

## A Study of Dental Fluorosis among high school children in a rural area of Nalgonda District, Andhra Pradesh

Ravi Kiran E, Vijaya K

### ABSTRACT

**Background:** Endemic fluorosis resulting from high fluoride concentration in groundwater is a major public health problem in India.

**Objectives:** To estimate the prevalence and severity of dental fluorosis as well as to compute Community Fluorosis index (CFI) among high school children of a rural area using Dean's index for its public health burden.

**Methods:** A cross-sectional study was carried out among 332 native high school students, aged 11–16 years residing in the study area. Data was collected by using a pretested questionnaire followed by a clinical examination to ascertain fluorosis and its grades of severity using Dean's index. CFI was computed by summing up the individual grades and dividing the sum by the total study sample. Data was analyzed using SPSS 12.

**Results:** The overall prevalence was 31.9%, with a female preponderance. Prevalence increases with the increase in age. Majority were in the category of 'Mild fluorosis'. CFI was 0.73; mean fluoride level of ground water was 2.9 ppm.

**Conclusion:** Defluoridated water to be supplied to the affected area and health education to be imparted to people to use the same. Local authorities should identify water sources having fluoride levels beyond permissible limits and formulate guidelines to reduce exploitation of ground water.

**Key words:** Community Fluorosis Index, dental fluorosis, Dean's index

### INTRODUCTION

Fluoride is an essential micronutrient for the health of an individual. Its deficiency leads to dental caries; while excess consumption (through water, food, drugs, inhalation of air-contaminated with fluorine and dentrifices) will lead to dental and skeletal fluorosis. The main dietary source of fluoride is drinking water. Optimal carioprotective fluoride content in drinking water is approximately 1mg/l in temperate climate. In tropical countries where intake of water is more, the desirable fluoride content of drinking water may be 0.5mg/l. Nearly 12 million of the 85 million tons of fluoride deposits in the earth's crust are found in India.<sup>1,2</sup> The most common cause of fluorosis in India is fluoride laden water derived from bore wells dug deep into earth.<sup>3</sup> Fluorosis is endemic in 20 out of 35 states and union territories of India. In Andhra Pradesh, Gujarat and Rajasthan, 70-100 % of the districts are affected. Fluoride levels in water in Andhra Pradesh vary from 0.4 mg/l to a very high level of 29mg/l.<sup>4</sup>

Dental fluorosis is the most sensitive sign of

prolonged high fluoride exposure.<sup>1</sup> Monitoring of the fluoride levels in drinking water is required to tackle and mitigate the problem of fluorosis in such areas. Nalgonda district of Andhra Pradesh consists of areas with varying levels of fluoride in drinking water, ranging from below optimum to above optimum levels. Most of the rural areas are devoid of piped water supply and as a result, people depend on ground water for drinking purposes so this area is ideal for assessing the prevalence and severity of dental fluorosis.<sup>5</sup> Very few studies have been conducted in this area hence this study was undertaken to estimate the prevalence of dental fluorosis and to study other variables among high school children.

### MATERIAL AND METHODS

**Study design and Population:** Descriptive, cross-sectional study was carried out among children aged 11-16 years, native of Cherlapally village of Nalgonda district. Data about dental fluorosis on permanent dentition (high school children) is more conclusive compared to mixed dentition (primary school children).<sup>6</sup> Study participants represent a population at risk for dental fluorosis as

calcification of teeth from infancy to 6 years of age is the vulnerable period for its onset.<sup>7</sup>

**Inclusion criteria:** School children who were residents of the area from birth; and were using the same source of water up to 10 years of age.

**Exclusion criteria:** The children who had recently migrated, and who obtained their drinking water from more than one source. School children with severe extrinsic stains on their teeth and those with orthodontic brackets were also excluded.

