

Estimation of Fluoride Concentration in Groundwater in some Villages of Jammikunta Mandal, Karimnagar District, Telangana, India

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ABSTRACT: A fluoride concentration of 1ppm (1mg/L) in potable water is essential for healthy teeth and bones. However, at higher concentrations (>1.5 ppm), it has adverse effects such as causing dental and skeletal fluorosis. Fluorosis is one of the major health risks faced by people in India. This may be due to consumption of more fluoride through drinking water. As same water is being used for irrigation purpose, fluoride can also enter into the food chain and finally reach human beings. In the present study, water samples from 15 villages of Jammikunta mandal, Karimnagar district of Telangana State were analyzed for fluoride content. Of the 23 water samples tested, four samples were found to contain more than permissible level (>1.5 mg/L) of fluoride in drinking water. Nine samples were also found to contain less than minimum required quantity of fluoride in water to prevent dental caries. The results are communicated to the villagers.

Key Words: Fluorosis, ground water, Jammikunta

I. INTRODUCTION

Fluoride is widely distributed in earth's crust and 13th most abundant element. It is most electronegative and highly reactive element. Therefore it does not occur in free state and mainly occurs in the form of compounds. As a result, the chances of leaching of fluoride into water are very high. Not only from drinking water itself but fluoride also enters into humans through the food chain. Thus principal sources of fluoride through which it can enter into human beings is drinking water and food. The effects of presence of fluoride in drinking water are double edged as it is known for both beneficial and detrimental effects on health¹. About 96 per cent of fluoride in the human body is found in bones and teeth and is essential for the normal mineralization of bones and formation of dental enamel². In potable water, a fluoride concentration of 1ppm (1mg/L) is necessary to prevent tooth decay. Inadequate intake of fluoride causes dental caries. The World Health Organization and Indian Council of Medical Research prescribed maximum permissible level of fluoride concentration in drinking water is 1.5 mg/L^{3,4}. However, if present in higher concentrations (>2 ppm), it has adverse effects such as causing dental and skeletal fluorosis. Excess fluoride intake is a slow poison as it affects every organ, tissue and cell in the body. Fluorosis affected people complain of having overlapping manifestations with several other diseases⁵. Prolonged exposure to excess fluoride may increase chances of renal failures⁶ and hip fractures⁷.

Fluorosis is an important health problem in many countries, including India, which lies in the geographical fluoride belt. Of the 85 million tones of fluorine found in different forms on the earth's crust, about 12 million tones are present in India alone. Therefore, it is natural to expect the wide spread prevalence of excess fluoride in India. The available data suggests that about 15 states, including Telangana and Andhra Pradesh, in India are endemic for both dental and skeletal fluorosis. Available data suggests that around 20 million people were severely affected by fluorosis and around 40 millions are exposed to its risk in India⁸. Though Nalgonda District in Telangana is well known for fluorosis, there are many other places in which ground water contains fluoride more than permissible levels, which is evident from the symptoms of dental and skeletal fluorosis. Soluble fluoride present in water is easily absorbed by the gastrointestinal tract. So fluoride present in water is main factor of both dental and skeletal fluorosis. The number of people, the number of regions affected by fluorosis is steadily increasing. This may be due to over exploitation of ground water in the form of tube wells and hand pumps. With persistent drought year after year, ground water is getting depleted and depth of digging bore wells is increasing. Therefore fluoride in ground water is increasing. In many areas water from tube wells and hand pumps is the only source of potable water. In majority of cases the water is not tested for fluoride.

People suffering from dental fluorosis can be identified by the symptoms⁹. Tooth enamel is primarily hydroxyapatite and when exposed to fluoride, fluorapatite is formed by the displacement of hydroxide ion by fluoride. On prolonged and over exposure of fluoride causes dental fluorosis. As a result, teeth become hard

and brittle and finally mottling of teeth. When affected by dental fluorosis, initially colour of teeth change from yellow to brown and finally to black. The coloration may be in the form of spots or as streaks. Depending upon the severity of exposure, pits on the teeth may also be observed¹⁰. A general observation of some of the school and college going students coming from different villages in Jammikunta region indicates that they are suffering from dental fluorosis. Therefore, an attempt is made to analyze the water for fluoride content in the drinking water in some villages of Jammikunta Mandal, Karimnagar District of Telangana State, India.

