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Research Article

A Pre-Experimental Evaluation of a Structured Teaching Program on Dental Caries Prevention Knowledge among School Students

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Abstract

Background: Dental caries is a highly prevalent oral health problem among school-aged children and is associated with poor oral hygiene, inadequate awareness, and unhealthy dietary practices. The present study aimed to evaluate the effectiveness of a structured teaching program on knowledge regarding dental caries and its prevention among primary school students in Anand District, Gujarat.

Materials and Methods: A pre-experimental one-group pre-test post-test design was adopted for this study. Using a convenient sampling technique, 60 primary school students studying in the 6th and 7th standards were selected. Baseline data were gathered using a validated structured knowledge questionnaire consisting of demographic variables and 26 multiple-choice questions (r = 0.75). A 30-min structured teaching program using audiovisual aids was administered, followed by a post-test administered 7 days later. Data were analyzed using descriptive and inferential statistics. The paired *t*-test was used to compare the pre-test and post-test knowledge scores.

Results: The overall knowledge level of the participants improved considerably from 52.3% in the pre-test to 81.2% in the post-test. The mean pre-test knowledge score was 30.0 ± 9.3, which increased to 48.0 ± 4.9 in the post-test. The obtained $P < 0.001$ which is less than the standard significance level of 0.05, showing that the improvement was statistically significant. The difference between the mean pre-test and post-test scores was statistically significant according to the paired *t*-test, $P < 0.05$, demonstrating the effectiveness of the structured teaching program.

Conclusion: The structured teaching program significantly improved knowledge regarding dental caries prevention among primary school children. School-based oral health education interventions may contribute to the promotion of healthy oral hygiene practices and preventive behaviors among students.

Keywords: Awareness, cavities, health education, oral hygiene, preventive practices, school children

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Introduction

Dental caries is one of the most common oral health problems affecting children worldwide and remains a major public health concern. According to the World Health Organization, oral diseases affect nearly 3.5 billion people globally, and untreated dental caries in permanent teeth is among the most prevalent health conditions worldwide.[1] School-aged children are particularly vulnerable to dental caries because of inadequate

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oral hygiene practices, frequent consumption of sugary foods, and limited awareness regarding preventive oral care.

In India, dental caries among children continues to be highly prevalent. Recent studies conducted among school-going children have reported prevalence rates ranging from 40% to 70%, indicating a substantial burden of oral diseases among the pediatric population.[2,3] Poor oral health during childhood may lead to pain, difficulty in chewing, impaired speech, school absenteeism, and reduced quality of life.[4] Furthermore, untreated dental caries may negatively affect children's nutritional status, growth, and academic performance.

Oral health education is recognized as an effective strategy for improving oral hygiene practices and promoting preventive behaviors among children. Schools provide an ideal setting for health education because children are more likely to adopt healthy habits during their formative years. Structured educational interventions supported by audiovisual aids and interactive teaching approaches have demonstrated significant improvements in children's knowledge, attitudes, and practices related to oral hygiene and dental care.[5,6] School-based oral health programs also contribute to the early identification and prevention of oral diseases among children. Limited evidence is available regarding the effectiveness of structured teaching programs on dental caries prevention among primary school children in Anand District, Gujarat. Therefore, this study was undertaken to assess baseline knowledge and evaluate the effectiveness of a structured teaching program by comparing pre-test and post-test knowledge scores regarding dental caries and its prevention among primary school students.

Materials and Methods

Study design and setting

A quantitative evaluative research approach with a pre-experimental one-group pre-test and post-test design was adopted to assess the effectiveness of a structured teaching program on knowledge regarding dental caries prevention among primary school students. The study was conducted in selected government primary schools of Anand district, Gujarat, India, namely Pay Centre Prathmik Kumar Shala and Prathmik Kanya Shala.

Population

The study included students studying in 6th and 7th standards who were willing to participate, able to read and understand Gujarati, and present during the data collection period. Students who were absent during data collection or unwilling to participate in the study were excluded.

