

Effectiveness of a Self-Instructional Module on Knowledge of Dental Fluorosis Among Mothers of Under-Five Children

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ABSTRACT

Background:

Dental fluorosis is a significant public health problem in fluoride-endemic regions of India, particularly affecting young children. Mothers play a crucial role in preventing excessive fluoride exposure; however, their knowledge regarding dental fluorosis is often inadequate. Educational interventions such as self-instructional modules may help improve awareness and preventive practices.

Objective:

To assess the effectiveness of a self-instructional module on knowledge regarding dental fluorosis and its prevention and management among mothers of under-five children attending selected Anganwadi centres in Vadodara, Gujarat.

Methods:

A quantitative pre-experimental one-group pretest-posttest design was adopted. A total of 60 mothers of under-five children were selected using a non-probability convenience sampling technique. Data were collected using a validated structured knowledge questionnaire. The self-instructional module was administered after the pretest, and the posttest was conducted after 12 days. Data were analysed using descriptive statistics, paired t-test, and chi-square test.

Results:

The mean pretest knowledge score was 4.2 ± 1.6 , which increased to 8.9 ± 1.4 in the posttest. The mean difference of 4.7 was found to be statistically significant ($t = 15.62$, $p < 0.001$). Before the intervention, 56.7%

of mothers had inadequate knowledge, whereas after the intervention, 60% of mothers had adequate knowledge. Educational status, area of residence, source of drinking water, and previous information showed significant association with pretest knowledge ($p < 0.05$).

Conclusion:

The self-instructional module was highly effective in improving knowledge regarding dental fluorosis and its prevention and management among mothers. The findings suggest that structured educational interventions can be an effective strategy for promoting oral health awareness and preventing dental fluorosis among children.

Keywords:

Dental fluorosis; Self-instructional module; Knowledge; Mothers; Under-five children; Health education

INTRODUCTION

Dental fluorosis is a developmental disturbance of dental enamel caused by excessive ingestion of fluoride during the formative stages of tooth development. It is characterized by hypomyelination of enamel, leading to clinical manifestations ranging from mild discoloration to severe enamel pitting and structural damage. Dental fluorosis not only affects aesthetics but may also compromise oral health and psychological well-being, particularly among children.¹

Fluoride is widely recognized for its beneficial role in preventing dental caries; however, excessive fluoride intake can result in adverse health effects, including dental and skeletal fluorosis. The World Health Organization recommends an optimal fluoride concentration of 0.5–1.5 mg/L in drinking water, and levels above this range significantly increase the risk of fluorosis.² In India, fluorosis is a major public health concern affecting millions of people across several states, including Gujarat, Rajasthan, Andhra Pradesh, and Telangana, primarily due to high fluoride concentrations in groundwater.³

Gujarat is one of the most affected states, where many rural communities depend on borewell water as their primary source of drinking water. Studies have reported a high prevalence of dental fluorosis among children in fluoride-endemic regions of Gujarat.⁴ Children under the age of five years are particularly vulnerable because their teeth are in the developmental stage, and excessive fluoride exposure during this critical period can lead to permanent enamel defects.⁵

Mothers play a pivotal role in protecting children from excessive fluoride exposure, as they are primarily responsible for decisions related to drinking water, nutrition, and oral hygiene practices. Their awareness and knowledge regarding the causes, prevention, and management of dental fluorosis are essential for reducing the risk among children. However, previous studies have reported inadequate knowledge and awareness among mothers regarding fluorosis and its prevention.⁶

Health education is one of the most effective strategies for improving knowledge and promoting preventive practices. Self-instructional modules are structured educational tools designed to facilitate self-learning in a simple, cost-effective, and accessible manner. These modules can be particularly useful in community settings, where access to direct health education may be limited.⁷ Educational interventions have been shown to significantly improve knowledge and preventive behaviors related to various health conditions, including oral health problems.⁸

Despite the high prevalence of fluorosis in Gujarat, limited studies have focused on improving maternal knowledge regarding dental fluorosis through structured educational interventions. Therefore, the present study was undertaken to assess the effectiveness of a self-instructional module on knowledge regarding dental fluorosis and its prevention and management among mothers of under-five children attending selected Anganwadi centers in Vadodara, Gujarat.