**Collection of data**

Ethical clearance was obtained from the Institutional Ethical Committee. Written consent from the Principal of the high school and informed verbal consent from parents were obtained for medical evaluation of the students. The data were collected from school records, interview and clinical examination in a predesigned and pretested structured close-ended questionnaire. Ten samples of ground water used by the participants were randomly collected and analyzed for the fluoride levels.

Oral examination of the school children was carried out in bright daylight by the investigators under the guidance of Dentistry experts for severity of dental fluorosis using Dean's Index on WHO modified oral health assessment form.<sup>8-11</sup>

CFI was computed by summing up the scores of individual grades of dental fluorosis as per Dean's criteria and dividing it by the total sample size.<sup>12,13</sup>

**RESULTS**

The present study sample comprised 332 school children aged 11-16 years. There were 193 (58.1%) boys and 139 (41.9%) girls. A major proportion (29.5%) of the study sample belonged to the age group of 11-12 years.

Majority of the school children were studying VI<sup>th</sup> standard and belong to Class III (34%) and class IV(29%) socio-economic status as per modified B.G.Prasad classification. Ninety two percent reported that they brushed their teeth only once with Neem stick (69%) everyday. Ground water from bore wells and tubewells was used by majority (72.6%). Almost two third children were taking 4-6 glasses of water every day-Table 1.

**Table 1.** Characteristics of the study population

Variable	Value (%)
Boys	58.1
Lower middle socio-economic status	34.0
VI <sup>th</sup> Standard	25.9
Frequency of brushing (1time/day)	92.5
Technique of brushing (Neem stick)	69.0
Source of drinking water	72.6
Amount of water consumed (4-6 glasses/day)	63.6
Prevalence of Dental Fluorosis by Dean's Index	31.9

106 cases of dental fluorosis of varying severity were identified in the study sample. The prevalence was 31.9%, and was more in girls (33.8%). (p > 0.05, statistically not significant) Major (35%) proportion of cases was in the age group of 15-16 years. Prevalence increases with the increase in age (p < 0.0001; statistically significant). (Table 2)

**Table 2.** Age and sex distribution of fluorosis cases.

Variables	Number of children		Prevalence(%)	p value
	Examined	Affected		
Gender				
Boys	193	59	30.5	p > 0.05
Girls	139	47	33.8	
Age (years)				
11-12	98	12	12.24	p < 0.0001
12-13	75	14	18.66	
13-14	66	19	28.7	
14-15	51	24	47.06	
15-16	42	37	88.09	
Total	332	106	31.9	

The proportion of school children in increasing order of severity of dental fluorosis, as per Dean's Index, were: 1.5%- 'Questionable fluorosis'; 5.1%- 'Very mild fluorosis'; 12.7%- 'Mild fluorosis'; 8.7%- 'Moderate fluorosis' and 3.9 % with 'Severe fluorosis'. The calculated CFI was found to be 0.73 which was designated as 'slight' public health significance. (Table 3). The mean fluoride level of the collected samples of ground water was 2.9 mg/l (ppm) ranging from 1.6- 4.7mg/l(ppm).

**DISCUSSION**

Majority of the study subjects belonged to Class III followed by Class IV socio-economic status. Most of the students (92.5%) were brushing their teeth once daily. These findings are

**Table 3** Distribution of Dental Fluorosis cases on the basis of Dean's Index

Category	Boys (%)	Girls (%)	Total (%)
Normal	134	92	226 (68.1)
Questionable fluorosis	3	2	5 (1.5)
Very mild fluorosis	12	5	17(5.1)
Mild fluorosis	22	20	42 (12.7)
Moderate fluorosis	15	14	29 (8.7)
Severe fluorosis	7	6	13 (3.9)
Total	193	139	332 (100)

Community Fluorosis Index = 0.73

consistent with a study done in Karnataka.<sup>13</sup> Majority (69%) of the children being resident in a rural area were using neem stick for brushing their teeth. This is in contrast to a study done in a rural area of Alappuzha district, Kerala where 73% of the study sample used toothpaste.<sup>5</sup> Most of the children (72.6%) used ground water accessed from bore wells and tube wells This finding is similar to a study done in the neighboring area.<sup>13</sup> However, this proportion is significantly less in other studies done elsewhere from India.<sup>7</sup>

