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Prevalence and severity of dental fluorosis in some endemically afflicted villages of district Doda, Jammu and Kashmir, India

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Abstract: A cross-sectional study was conducted among the residents of three villages of Doda district, J&K. A total of 391 individuals (202 males and 189 females) were examined from 60 households by house to house survey for recording the prevalence and severity of dental fluorosis by using Dean's Index (1942) along with WHO health assessment form (1997b) and Community fluorosis Index. Of the total studied population 299 (76.47%) have found to be affected with various grades of dental fluorosis with moderate (33.5%) level of fluorosis to be the most frequent category observed. Prevalence of dental fluorosis was more in males (86.61%) than females (63.49%). No significant relation (P>0.05) between prevalence of dental fluorosis to the socioeconomic status was found. Community fluorosis Index was found to be 2.05 which denotes "marked" category of public health significance. High prevalence and high community fluorosis Index suggest that fluorosis is a major public health problem in the area.

Keywords: Dean fluorosis Index, Dental fluorosis, Doda district, Fluoride, Prevalence

INTRODUCTION

Environmental pollution of groundwater by fluoride has been identified in many developing and some developed countries. About 5 billion people worldwide experience dental fluorosis presented in various forms of discomfort at different stages of its clinical presentation (Park, 2005). There are more than 20 developed and developing nations that are endemic for dental fluorosis with India and China among the worst affected counties in the world (Hussain *et al*., 2007). The major health problems caused by excessive fluoride include dental fluorosis, teeth mottling, skeletal fluorosis and deformation of bones in children and adults (Susheela, 1993; Susheela *et al*., 1993). Though fluoride also enters the body through food, industrial exposure, drugs, cosmetics, etc., drinking water remains the major source (75%) of its daily intake (Sarala and Rao, 1993). According to WHO (1997a), the fluoride concentration in drinking water should be less than 1.0 mg/l in the area with warm climate and in cooler climate it can increase up to 1.2 mg/l. The differentiation derives from the fact that people perspire more in hot weather and consequently drink more water.

With nearly 12 million of the 85 million tons of fluoride deposits on the earth's crust occurring in India, it is not surprising that dental fluorosis is endemic in 15 states of India. Doda district of J&K is also reported to be endemic for fluorosis. The epidemiological studies depicting the prevalence and etiology of fluorosis in J&K have been conducted by only few investigators (Gupta *et al.*, 1991; Gupta, 1995; Raina and Kant, 1995; Gazal and Raina, 2012). However, no study so far has been carried out to determine the severity and prevalence of dental fluorosis in Beoli, Malwas and Mothi villages of Doda district even though a number of cases of dental and skeletal fluorosis have been reported from the district (Susheela, 1987). Since clinical dental fluorosis is the most convenient biomarker of fluoride exposure (WHO, 1994). Thus, the present study was undertaken with an aim to assess the prevalence and severity of dental fluorosis among residents of these three villages of Doda district, J&K. Moreover, Community fluorosis Index (CFI) in the study population was also determined. The study is important as it can provide baseline data and information about dental fluorosis to public health authorities and can be of significant use in planning appropriate preventive strategies.

MATERIALS AND METHODS

Study area: Doda district lies in the east of Jammu region between 32° 17´ and 32° 40´ North latitude and 74° 35´ to 75° 10´ East longitude. Lying in the middle and outer Himalayan ranges, the district has mostly a hilly terrain with deep gorges and ravine. The average rainfall encountered in these areas is 35 inches per annum due to which whole of district has been declared as drought prone.

Survey of population: A house to house survey was conducted with the persons present at the time of examination being included in the study. A total of 60 households (approximately 10% of total households)

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were randomly selected and a total of 391 individuals comprising of 202 males and 189 females were examined during the survey. Information on the regularly used source of water for drinking purposes and socio-demographic structure of the household was also gathered.

Clinical examination: To record the clinical symptoms of fluorosis a check list was developed with the help of available literature. The oral examination of the subjects was carried out in their respective residences under the guidance and supervision of a dentist trained in the field of public health. The presence and severity of dental fluorosis was recorded using Dean's Index (1942) along with WHO health assessment form (1997b). Based on the symptoms, dental fluorosis was classified into six categories, viz. normal, questionable, very mild, mild, moderate and severe. Each tooth in the mouth was rated according to one of the six categories of Dean's Index and the individual's dental fluorosis score was arrived based on the severest form recorded for two or more teeth.

