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Original Research Article

Knowledge regarding dental fluorosis among middle school children's of Nelamangla town, Bengaluru, India: a pre-experimental study

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ABSTRACT

Background: Dental fluorosis is a becoming epidemic in most of the countries worldwide it is continuing to rise. In India the prevalence of dental fluorosis is about 46% which is really a cause of concern. The main objective of the study was to understand the knowledge level of middle school children's also to find out the effectiveness of the teaching program to educate the children's regarding dental fluorosis.
Methods: This were a pre-experimental study done on selected middle school children over the period of one month where 60 students have participated in the study. Demographic variables and structured knowledge questionnaires were used to collect the data. SPSS V16.0 was used for the data analysis.
Results: Our result shows majority of the students had inadequate to moderate knowledge and none of them had adequate knowledge regarding dental fluorosis. However, after the post-test there was an improvement of students' knowledge where mean score was 13.54, with a mean percentage of 45.13. The SD was 3.21, and the "t"-test value was 23.07 at the level of $p<0.001$.
Conclusions: The findings of the study indicate that there is a lot more to be done to educate and aware the students also the family members regarding dental fluorosis. Furthermore, proper health education, community education and health workers participation can have a rational control over the management of the disease.

Keywords: Dental fluorosis, Knowledge, Middle school children's, Pre-experimental study

INTRODUCTION

Dental fluorosis, or "mottled teeth," has long been recognized as an endemic problem affecting areas of the world with high levels of naturally occurring fluorides in the drinking water.[1] It is a health condition caused by a child receiving too much fluoride during tooth development. Between the ages of one and four is the crucial exposure time. In its mild form, which is the most common, fluorosis appears as tiny white streaks or specks that are often unnoticeable. In its severest form, which is also called mottling of dental enamel, it is characterized by black and brown stains, as well as cracking and pitting of the teeth.[2] Fluorosis may present as pitted enamel and dark brown stains in the middle of the teeth, far from the gum line. It can also appear as subtle white spots or streaks. Fluoride is seen as a two-edged weapon, and excessive fluoride exposure is never safe. Fluorosis is a common condition worldwide, primarily caused by high fluoride levels in drinking water.[3]

India is one of the epidemic centers of dental fluorosis, where approximately 25 million people are currently affected, and more than 66 million people are at risk of developing fluorosis, including children's. India is also

situated in the geographical fluoride belt, where fluoride content is high in soil or rocks, therefore causing an excessive fluoride level in the groundwater level.[4] Moreover, high-fluoride toothpaste is also given to children under 3 to 5 years old, which also increases the risk of dental fluorosis. Generally, 0.1 mg of fluoride is usually consumed during toothpaste and mouth rinses, whereas 20 mg or more can be ingested during fluoride gel applications. As most parents are responsible for their children's health, it is also important that parents be aware of dental fluorosis.[5] Fluoride is considered a double-edged weapon, and overexposure to fluoride is quite dangerous not only for the tooth enamel but also for the bones. As per the Bureau of Indian Standards (BIS), the desirable amount of fluoride in water is 1 ppm (parts per million), or 1 mg/l; however, it is always better to have less than that.[6] Due to the excess fluoride concentration, some of the oral diseases can happen, like decaying teeth, mission of teeth, oral infection, etc., which ultimately affect the quality of life of the children's.[5] The 85 years of fluorosis history in India, several states have seen a high prevalence, such as Andhra Pradesh, Telangana, Gujrat, Uttar Pradesh, and Karnataka.[6] According to the data released by the NPPCF, Karnataka is one of the fluoride-endemic states in India where Mysore, Bellary, Chikkaballapur, Koppal, Davangere, Tumkur, Bagalkot, Bengaluru, Raichur, Bijapur, Chitradurga, Gadag, Gulbarga, Hassan, Kolar, Mandya, Ramnagaram, and Shimoga are highly affected where high fluoride concentrations are seen in drinking water and urine.[3,4] In Karnataka, several districts have found the fluoride concentration varying from 0.2-18.0 mg/L, which is far more than the recommended prescribed level.[5] Identifying the magnitude and severity of the problem, this study was planned to explore the knowledge level among middle school children's in rural schools in Nelamangla city of Bengaluru on the north side.

