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Research Article

A CROSS SECTIONAL STUDY ON DENTAL FLUOROSIS AMONG SCHOOL CHILDREN INCLUDING CHEMICAL ANALYSIS OF POTABLE WATER SOURCES IN ADPALLI PHC, MULCHERA, GADCHIROLI, MAHARASHTRA, INDIA

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DOI: 10.7897/2321-6328.01209

Article Received on: 08/06/13
Accepted on: 12/08/13

Abstract

Dental fluorosis is a developmental disturbance of dental enamel, caused by successive exposures to high concentrations of fluoride during tooth development, leading to enamel with lower mineral content and increased porosity. The condition is more common in school children owing to their development stage. A study was carried out to assess the prevalence of dental fluorosis among school children with chemical analysis of potable water sources in and around the villages of Adapalli PHC, Gadchiroli. Survey method was adopted to assess the prevalence by previously trained health workers and the chemical analysis was carried out in the District Public Health lab, Gadchiroli, India. It was found that the prevalence of dental fluorosis among school children is highest in Kalinagar (76.62 %) and Laxmipur (57.65 %), Tumadi (44.44 %), Gandhinagar (39.25 %) and Bhaskarnagar (34.50 %) follow a descending order. On the other hand chemical analysis of potable water sources more especially ground water shows that Kalinagar has the highest Fluoride level in its water sources, such as 4.5 PPM in bore well, 8.0 PPM in well, 8.0 PPM in hand pump. Next to Kalinagar villages like Haripur (1.4 PPM), Vasantapur (1.0 PPM), Thakurnagar (1.0 PPM), Gundapalli (1.0 PPM) shows moderate level of Fluoride in hand pump water. Apart from dental fluorosis the level of Fluoride in drinking water in some of the villages may lead to skeletal fluorosis which may incapacitate the normal functioning of the inhabitants causing economic damage. The district public health authority has recommended a fluoride treatment plant and has also recommended "Nalgonda Process" for water treatment.

Keywords: Chemical Analysis, Cross Sectional Study, Dental Fluorosis, Potable Water Sources, School Children.

INTRODUCTION

Dental fluorosis is a developmental disturbance of dental enamel, caused by successive exposures to high concentrations of fluoride during tooth development, leading to enamel with lower mineral content and increased porosity. The severity of dental fluorosis depends on when and for how long the overexposure to fluoride occurs, the individual response, weight, degree of physical activity, nutritional factors and bone growth, suggesting that similar dose of fluoride may lead to different levels of dental fluorosis[1]. The safe level for daily fluoride intake is 0.05 to 0.07 mg F / Kg / day. Above this level, the risk of developing fluorosis due to chronic fluoride consumption will be evident[2]. Traces of fluorides are present in many waters; higher concentrations are often associated with underground sources. In seawater, a total fluoride concentration of 1.3 mg / liter has been reported[3]. In areas rich in fluoride containing minerals, well water may contain up to about 10 mg of fluoride per liter. The highest natural level reported is 2800 mg / liter. Fluorides may also enter a river as a result of industrial discharges[3]. Moderate amounts lead to dental effects, but long-term ingestion of large amounts can lead to potentially severe skeletal problems. The dental effects of fluorosis develop much earlier than the skeletal effects in people exposed to large amounts of fluoride. Clinical dental fluorosis is characterized by staining and pitting of the teeth. In more severe cases all the enamel may be damaged. Chronic high-level exposure to fluoride can lead to skeletal fluorosis. In skeletal fluorosis, fluoride accumulates in the bone progressively over many years. The early symptoms of skeletal fluorosis include stiffness and pain in the joints. In severe cases, the bone structure may change and ligaments may calcify, with resulting impairment of muscles and pain[4]. With this background a study was carried out to assess the prevalence of dental fluorosis in and around the villages of Adpalli PHC of Gadchiroli District, India which has reported several cases of dental fluorosis to the District Health Office.

OBJECTIVE

The main objective of the study is:

- To assess the prevalence of dental fluorosis among school children in different villages of Adapalli PHC with a special focus on Kalinagar village.
- To make chemical analysis of all potable water sources available in and around the PHC catchment area with a special focus on Kalinagar village.

METHODOLOGY

- For the purpose of prevalence study a survey method was adopted to assess the prevalence of dental fluorosis among school children of the PHC catchment area. For this purpose the health workers (Both male and female) were trained and oriented on the clinical manifestations of dental fluorosis and counseled how to approach the households and school children.
- For the purpose of chemical analysis sample from almost all potable water sources were collected and analyzed at the District Public Health lab, Gadchiroli, India.

