Original Article

Prevalence of dental fluorosis in school children of Bangarpet taluk, Kolar district

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ABSTRACT

Context: Fluorosis is an endemic disease resulting due to excess ingestion of fluoride. Ground water has been a significant water source for domestic, irrigating, and industrial purposes in India. India is placed in a geographical fluoride belt. Kolar, a drought prone area with semiarid climate, is one among 16 fluorosis endemic districts of Karnataka. **Aims:** To study the prevalence of dental fluorosis among school children and to estimate the fluoride levels in drinking water sources. **Settings and Design:** A cross-sectional study was conducted among school-going children. **Materials and Methods:** School-going children from two randomly selected schools of two randomly selected Panchayat areas of Kyasamballi and Gollahalli were studied in August 2011. All the children in these schools were evaluated for dental fluorosis based on Dean's index. Fluoride levels of drinking water sources in these communities were estimated by ion-electrode method. **Statistical analysis:** The data were analyzed with Epi-info 7 statistical software and expressed in proportions. Chi-square test was employed to test the significance. **Results:** A total of 380 children in the age group of 6-15 years were studied. The prevalence of dental fluorosis was 31.05%, predominant in females. The community fluorosis index was 0.718 indicating slight public health importances. The fluoride levels in drinking water sources exceeded 1.5 mg/L. **Conclusion:** Dental fluorosis is a public health problem in Kolar. High fluoride content in the sources of drinking water is the main reason for dental fluorosis, suggesting an urgent need for defluoridation of water sources with sustainable long-term measures in Kolar.

Key words: Community fluorosis index, Dean's index, fluorosis, ion-electrode method

INTRODUCTION

Fluorosis, an endemic disease, is caused due to excess ingestion of fluoride.[1] Fluoride acts as an essential component for normal mineralization of bone, teeth, and formation of dental enamel in minute amounts and at the same time when consumed in higher doses it has been a blight. Fluoride content of water sources above the permissible limits (1.5 mg/L) may lead to dental and skeletal fluorosis.[2] Ground water has been a significant water source for domestic, irrigating, and industrial purposes in India. More than 85% of rural and 50% of urban domestic water requirements are met from ground water resources.[3]

Globally, 23 nations have the problem of excess fluoride in drinking water, principally involving the developing countries including India.[4] India is placed in a geographical fluoride belt and fluorosis is prevalent in 17 states. Andhra Pradesh, Rajasthan, Punjab, Tamil Nadu, and Karnataka have reported highest endemicity rate.[5] Kolar, a drought prone area with semiarid climate, is one among 16 fluorosis endemic districts of Karnataka.[6] Fluoride concentration in ground water of Kolar ranges between 2.8 and 4.3 mg/L, far above the permissible limits.[7]

The Government and many International agencies have taken measures in the past to mitigate the problem. Small-scale community defluoridation units have been installed in many of the fluorosis-affected communities. These measures could not sustain because of poor community

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involvement.[7] With increasing water scarcity in Kolar, newer and deeper tube wells may have further worsened the problem of fluorosis. The estimate of fluorosis in Kolar is scarce, and hence this study was conducted to study the prevalence of dental fluorosis and to estimate the fluoride levels in drinking water sources.

MATERIALS AND METHODS

A cross-sectional study was conducted among 380 school going children from two randomly selected schools of two randomly selected Kyasamballi and Gollahalli Panchayat areas of Bangarpet taluk, Kolar district in August 2011. The dental fluorosis was assessed in the mixed dentition[8] and was graded using Dean's index.[9,10] Community fluorosis index was calculated to quantify public health significance of dental fluorosis.[11] A total of 10% of the sample were reexamined by the qualified dental surgeon as a quality control check.

The drinking water samples from the water sources of Gollahalli and Kyasamballi Panchayats were collected in a clean glass-stoppered bottles (Winchester Quart bottles) of 2 L capacity. Before collecting the sample, bottles were rinsed well three times with the water, filling it about 1/3rd full. Then, the bottles were filled with water and stopper was tied tightly down with a piece of cloth over it and sealing the string. The bottles were labelled, noted the date and time of collection, source of water collected with sample numbers. They were transported within 48 h to the civil engineering laboratory at Indian Institute of Science (IISc), Bangalore for fluoride analysis.

