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RESEARCH ARTICLE

Fluoride content distribution in the underground water of Central India Madhya Pradesh

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ABSTRACT : Presently our country facing the major fluoride related problem. The severity of fluorosis depends on the concentration of fluoride in the drinking water, daily intake, continuity and duration of exposure and climatic conditions. A number of cases of fluorosis have been reported mostly from the granite and gneissic complex of different states such as Madhya Pradesh. In our state 20 districts including Shivpuri, Mandla, and Jhabua are having excessive fluoride content in drinking water. By the Random method of sampling we analyzed water samples, by Alizarian photometric method. To study fluoride content , requirement of the treatment and disease due to fluoride contaminated water and the distribution of fluoride in the underground water.

KEY WORDS : Fluoride content, Defluoridation, Fluoridation, Permissible range, Alizarian photometric method

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INTRODUCTION

Fluoride concentration over and above the permissible limits (1.5 mg/l) in drinking water leads to human health hazards, such as dental and skeletal fluorosis, affecting millions of people in many parts of India. Preliminary investigations indicate that severe health disorders have been identified in parts of the Kachnarwa region, which is in the upper Panda river basin, Sonbhadra District, Uttar Pradesh, due to excess intake of fluoride through drinking water. The concentration of fluoride in the groundwater of the present study area varies from 0.14 to 3.06 mg/l, among the 50 samples analyzed. Most suffer from dental and skeletal fluorosis such as mottling of teeth, deformation of ligaments, bending of spinal column and ageing problem. An urgent need is to educate the people on the causes of fluorosis, encouraging rain-water harvesting and providing fluoride-free drinking water in the affected area.

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The source of fluoride :

The source of fluoride in the groundwater of the study area is mainly from geological occurrence (*i.e.* fluoride-bearing minerals, *viz.*, apatite and biotitic mica). Fluoride concentration in natural waters depends on various factors such as temperature, pH and solubility of fluorine bearing minerals, anion exchange capacity of aquifer materials and the nature of geological formations drained by water and contact time of water with a particular formation. Minerals which have the greatest effect on the hydro geochemistry of fluoride are fluorite, apatite, mica, amphiboles, certain clays and villiamite.

Effect and disease :

Fluoride is among the substances for which there are both lower (0.6 mg/l) and upper (1.2 mg/l) limits of concentration in drinking water, with identified health effect and benefits for human beings. Very low doses of fluoride (<0.6 mg/l) in water promote tooth decay. However, when consumed in higher doses (>1.5 mg/l), it leads to dental fluorosis or mottled enamel and excessively high concentration (>3.0 mg/l) of fluoride may lead to skeletal

fluorosis. In general, fluoride content in water between 1.5 and 2.0 mg/l may lead to dental mottling, which is characterized initially by opaque white patches on the teeth and in advanced stages leads to dental fluorosis (teeth display brown to black staining) followed by pitting of teeth surfaces. High manifestations of dental fluorosis are mostly found in children up to the age of 12 years, and skeletal fluorosis may occur when fluoride concentrations in drinking water exceed 4–8 mg/l. The high fluoride concentration manifests as an increase in bone density leading to thickness of long bones and calcification of ligaments. The symptoms include mild rheumatic/arthritic pain in the joints and muscles to severe pain in the cervical spine region along with stiffness and rigidity of the joints. The disease may be present in an individual at subclinical, chronic or acute levels of manifestation. Crippling skeletal fluorosis can occur when the water supply contains more than 10 mg/l of fluoride. The severity of fluorosis depends on the concentration of fluoride in the drinking water, daily intake, continuity and duration of exposure and climatic conditions. In India, an estimated 62 million people, including 6million children suffer from fluorosis because of consuming fluoride-contaminated water. Although fluorosis was identified as early as 1937, a program for controlling the disease through networking between State Rural Drinking Water Supply Implementing Agencies and Health Departments was launched during 1986–87. Generally, high fluoride contamination in hard-rock terrain is common due to water quality variation and changes in shallow and deep aquifers zones. But, in alluvial plain ground water, the variation and changes in fluoride levels are usually rare. A number of cases of fluorosis have been reported mostly from the granite and gneissic complex of different states such as Madhya Pradesh.

Fluorosis is an important clinical and public health problem in several parts of the world. The global prevalence of fluorosis has been reported to be about 32 per cent (Mell *et al.*, 1994). There are several million people in India exposed to drinking water sources with high fluoride content. Excess fluoride ingestion is a major health problem, 20 of the 30 states and Union territories in India being endemic for fluorosis (Susheela, 1993). Fluoride concentration up to 38.5 ppm has been reported in drinking water (Susheela and Ghosh, 1990). Teotia and Teotia (1984) have reported dental and skeletal fluorosis in residents of rural areas consuming water containing 0.6ppm fluoride.

