

DENTAL FLUOROSIS AND FLUORIDATED COMMUNITY

Chemistry

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ABSTRACT

Case-control study was done to determine the sources of fluoride contamination that are particular risk factors to dental fluorosis. Identification was done by the screening of 12-16 year old rural school children in the fluoridated community of Beed district. Discussion with parents was done to enquire about the diet of children and preventive measures taken by them. The fluoride content in water was estimated by SPADNS spectrophotometric method. Studies showed the correlation between the dental fluorosis and the fluoride levels in the drinking water in the Beed district as more than 80% samples show upper limit of fluoride concentration of 1.5 mg/L laid down by World Health Organization (WHO). Water samples in some villages were found to have presence of fluoride between 1.5-3 ppm, some were found to have 3-5 ppm and also above 5 ppm. It is recommended to defluoridate the drinking water in these areas to contain appropriate fluoride levels.

KEYWORDS

Fluoride, dental fluorosis, drinking water, fluoridated community

1. INTRODUCTION

Dental Fluorosis is serious problem in all over India. It is to be noted that 85 million tons of fluoride deposits are present on the earth's crust and it is unfortunate that out of it 12 million are found in India [1]. From literature survey it is proved that 15 states in India are suffering from fluorosis (fluoride level in drinking water >1.5 mg/L), and near about 62 million people in India suffer from dental, skeletal and non-skeletal fluorosis. Out of these, 6 million are children under the age of 14 years [2, 3]. Thus it is quite natural that fluoride contamination and thereby fluorosis is widespread, severe and alarming in all over India. Fluoride in traces occurs in natural water sources. Fluorine binds up with the minerals found in rocks and soil and form salts [4]. Once these salts come into contact with moisture they dissolve and dissociate. Thus it is clear that these salts breakdown to form charged fluoride ions. As stated Fluorine is the most abundant in nature and nearly 96% of fluoride in the human body is located in bones and teeth. Fluorine is essential for the regular mineralisation of bones and formation of dental enamel [5]. We get fluoride regularly from drinking water and food like cheese, sea fish and tea [6, 7]. At low concentrations of approximately 1.0 mg/L, it inhibits dental caries, at high concentrations of > 4.0 mg/L, it causes skeletal fluorosis and at midway concentrations it results in mottling of teeth. Fluoride falls under the primary and secondary water standards lists. Fluoride can be up to 4 mg/L in drinking water, but the Environmental Protection Agency (EPA) suggests that the actual level of fluoride should be <2 ppm. The purpose for most water facilities is to have around 1.0 mg/L of fluoride coming out of your tap. The prescribed level of fluoride in drinking water in India is 0.5 to 0.8 mg/L. Although World Health Organization (WHO) has set the upper limit of fluoride concentration in potable water at 1.5 mg/l [8], the Bureau of Indian Standards (BIS), has laid down Indian standards as 1.0 mg/l as maximum permissible limit of fluoride [9].

Ingesting fluoride contaminated water higher than the optimum level is the major reason for dental and skeletal fluorosis [10]. If fluoride levels surpass the EPA Primary Standard MCL (maximum contaminant level) of 4 mg/L people suffer from something named as skeletal fluorosis. Skeletal fluorosis is a bone disease where fluoride combines with the calcium in bones and gives a precipitate. The calcium then leaches from the bones. A moderate impact happens when the fluoride concentration surpasses the EPA Secondary Standard MCL of 2 mg/L. Fluoride at that stage characteristically results in cosmetic effects such as mottled and/or discolored teeth. The Dental fluorosis is a particular disturbance of tooth formation owing to excessive fluoride consumption. The disturbance adversely affects the formation of enamel during its late secretory and maturation phases [11]; water and secretory proteins, such as amelogenins are reserved, resulting in enamel sub-surface porosity [12]. Since, any fluorosis is irreversible; its prevention is essential, employing various intervention actions.

After meeting with dentists and doctors it has been found that many children in Beed region suffer from Dental fluorosis. Fluoride in groundwater is mainly from the rocks which are rich in fluoride contents. Most of the people suffering by high fluoride concentration in

groundwater live in the villages as they strongly consider that consumption of groundwater is safer for drinking purposes.