Table 1: Prevalence of Dental Fluorosis in different villages of Adpalli PHC

Name of the village	Total number of children screened	Total number of children with dental fluorosis	Prevalence Dental Fluorosis
Kalinagar	143	111	76.62 %
Gandhinagar	135	53	39.25 %
Laxmipur	111	64	57.65 %
Bhaskarnagar	200	69	34.50 %
Vasantapur	191	43	22.51 %
Anandgram	219	47	21.46 %
Malejhari	96	9	9.37 %
Adapli	32	5	15.62 %
Subashgram	325	37	11.38 %
Somanpur	29	1	3.44 %
Tumadi	27	12	44.44 %
Gundapali	332	44	13.25 %
Bahadurpur	268	26	9.70 %
Rammohanpur	106	10	9.43 %
Total	2214	531	23.98 %

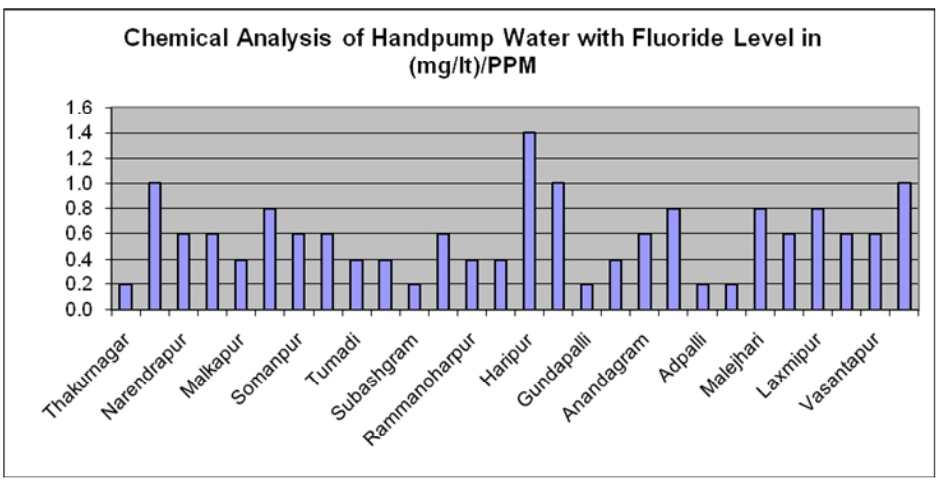

Figure 1: Chemical Analysis of Hand Pump Water with Fluoride Level in PPM

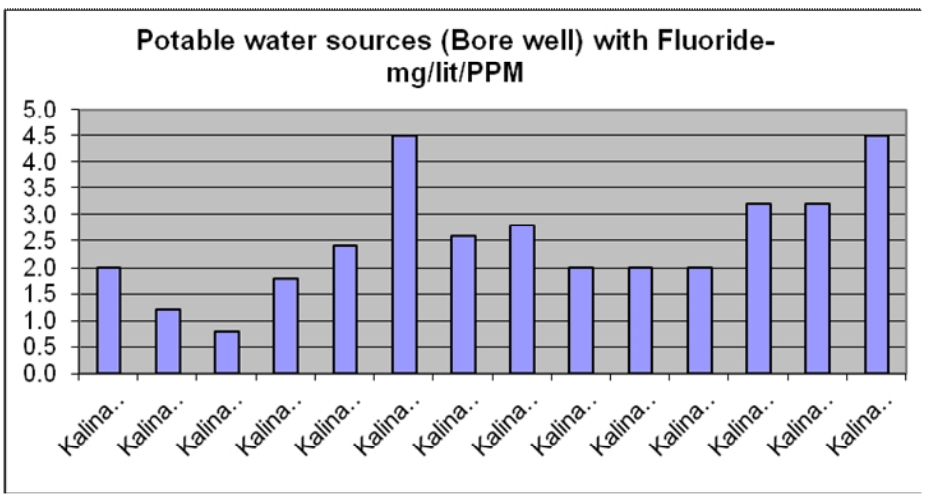

Figure 2: Chemical Analysis of Bore well Water (Kalinagar) with Fluoride level in PPM