METHODS

Study design and population

A pre-experimental study with one group pre- and post-test design was adopted for this study in selected middle school children's in the rural schools of Nelamangla in the years 2023-2024, where a total of 60 students have participated in the study.

Study setting

This study was done on the rural side of Nelamangla town, which is in the Bengaluru rural district of Karnataka state. A few rural schools have been selected for the purpose of this study.

Sample size and sampling procedures

A total of 60 middle school children's have participated in the study using the probability simple random sampling technique (lottery method). Children who can read and write Kannada and English and are studying in middle school in the age group between 11 and 14 years have been included in the study. Moreover, children who are not willing to participate or were not present on the day of data collection have been excluded from the study.

Institutional ethical committee approval was obtained before the data collection, and approval was also obtained from the school principals before the pilot and main studies.

Data collection instrument

The tool was prepared by the investigator and is divided into two sections. Before the administration of the tools, an interview was conducted with each student to make them feel comfortable. Section A included demographic characteristics such as age, gender, religion, type of family, education of the family, education of the father, father's occupation, family income, sources of water supply, dietary patterns, and habits. Section B consisted of 30 questions in the areas of general introduction of teeth, general information regarding fluoride, dental fluorosis, pathophysiology, diagnosis, and management, including dietary patterns.

Data collection technique

After the formal permission taken from the principals, the students were requested to fill out the form, which consisted of a consent form and questionnaires. Each student was made to participate in all activities of the structured teaching program. The methods used in the training program were charts, pictures, flash cards, and handouts. Lectures, discussions, and feedback are also ensured to be carried out by the entire population of respondents. Adequate precautionary measures were taken to ensure the physical setting, such as space, lighting, ventilation, and furniture. After keeping everything prepared, the following activities were conducted: It took around 45 to 50 minutes, depending on the level of engagement of participants with the topic of knowledge level on dental fluorosis.

Data analysis

SPSS V16.0 was used for the data analysis. Descriptive and inferential statistics were used for the analysis, along with the mean, frequency, percentage, standard deviation, paired t-test, chi-square test, and multiple linear regression**.**

RESULTS

Table 1 depicts the sociodemographic variables of middle school students. Among the school students, the majority, 48 (80%), were male, were in the age group of 13 years 13(46.67%), and belonged to the Hindu community 24 (40%). Furthermore, the majority of the students, 36

(60%), are living in a joint family with a monthly income of 2000 to 3000 Rs. 20 (33.33%). With regards to education and occupation of the fathers, the majority of them 20 (33.33%) have primary education and are employed 18 (30%) or self-employed 18 (30%). Whereas, most of the participants houses are equipped with 24 (40%) wells for the water supply. In terms of dietary patterns, the majority of the students are vegetarians 36 (60%) and have the habit of chewing tobacco, and drink caffeinated beverages 24 (40%).

Table 1: Description of socio-demographic variables of middle-school students (n=60).

Demographic variables	Categories	Frequency (f)	Percentage (%)
Age in years	11	8	13.33
	12	20	33.33
	13	28	46.67
	14	4	6.67
Religion	Hindu	24	40.00
	Muslim	18	30.00
	Christian	12	20.00
	Any others	6	10.00
Type of the family	Nuclear	24	40.00
	Joint	36	60.00
Gender	Male	48	80.00
	Female	12	20.00
Education of father	Illiterate	12	20.00
	Primary education	20	33.33
	Middle school education	18	30.00
	Higher secondary	6	10.00
	Graduates	4	6.67
	Post graduate	0	0.00
Occupation of father	Unemployed	18	30.00
	Self employed	18	30.00
	Daily wages	12	20.00
	Private employed	6	10.00
	Govt. employed	6	10.00
Family income (in rupees per month)	1000-2000	12	20.00
	2001- 3000	20	33.33
	3001- 4000	18	30.00
	4001-5000	6	10.00
	Above 5000	4	6.67
Source of water supply	Well	24	40.00
	Tap	12	20.00
	Hand pump	12	20.00
	Pond	6	10.00
	Lake	6	10.00
Dietary pattern	Vegetarian	36	60.00
	Non vegetarian	24	40.00
Habits	Smoking	0	0.00
	Alcohol intake	0	0.00
	Tobacco chewing	24	40.00
	Caffeinated beverages	24	40.00
	Drug abuse	0	0.00
	Nil	12	20.00