Study period and duration

The study was conducted over a period of approximately 4 weeks, including pilot testing, pre-test assessment, implementation of the structured teaching program, and post-test evaluation. Data collection for the main study was carried out from April 13, 2024, to April 20, 2024.

Sample size and sampling technique

A total of 60 primary school students were included in the study. The sample size was determined based on feasibility, availability of participants, and the objectives of the study. A convenient sampling technique was used to select participants who met the eligibility criteria and were available during the data collection period.

Sample size justification

The sample size was considered adequate for detecting differences between pre-test and post-test knowledge scores in a pre-experimental educational intervention study. Similar studies conducted among school children have also utilized comparable sample sizes.

Research variables

The independent variable in the study was the structured teaching program regarding dental caries and its prevention, while the dependent variable was the knowledge score of primary school students regarding dental caries prevention. The demographic variables included age, gender, standard of study, name of the school, and presence of dental problems.

Description of the research tool

A structured self-administered knowledge questionnaire was developed by the investigator based on review of literature, expert consultation, textbooks, journals, and previous studies. The questionnaire was prepared in the Gujarati language to ensure better understanding among participants.

The tool consisted of two sections:

Section I: Demographic variables

This section included five items related to age, gender, standard, school name, and history of dental problems.

Section II: Knowledge questionnaire

This section consisted of 26 multiple-choice questions related to:

- Meaning of dental caries
- Causes and risk factors
- Signs and symptoms
- Prevention and oral hygiene practices
- Healthy dietary habits.

Each correct response carried one mark, and incorrect responses received zero marks. The maximum obtainable score was 26.

Scoring pattern and interpretation criteria

The knowledge scores were categorized as adequate (>75%), moderate (50–75%), and inadequate (<50%) based on the percentage of correct responses obtained by the participants.

Validity and reliability of tool

Content validity of the questionnaire and structured teaching program was established through expert review by eight specialists. Reliability was assessed using the test-retest method, and the questionnaire demonstrated acceptable

reliability with a Karl Pearson's correlation coefficient of r = 0.75.

Pilot study

A pilot study was conducted among students not included in the final sample to assess the feasibility of the study, clarity of the questionnaire, and suitability of the intervention. The results confirmed the feasibility of the study procedures. The structured teaching program covered the causes and prevention of dental caries, oral hygiene practices, healthy dietary habits, and proper tooth-brushing techniques. The session was delivered through a lecture-cum-discussion method using audiovisual aids and lasted approximately 30 min.

Ethical considerations

Ethical approval for this research was officially granted by the Institutional Ethics Committee under approval number IEC/2024/56 dated January 15, 2024. Before initiating data collection, written informed consent was acquired from all participants (and school authorities). Participant anonymity and strict data confidentiality were rigidly maintained throughout all phases of the study.

Statistical analysis

The collected data were coded, tabulated, and analyzed using the Statistical Package for the Social Sciences version 20.0. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the data. Inferential statistics including paired *t*-test and Chi-square test were applied to determine the effectiveness of the intervention and association between demographic variables and knowledge scores. Statistical significance was considered at $P < 0.05$ with a 95% confidence interval.

Results

The collected data were analyzed using descriptive and inferential statistics. The findings include participant demographics, knowledge scores, and statistical comparison of pre-test and post-test scores.

Table 1 shows that primary school students with equal representation from 6th to 7th standards were included in the study. Male and female participants were equally distributed. Most participants belonged to the 11–12-year age group.

The study included 60 participants with equal representation of male and female students as well as students from 6th to 7th standards. Most participants belonged to the age group of 11–12 years. This distribution is shown in Figure 1.

Table 1: Demographic characteristics of study participants (n=60)

Variable	Category	Frequency (*n*)	Percentage
Age (years)	11	30	50.0
	12	29	48.3
	>12	1	1.7
Gender	Males	30	50.0
	Females	30	50.0
Educational standard	6th Standard	30	50.0
	7th Standard	30	50.0
Total		60	100.0

Table 2 revealed a noticeable improvement in students' knowledge regarding dental caries prevention after the implementation of the structured teaching program. Post-test scores were consistently higher than pre-test scores across all knowledge domains. Statistically significant improvement was identified in the areas related to the content of teeth and the need for brushing. Substantial enhancement was also observed in understanding dental caries, oral hygiene practices, tooth development, and correct brushing techniques, suggesting that the educational intervention was effective in improving oral health awareness among primary school students.

