A SURVEY OF FLUORIDE DISTRIBUTION IN THE UNDERGROUND WATER OF CENTRAL INDIA

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Abstract: India is among 23 nations around the globe where health problems occur due to excess ingestion of fluoride (> 1.5 mg/L) in drinking water. An exploratory qualitative survey was conducted of the community regarding fluoride and related health problems in central India. The study indicated that, except at two sampling station viz. Chhattisgarh, the fluoride levels in drinking water is within the prescribed limit of WHO standards. It is significant to state that the study area exhibit marginal levels of fluoride contents (1.4 mg/L). The study revealed the heterogeneous fluoride distribution in the underground water and the result of these analyses are concluded that proper defluoridation measures seems to be needed to protect the habitants of central India from the problems of fluorosis.

Keywords: Hand pump water, fluoride, de-fluoridation

INTRODUCTION

Study area is situated in the centre of Chhattisgarh and it has been explored for fluoride distribution in the underground water (Achari and Krishnamurthy, 2015). These distributions have been conducted in various seasons of the years from July 2018 to December 2018 within the significant biodiversified territory of Chattisgarh located in the centre part of Chattisagrh, positioned at 21.47°N latitude and 81.14°E longitude. Temperature varies from 20° C to 48°C. People of this region have divergent way of life and civilization, enriched as it is with south eastern central railway zone, high court, national thermal power of corporation and very diverse population comprising to a number of tribes. The individual of Chhattisgarh be desperate to commence agriculture, sericulture and horticulture. Life here is governed by urban customs, culture and traditions. In the rural areas of the region, people are dependent largely on agriculture and minor forest produce. Further groundwater is a major source of drinking water in urban and rural areas. Near about ninety percent of the rural population uses groundwater for household purposes. Nearly one third of the population of study area is illiterate, not at all aware of the water borne diseases affecting their health. Millions of people all over the world, including Indian are suffering with fluorosis due high concentration of fluoride in the drinking water (Achari and Krishnamurthy, 2015; Chuah *et al* 2016; Junyong *et al* 2016; Mohammadi *et al* 2017). When the fluoride level cross the optimum concentration i.e., 1.5 mg/L, then it exhibit the toxic effects in the human body. Long-term exposure to high level of fluoride can caused several adverse effects on human health including dental and skeletal fluorosis (Mohammadi *et al* 2017).

The Indian districts such as Andhra Pradesh, Tamilnadu, Karnataka, Kerla, Rajasthan, Delhi, Bihar, Jharkand, Uttar Pradesh, Orrisa, Jammu Kashmir have been reported to contain high fluoride levels (Rammamohan, 1964; Rao, 1974; Susheela, 1993; WHO, 1994) rendering these areas of the contrary as either affected areas from fluorosis to various extends or to the risk of the same (Achari and Krishnamurthy, 2015). Near about one lack people of Assam (Karbi Anglong district) affected by excessive fluoride levels in ground water in June 2000. The symptoms were anemia, stiff joints, painful and restricted movement, mottled teeth and kidney failure. Moreover fluoride in the water, other factors contribute to the endemic fluoride problem such as nutritional deficiencies, high ambient temperature, high water alkalinity, low calcium and vitamin C intake. Moreover, there has also been large increase in the use of fluoride-containing sachets of *pan masala, gutka* (containing tobacco), and mouth washes and mouth rinses in Chhattisgarh.

MATERIALS AND METHODS

Central India exhibit variety of ecosystems ranging from mountains supporting thick forests, coastal plains, we were selected seven sampling station at various locations in the study area with view to cover most of the segment of the Chhattisgarh. These sampling stations were *A1 = Bilaspur, A2 = Seepat, A3 = Belha, A4 = Gourella, A5 = Marwahi, A6 = Takatpur, A7 = Lormi*. Water samples were collected from the public hand pumps situated at these sampling sites on monthly basis over a period of half calendar year. These samples were taken to laboratory and subsequently analyses for their fluoride contents. The analysis of fluoride contents were performed spectro-photometrically using ALPHA, AWWA and APCF (1985) Standard Method for Examination of Water and Wastewater. The de-colorization of SPANDS Zitconyl complex was found to follow a linear relationship with fluoride contents.

RESULTS AND DISCUSSION

The study reveals the heterogenous fluoride distribution in the underground water of the area and the results of these analyses are reported (Table 1). All the groups of sampling station the fluoride level was within permissible fluoride limits for drinking water as recommended by WHO (WHO,1970; National research, 1977; WHO guidelines, 1984). The frequency distribution of fluoride was different in the A3 - Belha and A4 -Gourella groups characterized by relatively higher concentration (Table 1). These groups exhibit nearly equal to maximum permissible limits (1.5 mg/L) recommended by WHO (WHO guidelines, 1984). The effect of fluoride in human body differs individually, but the common person is evidence for prevention of tooth decay, strengthening of skeleton in 0.8–1.2 mg/L fluoride concentration (Achari and Krishnamurthy, 2015; Mohammadi *et al* 2017). Similarly Mohammadi and his colleque (2017) worked on river and well water by SPANDS method and suggested for the de-fluoridation from the immediate effects. Further when the concentration exceeds more than 1.5 mg/l, Fluorosis occurs in which pitting of tooth enamel and deposits in bones are common phenomenon (Achari and Krishnamurthy, 2015; Chuah *et al* 2016; Junyong *et al* 2016). Subsequently when about 10 mg/L, fluoride in the drinking water confirm the signs of Crippling skeletal fluorosis (Deshmukh and Malpe, 1996). Therefore, it is remarkable that proper de-fluoridation measures seem to be needed to protect the populations of Belha and Gourella area from the problems of fluorosis. The removal of fluoride from drinking water is common now, Junyong *et al* (2016) used Freundlich model based on ultralong hydroxyapatite nanowires which is a thermodynamic parameters suggest that the adsorption of fluoride in a spontaneous endothermic phenomenon. The maximum of adsorption capacity of this model is 40.65 mg/g at pH 7.0 when the fluoride concentration is 200 mg/L. Similarly other models are also available for the removal of fluoride from drinking water (Zheng *et al* 2016).

Table 1 : Fluoride distribution in Bilaspur District

SN	Sample	Concentration of Fluoride (mg/L)					
		July	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
A1	Bilaspur	0.20	0.23	0.34	0.40	0.44	0.38
A2	Seepat	0.22	0.25	0.24	0.35	0.34	0.38
A3	Belha	**0.18**	**1.02**	**1.25**	**1.20**	**1.22**	**1.10**
A4	Gourella	**1.38**	**1.39**	**1.39**	**1.40**	**1.40**	**1.36**
A5	Marwahi	0.43	0.46	0.34	0.41	0.47	0.39
A6	Takatpur	0.21	0.24	0.29	0.38	0.39	0.36
A7	Lormi	0.29	0.34	0.44	0.31	0.36	0.40

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