Table 2 depicts the frequency and percentage distribution of pre- and post-test knowledge of middle school students regarding dental fluorosis. And the results show that the majority of the students had inadequate knowledge 48 (80%) and moderate knowledge 12 (20%) during the pre-test, and none of them had adequate knowledge. However, after the education program, the post-test results show the majority of the participants have

moderate knowledge 28 (46.67%) and adequate knowledge 30 (50%), and only 2 of them (3.33%) had the same level of knowledge even after the education program.

Table 2: Frequency and percentage distribution of pre and post-test knowledge of middle school students regarding dental fluorosis (n=60).

Level of knowledge	Pre-test		Post-test	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Inadequate knowledge (<50%)	48	80	2	3.33
Moderate knowledge (50-75%)	12	20	28	46.67
Adequate knowledge (>75%)	-	-	30	50
Total	60	100	60	100

Paired "t" test analysis was done to find out the significance of the pre- and post-test knowledge of middle school students regarding dental fluorosis. The table shows that there was a significant enhancement of knowledge after the post-test. Where the maximum score was 30, the mean score was 13.54, with a mean percentage of 45.13. The SD was 3.21, and the "t"-test value was 23.07 at the level of p<0.001.

Table 3: Paired "t" test analysis for the pre and post-test knowledge of middle school students regarding dental fluorosis (n=60).

Variable (knowledge)	Paired t-test difference				P-value	t-test value
	Max. score	Mean	Mean %	SD		
Pre-test	30	8.37	39.84	4.25		
Post-test	30	21.9	73	3.41	p<0.001	23.07*
Enhancement		13.54	45.13	3.21		

Note: *- Denotes significant (p<0.0001)

Table 4: Association of post-test knowledge scores with selected demographic variables (n=60).

Demographic variables	(f)	(%)	Inadequate		Moderate		Adequate		χ^2-value	P value
			No	%	No	%	No	%		
Age										
11	8	13.33	0	0.00	6	10.00	2	3.33	4.33 df 6 N.S	p>0.05
12	20	33.33	0	0.00	10	16.67	10	16.67		
13	28	46.67	2	3.33	12	20.00	14	23.33		
14	4	6.67	0	0.00	0	0.00	4	6.67		
Religion										
Hindu	24	40.00	0	0.00	8	13.33	16	26.67	6.60 df 6 N.S	p>0.05
Muslim	18	30.00	2	3.33	12	20.00	4	6.67		
Christian	12	20.00	0	0.00	4	6.67	8	13.33		
Any others	6	10.00	0	0.00	4	6.67	2	3.33		
Type of the family										
Nuclear	24	40.00	0	0.00	6	10.00	18	30.00	8.97 df 2 N.S	p>0.05
Joint	36	60.00	2	3.33	22	36.67	12	20.00		
Gender										
Male	48	80.00	0	0.00	24	40.00	24	40.00	4.29 df 2 S	p<0.05
Female	12	20.00	2	3.33	4	6.67	6	10.00		
Education of father										
Illiterate	12	20.00	2	3.33	10	16.67	0	0.00	14.99 df 8 S	p<0.05
Primary education	20	33.33	0	0.00	12	20.00	8	13.33		
Middle school education	18	30.00	0	0.00	6	10.00	12	20.00		
Higher secondary	6	10.00	0	0.00	0	0.00	6	10.00		

Continued.