Fluoride levels in the samples were analysed by Ion Electrode Method at IISc. The ion electrode instrument was calibrated before testing. A total of 10 mL of samples were taken in a beaker at 10 mL fluoride buffer solution. The stirring bar was put into the beaker, electrode was immersed, and the magnetic stirrer was started for stirring at a constant rate. After reading had stabilized, recording was done. Electrode was washed with distilled water after use. Drinking water specifications of Bureau of Indian standards, maximum desirable limit of fluoride content in water as 1.0 mg/L and maximum permissible limit in the absence of alternate source as 1.5 mg/L was considered.[12]

The data were analyzed with Epi-info 7 statistical software. The data were expressed in proportions and chi-square test was used to test the significance of qualitative data. $P < 0.05$ was considered as statistically significant.

RESULTS

A total of 380 school going children in the age group of 6-15 years were studied. The mean age was 11 ± 2 years, 30.3% were in 6-10years and 69.7% were in 11-15years age group. The prevalence of dental fluorosis was 31.05% and was significantly associated with age (chi-square test 19.2, $P < 0.001$) [Table 1].

The male to female ratio was 1:1.3. The prevalence of dental fluorosis was more in females and was significantly associated with gender (chi-square test 11.6, $P = 0.02$) [Table 2].

Dental fluorosis of grade-2, very mild fluorosis as assessed by Dean's index predominated the study and the Community Dean's index was 0.718, suggesting slight public health importance [Figure 1].

The water analysis reports revealed the presence of fluoride levels of >1 mg/L in five villages viz., T. Gollahalli belonging to Gollahalli Panchayat area and Batwaarahalli, Raamapura, Ananthraamapura, and Thimmasandra belonging to Kyasamballi Panchayat areas [Figure 2].

Table 1: Prevalence of dental fluorosis according to age

Age group	Dean's index					Total	*P* value
	Grade 0 Normal	Grade 1	Grade 2	Grade 3	Grade 4		
6-10 years	95 (82.6)	2 (1.7)	12 (10.5)	5 (4.3)	1 (0.9)	115 (30.3)	0.001
11-15 years	167 (63.0)	26 (9.8)	31 (11.7)	24 (9.0)	17 (6.5)	265 (69.7)	
Total	262 (69.0)	28 (7.4)	43 (11.3)	29 (7.6)	18 (4.7)	380 (100.0)	

Note: The figures in parenthesis denotes percentages

Table 2: Prevalence of dental fluorosis according to gender

Gender	Dean's Index					Total	*P* value
	Grade 0 Normal	Grade 1	Grade 2	Grade 3	Grade 4		
Male	127 (76.5)	12 (7.2)	10 (6.0)	9 (5.5)	8 (4.8)	166 (43.7)	0.02
Female	135 (63.1)	16 (7.5)	33 (15.4)	20 (9.3)	10 (4.7)	214 (56.3)	
Total	262 (69.0)	28 (7.4)	43 (11.3)	29 (7.6)	18 (4.7)	380 (100.0)	