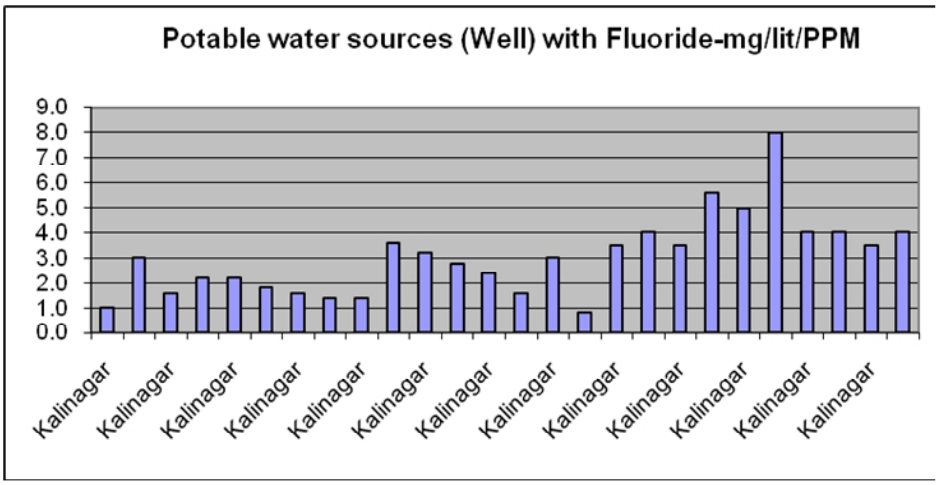

Figure 3: Chemical Analysis of Well Water (Kalinagar) with Fluoride level in PPM

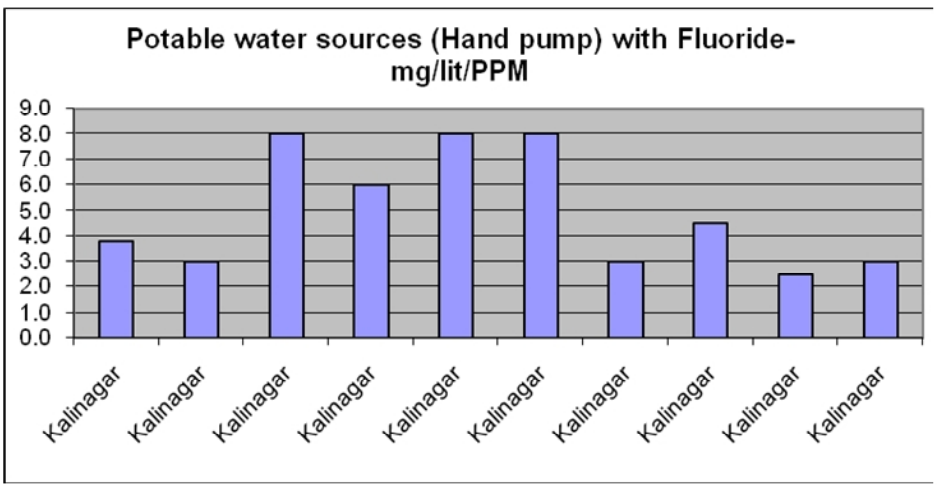

Figure 4: Chemical Analysis of Hand pump water (Kalinagar) with Fluoride level in PPM

OBSERVATION AND DISCUSSION

PHC Adpalli comes under Mulchera Taluka / Block of Gadchiroli district, India and is one of the tribal areas of the district. The population of the district is 970294 that include 491101 Males and 479193 Females (As per Census 2001). The present study was carried out in Adpalli PHC owing to increased reporting of dental fluorosis cases from Kalinagar and some of the adjacent villages of PHC Adpalli. The study was carried out in 14 villages of Adpalli PHC where 2214 children were screened out of which 531 children were found with dental fluorosis. The prevalence of dental fluorosis among school children is highest in Kalinagar (76.62 %) following which Laxmipur (57.65 %), Tumadi (44.44 %), Gandhinagar (39.25 %) and Bhaskarnagar (34.50 %) appear in a descending order. Acute high-level exposure to fluoride is rare and usually due to accidental contamination of drinking-water or due to fires or explosions. Moderate-level chronic exposure (above 1.5 mg / litre of water - the WHO guideline value for fluoride in water) is more common. People affected by fluorosis are often exposed to multiple sources of fluoride, such as in food, water, air (due to gaseous industrial waste) and excessive use of toothpaste. However, drinking water is typically the most significant source[4].