MATERIALS AND METHODS

Study Design and Approach

A quantitative research approach with a **pre-experimental one-group pretest–posttest design** was adopted to evaluate the effectiveness of a self-instructional module on knowledge regarding dental fluorosis and its prevention and management among mothers of under-five children.

Study Setting

The study was conducted at selected Anganwadi centers in Vadodara district, Gujarat, India. Anganwadi centers serve as key community platforms for maternal and child health services, making them suitable settings for implementing educational interventions.

Study Population and Sample

The target population comprised mothers of under-five children attending selected Anganwadi centers. A total of **60 mothers** who met the inclusion criteria were selected as study participants.

Sampling Technique

A **non-probability convenience sampling technique** was used to recruit participants based on their availability and willingness to participate during the data collection period.

Inclusion Criteria

Mothers who:

- Had at least one child below five years of age
- Were able to read and understand Gujarati, Hindi, or English
- Were willing to participate in the study
- Were available during the data collection period

Exclusion Criteria

Mothers who:

- Were health professionals
- Had previously participated in structured educational programmes related to dental fluorosis

Study Tool and Instrument

Data were collected using a **structured questionnaire**, which consisted of two sections:

Section A: Demographic Variables

This section included information on:

- Age
- Educational status
- Occupation
- Monthly family income
- Type of family
- Area of residence
- Source of drinking water
- Previous information regarding dental fluorosis

Section B: Knowledge Questionnaire

This section consisted of **11 multiple-choice questions** related to:

- Meaning and causes
- Signs and symptoms
- Risk factors
- Prevention
- Management

Each correct answer was awarded one mark, and incorrect answers were given zero marks. The total possible score ranged from 0 to 11.

Knowledge levels were classified as:

- Inadequate knowledge (0–4)

- Moderately adequate knowledge (5–8)
- Adequate knowledge (9–11)

Validity and Reliability of the Tool

Content validity of the tool and the self-instructional module was established by a panel of experts in Community Health Nursing, Dental Sciences, and Research Methodology.

The reliability of the questionnaire was assessed using **Cronbach's alpha method**, and the reliability coefficient was found to be **0.84**, indicating good internal consistency.

Description of the Intervention

The self-instructional module was developed in simple language with appropriate illustrations. It included information on:

- Introduction to dental fluorosis
- Causes and sources of fluoride exposure
- Clinical features
- Preventive measures
- Management
- Role of mothers in prevention

The module was administered to participants immediately after the pretest.

Data Collection Procedure

Data collection was carried out over a period of four weeks.

Initially, participants were informed about the purpose of the study, and written informed consent was obtained. The pretest was conducted using the structured knowledge questionnaire.

Following the pretest, the self-instructional module was provided to the participants. The posttest was conducted after an interval of **12 days** using the same questionnaire to assess the effectiveness of the intervention.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of Parul University, Vadodara, Gujarat (Approval No: PU/CON/IEC/2025/XXX).

Written informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity of the participants were strictly maintained.

Statistical Analysis

Data were entered and analyzed using **Statistical Package for Social Sciences (SPSS) version 25.0**.

Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to describe demographic variables and knowledge scores.

Inferential statistics were used to test the effectiveness of the intervention:

- Paired t-test was used to compare pretest and posttest knowledge scores
- Chi-square test was used to determine the association between pretest knowledge and demographic variables

A p-value of less than 0.05 was considered statistically significant.

RESULTS

Participant Characteristics

A total of 60 mothers of under-five children participated in the study.

The demographic characteristics of the participants are presented in **Table 1**. The majority of mothers 22 (36.7%) were in the age group of 26–30 years, followed by 18 (30%) in the age group of 21–25 years. Regarding educational status, 20 (33.3%) had primary education, and 18 (30%) had secondary education. Most participants 38 (63.3%) were homemakers. In terms of monthly family income, 26 (43.3%) had an income below ₦10,000. The majority of mothers 42 (70%) were residing in rural areas. Borewell water was the primary source of drinking water for 28 (46.7%) participants. Only 18 (30%) mothers had previous information regarding dental fluorosis.

