



Prevalence of dental fluorosis in children and associated fluoride levels in drinking water sources of District Doda, J&K, India

Sehrish Gazal and Anil K. Raina✉

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Abstract

The present study was carried out to find the relationship between prevalence of dental fluorosis among the school children and concentration of fluoride ion in drinking water sources of village Arnora and Bhaboor of District Doda, J&K, India. All the underground drinking water sources of the area were analysed for fluoride ion estimation which was found ranging between 0.3-2.4 mg/land 1.5-2.5 mg/l in spring and hand pump, respectively. Dental health status for a total of 215 school children of the age group 12-16 years was examined using Dean's fluorosis Index. The prevalence of dental fluorosis was 78.6% with 80% in female and 77.14% in males. No significant relation ($P>0.05$) between prevalence of dental fluorosis to the socioeconomic status of the children was found. The high prevalence of dental fluorosis in the area under survey suggests that the children are exposed to higher than optimal level of fluoride.

Keywords: Dean's fluorosis Index, dental fluorosis, fluoride, prevalence, school children.

Introduction

Fluoride is one of the very few chemicals known to cause significant effects on public health through drinking water. Like several other naturally occurring elements, fluoride can enter human body through air as well as by ingestion of food and water, and thus affect health (WHO, 1996). The critical period of exposure of fluoride that leads to manifestations of enamel or dental fluorosis is during the formation of permanent teeth, generally from birth to the age of 7-8 years. The excessive exposure to fluoride in drinking water alone, or in combination with exposure of fluoride from other sources, can give rise to a number of adverse effects. The effects of fluorosis range from mild dental fluorosis to crippling skeletal fluorosis and are associated with increase in the level and period of exposure to fluoride (Fawellet *al.*, 2006). Endemic fluorosis is now known to occur globally in almost all continents affecting millions of people worldwide and is a public health concern in 24 nations around the globe including India. In India approximately 62 million people (including 6 million children) suffer from dental, skeletal or

non-skeletal fluorosis due to consumption of water with high fluoride content (Susheela, 1999). The highest rate of endemicity in India has been reported from Andhra Pradesh, Haryana, Karnataka, Punjab and Tamil Nadu (Gopalakrishnanet *al.*, 1999). Though Jammu and Kashmir has approximately 33% of the districts affected with fluorosis, Susheela, (1987 & 2007), only few references highlighting the problem of fluorosis in the state are available (Raina and Kant, 1995). Despite the frequent occurrence of a number of cases of dental fluorosis in district Doda (J&K) no published data regarding the prevalence of the disease and its association with fluoride level in drinking water is available. The problem of high fluoride concentration in drinking water source has become an important health related geo-environmental issue in various areas of district Doda. Therefore a study was carried out to find out the relationship between prevalence of dental fluorosis along with assessing the concentration of fluoride ion in drinking water sources of two villages of District Doda viz. Village Arnora (consisting of 6 hemlets viz. Ghat, Arnora, Badroon, Bari, Shaie and Bhali) and Village Bhaboor (consisting of 5 hemlets viz. Bhaboor, Manyana, Arshala, Rai and Shira) located in middle

Author's Address

Department of Environmental Sciences, University of Jammu Jammu, (J&K), India.
E-mail: anilraina@yahoo.com



mountains of Himalaya. This paper presents the first report on dental fluorosis and associated fluoride level in drinking water sources in district Doda.

Material and Methods

Sampling of water sources

Thorough survey of the two villages viz. the revenue village Arnora, and the village Bhaboor of Doda district have been conducted to identify different drinking water sources used by the public for the drinking purposes. Samples were collected in strong, colorless polyethene bottles of two liters capacity from almost all the sources and analyzed in laboratory for the fluoride content using SPADNS method.

Statistical survey

Schools (both private and government) falling in the study area have been surveyed for determining the prevalence of dental fluorosis in and among children of the study area. A total of 215 children of age group ranging from 12 to 16 years were examined for dental mottling and characteristic dental pigmentation. The oral examination of each student was carried out under bright daylight under the supervision of a dentist trained in the field of public health. The presence and severity of dental fluorosis was recorded using Dean's index (1934) [Table 1] as previously used by Baskardosset *al.* (2008) and according to WHO (1997) criteria. 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 given based on severest form recorded for two or more teeth. The association of dental fluorosis with gender as well as with socioeconomic status was studied using chi square test.

