Research Article

MYSTERIOUS PREVALENCE OF DENTAL FLUOROSIS IN WAGHDHARA

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ABSTRACT

Context: There are various regions in India that have high levels of fluoride in drinking water sources. Many people residing in such places suffer from dental fluorosis (DF).

Aims: To evaluate the etiology for the wide spread prevalence of DF in children residing in Waghdhara village in vidharbha region of Maharashtra and also to find any correlation between DF and other related parameters.

Materials and Methods: Data was acquired through interview & clinical examination using Dean's fluorosis index. Water samples were collected at different location and area & Samples were sent to National Environmental Engineering Research Institute (NEERI) for analysis in laboratory for fluoride concentration.

Results: Drinking Water fluoride levels were surprisingly within the normal range as prescribed by BIS: 10500 -2012.

Conclusion: Fluoride concentrations of all drinking water samples are well within the permissible limits as prescribed by BIS and WHO & hence this study ruled out Drinking water fluoride as an etiological source of dental fluorosis in this geographical area. In order to explain high levels of fluorosis prevalent in the people of these region further studies are underway to determine the true possible cause.

INTRODUCTION

In India about 62 million people including 6 million children, suffer from fluorosis due to high content of Fluoride in water (Susheela, 1999). Fluorides are present in both surface water and ground water. Most of the fluoride found in ground water results from weathering, dissolution of minerals and circulation of water in rocks and soils. Fluorosis was first described by Shortt *et al.,* 1937 as a public health problem in different parts of India. Many states of India (Table 1) have alarmingly high concentrations of fluoride in their water resources as reported in a large volume of literature (Susheela, 2007; Misra *et al.,* 2006). Excessive intake of fluoride leads to serious effects on teeth during tooth formation and abnormal hardening of bones, leading to a condition known as fluorosis that is exacerbated by poor diets deficient in calcium and vitamins. Dental fluorosis is characterized by lusterless, opaque white, patches in enamel which become stained yellow to dark brown and in severe forms cause marked pitting and brittleness of teeth.

India lies in geographical fluoride belt which extends from Turkey up to China and Japan through Iraq, Iran and Afghanistan. Fluorosis is endemic in 20 out of 35 states and union territories of Indian Republic. Many studies reported in Maharashtra and particularly in Chandrapur district are affected by high fluoride in drinking water (Somvanshi *et al.,* 1990; Kamble and Chandekar, 2010) but no substantial work has been done on dental fluorosis and evaluating the risk factor associated with the condition. This study was aimed at dental fluorosis among these children in this region of Waghdhara village Nagpur Maharashtra, from where a very high number of children are coming to our dental hospital with dental fluorosis. The aim of this study was to evaluate the etiological factors responsible for the wide spread prevalence of Dental Fluorosis in children residing in Waghdhara and also to find any correlation between DF and other related sources.

The objectives of this study include

- To study the prevalence & severity of Dental Fluorosis among the children of the village.
- To search the etiological factors for the Dental Fluorosis.

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- To spread the awareness among the people regarding disease.

Table 1. Distribution of Fluorosis in India

	Category and percentage	Names of states
I	(30% districts affected)	Jammu and Kashmir, Delhi, Kerala and Orissa
II	(30 –50% districts affected)	Maharashtra, Karnataka, Vidharbha and Bihar
III	(50–100% districts affected)	Uttar Pradesh, Rajasthan, Gujarat, Andhra Pradesh and Tamil Nadu

MATERIALS AND METHODS

The prevalence of fluorosis in this region was assessed by 2 ways. One is by the clinical examination of randomly segregated subjects & secondly by analyzing the fluoride content in the water resources of this region. Prior to starting the study, an investigator received training to evaluate and score different grades of DF with help of archival records of dental photographs from the Department. The examiner had evaluated untreated caries, lesions, and DF (for permanent anterior teeth and molars) using the Dean's fluorosis index (Dean *et al.,* 1942) in all the children, thereby eliminating any chance of inter-examiner variability. Waghdhara is a small village in Yavatman district of Vidharbha, Maharashtra situated from Nagpur at a distance of 140 kms. According to 2011 census it has a total population of 18000, out of which 55% are male & 45% female & the literacy rate is 80%. Data was collected from the 11-18 years old children who & their parents were lifelong residents of Waghdhara. Majority of people in study area belong to low socio economic class. Ethical permission was taken from the Institutional Ethics Committee before start of the study. Written consent was taken from respective parents of the children for examination. Children with developmental defects of teeth or the absence of permanent teeth were excluded from the study. One school from each block was randomly selected for the study using the lottery method. Data was acquired through interview & clinical examination. Examination of teeth was carried out under daylight, using sterile instruments from sealed pouches. Subjects were graded by comparing their teeth to the ideal flourosis photos of Dean's fluorosis index.[7] the results obtained were tabulated & revelent statistical analysis were applied (Table 2). Apart from this, during the second stage of analysis, water samples were collected at different location and area from sources like bore wells, river, hand pump & tap water. The samples were collected in clean polythene bottles of 1 ltr capacity. The bottles were first rinsed with distilled water and then sample water was collected for analysis. Samples were sent to National Environmental Engineering Research Institute (NEERI) for analysis in laboratory for fluoride concentration. The fluoride concentration was determined by employing standard methods of APHA (American Public Health Association) & parameters prescribed in standard methods for the Examination of water and wastewater APHA (1995) & 2005.