Figure 1, depicts the level of fluoride in hand pump water in different villages of PHC Adpalli except Kalinagar. A total of 28 potable hand pump water samples were analyzed. Kalinagar has reported highest number of dental fluorosis cases and the level of Fluoride in various potable water sources in the village is also highest in comparison to other villages. So Kalinagar has been described separately. Next to Kalinagar villages like Haripur (1.4 PPM), Vasantapur (1.0 PPM), Thakurnagar (1.0 PPM), Gundapalli (1.0 PPM) shows moderate level of Fluoride in hand pump water. Following figures depicts the level of Fluoride (PPM) in different potable water sources. These potable water sources include bore well, well and hand pump.

Figure 2, depicts the level of Fluoride in bore well water of the village Kalinagar. It shows 12 potable water sources above the permissible limit (1.5 PPM) leaving only 2 sources usable for drinking purpose. The highest level is 4.5 PPM.

Figure 3, depicts the level of Fluoride in well water of the village Kalinagar. It shows 22 potable water sources above the permissible limit (1.5 PPM) leaving only 4 sources usable for drinking purpose. The highest level is 8.0 PPM.

Figure 4, depicts the level of Fluoride in hand pump water of the village Kalinagar. It shows all the 10 potable water sources above the permissible limit (1.5 PPM) leaving no sources usable for drinking purpose. The highest level is 8.0 PPM. The overall chemical analysis of potable water sources more especially ground water shows that Kalinagar has the

highest Fluoride level in its water sources, that include 4.5 PPM in bore well, 8.0 PPM in well, 8.0 PPM in hand pump. Next to Kalinagar villages like Haripur (1.4 PPM), Vasantapur (1.0 PPM), Thakurnagar (1.0 PPM), Gundapalli (1.0 PPM) shows moderate level of Fluoride in hand pump water. Fluoride in water is mostly of geological origin. Waters with high levels of fluoride content are mostly found at the foot of high mountains and in areas where the sea has made geological deposits. Known fluoride belts on land include: one that stretches from Syria through Jordan, Egypt, Libya, Algeria, Sudan and Kenya and another that stretches from Turkey through Iraq, Iran, Afghanistan, India, northern Thailand and China. There are similar belts in the Americas and Japan[4].

CONCLUSION

The cosmetic and psychological effects of fluorosis are significant. Dental fluorosis is not limited, however, to cosmetic concerns. The teeth are not the only tissue in the body that accumulates fluoride (the bones, pineal gland, and arteries accumulate it as well). The paradox with fluoride ingestion is that a low level may prevent dental caries whereas excessive intake may lead to dental or even skeletal fluorosis. The prevalence of dental and skeletal fluorosis is not entirely clear. It is believed that fluorosis affects millions of people around the world, but as regards to dental fluorosis the very mild or mild forms are the most frequent. Removal of excessive fluoride from drinking-water is difficult and expensive. The preferred option is to find a supply of safe drinking-water with safe fluoride levels. Where access to safe water is already limited, de-fluoridation may be the only solution. Methods include: use of bone charcoal, contact precipitation, use of Nalgonda or activated alumina (Nalgonda is called after the town in South India, near Hyderabad, where the aluminum sulfate-based defluoridation was first set up at a water works level). Since all methods produce sludge with very high concentration of fluoride that has to be disposed of, only water for drinking and cooking purposes should be treated, particularly in the developing countries. Health education regarding appropriate use of fluorides should be advocated. Mothers in affected areas should be encouraged to breastfeed since breast milk is usually low in fluoride. From the above results it is clearly evident that besides dental fluorosis the level of Fluoride in drinking water in some of the villages of PHC Adpalli may lead to skeletal fluorosis which may incapacitate the normal functioning of the inhabitants causing economic damage. The district public health authority has recommended a fluoride treatment plant and has also recommended "Nalgonda Process" for water treatment.

ACKNOWLEDGEMENT

We convey immense thanks to Mr Chandrasekhar Tilgude, Chief Bacteriologist, DPHL, Gadchiroli, India and his team for analyzing all the samples collected from different villages in and around Adpalli PHC and providing timely information.

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Cite this article as:

Janmejaya Samal and P K Rathod. A cross sectional study on dental fluorosis among school children including chemical analysis of potable water sources in Adpalli PHC, Mulchera, Gadchiroli, Maharashtra, India. J Biol Sci Opin 2013; 1(2): 77-80 http://dx.doi.org/10.7897/2321–6328.01209

Source of support: Nil; Conflict of interest: None Declared