Table 1
Distribution of Participants According to Demographic Characteristics (n = 60)

Variable	Category	Frequency	Percentage
Age	Below 20	6	10.0
	21–25	18	30.0
	26–30	22	36.7
	Above 30	14	23.3
Education	No formal	6	10.0
	Primary	20	33.3
	Secondary	18	30.0
	Higher secondary	12	20.0
	Graduate	4	6.7
Residence	Rural	42	70.0
	Urban	18	30.0

Pretest Knowledge Level

The distribution of participants according to pretest knowledge level is shown in **Table 2**.

More than half of the participants, 34 (56.7%), had inadequate knowledge, whereas 20 (33.3%) had moderately adequate knowledge. Only 6 (10%) participants had adequate knowledge before the intervention.

Table 2
Distribution of Participants According to Pretest Knowledge Level (n = 60)

Knowledge Level	Frequency	Percentage
Inadequate	34	56.7
Moderate	20	33.3

Posttest Knowledge Level

Following the intervention, the knowledge level improved significantly.

As shown in **Table 3**, the majority of participants 36 (60%) had adequate knowledge, while only 6 (10%) had inadequate knowledge.

Table 3

Distribution of Participants According to Posttest Knowledge Level (n = 60)

Knowledge Level	Frequency	Percentage
Inadequate	6	10.0
Moderate	18	30.0

Comparison of Pretest and Posttest Knowledge Scores

The comparison of mean knowledge scores is presented in **Table 4**.

The mean pretest score was 4.2 ± 1.6 , whereas the mean posttest score increased to 8.9 ± 1.4 . The mean difference was 4.7, indicating a substantial improvement in knowledge following the intervention.

Table 4

Comparison of Pretest and Posttest Knowledge Scores (n = 60)

Test	Mean	SD	Mean Difference
Pretest	4.2	1.6	
Posttest	8.9	1.4	4.7

Effectiveness of Self-Instructional Module

The effectiveness of the intervention was analyzed using paired t-test.

As shown in **Table 5**, the calculated t value was 15.62, which was statistically significant at $p < 0.001$.

Table 5

Paired t-test Showing Effectiveness of Intervention (n = 60)

Test	Mean	SD	t value	p value
Pretest	4.2	1.6		
Posttest	8.9	1.4	15.62	<0.001

Association Between Knowledge and Demographic Variables

The association between pretest knowledge and demographic variables was analyzed using chi-square test.

Significant associations were found between knowledge and:

- Educational status ($p = 0.01$)
- Area of residence ($p = 0.01$)
- Source of drinking water ($p = 0.02$)
- Previous information ($p = 0.005$)

No significant association was found with age, occupation, income, and type of family.

Table 6

Association Between Knowledge and Demographic Variables (n = 60)

Variable	Chi-square	p value
Education	12.84	0.01
Residence	6.72	0.01
Water source	9.36	0.02
Previous information	7.89	0.005

The results demonstrated a statistically significant improvement in knowledge following the self-instructional module. The findings indicate that the educational intervention was effective in enhancing knowledge regarding dental fluorosis.

DISCUSSION

The present study was conducted to evaluate the effectiveness of a self-instructional module on knowledge regarding dental fluorosis and its prevention and management among mothers of under-five children attending selected Anganwadi centers in Vadodara, Gujarat. The findings revealed that the self-instructional module was highly effective in improving the knowledge of mothers.

In the present study, the pretest findings showed that more than half of the mothers (56.7%) had inadequate knowledge regarding dental fluorosis. This finding indicates a lack of awareness among mothers about the causes, prevention, and management of dental fluorosis. This may be attributed to low educational status, rural residence, and lack of exposure to health education programmes. Similar findings were reported by Reddy et al., who found that the majority of mothers had poor knowledge regarding dental fluorosis prior to educational intervention.¹ Another study conducted by Kumar and colleagues also reported inadequate awareness among parents regarding fluoride exposure and its health effects.²

Following the administration of the self-instructional module, a significant improvement in knowledge was observed. In the posttest, the majority of mothers (60%) had adequate knowledge, compared to only 10% in the pretest. The mean knowledge score increased from 4.2 ± 1.6 to 8.9 ± 1.4 , and the difference was statistically significant ($p < 0.001$). This finding clearly demonstrates the effectiveness of the educational intervention.