II. MATERIALS AND METHODS

A total of 23 ground water samples were procured from 15 different villages in Jammikunta mandal. Jammikunta is a mandal headquarter in Karimnagar district of Telangana State, India. It is located in northern part of Telangana. The water samples brought in pre cleaned plastic bottles and labeled with information like the date of collection, source and place of collection. Most of the samples are from bore wells and some from the wells and used for drinking purposes in addition to agriculture. Fluoride concentration was analyzed with the help of a commercially available visual colorimetric reagent. Concentration of TDS is measured with the help of a digital TDS meter.

III. RESULTS AND DISCUSSION

Ground water samples were randomly collected from 23 different locations spreading over 15 villages in Jammikunta mandal from the bore wells, tube wells and open wells. The samples were collected in pre-monsoon season in the months of March and April, 2016. In majority of these villages they are the only sources of potable water. The water is used for cooking and direct consumption in addition to agricultural purposes. All the ground water samples collected were clear without any turbidity, colour and odour. The water was tested for total dissolved solids (TDS) and fluoride.

TOTAL DISSOLVED SOLIDS (TDS)

The Bureau of Indian Standards (BIS) prescribed acceptable limit of TDS for drinking water is 500 mg/L. TDS concentration in the samples studied varied between 620 mg/L to 840 mg/L. All the samples were found to contain TDS above the permissible limit. Higher concentration of TDS observed in the ground water samples may be attributed to granite rocks present in the study area. Karimnagar district is well known for granite rocks. Well water in Sirisedu has TDS concentration of 426mg/l, which is well within the permissible level of TDS in drinking water.

FLUORIDE CONCENTRATION

Out of 23 water samples analyzed for fluoride, only in 6 samples exceed the maximum permissible limits of fluoride (1.5mg/L) set by WHO. The results were presented in Table 1. In Pittalawada and Rachapally villages, the concentration of fluoride was found to be moderately higher (1.5 – 2.0 mg/L) when compared to WHO standards for drinking water. The water from Sriramulapally village found to contain more toxic level of fluoride concentration of more than 2mg/L. In this village, teeth of many school and college going students were discolored ranging from yellow to brown in the form of spots or lines which are the symptoms of dental fluorosis. In nine samples, the concentration of fluoride was found to be between 0 – 1.0 mg/L, which is less than minimum required quantity of fluoride in water to prevent dental caries. These sites are from Jammikunta headquarters, Siresedu, Abadi Jammikunta. Interestingly the water from Sirisedu also contains TDS concentration of 426 mg/L which is well within the permissible range of TDS in drinking water. Thus the results indicate considerable variation of fluoride concentration among the analyzed ground water samples.

Table 1: Distribution of fluoride in different locations of Jammikunta mandal

Concentration of fluoride	< 1.0 mg/L (deficient)	1.0 – 1.5 mg/L (safe level)	1.5 – 2.0 mg/L (moderately toxic)	> 2.0 mg/L (highly toxic)
Number of samples	9	9	3	1

IV. CONCLUSION

This study identified about 18 percent of the villages in the study area is fluoride affected. High concentration of fluoride in the water may be due to geological formation. Karimnagar district is well known for granite aquifers. Therefore, the water from bore wells or wells in the affected villages is not safe. Purified surface water may be the best option for drinking. About 22 percent of the samples have acute shortage of fluoride (0.5 mg/L). In these areas usage of fluoridated toothpaste may be advised to prevent dental caries.

V. ACKNOWLEDGEMENTS

We acknowledge the efforts of students and faculty in procuring the water from different villages. We also acknowledge the Principal, Government Degree College, Jammikunta for providing laboratory facilities.

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