Community fluorosis index: Community fluorosis index (CFI) was calculated to identify dental fluorosis as a common health problem in the study area. The method has been proposed by Dean and Elvove (1935) to calculate the prevalence and severity of dental fluorosis in a group or community. CFI can be computed by summing up the scores of individual grades of dental fluorosis as described by Dean and dividing the sum by the total sample size.

$$CFI = \frac{\text{Sum of (number of individuals} \times \text{statistical weight)}}{\text{Number of Individuals examined}}$$

Only when the C.F.I. value is greater than 0.6, fluorosis is considered to be a public health problem in that area.

CFI value range	Public health significance
0.0-0.4	Negative
0.4-0.6	Borderline
0.6-1.0	Slight
1.0-2.0	Medium
2.0-3.0	Marked
3.0-4.0	Very Marked

Sources of drinking water: The main source of drinking water in study population was groundwater (springs). In addition to springs, study population had a known public drinking supply system. In this system water is collected from springs into a storage tank erected at some higher altitude and from there water is distributed to households by pipe network.

RESULTS AND DISCUSSION

The fluoride content in the drinking water samples of Doda district ranges from traces to 4.9 mg/l. In about 22.7% of the drinking water samples collected from Doda district by Central Ground Water Board (2010) the fluoride concentration was found to exceed the maximum permissible limits of 1.5 mg/l as prescribed by WHO (2004). Furthermore, fluoride contents in drinking water sources of some nearby villages (Arnora and Bhaboor) of district Doda have been observed to range from 0.08 to 2.4 mg/l (Gazal and Raina, 2012). The presence of fluoride in the underground water can be attributed to geological deposit and geochemistry of location (Karthikeyan *et al.*, 2010). Interestingly, occurrence of fluorosis can vary widely among different locations having almost the same fluoride concentrations in the drinking waters (Choubisa, 2001). In the present study a high prevalence of dental fluorosis viz. 76.74% (Table 1) has been found with the fluoride level ranging from 0.04 to 4.9 mg/l. Similar results have been found by Bhat and Kumar (2011) in Karnataka where prevalence of 89.6% was found to be associated with fluoride level of 2.79 ppm. Similarly, a higher prevalence at lower fluoride concentration in drinking water (0.2-2.8ppm) has been reported in Saudi Arabia (Akpata *et al.*, 1997) and Kenya (Na'ang'a and Valderhaug, 1993). However, Manji *et al.* (1986) in Kenya has reported 100% prevalence at 2ppm fluoride exposure. In contrast several authors have reported much less prevalence of dental fluorosis at higher fluoride concentration (Kotoky *et al.*, 2008; Baruah *et al.*, 2011). This indicates that occurrence of fluorosis in an area can be affected by a number of other factors such as nutritional status, difference in life styles, climate, altitude, individual susceptibility and biological response, duration of fluoride exposure and dissolved salts in drinking waters (Choubisa, 2001).

Severity of dental fluorosis was calculated as per Dean's Index and most of the affected population was found to fall under moderate category (33.5%) followed by mild category (21.99%). Only 11.76% of the population exhibited severe dental fluorosis while mild fluorosis was observed in 9.2% population (Table 2). Ramezani *et al.* (2004), Baskaradoss *et al.* (2008) and Umeshi Koleoso (2004) have found maximum cases of mild dental fluorosis among the school children of Dyer city (Iran), District Kanyakumari (Tamil Nadu) and in Nigerian children, respectively. This indicates that the dental fluorosis, calibrated according to Dean's Index has higher severity in the studied population.

The most commonly affected age group, as depicted in Table 2, was found to be 6-17 years (85.98%) followed by 18-30 years (75.76%) and 31-60 years (72.9%). Similar results have been observed by Bhat and Kumar (2011) in Ramnagram district of Karnataka where age group of 11-20 was found to be most affected (93.9%) followed by 21-30 (93%) while age group of 61-80 was least affected by dental fluorosis (80.93%). Raina and Kant (1995) also

Table 1. Prevalence of dental fluorosis in the study population.

Fluorosis			
Valid	**Frequency**	**Valid %**	**Cumulative frequency**
Present	299 (M-179; F-120)	76.47 (M-;86.61; F-63.49)	76.47
Absent	92 (M-23; F-69)	23.53 (M-10.89; F- 36.51)	100
Total	391	100.0	-

Table 2. Prevalence and severity of dental fluorosis in the study population based on Dean's Index.

