Original article:

A cross-sectional study to estimate the magnitude and severity of dental fluorosis in Rajgarh, Churu, Rajasthan

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ABSTRACT:

BACKGROUND: Endemic fluorosis is a public health problem in Churu area.

OBJECTIVES: 1. To study the problem statement of dental fluorosis. 2. To determine the association between severity of dental fluorosis and demographic profile.

STUDY DESIGN: Cross-sectional community based study.

STUDY PLACE: Rajgarh, Churu. STUDY DURATION: 6 months (Jan 2014- Jun 2014). STUDY TOOL: Pre-structured and pre-tested questionnaire.

DATA ANALYSIS: Data were analyzed with the help of mean, SD, appropriate test of significance.

RESULTS: Majority of the subjects (mean age 27.28± 18.11 years) had severe type of dental fluorosis (22.90%). Two twenty six subjects had very mild fluorosis (18.80%) A direct association existed between age and the severity of dental fluorosis. With advancing age, the prevalence of DF and DDF increased, and there was statistically significant association between age and DF, ($p< 0.05$) and DDF ($p< 0.05$). Dental fluorosis was more prevalent among males (92.60%) than the females (89.39%) and gender difference was statistically not significant ($p>0.05$).

KEYWORDS: Dental fluorosis, Defect Dental Fluorosis, Dean's index, Cumulative fluorosis index.

INTRODUCTION:

"Fluoride is a double-edged weapon to humans" [(1)] - the optimal and judicious use offers maximum caries protection whereas excessive systemic consumption may lead to chronic fluoride toxicity which manifests as dental and skeletal fluorosis. Therefore endemic fluoride belts serve as natural laboratories for public health professionals to study effect of fluoride concentration on health of residents of a particular fluoride belt.

Endemic fluorosis resulting from high fluoride concentration in groundwater is a public health problem in India. The available data suggest that 15 States in India are endemic for fluorosis (fluoride level in drinking water >1.5 mg/l) [(2)], five of these have category III (>50% of the districts affected) which includes Rajasthan. [(3)]

World Health Organization (WHO) has set the upper limit of fluoride concentration in drinking water at 1.5 mg/l [(5)]. The Bureau of Indian Standards, has therefore, laid down Indian standards as 1.0 mg/l as maximum permissible limit of fluoride with further remarks as "lesser the better". [(6)] Present study aims at assessing problem statement of dental fluorosis and association of severity of dental fluorosis with demographic factors (age, gender) of affected subjects.

MATERIAL AND METHODS:

A Cross-sectional community- based survey was performed to collect data from Rajgarh, Churu area of Rajgarh, Churu urban agglomerate during Jan 2014 – June 2014. Simple random sampling (houses were selected randomly from lottery method) was used to select study population, this came out to be 1205 subjects study area. All residents of Rajgarh, Churu from 5-60 years who were living there since birth or > 3 years were included in the study. The migrant population residing in that area for <3 years was not included in study. A pre-tested pre-structured questionnaire was administered for demographic profile and clinical assessment of Dental Fluorosis (DF) among study subjects. Dean's index [(2)] was used for grading of severity of dental fluorosis. Quantitative assessment of severity of dental fluorosis was done by calculating Cumulative Fluorosis Index (CFI) [(11)]. To calculate CFI, each of Dean's grade was given a numerical weight and was then multiplied by corresponding number of individuals within that grade. The products thus obtained from all categories were added up and sum total divided by total number of subjects (N=1205), gave CFI. When CFI >0.6, fluorosis is considered to be a public health problem in that area (Dean).

$$\text{CFI} = \frac{\Sigma(\text{NUMBER OF SUBJECTS} \times \text{DEANS NUMERICAL WEIGHT})}{\text{TOTAL NUMBER OF CASES EXAMINED}}$$

$$\text{Prevalence of dental fluorosis (DF \%)} = \frac{\text{NO.OF CASES WITH VERY MILD TO SEVERE DENTAL FLUOROSIS}}{\text{NO.OF CASES INVESTIGATED}} \times 100$$

DDF was assessed by WS/T208-2001 scheme [(12)] which indicates sum of grade 4 & 5 subjects having dental fluorosis as per Dean's criteria.

$$\text{Prevalence of defect dental fluorosis (DDF \%)} = \frac{\text{NO.OF CASES WITH DEFECT DENTAL FLUOROSIS}}{\text{NO.OF CASES INVESTIGATED}} \times 100$$

Fluoride content in drinking water being supplies was determined by with the help of PHED Lab of Rajgarh, Churu district.

Data thus collected were transferred into Excel worksheet and were analyzed using Mean, SD & appropriate test of significance wherever required.

OBSERVATIONS:

Total 1205 subjects (males= 649, females= 556) in the age group 5- 60 years (mean age 27.28±18.11) exposed to fluoride (5.9 mg/L). Community Fluorosis Index for different age groups ranged from 1.66 to 2.42. The dental fluorosis index among males and females was 92.6% and 89.39%, respectively and Community Fluorosis Index was about 2.05 and 1.94 respectively.