Demographic variables	(f)	(%)	Inadequate		Moderate		Adequate		χ^2-value	P value
			No	%	No	%	No	%		
Graduates	4	6.67	0	0.00	0	0.00	4	6.67		
Post graduate	0	0.00	0	0.00	0	0.00	0	0.00		
Occupation of father										
Unemployed	18	30.00	0	0.00	14	23.33	4	6.67		
Self employed	18	30.00	0	0.00	8	13.33	10	16.67	10.73	
Daily Wages	12	20.00	2	3.33	4	6.67	6	10.00	df 8	p>0.05
Private employed	6	10.00	0	0.00	2	3.33	4	6.67	N.S	
Govt. employed	6	10.00	0	0.00	0	0.00	6	10.00		
Family income (In Rs)										
1000-2000	12	20.00	0	0.00	10	16.67	2	3.33		
2001- 3000	20	33.33	2	3.33	6	10.00	12	20.00	6.21	
3001- 4000	18	30.00	0	0.00	8	13.33	10	16.67	df 8	p>0.05
4001-5000	6	10.00	0	0.00	2	3.33	4	6.67	N.S	

Note: S-Significant at 5% level (i.e. p<0.05), NS-Not significant at 5% level (i.e. p>0.05).

Table 4 shows the association between the post-test knowledge scores with their selected demographic variables. Gender ($\chi 2$ = 4.29), and the education of the father ($\chi 2$ = 14.99) was found to be statistically significant in this research study. Whereas age, religion, type of family, occupation of father, family income, source of water supply, dietary pattern and habits were found to be statistically insignificant.

DISCUSSION

Oral health is mostly dependent on the preschool period, where students and children's learning regarding oral care and hygiene. Though the Indian government has initiated many health programs in schools, fluoride problems still exist.[7] In our research, we tried to determine the knowledge regarding dental fluorosis among middle school students. Our results show that the majority of the students had inadequate knowledge 48 (80%) and moderate knowledge 12 (20%) during the pre-test, and none of them had adequate knowledge. But after the education program, the post-test results show that the majority of the participants have moderate knowledge 28 (46.67%) and adequate knowledge 30 (50%), and only two of them (3.33%) had the same level of knowledge even after the education program. Our findings are consistent with the study done in India.[8-9]

However, our result was inconsistent with the studies done in Ethiopia and India.[10-12] This difference in result might be due to the type of school, the urban school setup, and also the knowledge among parents regarding dental fluorosis. We also saw a higher prevalence rate of dental fluorosis in multiple studies done in different countries where dental fluorosis is still a cause for concern. In India, mainly in the south-Indian region, such as Karnataka and Tamil Nadu, are badly affected by dental fluorosis. As Karnataka falls into the fluoride belt, proper water fluoride content checking is very important to reduce this epidemic.[3,4,13-15]

Our study shows multiple associations between the post-test knowledge scores with their selected demographic variables. Gender ($\chi 2$ = 4.29) and the education of the father ($\chi 2$ = 14.99) were found to be statistically significant in this research study. A similar result was also found in a study done in India.[8] One of the studies done in Pakistan found a statistically significant association between sources of knowledge with demographic variables.[16]

This shows that education and a proper source of information indeed play a very important role in improving knowledge among students regarding dental fluorosis. Hence, a multicultural approach should be taken to tackle this epidemic.

CONCLUSION

In India, the level of knowledge regarding dental fluorosis, especially any childhood disease, is found to be very low. The lack of awareness of general information on dental hygiene and about the disease conditions can further worsen the condition by delaying treatment and by not caring to restrict risky foods and wrong lifestyles, which highlights the importance of knowledge to reduce the chance of dental fluorosis and other dental caries in children.

Recommendations

Identification of the fluoride content of water sources is a must. A health education program in health care organizations and also in schools is necessary. Social workers and ASHA workers can be trained to teach villagers about the water purification process. Proper identification of the affected children's needs is important to provide proper and prompt treatment. The national and state government oral care programs should be reformed and implemented thoroughly throughout the state. The water control body should take the necessary steps to reduce fluoride content or improve the water quality across the region.