The post-test findings demonstrated improvement across all domains of knowledge related to dental caries prevention following the structured teaching program. Significant improvement was observed in knowledge related to tooth content and the need for brushing. These findings are further depicted in Figure 2.

Table 3 reveals that the mean knowledge score of the participants increased from 30.0 in the pre-test to 48.0 in the post-test, with a mean difference of 18.0. The obtained *P*-value was <0.05, showing that the improvement was statistically significant. These results suggest that the structured teaching program was effective in enhancing knowledge regarding dental caries prevention among primary school students.

Figure 3 shows that overall mean knowledge score was increased following administration of the structured teaching program, indicating improvement in students' knowledge regarding dental caries prevention.

Discussion

The present study evaluated the effectiveness of a planned teaching program (PTP) on knowledge regarding dental caries prevention among primary school students. The findings revealed a significant improvement in knowledge scores following the intervention, with the mean score increasing from 30.0 (52.3%) in the pre-test to 48.0 (81.2%) in the post-test ($P < 0.001$). These results indicate that the structured teaching program was effective in enhancing students' knowledge regarding dental caries and its prevention. The findings are consistent with previous studies that reported improved oral health knowledge among school children following educational interventions. Saravanam *et al*.[7] reported a high prevalence of dental caries among rural school children and emphasized the need for oral health education. This baseline dynamic is further supported by Sudha *et al*.,[8] whose cluster sampling analysis of school children aged 5–13 years in Mangalore highlighted a severe discrepancy between socio-economic classes, noting a 96.2% caries prevalence within lower socio-economic demographics compared to 77.1% in higher-income brackets. Conversely, the baseline vulnerabilities of the Anand cohort present a contrast to the findings of Pandit *et al*.[9] in rural

Table 2: Domain-wise comparison of pre-test and post-test oral health knowledge among participants (*n*=60)

Knowledge domain	Pre-test *n* (%)	Post-test *n* (%)	*P*-value
Knowledge of healthy teeth	28 (46.7)	50 (83.3)	0.391
Functions of teeth	36 (60.0)	51 (85.0)	0.520
Number of teeth	41 (68.3)	55 (91.7)	0.064
Content of teeth	36 (60.0)	55 (91.7)	0.031*
Knowledge of teeth growth	27 (45.0)	50 (83.3)	0.280
Knowledge of dental caries	17 (28.3)	51 (85.0)	0.298
Knowledge of healthy diet	40 (66.7)	47 (78.3)	0.316
Causative factors of dental caries	22 (36.7)	41 (68.3)	0.602
Knowledge of adverse habits	34 (56.7)	43 (71.7)	0.535
Knowledge of tooth infection	19 (31.7)	42 (70.0)	0.064
Need for brushing	28 (46.7)	47 (78.3)	0.013*
Causes of mouth odor	45 (75.0)	49 (81.7)	0.516
Knowledge of tooth development	20 (33.3)	48 (80.0)	0.456
Effects of soft drinks on teeth	19 (31.7)	41 (68.3)	0.384
Brushing duration	48 (80.0)	56 (93.3)	0.377
Brushing frequency	37 (61.7)	56 (93.3)	0.243
Prevention of dental caries	27 (45.0)	47 (78.3)	0.137
Care during tooth pain	28 (46.7)	45 (75.0)	0.362
Knowledge of tooth care	29 (48.3)	40 (66.7)	0.244
Tooth cleanliness	41 (68.3)	55 (91.7)	0.137
Benefits of tooth cleaning	27 (45.0)	50 (83.3)	0.391
Correct brushing technique	14 (23.3)	46 (76.7)	0.239

*Indicates statistical significance at $P<0.05$

Table 3: Comparison of pre-test and post-test overall oral health knowledge scores (*n*=60)

Knowledge score	Mean (M)	Standard deviation	Mean difference	*P*-value
Pre-test	30.0	9.3	-	<0.001
Post-test	48.0	4.9	18.0	<0.05*

