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Fluoride distribution in drinking water and dental fluorosis in children residing in Chandrapur District of Maharashtra

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ABSTRACT

The survey was conducted to find out the fluoride (F^-) distribution in drinking water and dental fluorosis in children. 5-14 years old children who were lifelong residents of Dongargaon, Pijdura and Chikni villages of Warora Tehsil of Chandrapur district, Maharashtra and who consumed drinking water from the same source of their life. The fluoride concentration was determined from different sources of water in Dongargaon, Pijdura and Chikni villages of Warora Tehsil, Chandrapur district of Maharashtra. The results revealed that about 40% of drinking water samples were found to contain more F^- concentration than WHO and BIS recommended limit i.e. 1.5 mg/L and 1.2 mg/L respectively. During the survey six hundred and ninety nine children of 5-14 years (353 boys and 356 girls) were clinically examined. About 80% children from these villages show dental fluorosis. The % of dental fluorosis increased with the age and more in girls as compared to boys. Dental fluorosis is clearly indicates over-exposure to fluoride when the teeth were in developing stage. This is commonly observed across the all study sites. The dental fluorosis children shows loss of confidence and especially in the girl's inferiority complex has been seen in the study area. A well designed epidemiological investigation can be undertaken to evaluate the risk factor associated with condition in the study area.

KEYWORDS

Chandrapur district, dental fluorosis, drinking water, fluoride

INTRODUCTION

Endemic fluorosis has been observed in many parts of world where drinking water contain excessive amount of fluoride. Excess fluoride in drinking water causes dental and skeletal fluorosis, which is in countered in endemic properties in an at least 25 countries access the globe (Fawell *et al.*, 2006). It is a highly advanced stage of fluoride poisoning and an irreversible, practically helpless body disorder. Dental fluorosis is characterized by lusterless, opaque white, patches in the enamel which may become stained yellow to dark brown and in severe forms cause marked pitting and brittleness of teeth. More and more areas are being discovered regularly that are affected by fluorosis in different parts of the world. India lies in geographical fluoride belt which extends from Turkey up to China and Japan through Iraq, Iran and Afghanistan. The WHO organization guideline recommendation for maximum limit of fluoride in drinking water is 1.5mg/L (WHO, 2004). Fluorosis is endemic in 20 out of 35 states and union territories of Indian Republic. Children in the age groups of 0-12 years are most prone to fluorosis as their body tissues are in formative or growth stage during this period. Some studies have been reported in different part of Maharashtra (Somvanshi *et al*., 1990) and particularly in Chandrapur district affected by high fluoride in drinking water (Kamble *et al*., 2010). The primarily work has been reported on fluorosis in the study area but no substantial work has been done on dental fluorosis and evaluating the risk factor associated with the condition. Therefore study aimed at dental fluorosis among the children in the Dongargaon, Pijdura and Chikni of Warora tehsil of Chandrapur district of Maharashtra.

MATERIALS AND METHODS

Research and study design:

Study area: Warora Tehsil, Chandrapur district, Maharashtra. We had selected villages that affected by fluoride in groundwater and where there is significant occurrence of fluorosis. An unpublished report indicating that the area was endemic dental fluorosis. Majority of people in study area belong to low socio economic class. Dongargaon, Pijdura, Chikni villages are the most affected by fluorosis. These villages are located at Western part of the Chandrapur district. It is about 70 km away from the Chandrapur city.

Source of data

Data was collected from the 5-14 years old children who were lifelong residents of Dongargaon, Pijdura and Chikni villages of Warora tehsil of Chandrapur district, Maharashtra and who consumed drinking water from the same source of their life. Ethical permission was taken from Departmental Ethics Committee before start the study. Written consent was taken from respective parents of the children for examination. Data was collected, through, interview and clinical examination. A door to door survey with face to face interview was carried out to find out the natural history of fluorosis. The information collected was entered in pre- coded questionnaires. The survey is carried out for problem causes due to high fluoride concentration in drinking water which cause dental fluorosis in children.

Apart from the survey of Dental fluorosis, 15 water samples were collected at different location and area from both sources i.e. bore wells and dug wells respectively (Table 1). Samples were analyzed in laboratory for fluoride concentration (Table 1). The fluoride content in the ground water samples was determined by the "SPANDS" methods. The fluoride concentration was determined by employing standard methods of APHA (2005).

RESULTS

The fluoride content in drinking water samples from various sources in the study area has been shown in table-1. The result shown that about 40% of drinking water samples were more than 1.5 mg/L of F concentration and 60% in the range of 0.5-1.5 mg/L. Permissible limit for F- concentration is 1-1.5 ppm and 1.2 ppm according to WHO (2004) and BIS (2003) respectively.

Table 1- Distribution of F concentration in different sources of water in study area.