The overall prevalence of dental fluorosis was found to be 31.9%, a finding comparable to studies done by Saravanan S et al and Mane AB et al.<sup>6,15</sup> But, studies done in Juai Kalan village, Harayana (92.73%)<sup>14</sup> and Kheru Tanda, Karnataka (89%)<sup>13</sup> found a significantly high prevalence of dental fluorosis. Similar to a study done in Kerala,<sup>7</sup> dental fluorosis in this population is seen more in girls than boys ( $p > 0.05$ , statistically insignificant). However, in most of the studies done in India as well as in other countries, boys are seen to be more affected than girls.<sup>2,12,13,16,17,18</sup> Prevalence increases with the increase in age ( $p < 0.0001$ ; statistically significant) Similar observations were made in studies done in Tamil Nadu<sup>13,19</sup>, Haryana<sup>14</sup> and in Karnataka.<sup>13</sup> Most (12.7%) of the children were diagnosed with 'Mild fluorosis' and 3.9% had 'Severe fluorosis'. This finding is inconsistent with the studies done in Tamil Nadu,<sup>20</sup> Karnataka,<sup>13,21</sup> Klang district, Malaysia<sup>22</sup> where the majority were diagnosed as 'Very Mild fluorosis'.

The CFI estimated in the present study was 0.73

('Slight' public health significance). This is in accordance with a study done in Kerala (CFI- 0.69),<sup>7</sup> and in contrast to studies done in rural areas of Tamil Nadu (CFI- 0.16 - 0.54),<sup>11</sup> and Karnataka (mean CFI=0.44).<sup>13</sup> The mean fluoride level of the samples of ground water in our study area was 2.9 ppm (ranging from 1.6 to 4.7 ppm). This level is higher compared to that found in Tamil Nadu (0.10 - 0.67 ppm)<sup>11</sup> and Karnataka (0.8 - 2.0 ppm).<sup>13</sup>

## LIMITATIONS

As this study is a cross-sectional study, the exact amount of fluoride exposure i.e., the fluoride content of drinking water consumed during the time of calcification of teeth cannot be measured now. It is presumed that water sources are constant and that the fluoride content has not changed over the last 15 years.

## CONCLUSION

The present study gives us an insight into the problem of dental fluorosis among high school children in a rural area of Nalgonda district, where fluorosis is a public health problem of 'slight significance'. The CFI value and the fluoride level of water warrant the urgent need to provide defluoridated water to the affected area and also to educate the people to use safe sources of water for drinking.

## ACKNOWLEDGEMENT

The authors are grateful to the Department of Community Dentistry, KIMS Dental College, Department of Biochemistry, KIMS Medical College, Narketpally, to the interns who have helped in data collection and the principal, teachers, and students of ZPHS for extending their cooperation in the study.

## AUTHOR NOTE

Ravi Kiran Epari, Professor, Contact- 09441025412, E mail: dreravikiran@yahoo.co.uk

**(Corresponding Author)**

Vijaya Karri, Professor

Department of Community Medicine  
Narayana Medical College, Chinthareddypalem,  
Nellore-524002, A.P

