changes across assessment periods, while paired t-tests were used for comparison of baseline and post-intervention clinical parameters. Pearson correlation was used to examine relationships among selected variables. Statistical significance was set at $\mathbf{p<0.05}$.

RESULTS

Participant characteristics

Among the 200 participants, 104 (52%) were aged 13–15 years, 58 (29%) were aged 10–12 years and 38 (19%) were aged 16–18 years. Males constituted 108 (54%) and females 92 (46%) of the sample. A family history of diabetes was reported by 122 (61%) participants.

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Table 1. Selected baseline characteristics of participants

n=200

Characteristic	Samples (n)	Percentage (%)
Age		
10–12 years	58	29
13–15 years	104	52
16–18 years	38	19
Gender		
Male	108	54
Female	92	46
Family history of diabetes		
Present	122	61
Absent	78	39

Baseline knowledge and practices

Before the intervention, 84 (42%) participants had poor knowledge, 90 (45%) had average knowledge and only 26 (13%) had good knowledge. For preventive practices, 92 (46%) had poor practices, 84 (42%) had average practices and 24 (12%) had good practices.

The baseline clinical indicators were BMI **25.8 ± 2.4 kg/m²**, waist circumference **82.4 ± 4.8 cm** and random blood sugar **110.6 ± 8.7 mg/dL**.

Effect on knowledge and preventive practices

In the experimental group, mean knowledge increased progressively from **13.24 ± 4.10** at baseline to **18.67 ± 3.82** at 2 weeks, **22.45 ± 3.36** at 4 weeks and **25.92 ± 2.84** at 8 weeks.

Mean self-reported practice scores increased from **11.82 ± 3.54** at baseline to **15.73 ± 3.18**, **19.86 ± 2.74** and **23.44 ± 2.36** at 2, 4 and 8 weeks, respectively.

Table 2. Change in knowledge and self-reported practice scores

n=200

Outcome	Pre-test Mean ± SD	2 weeks	4 weeks	8 weeks	F	p
Knowledge	13.24 ± 4.10	18.67 ± 3.82	22.45 ± 3.36	25.92 ± 2.84	286.4	<0.001
Practice	11.82 ± 3.54	15.73 ± 3.18	19.86 ± 2.74	23.44 ± 2.36	258.7	<0.001

Changes in clinical risk indicators

At the final assessment, mean BMI decreased from **25.8 ± 2.4 to 24.6 ± 2.2 kg/m²**, mean waist circumference decreased from **82.4 ± 4.8 to 79.3 ± 4.1 cm**, and random blood sugar decreased from **110.6 ± 8.7 to 101.8 ± 7.5 mg/dL**.

Table 3. Pre-test and 8-week clinical parameters in the experimental group

n=200

Clinical parameter	Pre-test Mean ± SD	8-week Mean ± SD	Mean change	t	p
BMI (kg/m²)	25.8 ± 2.4	24.6 ± 2.2	1.2	8.76	<0.001
Waist circumference (cm)	82.4 ± 4.8	79.3 ± 4.1	3.1	9.32	<0.001
Random blood sugar (mg/dL)	110.6 ± 8.7	101.8 ± 7.5	8.8	10.24	<0.001

CORRELATION AMONG STUDY VARIABLES

A strong positive correlation was observed between knowledge and self-reported preventive practices (**r=0.78, p<0.001**). Knowledge was moderately negatively correlated with BMI (**r=-0.42**), while preventive practices demonstrated a moderate negative correlation with blood sugar (**r=-0.58**).

DISCUSSION

The present study demonstrated that a structured community-based diabetes prevention program was associated with substantial improvements in diabetes-related knowledge among high-risk school children. Mean knowledge increased progressively from 13.24 at baseline to 25.92 at 8 weeks, with a statistically significant repeated-measures result ($F=286.4$, $p<0.001$). The finding suggests that repeated, age-appropriate health education combined with interactive learning strategies may be useful for improving children's understanding of diabetes risk and prevention.

The improvement in self-reported preventive practices was also substantial. The mean practice score increased from 11.82 to 23.44, with a significant repeated-measures result ($F=258.7$, $p<0.001$). This finding is consistent with evidence from school-based health-promotion interventions demonstrating that behavioral programs incorporating healthy nutrition and physical activity can improve health behaviours among children and adolescents. The thesis cites evidence from school-based interventions and obesity-prevention studies supporting the role of structured lifestyle interventions.

An important finding was the improvement in clinical risk indicators. BMI decreased by 1.2 kg/m², waist circumference by 3.1 cm and random blood sugar by 8.8 mg/dL, with all changes statistically significant. These findings are broadly consistent with previous research demonstrating favorable changes in body composition and metabolic indicators following lifestyle interventions among children and adolescents at increased metabolic risk.

The strong positive relationship between knowledge and preventive practices ($r=0.78$) provides further support for the importance of health education as one component of behavioral change. However, the observational nature of this correlation does not establish that increased knowledge alone caused the behavioral or clinical changes. Other components of the intervention, including physical activity, dietary modification and family involvement, may have contributed.

The study therefore supports a multidimensional approach to diabetes prevention in schools. The involvement of community health nurses can strengthen screening, education, counselling, family engagement and follow-up. Such interventions may be particularly relevant for children with multiple risk factors, including a positive family history and elevated anthropometric measures.

STRENGTHS OF THE STUDY

The study had several strengths. First, it used a control-group design and repeated assessments, allowing changes to be monitored over time. Second, the intervention addressed multiple modifiable risk factors rather than relying solely on didactic education. Third, the study assessed both behavioral outcomes and objective clinical indicators. Finally, family involvement was incorporated into the intervention, which may facilitate reinforcement of healthy behaviours outside the school environment.

IMPLICATIONS FOR NURSING AND SCHOOL HEALTH

The findings have important implications for community health nursing and school health services. Community and school health nurses can contribute to early identification of children with diabetes risk factors, provide structured health education, promote healthy dietary practices and physical activity, counsel families and coordinate referral when abnormal findings are identified.

The integration of periodic BMI and waist-circumference assessment, appropriate glucose screening, lifestyle education and family counselling into school health programs may provide an opportunity for early risk reduction. The thesis specifically identifies screening, health education and family-centered lifestyle promotion as important nursing applications.

CONCLUSION

The findings indicate that the community-based diabetes prevention program was associated with significant improvements in diabetes-prevention knowledge and self-reported preventive practices among high-risk school children. Significant reductions were also observed in BMI, waist circumference and random blood sugar over the intervention period.

The strong association between knowledge and preventive practices further highlights the importance of health education as part of comprehensive lifestyle interventions. However, the observed clinical changes should be interpreted as improvements in selected **diabetes-risk indicators**, rather than definitive evidence of diabetes prevention. Larger randomized studies with longer follow-up are required to establish the sustained effectiveness and generalizability of such programs.

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