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REFERENCES

1. Wikipedia. Dental fluorosis. Available at: https://en.wikipedia.org/wiki/Dental_fluorosis.
2. Centre of disease control and prevention. Fluorosis, 2019. Available at: https://www.cdc.gov/fluoridation/faqs/dental_fluorosis/index.htm#:~:text=Dental%20fluorosis%20is%20caused%20by,adults%20cannot%20develop%20dental%20fluorosis. Accessed 12 February 2024.
3. Prasad UV, Vastrad P, N C, Barvaliya MJ, Kirte R, Ray SK, et al. A community-based study of dental fluorosis in rural children (6–12 years) from an aspirational district in Karnataka, India. Front Publ Heal. 2023;11:1110777.
4. Verma A, Shetty BK, Guddattu V, Chourasia MK, Pundir P. High prevalence of dental fluorosis among adolescents is a growing concern: a school based cross-sectional study from Southern India. Environm Heal Prevent Medi. 2017;22(17):1-7.
5. Kumar V, Gaunkar R, Thakker J, Ankola AV, Iranna Hebbal M, Khot AJ, et al. Pediatric dental fluorosis and its correlation with dental caries and oral-health-related quality of life: a descriptive cross-sectional study among preschool children living in Belagavi. Children. 2023;10(2):286.
6. Fluorosis. National centre for disease control, 2022. Available at: https://ncdc.mohfw.gov.in/WriteReadData/l892s/9880728540165174 6944.pdf. Accessed 12 February 2024.
7. Mota A, Oswal KC, Sajnani DA, Sajnani AK. Oral health knowledge, attitude, and approaches of pre-primary and primary school teachers in Mumbai, India. Scientifica. 2016;2016:1-8.
8. Singh DS. A study to assess the effectiveness of planned teaching programme on knowledge regarding dental fluorosis and its management among mothers of under five children at selected anganwadi centres of Udaipur district. Int J Res Paediat Nur. 2020;2(2):26-30.
9. Yadav R, Yadav A, Oberoi SS. Knowledge, attitude and aesthetic perceptions about dental fluorosis among 12-15 years old government school children in farukh nagar, Haryana. J Heal Commu Dentist. 2014;8(1):1-5.
10. Duguma FK, Jeylan M. Assessment on knowledge, attitude and practice towards dental fluorosis and its impact among goro secondary school students in Adama Town, Ethiopia, June 2016. Advan Dentis Oral Heal. 2019;11(2):66-79.
11. MK JS, Umadevi R, VM AE. Knowledge, attitude and practice on oral hygiene among primary school children in an urban area of Kancheepuram district, Tamil Nadu. Int J Commu Medi Publ Heal. 2020;7(1):311.
12. Meena P, Monisha R. Assess the effectiveness of knowledge on prevention and management of dental fluorosis among mothers of under-five children in selected area at Vellore. Ind J Res. 2020;9(10):96-7.
13. Saravanan S, Kalyani C, Vijayarani MP, Jayakodi P, Felix AJ, Nagarajan S, et al. Prevalence of dental fluorosis among primary school children in rural areas of Chidambaram Taluk, Cuddalore District, Tamil Nadu, India. Ind J Commu Medi. 2008;33(3):146-50.
14. Anuradha BR, Laxmi GS, Sudhakar P, Malik VN, Reddy KA, Reddy SN, et al. Prevalence of dental caries among 13 and 15-year-old school children in an endemic fluorosis area: A cross-sectional study. J Contemp Dent Pract. 2011;12(6):447-50.
15. Bhat PK, Jayachandra MY, Amrita K, Jayanth KK, Nair NS. Prevalence of dental fluorosis among children aged 12 to 17 years in an endemically affected area of rural Bangalore- a cross sectional study. IOSR. 2016;15(1):34-7.
16. Sami E, Vichayanrat T, Satitvipawee P. Caries with dental fluorosis and oral health behaviour among 12-year school children in moderate-fluoride drinking water community in Quetta. Pakistan. J Coll Physicians Surg Pak. 2016;26(9):744.

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