Results and Discussion

The analysis of the water samples showed that 71% of the water sources have fluoride level higher than the recommended level of 1.5 mg/l (WHO, 2004). The fluoride content of the collected water samples ranged between 0.28 mg/l to 2.4 mg/l. According to Ministry of water resources, Central Ground Water Board (2010) the fluoride content in the Doda district ranges from traces to 4.7 mg/l (Kanga). Gopalakrishnan (2000), Srinivaset *al.* (2000), Tripathi and Sultana (2007) and Rajuet *al.* (2009) have reported higher fluoride concentration in the ground waters of Tamil Nadu, Hyderabad,

Table 1: Clinical criteria for Dean's enamel fluorosis Index (Dean 1934).

Type (Diagnosis)	Weight	Description
Normal Enamel	0	The enamel presents the usual translucent semi-vitriform type of structure. The surface is smooth, glossy, and usually of a pale, creamy-white color.
Questionable fluorosis	0.5	Slight aberrations from the translucency of normal enamel seen, ranging from a few white flecks to occasional white spots.
Very mild fluorosis	1	Small opaque, paper white areas scattered irregularly over the tooth but not involving as much as approximately 25% of the tooth surface.
Mild fluorosis	2	The white opaque areas in the enamel of the teeth are more extensive, but do not involve as much as 50% of the tooth.
Moderate fluorosis	3	All enamel surfaces of the teeth are affected and surfaces subject to attrition show marked wear. Brown stain is frequently a disfiguring feature.
Severe fluorosis	4	All enamel surfaces are affected and hypoplasia is so marked that the general form of tooth may be affected. The major diagnosis of this classification is the discrete or confluent pitting. Brown stains are widespread, and teeth often present a corroded like appearance.

Tehsil Purwa of Unnao and Sonbhadra district (Uttar Pradesh), respectively. Data collected from the survey of different schools revealed that no school was free of being affected with prevalence ranging from 62.96 to 100%. The occurrence of dental fluorosis was found maximum in English medium school Arshalla and minimum in Government middle school Bhaboor [Table 2]. A total number of 215 students (boys=105, girls=110) were examined and a high prevalence (78.6%) was found in the study area [Table 3] which is in agreement with Ramezani *et al.* (2004) who has found a high prevalence (80%) of dental fluorosis in the students of Dyer city (Iran). Similar results have been obtained by Tripathi and Sultana (2007)

Table 2: Prevalence of dental fluorosis in children from various schools

School	Name and Place of school	No. of students examined	No. of students affected	% of affected students	% of boys affected	% of girls affected
1.	Govt. Girls Middle School Ghat	22 B=12 G=10	20 B=11 G=9	90.9	55	45
2.	Govt. Boys Middle school Ghat	26 B=14 G=12	17 B=9 G=8	65.38	52.9	47.05
3.	Govt. Higher Secondary school Ghat	39 B=8 G=31	32 B=7 G=25	82.05	21.87	78.12
4.	Royal Academy Ghat	40 B=22 G=18	27 B=14 G=13	67.5	51.16	48.14
5.	English Medium School Arshalla	8 B=4 G=4	8 B=4 G=4	100	50	50
6.	Govt. Middle School Bhaboor	27 B=15 G=12	17 B=10 G=7	62.96	58.8	41.17
7.	Public High School Arnora	53 B=30 G=23	48 B=26 G=22	90.56	54.16	45.83
Total		215 B=105 G=110	169 B=81 G=88			

B= Boys; G= Girls

Table 3: Percentage incidence of dental fluorosis among children.

Fluorosis			
Valid	Frequency	Percent	Cumulative Frequency
Present	169	78.60	78.60
Absent	46	21.40	100
Total	215	100.0	-

who also reported a high prevalence of 84% in the village Vishnu Khera of Tehsil Purwa of Unnao (UP). However, Baskardosset *al.* (2008) has reported a lower prevalence (15.8%) in the school children of Kanyakumari District, Tamil Nadu.

In the present study Dean's Index was used to evaluate the severity of dental fluorosis among the school children and it has been observed that most of the affected children have moderate category of dental fluorosis (26.9%) followed by severe category (22.32%). Mild dental fluorosis was found to be present in 15.8% of children while 13.49% were having very mild fluorosis and 14.9% were found to exhibit questionable fluorosis. Only 6.5% of children represented normal status [Table 4]. Ramezani *et al.* (2004), Baskardosset *al.* (2008) and UmeshiKoleoso (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 indicated that the severity of dental fluorosis, calibrated according to Deansfluorosis Index, was high in the examined sample. Analysis of data to know the severity of fluorosis with respect to age revealed that children of age 13 were affected to the maximum extent [Table 5]. A similar type of study was carried out by Nagarajan *et al.* (2004) among school children of age group 7-13 and children of 9-10 age groups were found to be affected the most.

