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ORIGINAL ARTICLE

EFFECT OF FLUORIDE CONTENT OF DRINKING WATER ON DENTAL FLUOROSIS IN THE PUNJAB STATE

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ABSTRACT:
Background: Fluoride content of drinking water of South-Western district of the Punjab state has been reported which varied from 0.28 to 14.04 mg/l with a mean value of 5.15 mg/l. The survey was, therefore, conducted to assess the magnitude of dental fluorosis in some villages of Bhatinda district of the Punjab state. **Materials and methods:** A cross-sectional study was conducted in districts of Punjab state, with high fluoride level in drinking water. The data collection was made by house-to-house visits twice during the study period. **Results:** The adult residents of these villages use drinking water high in fluoride content which may be the primary cause of dental fluorosis. During examination of the teeth of adults residents of these areas, it was observed that 61.06% of the residents of the high fluoride and 48.32% areas were suffering from dental fluorosis. **Conclusion:** Risk of dental fluorosis was significantly higher in the areas showing more fluoride content in drinking water. Defluoridation of drinking water is the only remedy to save the local population from dental fluorosis.
Key words: Dental fluorosis, defluoridation, drinking water.

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INTRODUCTION

Fluoride (F) is a natural element that is found in soil, water and in various foods. Fluoride in water is mostly of geological origin and is released into the environment by the process of weathering and volcanic activity. The amount of fluoride occurring naturally in ground water is governed principally by climate, composition and the host rock and hydrology.

Fluoride is one of chemical elements necessary for human life. Deficiency or excess of fluoride in the environment is closely associated with human health (Zhang *et al*., 2003).[1] The problem of high concentration of fluoride in ground water sources has now become one of the most important toxicological and geoenvironmental issues in India. The link between the fluoride geochemistry of water in an area of incidence of dental and skeletal fluorosis is well established geochemical relationship (Chandrajith *et al*., 2007).[2]

Ground water is the major source of drinking water in the villages of Bathinda district of the Punjab state. Endemic fluorosis resulting from high fluoride concentration in groundwater is a public health problem in India. Endemic fluorosis as well as its prevalence and severity is not well known to the residents of these villages. The present study was, therefore, undertaken to know the prevalence of dental fluorosis among the residents of the villages.

MATERIALS AND METHODS

This cross-sectional prevalence study was conducted to assess the quality of underground water with special reference to fluoride content in alluvial shallow aquifiers of arid regions of Punjab (Kuldip Singh *et al*., 2013).[3] They studied fluoride content in groundwater of south west districts of Punjab and reported that fluoride content varied from 0.28 to 14.04 mg/l with a mean value of 5.15 mg/l. The

elevated pH, dissolved salts, alkali metals (Sodium and Potassium) and anions (chloride, bicarbonate and sulphate) were accompanied by high mean, median, 75th and 90th percentile fluoride concentration in groundwater. Keeping in view the World Health Organization's safe limit of fluoride (1.5 mg/l), more than 68% of the total water samples were found unfit for drinking. Water samples were collected from all the water sources (maximum 5) from all these selected villages. The analysis for the fluoride level was made by auto analyzer using a spectrophotometric method. This study reports the prevalence of dental fluorosis among the adult residents of the villages drinking water high in fluoride content.

RESULTS AND DISCUSSION

The fluoride content in the drinking water of Sailbrah, Rampuraphool, Shehna and Bhadaur of Bathinda district is considerably more than the safe limit laid down by WHO. During examination of the teeth of adults residents of these areas, it was observed that 61.06% of the residents of the high fluoride and 48.32 areas were suffering from dental fluorosis. However, they had dental fluorosis of varying grades which may be attributed to many factors including fluoride content of water, period of exposure, physical activity and dietary habits (Kumar and Gopal, 2000; Kuldip Singh *et al*., 2013).[3,4] Similarly Yadav *et al*. (2009) reported the prevalence of dental fluorosis to the extent of 30 to 94.85% in some villages of Jhajjar district of Haryana.[5] The major health problems caused by excessive fluoride include tooth mottling, skeletal and dental fluorosis besides deformation of bones if water contain more than 6 mg fluoride/l (Susheela, 1993).[6] The toxicity of fluoride is due to the high concentration of fluoride ions, a direct poison that binds and interferes with the activity of proteolytic and glycolytic enzymes. Fluorine being a highly electromagnetic element, has ordinarily tendency to get attached by positively charged ions like Ca. Hence, the highest amount of fluoride gets deposited as crystalline hydroxyapatite. High doses of fluoride cause destruction of metabolic Ca and P besides inhibition of enzymatic process in the body resulting in interruption of endocrine system leading to fluorosis. Ministry of Health, Government of India (1962) has also listed several places in India including areas of the Punjab state where the residents are suffering from fluorosis due to consumption of underground water containing relatively higher concentrations of fluoride anions.

The remedial measure of the problem of excessive fluoride in drinking water is to remove its excess by using any of the suggested methods. These methods include adsorption (Raichur and Basu, 2001)[7], precipitation coagulation (Reardon and Wang, 2001)[8], ion exchange (Singh *et al*., 1999)[9], membrane separation process (Amer *et al*., 2001)[10], electrolytic defluoridation (Mameri *et al*., 2001)[11] and electro dialysis (Adhikari *et al*., 1989).[12]

While discussing effect of fluoride in drinking water on dental fluorosis, one major confounder may be for those who stay currently in high or normal fluoride areas but at the time of the permanent dentition (first 6 years of their life) may not be staying there and, therefore, would be misleading the analysis. To correctly interpret the data, we need to have the exact information of their stay at the time of dentition. The crude, and age and sex adjusted relative risk also increased for dental fluorosis for high fluoride area. Further, it also indicates that fluoride in water is more a risk factor for fluorosis than a protective factor for dental caries.[13]

Table I: Distribution of dental fluorosis in the studied population

Cases	*High fluoride areas*			*Normal fluoride areas*		
	Males (1448)	Females (1462)	Total (2910)	Males (1642)	Females (1764)	Total (3406)
Dental fluorosis	892	885	1777	782	864	1646
Percentage	61.60	60.53	61.06	47.62	48.97	48.32

CONCLUSION: Risk of dental fluorosis was significantly higher in the areas showing more fluoride content in drinking water. There was also an increased problem of dental fluorosis with the passage of time. It is recommended to reduce the fluoride content of drinking water in the high fluoride area by making either alternative sources available or providing water with reduced fluoride content.

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