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Table 1: Dental Fluorosis: Prevalence and Frequency

Fluorosis	Frequency	Percent
Absent	107	8.88
Present	1098	91.12
Total	1205	100.0

Table-1 shows that the overall prevalence of dental fluorosis in 1205 study subjects was 91.2%.

Table 2: Prevalence of Dental Fluorosis among study subjects by age (n= 1205)

Age (years)	N	Normal	Questionable	V. Mild	Mild	Moderate	Severe	Chi Square test
5-8	165	19 (11.50)	35 (21.20)	38 (23.00)	26 (15.80)	20 (12.10)	27 (16.40)	$\chi 2 = 23.562$
8-12	170	14 (8.20)	29 (17.00)	49 (28.80)	18 (10.60)	28 (16.50)	32 (18.80)	DF= 5* (*subjects in each age group were divided acc. To they had/ hadn't fluorosis)
12-20	165	17 (10.30)	41 (24.80)	30 (18.20)	25 (15.20)	23 (13.90)	29 (17.60)	
20-30	162	11 (6.80)	26 (16.05)	31 (19.14)	22 (13.60)	29 (17.90)	43 (26.50)	
30-40	179	16 (8.90)	24 (13.41)	28 (15.64)	33 (18.40)	31 (17.30)	47 (26.30)	
40-50	184	19 (10.30)	33 (17.93)	26 (14.13)	26 (14.10)	35 (19.0)	45 (24.50)	$p << 0.001$
50-60	180	11 (6.10)	17 (9.44)	28 (15.56)	27 (15.00)	43 (23.90)	54 (30.0)	
Total	1205	107	205	230	177	209	277	

Severity of dental fluorosis was calibrated according to Dean's fluorosis index. The table-2 shows that prevalence rate of moderate (12.10- 23.90%) and severe (16.40- 30.0%) type of dental fluorosis was enhanced with increasing age. There was statistically significant ($p< 0.05$) association between age and DF.

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Table 3: Prevalence of Dental Fluorosis (DF) and defect dental fluorosis (DDF) in different age groups

Age (years)	N	No with DF	No with DDF	DF%	DDF%	CFI
5-8	165	146	47	88.49	28.48	1.66
8-12	170	156	60	91.76	35.29	1.83
12-20	165	148	52	89.69)	31.52	1.73
20-30	162	151	73	93.21	45.06	2.14
30-40	179	163	78	91.06	43.57	2.16
40-50	184	165	80	89.67	43.47	2.06
50-60	180	169	97	93.88	53.88	2.42
Total	1205	1098	487			

Maximum 93.88% and 93.21% prevalence of dental fluorosis was noted in 20-30 years and 50- 60 years age group. The prevalence of DDF varied from 28.48% to 53.88%. As age increased, the prevalence of DF and DDF increased. With the similar trend CFI also increased. Table 4: Gender wise distribution of different grades of dental fluorosis among children and adults (n= 1205)

Gender	N	Normal	Questionable	V. Mild	Mild	Moderate	Severe
Male	649	48 (7.39)	110 (16.69)	132 (20.34)	87 (13.41)	123 (18.95)	153 (23.57)
Female	556	59 (10.61)	95 (17.09)	98 (17.63)	90 (16.19)	86 (15.47)	124 (22.30)
Total	1205	107	205	230	177	209	277

X^2= 1.584, DF= 2 (gender with presence of fluorosis) p= 0.208

The association of gender with presence of dental fluorosis was found to be statistically insignificant.

DISCUSSION:

Many similar epidemiological studies have been carried out. These studies clearly establish that fluoride primarily produces effects on skeletal tissues (bones and teeth). Low concentrations provide protection against dental caries, especially in children. However, fluoride can also have an adverse effect on tooth enamel and may give rise to mild dental fluorosis (prevalence: 12–33%) at drinking-water concentrations between 0.9 and 1.2 mg/litre [(14)]. This has been confirmed in numerous subsequent studies, including a large-scale survey carried out in China (Chen et al., 1988).

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The prevalence of dental fluorosis in the study population was 91.12 per cent. Whereas Choubisa reported the prevalence of dental fluorosis as 45 per cent among 21 different villages in southern Rajasthan. [15] A study conducted in a village in Maharashtra also found the prevalence of dental fluorosis as 43 per cent. [16]

In Tanzania, Vuhahula *et al* observed the prevalence of dental fluorosis as 96.3 per cent.

The prevalence of dental fluorosis has statistically highly significant association with increasing age whereas the association of presence of dental fluorosis with gender was statistically insignificant. It indicates as there is increase in duration of exposure in terms of years of stay there is an increase in dental fluorosis occurrence. Among all age groups, CFI was >0.6 which further concludes dental fluorosis to be a significant public health problem and highlights the need for appropriate timely strategic interventions which can be done only by strong political commitment, intersectoral collaboration with PHED, Irrigation and Agricultural department and efficient health care delivery system.

In conclusion, there was an increased problem of dental fluorosis with the passage of time. It is recommended to reduce the fluoride content of drinking water in the high fluoride area by making either alternative sources available or providing water with reduced fluoride content.

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