Age group	**Total individuals**		**Type of dental fluorosis**						**Prevalence of dental fluorosis P = 1+2+3+4**
	No.	**%**	**0**	**0.5**	**1**	**2**	**3**	**4**	
6-17	107	27.36	6	9	8	26	47	11	92 (85.98%)
18-30	132	33.76	19	13	8	34	49	9	100 (75.76%)
30-60	107	27.36	19	10	10	23	24	21	78 (72.9%)
> 60	45	11.51	15	1	10	3	11	5	29 (64.44%)
Total	**391**	**100**	**59** (15.09%)	**33** (8.44%)	**36** (9.22%)	**86** (21.99%)	**131** (33.5%)	**46** (11.76%)	**299 (76.47%)**

%=Percentage; CFI=Community fluorosis index; 0=Normal; 0.5=Questionable; 1=Very Mild; 2=Mild; 3=Moderate; 4=Severe, P= Prevalence. Statistical weight for types of dental fluorosis:0 = Normal; 0.5 = Questionable; 1 = Very mild; 2 = Mild; 3 = Moderate; 4 = Severe

reported that the children in the age group of 5 to 10 years and 11 to 20 years were more affected than the adults and aged. However, Choubisa (2001) reported adults to be more affected by dental fluorosis than children, which is contrary to the present findings.

Prevalence of dental fluorosis was also assessed according to gender and perusal of Table 3 reveals a higher prevalence in males (86.61%) as compared to females (63.49%). However, gender difference was not found to be statistically significant (P>0.05). Similar results have been found by Saravanan *et al.* (2008) in Tamil Nadu where dental fluorosis was found to be more prevalent among boys than girls, however, no statistically significant relationship was reported. However, Choubisa (2001) reported a significantly higher proportion of affected males than that of females in Rajasthan which he attribute to more intakes of liquids to compensate for fluid loss during field work and also due to the fact that men drink more wine and tea, both of which can increase fluoride intake. The smaller proportion of women affected with fluorosis may be attributed to the flux of women into villages on marriage from areas where fluorosis is not endemic.

Dental fluorosis with regards to socioeconomic status (Table 4) revealed that the people belonging to lower socioeconomic status was affected more (79.08%) in comparison to those with higher socioeconomic status (73.85%). However, no significant relation between

Table 3. Prevalence of dental fluorosis according to sex.

Gender	**Total (%)**	**Not affected (%)**	**Affected (%)**
Male	202 (51.66)	23 (10.89)	179 (86.61)
Female	189 (48.34)	69 (36.51)	120 (63.49)

Table 4. Prevalence of dental fluorosis according to socioeconomic status.

Socioeconomic status category	**Total no. of individuals**	**%age**	**Affected (%)**	**Not affected (%)**
APL (Above poverty line)	195 (M=103, F=92)	49.81	144 (73.85)	51 (26.15)
BPL (Above poverty line)	196 (M=99, F=97)	50.13	155 (79.08)	41 (20.92)

Table 5. Community fluorisis index (CFI) for study population.

Dean's weightage for different categories of dental fluorosis (x)	No. of individuals in different categories (y)	Product (xy)	CFI Index (xy/z)
0	59	0	
0.5	33	16.5	
1	36	36	
2	86	172	**2.05**
3	131	393	
4	46	184	
Total (z) = 391			

prevalence of dental fluorosis to the socioeconomic status was observed (P>0.05; P=0.22). Similar results were obtained by Crosato *et al.* (2005) where no association between fluorosis and socioeconomic status (p=0.848) was found.

Community fluorosis index (CFI) was also calculated and was found to be 2.05 which denotes "marked" category of public health significance (Table 5). However, the study carried by Bhat and Kumar (2011) in Ramnagram, Karnataka showed a community fluorosis index of 1.76 (medium category) even at a high prevalence of 89.6%. The probable reason for such a high CFI value at a prevalence rate of 76.74% in the present study could be due to increased number of people affected with moderate category of dental fluorosis.

Conclusion

The present study revealed that whole of the community under study is afflicted with dental fluorosis, therefore, it represents a major public health problem to the community. There is an urgent need for establishment of water defluoridation units in the affected areas which would improve the quality of water thereby lowering the burden of dental fluorosis in the community. Apart from defluoridation of water before usage, proper awareness, health education and better knowledge about fluoride toxicity must be given by the administration to the people of Doda district to minimize this endemic disease. The Government should also establish a fluorosis management centre in the area.

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