## REFERENCES

1. World Health Organization. Fluorides and Oral Health. WHO Technical Report Series 846. Geneva: World Health Organization;1994.
2. Baskaradoss JK, Clement RB, Narayanan A. Prevalence of dental fluorosis and associated risk factors in 11-15 year old school children of Kanyakumari District, Tamilnadu, India: a cross sectional survey. *Indian J Dent Res.* 2008;19(4):297-303.
3. Choubisa SL, Sompara K, Choubisa DK, et al. Fluoride content in domestic water sources of Dungarpur districts of Rajasthan. *Ind J Environ Health.* 1995;3;157-60.
4. Available from: <http://www.fluorideandfluorosis.com/fluorosis/prevalence.html>. (Last accessed on 2012 May 6).
5. Sudhir KM, Prashant GM, Subba Reddy VV, Mohandas U, Chandu GN. Prevalence and severity of dental fluorosis among 13- to 15-year-old school children of an area known for endemic fluorosis: Nalgonda district of Andhra Pradesh. *J Indian Soc Pedod Prev Dent.* 2009;27:190-6.
6. Saravanan S, Kalyani C, Vijayarani M, Jayakodi P, Felix A, Nagarajan S, et al. Prevalence of dental fluorosis among primary school children in rural areas of chidambaram taluk, cuddalore district, Tamil Nadu, India. *Indian J Community Med.* 2008 Jul;33(3):146-50.
7. Gopalakrishnan P, Vasana RS, Sarma PS, Nair KS, Thankappan KR. Prevalence of dental fluorosis and associated risk factors in Alappuzha district, Kerala. *Natl Med J India.* 1999 May-Jun;12(3):99-103.
8. Dean HT. Classification of mottled enamel diagnosis. *J Am Dent Assoc.* 1934;21:1421- 26.
9. World Health Organization. Oral Health Surveys: Basic methods, 4<sup>th</sup> ed. World Health Organization: Geneva; 1997.
10. Dean HT. Chronic endemic dental fluorosis (mottled enamel). *JAMA.* 1936;107:1269-72.
11. Dean 1942. As reproduced in "Health Effects of Ingested Fluoride". National Academy of Sciences. 1993:169.
12. Murray JJ, Rugg-Gunn AJ, Jenkins GN. Fluorides in caries prevention, 3<sup>rd</sup> ed. Butterworth-Heinemann Ltd. Oxford. 1991: 225-32.
13. Mane AB, Revathi S, Savale PG, Paul CN, Heremath SG. Study of dental fluorosis among primary school children residing in a rural area of Raichur District, Karnataka. *Int J Biol Med Res.* 2011;2(3):716-20.
14. Dahiya S, Kaur A, Jain N. Prevalence of fluorosis among school children in rural area, District Bhiwani: A case study. *Indian J Environ Health.* 2000;42:192-95.
15. Shivashankara AR, Shankara SYM, Rao HS, Bhat GP. A clinical and biochemical study of chronic fluoride toxicity in children of Kheru Thanda of Gulbarga District, Karnataka, India. *Fluoride.* 2000;33(2):66-73.
16. Singh AA, Singh B, Kharbanda OP, Shukla DK, Goswami K, Gupta S. Dental fluorosis in rural school children from Haryana: A basic report. *Indian J Prev Soc Med.* 2001;54:235-9.
17. Chandrasekhar J, Anuradha KP. Prevalence of dental fluorosis in rural areas of Davangere, India. *Int Dent J.* 2004;54:235-9.
18. Mabelya L, van Palenstein Helderma WH, van't Hof MA, König KG. Dental fluorosis and the use of a high fluoride-containing trona tenderizer (magadi). *Community Dent Oral Epidemiol.* 1997 Apr;25(2):170-6.
19. Dental Council of India. Natural oral health survey and fluoride mapping 2002-2003, Tamil Nadu. Dental Council of India: New Delhi; 2004.
20. Subramanian A. Epidemiology study of dental fluorosis in rural population of Kanyakumari district. *Journal of Biology, Agriculture and Healthcare.* 2011;1(4):1-10.
21. Bharati P, Kubakaddi A, Rao M, Naik RK. Clinical symptoms of dental and skeletal fluorosis in Gadag and Bagalkot Districts of Karnataka. *J Hum Ecol.* 2005;18(2):105-7.
22. Esa R, Razak IA. Dental fluorosis and caries status among 12-13 year school children in Klang District, Malaysia. *Ann Dent Univ Malaya.* 2001;8:20-4.