2. MATERIALS AND METHODS

There are two famous methods to measure fluoride concentration without employing large instrumentation; colorimetry and potentiometry. Each method has their own advantages. It is to be noted that colorimetric methods that include the use of a spectrophotometer are more accurate than standard test kits as the color is read by an instrument instead of the human eye. It eliminates the subjectivity variable. I used SPADNS spectrophotometric method for the estimation of fluoride ions. For the Fluoride contamination check-up water samples were collected from different villages of Beed district. The water samples were collected in pre-cleaned polyethylene bottle. As the SPADNS Method for fluoride determination includes the reaction of fluoride with a red zirconium-dye solution, the former binds up with the part of the latter to form a colorless complex. Thus it bleaches the red color in an amount proportional to the fluoride concentration. A calibration standard solution of fluoride ranging from 0 to 1.4 mg/L was prepared by diluting an appropriate volume of standard fluoride solution. To 50 mL of standard solution, 10.0 ml the SPADNS reagent was added and mixed well. The spectrophotometer was set at wavelength of 570 nm, and a calibration graph was prepared from different standard concentrations.

3. RESULTS AND DISCUSSION

A total of 20 samples, with one from each village, were collected from 20 villages of Beed district region as shown below in Figure 1. Among these villages, 17 drinking water samples contain above 1.5 mg/L of fluoride. The results specify that the fluoride content in more than 80% of sampling stations was found to be higher than the permissible levels as per WHO standards. The drinking water fluoride levels of all locations in selected villages of Beed district region are shown in the Figure 1.

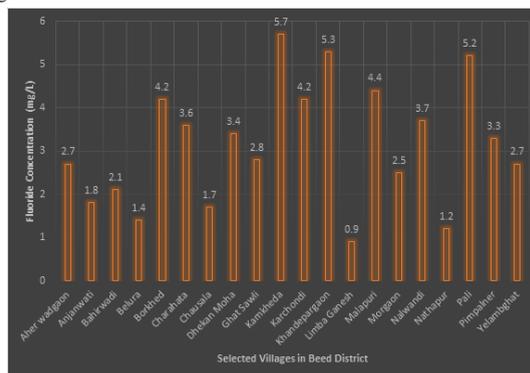


Figure 1. Drinking water fluoride level in Beed district area.

It was found that, major school children had yellow, brown and black coloured teeth and the coloration on the teeth was noticed in the form of

streaks or spots. Most of the rural school children of age group 12-16 years had discoloured teeth and with pits in their teeth. Dean's classification of dental fluorosis is given in Table-1 [13].

Table 1: Criteria for Dean's Fluorosis Index Score Criteria

Score	Criteria
Normal	The enamel represents the usual translucent semivitriform type of structure. The surface is smooth, glossy, and usually of a pale creamy white colour.
Questionable	The enamel discloses slight aberrations from the translucency of normal enamel, ranging from a few white flecks to occasional white spots. This classification is utilized in those instances where a definite diagnosis of the mildest form of fluorosis is not warranted and a classification of "normal" is not justified.
Very Mild	Small opaque, paper white areas scattered irregularly over the tooth but not involving as much as 25% of the tooth surface. Frequently included in this classification are teeth showing no more than about 1-2 mm of white opacity at the tip of the summit of the cusps of the bicuspid or second molars.
Mild	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	All enamel surfaces of the teeth are affected, and the surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature.
Severe	Includes teeth formerly classified as "moderately severe and severe." All enamel surfaces are affected and hypoplasia is so marked that the general form of the tooth may be affected. The major diagnostic sign of this classification is discrete or confluent pitting. Brown stains are widespread and teeth often present a corroded-like appearance.

4.CONCLUSION

The survey and study tried to find the correlation between the fluorosis in rural school children of age group 12-16 years and the fluoride levels in the drinking water in the Beed district area. Dental fluorosis can be completely stopped by avoiding excessive fluoride intake during the late secretory and maturation phases of enamel, a period that extends to 3-4 years of age for permanent anterior teeth. Thus, potable water in such areas with endemic dental fluorosis should be defluoridated to hold appropriate fluoride levels. It was found that almost all children use fluoride toothpaste widely and that too is one of the major risk factors for the increase in the occurrence of dental fluorosis in these areas. This is partly, as children swallow a substantial part of the toothpaste they use. To reduce the amount of toothpaste swallowed, tooth brushing by children below 5 years of age should be under strict supervision. The quantity of toothpaste used each time should be linked to their age and/ body weight and they should be suggested to spit out the toothpaste every time after brushing. Extrinsic tints on teeth with very mild fluorosis can be removed by bleaching with hydrogen peroxide. The tooth-whitening may be accomplished suitably by the home bleaching technique or in-practice vital bleaching.

Actually, high fluoride concentration in drinking water in the Beed district area may result in aesthetically offensive dental fluorosis in many rural school children. Future research should be focused to validate the clinical approach for the controlling of dental fluorosis presented.

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