*Indicates statistical significance at $P<0.05$. The increase in the post-test mean score demonstrates improvement in students' knowledge following the educational intervention

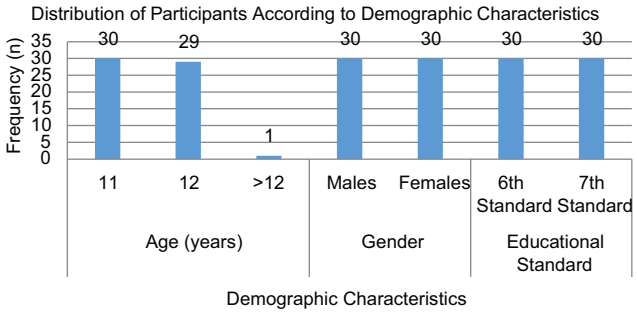

Figure 1: Distribution of participants according to age and gender

Delhi, who observed a lower incidence of advanced periodontal decay despite a general indifference toward standard oral hygiene routines, suggesting traditional rural dietary models might occasionally buffer against rapid enamel breakdown. However, as children transition toward modern diets containing higher proportions of refined carbohydrates, the necessity of targeted educational interventions becomes paramount. The post-intervention knowledge escalation observed in this study directly reinforces the localized clinical trials executed by Nair *et al*.,[10] where structured educational modules led by pediatric nursing groups produced a substantial increase in health scores across distinct rural school networks.

On a global scale, the structural variation in knowledge domains observed among these 6th and 7th-grade subjects aligns with international health literacy patterns. In the pre-test phase, participants displayed a selective understanding of dental wellness; they were superficially aware of baseline habits but lacked deeper technical comprehension regarding tooth anatomy and internal cariogenic mechanisms. This deficit mirrors the cross-sectional data published by Oliveira *et al*.[11] in their assessment of third-grade school children, which revealed that while 58% maintained fair brushing habits, only 48% possessed correct fundamental knowledge regarding caries etiology. The long-term efficacy of structured classroom interventions is heavily reinforced by Al-Jundi *et al*.[12] through their extensive 4-year longitudinal evaluation of school-based caries prevention initiatives. Their findings demonstrated that cohorts subjected to consistent, structured hygiene education, and fluoridated regimens exhibited significantly better dental metrics than standard control groups ($P = 0.001$). Furthermore, the extreme statistical significance ($P < 0.001$) tracking the upward shift of knowledge scores in the Anand District matches the empirical outcomes of experimental trials conducted by Al-Dossary and Al-Malki (2022),[13] where structured classroom dentistry presentations generated a rapid, highly localized enhancement in preventative health habits. This international alignment confirms that structured