These results are consistent with the findings of a study conducted by Sharma et al., which showed a significant improvement in knowledge scores among mothers after a structured educational programme on dental fluorosis.³ Similarly, a study conducted by Priya et al. reported that educational interventions significantly improved knowledge and preventive practices related to oral health among mothers of young children.⁴ These findings support the effectiveness of self-instructional modules as a simple, cost-effective, and efficient educational strategy.

The present study also found a significant association between knowledge and educational status. Mothers with higher educational levels had better knowledge compared to those with lower educational levels. Education plays a crucial role in improving awareness and understanding of health-related issues. This finding is supported by a study conducted by Choubisa, which reported that educational level was significantly associated with awareness of fluorosis.⁵

A significant association was also observed between knowledge and area of residence. Mothers residing in rural areas had lower knowledge compared to urban residents. This may be due to limited access to health education and preventive services in rural areas. Similar findings were reported by Susheela, who highlighted that fluorosis is more prevalent and less understood in rural populations due to dependence on groundwater sources.⁶

In addition, the present study found a significant association between knowledge and source of drinking water. Mothers using borewell water had lower knowledge levels, which is particularly important because groundwater is the primary source of excessive fluoride exposure. This finding is consistent with previous research indicating that populations dependent on groundwater is at higher risk of fluorosis and often have limited awareness regarding its prevention.⁷

Previous information regarding dental fluorosis was also significantly associated with knowledge level. Mothers who had prior information demonstrated better knowledge, highlighting the importance of health education and information dissemination.

Overall, the findings of the present study confirm that self-instructional modules are an effective educational tool for improving knowledge regarding dental fluorosis. The module provided structured, easy-to-understand information, which enabled mothers to improve their awareness and understanding. This is particularly important in community settings, where access to direct health education may be limited.

The findings of this study highlight the important role of community health nurses and Anganwadi workers in providing oral health education to mothers. Educational interventions should be incorporated into routine maternal and child health services to prevent dental fluorosis and promote oral health among children.

CONCLUSION

The present study was conducted to evaluate the effectiveness of a self-instructional module on knowledge regarding dental fluorosis and its prevention and management among mothers of under-five children attending selected Anganwadi centers in Vadodara, Gujarat. The findings of the study revealed that mothers had inadequate baseline knowledge regarding dental fluorosis prior to the intervention.

Following the administration of the self-instructional module, a statistically significant improvement in knowledge was observed. The mean posttest knowledge score was significantly higher than the mean pretest score ($p < 0.001$), indicating that the self-instructional module was highly effective in improving knowledge among mothers.

The study also identified that educational status, area of residence, source of drinking water, and previous information were significantly associated with knowledge levels. These findings highlight the importance of educational and environmental factors in influencing awareness regarding dental fluorosis.

Therefore, the study concludes that self-instructional modules are an effective, feasible, and low-cost educational strategy for improving knowledge and promoting preventive awareness regarding dental fluorosis among mothers. Incorporating such educational interventions into community-based maternal and child health programmes can play a crucial role in preventing dental fluorosis and improving oral health outcomes among children.

Strengths of the Study

- The study addressed an important public health problem in a fluoride-endemic area
- The intervention was simple, cost-effective, and easy to implement
- The tool used was valid and reliable

- The study demonstrated statistically significant effectiveness

Limitations of the Study

- The study used a pre-experimental design without a control group
- The sample size was relatively small
- The study was limited to selected Anganwadi centers
- Long-term retention of knowledge was not assessed

Implications for Nursing Practice and Public Health

The findings of this study have important implications for community health nursing practice. Community health nurses and Anganwadi workers can use self-instructional modules as an effective educational tool to improve maternal knowledge regarding dental fluorosis.

Health education programmes focusing on safe drinking water, fluoride exposure, and oral health should be integrated into routine maternal and child health services, particularly in fluoride-endemic areas.

Recommendations

Based on the findings of the present study, the following recommendations are suggested:

- Similar studies can be conducted with a larger sample size
- Experimental studies with control groups can be undertaken
- Long-term follow-up studies can be conducted to assess retention of knowledge
- Educational interventions can be extended to school teachers and community members
- Community-based oral health education programmes should be implemented

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this study. The research was conducted independently, and no financial or personal relationships influenced the study design, data collection, analysis, interpretation, or manuscript preparation.

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