RESULTS

A total of 618 school children were examined out of which 278 children were from the age group of 11-14 years & 340 children were from the age group of 15-18 years. In the age

group of 11-14 years 152 males & 126 females were examined. In the age group of 15-18 years 187 males & 153 females were examined. In the age group of 11-14 years males had more prevalence of dental fluorosis whereas in the age group of 15-18 the results were vice versa (Table 2). Even the analysis of different water sample as done in the NEERI laboratory showed all the values were surprisingly within the normal range as prescribed by BIS: 10500 -2012 (Table 3). This ruled out drinking water fluoride content as a primary source of dental fluorosis in these subjects.

Table 2. % of subjects affected by dental Fluorosis

Female		Male	
Age in years	% of affected cases	Age in years	% of affected cases
11-14	76.9	11-14	90
15-18	80.5	15-18	69.5

Table 3. Water sample testing results as obtained from NEERI

Sl. No.	Parameters	Well (No. 1)	River (No.2)	Hand pump, Aashram School (No.3)	Borewell (No.4)	Tap water (No.5)	Hand pump, village (No.6)	BIS : 10500 – 2012 Desirable / Permissible Limit
1	pH	7.7	7.5	7.7	7.7	8.1	8.2	6.5-8.5
2	Total Dissolved Solids (TDS)	422	670	339	803	500	643	500-2000
3	Total Alkalinity as CaCO₃	276	240	216	336	272	84	200-600
4	Total Hardness as CaCO₃	244	376	260	240	264	80	75-200
5	Calcium as Ca^{2+}	70	58	88	64	61	21	30-100
6	Magnesium as Mg^{2+}	16	56	10	19	27	7	-
7	Sodium as Na^+	60	88	92	108	66	220	-
8	Potassium as K^+	0.9	15	0.4	2.4	0.8	6.4	-
9	Nitrate as NO_3^-	23	29	33	99	44	4	45
10	Fluoride as F^-	0.71	0.5	0.38	0.38	0.77	0.78	1.0-1.5

DISCUSSION

Below the permissible limits, fluoride is an effective preventive of dental curies, but above permissible limits cause disfigurement of teeth and severe skeletal fluorosis. Such water should be defluorinated to reduce fluoride concentration to the acceptable levels for drinking purpose. Permissible limit for F-concentration is 1-1.5 ppm and 1.2 ppm according to BIS (2003) and WHO (2004) respectively. The Dean's index[7] was used for examining DF because of its simplicity and uniformity of use in many previous studies. It is also the recommended index for use when the water fluoride level is below 5 ppm (Rozier, 1994). The observed results were compared with the standard values of BIS and WHO. The percentage of dental fluorosis was seen more in girls (80.5%) as compared to boys (69.5%) and this association was found to be statistically significant by χ^2 test (p < 0.001). Results of our study differed from the one obtained by Choubisa *et al.,* 2010 who found no correlation between age and occurrence of DF. 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. These may be due to differences in frequency of fluoride intake at different ages that would have corresponded with development of certain teeth. It may also be due to variations in water fluoride level where the children resided during the development of their permanent teeth. In relation to gender DF was found to be more prevalent in female children in two previous studies (Murugan and Subramanian, 2011;

Gopalakrishnan *et al.,* 1999) & more in males Kotecha *et al.,* 2012 but in our current study it had nearly equal distribution among both the genders. A substantial amount of fluoride is released during tea infusion, and nearly, all (94.9%) of the fluoride released is absorbed by consumers (Li, 2009). Water brewed with tea leaves, increased its fluoride content by 3–4 times (Pehrsson *et al.,* 2011). rate and extent of fluoride absorption from gastrointestinal tract are reduced by ingestion of foods rich in calcium, such as milk or infant formula (Spak *et al.,* 1982). Cooking in aluminum vessels using fluoridated water results in formation of aluminum fluoride complexes that get absorbed rapidly from intestine resulting in fluoride toxicity (Chen *et al.,* 1997). Fluoride will also be present in the soil due to weathering of rocks & if agriculture is carried out in such soil then there is a fair bit of chance that the fluoride is transported through the food chain in our system which can also lead to fluorosis. The confirmation of this null hypothesis is the aim of the second part of our study which is presently being carried out by us.

Conclusion

The present analysis concludes that, the fluoride concentrations of drinking water samples are well within the permissible limits as prescribed by BIS and WHO & hence we ruled out drinking water fluoride as an etiological source of dental fluorosis. Hence further studies are underway to determine the other possible cause of this high level of flourosis present in the subjects of these areas.

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