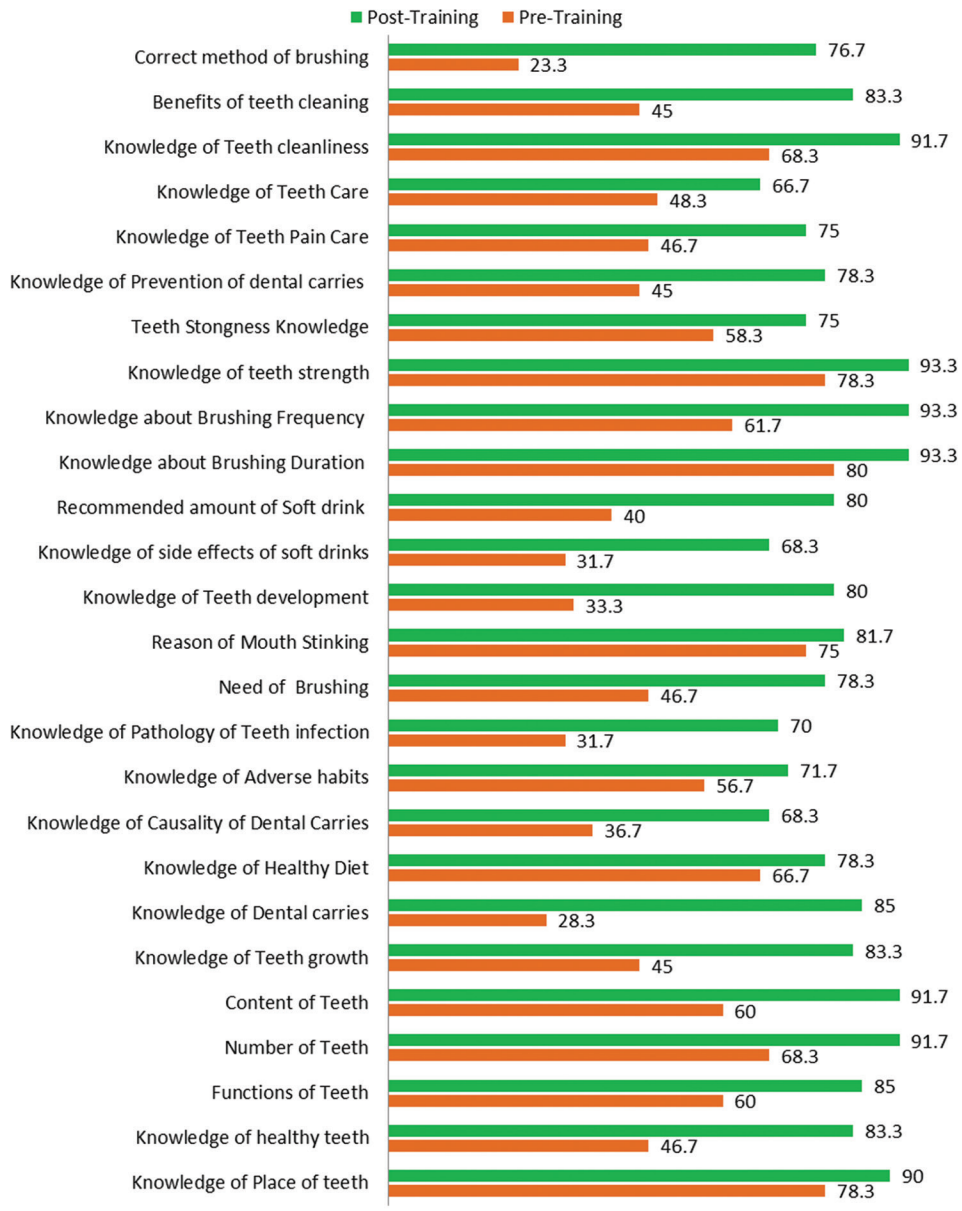

Figure 2: Comparison of pre-test and post-test knowledge levels

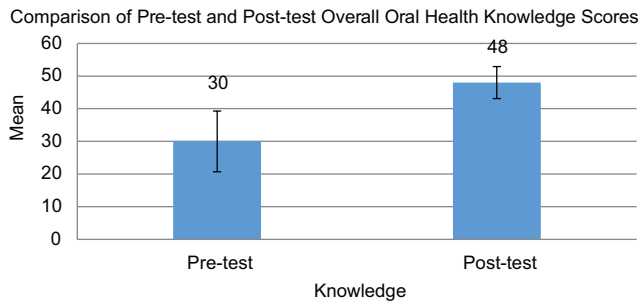

Figure 3: Mean pre-test and post-test knowledge scores

pedagogical frameworks developed by health professionals remain a highly reliable method to achieve uniform literacy improvements across globally diverse student populations.

The significant improvement observed in the present study may be attributed to the structured content, use of audiovisual aids, and interactive teaching methods employed during the program. These findings support the integration of oral health education into school health services and emphasize the important role of nurses and educators in promoting oral hygiene awareness among children.[7,8,10,12,13]

Conclusion

The PTP significantly improved knowledge of dental caries prevention among school children, with mean scores increasing from 52.3% to 81.2% ($P < 0.001$). However, the findings are limited by the small sample size, absence of a control group, and short follow-up period. Further studies with larger samples and randomized controlled designs are recommended.

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Conflict of Interest

The author declares no conflicts of interest regarding the publication of this manuscript.

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