Table 4: Degree of fluorosis among children based on Dean's Index.

Classification	Frequency	Percent (%)	Cumulative frequency
Normal	14	6.51	6.51
Questionable	32	14.91	21.42
Very Mild	29	13.49	34.91
Mild	34	15.8	50.71
Moderate	58	26.97	77.68
Severe	48	22.32	100
Total	215	100	



Table 5: Percentage distribution of dental fluorosis according to age.

Age (in years)	Deans Fluorosis Classes						Total	Prevalence P = 1+2+3+4
	0	0.5	1	2	3	4		
12	2 (2.7%)	13 (17.3%)	10 (13.3%)	18 (24%)	22 (29.3%)	10 (13.3%)	75	60 (80%)
13	1 (2%)	8 (16%)	6 (12%)	5 (10%)	16 (32%)	14 (28%)	50	41 (82%)
14	4 (11.1%)	6 (16.7%)	3 (8.3%)	4 (11.1%)	10 (27.8%)	9 (25%)	36	26 (72.2%)
15	2 (12.5%)	1 (6.25%)	3 (18.7%)	2 (12.5%)	6 (37.5%)	2 (12.5%)	16	13 (81%)
16	5 (13.1%)	4 (10.5)	7 (18.4%)	5 (13.1%)	4 (10.5%)	13 (34.2%)	38	29 (76.3%)
Total	14 (6.5%)	32 (14.9%)	29 (13.5%)	34 (15.8%)	58 (26.9%)	48 (22.3%)	215	169 (78.6%)

Statistical weight for Deans Fluorosis Classes:
0 = Normal; 0.5 = Questionable; 1 = Very mild; 2 = Mild; 3 = Moderate; 4 = Severe

Also study carried out by Raina and Kant (1995) revealed that the children within the age group of 5-10 years and 11-20 years were more affected than the adults and the aged.

Prevalence of dental fluorosis was also assessed according to gender which revealed that more girls (80%) were affected as compared to boys (77.14%) thus showing a greater risk for girls to develop dental fluorosis than boys [Table 6]. However, gender difference was not statistically significant ($P>0.05$). Our results are consistent with Gopalakrishnan *et al.* (1999) and Nagarajan *et al.* (2004) who have reported higher prevalence of fluorosis in females of Tirunelveli Kattabomman district and Salem District of Tamil Nadu, respectively.

Dental fluorosis in case of children with lower socioeconomic strata was found to be 77.42% and for children with higher socioeconomic strata was 80.22% [Table 7]. However, no relation between prevalence of dental fluorosis to the socioeconomic status was observed ($P>0.05$).

Table 6: Prevalence of dental fluorosis according to gender.

Variables	No. of children examined		Prevalence %
	Examined	Affected	
Gender			
Boys	105	81	77.1
Girls	110	88	80

Table 7: Distribution of school children according to socio-demographic characteristics and frequency of fluorosis

Category	Total No. of Students	Percentage %	No. of children not affected	%ge of children not affected	No. of affected children	%ge of affected children
APL	91 B = 41 G = 50	42.3 B = 45.1 G = 54.9	18 B = 9 G = 9	19.78 B = 50 G = 50	73 B = 32 G = 41	80.22 B = 43.8 G = 56.2
BPL	124 B = 64 G = 60	57.7 B = 51.6 G = 48.4	28 B = 15 G = 13	22.58 B = 53.6 G = 46.4	96 B = 49 G = 47	77.42 B = 51.1 G = 48.9

APL= Above poverty line; BPL= Below poverty line



Conclusion

From the above study it can be concluded that both of the selected villages of district Doda have fluoride content in ground water above the recommended level and also there is a high prevalence of mild-to-severe dental fluorosis. The study acts as a pointer to public health physicians, dentists, chemists, planners, administrators, engineers and water supply authorities. The information furnished can be utilized as preliminary data and a well-designed epidemiological investigation can be undertaken at tehsil level and district level to confirm and assess dental fluorosis and to evaluate the risk factors associated with the condition in the study region. There is a need to improve water supplies and defluoridation of water sources in affected area. An urgent awareness based programme is also needed for rural population regarding the fluoride consumption and its ill effects on health.

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