Note: The figures in parenthesis denotes percentages

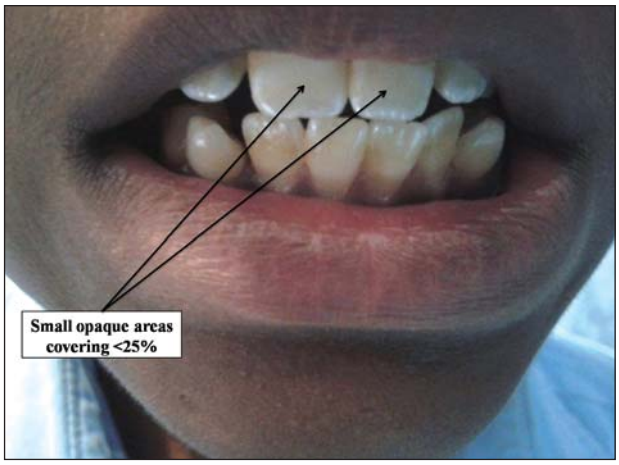

Figure 1: Dean's index grade-2, very mild fluorosis

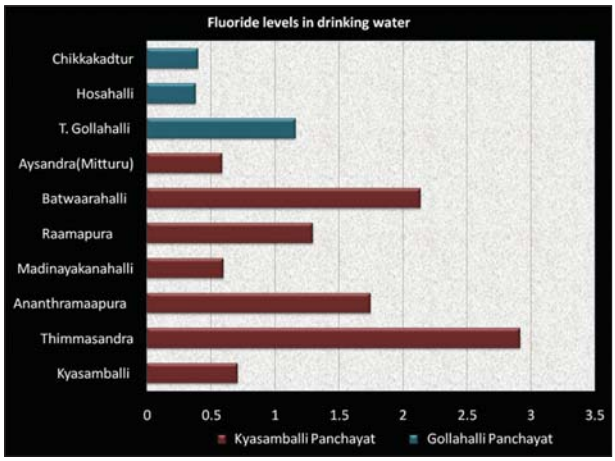

Figure 2: Fluoride levels in the sources of drinking water

DISCUSSION

The dental fluorosis is playing havoc in Kolar with the fluoride levels being more than the permissible limits in most of the drinking water sources in many villages of Kolar. The proneness for drought conditions, semiarid climate, and ground water being the most important source of drinking water, significantly adds to the problem.

The findings from the present study imply 31.05% prevalence of dental fluorosis, significantly being associated with age and female gender. A study conducted by Veeresh *et al.*,[5] on prevalence of dental fluorosis in two rural areas of Bagalkot district has shown that the prevalence of dental fluorosis, assessed by Dean's index for 5-6 years and 12-14 years in Kategari, was 49.8% and 37.3% and in Sikkeri 9.1% and 15.42%, respectively, which significantly increased with age.[5] Saravanan *et al.*,[13] in Chidambaram Taluk, Cuddalore district, Tamil Nadu, among 5-12 years age group, reported 31.4% prevalence of dental fluorosis and a significant association with age ($P < 0.001$) similar to our study. A study done by Choubisa[14] evidently showed a dental fluorosis prevalence of 30.4%, 42.4%, and 29.4% in the villages of Banswara, Dungarpur, and Udaipur districts, respectively, and a significant association with age and gender. Gopalakrishnan *et al.*,[15] in Alappuzha district, Kerala showed 35.6% prevalence of dental fluorosis with female preponderance and an inverse association with age.

Present study showed a predominated dental fluorosis of grade-2 (very mild fluorosis) as per Dean's index in 11.3% subjects and community fluorosis index of 0.718, indicating slight public health importance. Similarly, in a study conducted by Arvind *et al.*,[16] in 2009 among primary school children in the rural areas of Kaiwarahobli, showed a high prevalence of very mild dental fluorosis compared with other categories. Villa and Guerrero,[17] in two Chilean twin cities, reported a community fluorosis index of 0.59-0.79. Bhat and Kumar[18] in their study on dental fluorosis among residents of Hanumantharayanaplaya, Ramnagaram district, Karnataka showed that 36.4% were affected with mild grade fluorosis and community fluorosis index of 1.76.

Fluoride toxicity affects children more severely and after short exposure to fluoride than adults. The water analysis revealed fluoride levels of >1 mg/L in five villages. High fluoride content is the main reason for dental fluorosis; people should be advised to consume safe water through mixing two different sources of water, diluting the fluoride concentration wherever possible. Alternatives measures like defluoridation of water or to deliver safe water through pipelines should be taken.

The fluoride concentration in the ground water can fluctuate with the seasons and seasonal changes (sunshine, rainfall, humidity, and temperature), and hence an annual average is a better indicator of fluoride levels in sources of drinking water. Evidence on permanent dentition is more appropriate in the primary school children compared to mixed dentition and drinking water alone cannot be attributed for dental fluorosis, the use of other fluoride-rich sources like fluoridated tooth paste, fluoridated mouth rinse, infant milk formulas, foods grown in fluoride rich areas, tea, chat masalas are even necessary.

CONCLUSION

Fluorosis is a public health problem in children of Kolar. High fluoride content in the sources of drinking water is the main reason for dental fluorosis, suggesting an urgent need for defluoridation of water sources involving synergistic action of health planners, health

administrators, engineers, and health authorities to lower the burden of dental fluorosis in the community.

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