Sr. no.	Name of villages	Sources of water	'F'Conc. (mg/l)
1.	Dongargaon	Fluoride mine	**4.66**
2.	Dongargaon	Defluoridation plant	**2.26**
3.	Dongargaon	Dug well	0.53
4.	Dongargaon	Bore well	**5.00**
5.	Dongargaon	Bore well	**1.4**
6.	Pijdura	Bore well	1.06
7.	Pijdura	Dug well	0.8
8.	Pijdura	Bore well	1.6
9.	Pijdura	Bore well	**2.12**
10.	Pijdura	Bore well	**2.26**
11.	Chikni	Bore well	0.93
12.	Chikni	Dug well	0.80
13.	Chikni	Bore well	0.73
14.	Chikni	Dug well	1.26
15.	Chikni	Bore well	**1.86**

Total 699 childrens were examined in this study from Dongargaon (247), Pijdura (170) and Chikni (282) villages of Warora tehsil, among them 353(50.5%) boys and 356(50.9%) were girls. According to age wise division 71 (45 boys and 26 girls) belonging to the age group 5-7 years, 213 (103 boys and 110 girls) and 415 (205 boys and 210 girls) to the age group of 8-10 years and 11-14 years respectively (Table 2).

Table -2: Distribution of the children according to age group and sex

Sr. no.	Age distribution	Sex distribution		Dongargaon		Pijdura		Chikni	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1.	5-7 yrs	45	26	15	9	9	15	21	12
2.	8-10 yrs	103	110	36	26	22	27	45	57
3.	11-14 yrs	205	210	81	80	42	55	82	75
4.	Total	353	356	132	115	73	97	148	144

Table -3: Symptoms of Dental fluorosis among 5-14 years old children

Variables	Number of Children		
	Examined	Affected	Dental fluorosis
Gender*			
Boys	353	266	75%
Girls	356	300	84%
Age group#			
5-7	71	45	63.3%
8-10	213	171	80%
11-14	415	350	84%
Total	699	566	80%

*χ^2 = 8.750, df = 1, p< 0.001; #χ^2 =17.37, df= 2, p< 0.0001

Fig.-1 Normal teeth

Fig.-2 Mild dental fluorosis

Fig.-3 Moderate dental fluorosis

Fig.-4 Severe dental fluorosis

About 80% (566) children from these villages show different grades like mild, moderate and severe dental fluorosis (Fig. 1- 4). The highest rate of dental fluorosis observed in the age group of 11-14years (84.3%), 8-10 years (80%) and 5-7 years (63.3%) as well as it is increased with increased in age (p< 0.0001) shown in Table-3. The rate of dental fluorosis was more in girls (84%) as compared to boys (75%) which found to be statistically significant by χ^2test (p < 0.001) shown in Table -3.

DISCUSSION

The fluoride concentration in groundwater of some villages of Haryana varied from 0.3-6.9 ppm causing dental fluorosis among the people especially children of these villages (Meenakshi, *et al.,* 2004). The present study was reported the similar finding on fluoride concentrations in Dongargaon, Pijdura and Chikni villages of Warora tehsil ranged from 0.53-5 ppm. causing dental fluorosis among the children.

On the basis of clinical symptoms, the dental fluorosis was observed with the various grades of discolouration of teeth ranging from chalky white to yellow and brown with pitting. This differences being attributed of fluoride content of drinking water. Similar findings were reported by Susheela A. K. (2005). In the present survey it was seen that the dental fluorosis in children has been found 80% at the range of 0.53-5mg/L. of fluoride concentrations in drinking water. Similar observation was made in Maxico 81% (Medina-Solis *et al.,* 2008) and close to this finding in Iran 86% (Ramezani *et al.,*2004) and Bagalghat district of Karnataka 77% (Bharti *et al.,*2005) respectively. Sudhir *et al.,* (2009) and Manji *et al,*.(1986)was recorded 100 % dental fluorosis among the children of 5-14years age groups in Nalgonda district of Andhra Pradesh and Kenya, in contrast low dental fluorosis rate 30.6% in Nalgonda district of A.P. was reported by Nirgude *et al.,*(2010).

The % of dental fluorosis was seen more in girls (84%) as compared to boys (75%) and this association was also found to be statistically significant by χ^2 test ($p < 0.001$). The similar result was reported by Nirgude *et al.,*(2010) in Nalgonda district of Andhra Pradesh. The differences between in age groups were significant and increased with the age was found to be statistically significant by χ^2 test ($p < 0.0001$). The similar result was reported in Brabanki district Uttar Pradesh by Singh *et al.,* (2011).

CONCLUSION

In the present study, it can be concluded that children of Dongargaon, Pijdura and Chikni villages of Warora Tehsil consuming water more than 1.5 ppm of fluoride ranges from 0.53-5ppm are suffering from dental fluorosis. This study establishes relationship between the fluoride levels in drinking water and dental fluorosis. Major symptoms of dental fluorosis from study area included lack of luster and browning colour of teeth. This is commonly observed that dental fluorosis results in the loss of confidence among the students especially in girls. Practical training, workshop etc for health staff, low cost water treatment technologies and health education to people will help in mitigating the problem of dental fluorosis.

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