Central India is having arduous geological and geomorphologic structure, this area is facing major water problem used for regular purposes. The land is rocky and the profile is undulating in district due to this rain water run off doesn't stay. In this district water is contaminated by fluoride which is found in underground rocks of Jabalpur. Today not only this district but also other districts are facing the serious problem caused by excessive fluoride content in water. In our state 20 districts including Shivpuri, Mandla, and Jhabua are having excessive fluoride content in drinking water. It was a matter of nation wide discussion on the severe damage to the people of this district.

Main objective of the present study :

–To study the distribution of fluoride in the underground water, to analyze the fluoride content of water, to categorize the water weather it is good for health or not, to recommend that fluoridation or de fluoridation required or not and which kind of diseases can occur in use of fluorine contaminated water?

EXPERIMENTAL PROCEDURE

Selected area :

According to geological survey 3 majar districts were selected for the study *i.e*. Chhapara, Mandla and Seoni by the random method of sampling. Water samples were analyzed by Alizarian photometric method.

Samples were taken randomly.

Limit of sample :

– Fluoride concentration < 1mg/litre.
Fluoride content is less – fluoridation required.
– Fluoride concentration > 2mg/litre.
Fluoride content is high – de-fluoridation is required.

EXPERIMENTAL FINDINGS AND ANALYSIS

We have analyzed the main area of central India, Jabalpur's out skirts; Mandla, Chhapara, Seoni. The results are presented in Table 1.

On the basis of data presented in Table 1 it can be inferred that :

– The occurrence of fluoride in underground water source was non-uniform in term of depth and location within the same area.

– By the analysis it can be said that not a single sample was in the permissible range either they required fluoridation or defluoridation.

– There was no specialized treatment required for fluoridation, because there are so many other sources of fluoride by which fluoride need, can be fulflled.

– Deep tube wells are affected by fluoride presence because of the tapping up of the deep and confined aquifers occurring in Dharwar's and archean where granite has been penetrated.

– To avoid deformity by excessive intake fluoride it is easy to stop using that water for drinking purpose. They can

Table 1 : Analysis of water samples of thrce districts

		Mandala		
Sr. No.	Perticular sample	% Transmittance	Fluoride contents (mg/L)	Remark
1.	Marajpur near gurdwara Mandla	52.7	less amount	Required Fluoridation
2.	Kharicon Mandla	52.2	less amount	Required Fluoridation
3.	Dr. Radhakrishan ward Mandla	52	less amount	Required Fluoridation
4.	Lalbadhur Shastri ward Mandla	54.4	less amount	Required Fluoridation
5.	Swami Sitaraman ward no.1 Mandla	52.9	less amount	Required Fluoridation
6.	Swami Sitaraman ward no.2 Mandla	52.7	less amount	Required Fluoridation
7.	Uday chowk Mandla	51.4	less amount	Required Fluoridation
8.	Katra Mandla	53.3	less amount	Required Fluoridation
9.	Phool sagar Mandla	52.2	less amount	Required Fluoridation
10.	Gwari Mandla	51.4	less amount	Required Fluoridation
11.	Lalipur Mandla	51.3	less amount	Required Fluoridation
12.	Narayan ganj Mandla	52.4	less amount	Required Fluoridation
13.	Tikariya Mandla	53.6	less amount	Required Fluoridation
14.	Kuda mahandi Mandla	56.3	less amount	Required Fluoridation
15.	Muktidham Mandla	96.3	2.96	Required DE-Fluoridation
16.	Badi kheri mandla	97.6	3.06	Required DE-Fluoridation
17.	Mangal gao Mandala	87.3	2.26	Required DE-Fluoridation
		Chhapara		
1.	Khurshipaar Chhapara near tube well pariyojana Chhapara	90.6	2.52	Required De-Fluoridation
2.	Khurshipaa Chhapara road side	60.1	less amount	Required Fluoridation
3.	Girls school Anjania Chhapara	93.2	2.72	Required De-Fluoridation
4.	Channi near purani basti Chhapara	65.8	0.58	Required Fluoridation
5.	Sahuji house Ganai Raiyat	52.8	less amount	Required Fluoridation
6.	Opp. to Aganbadi Gangai Raiyat	78.8	1.59	Required De-Fluoridation
7.	Panchayat bhavan gangai raiyat	47.6	less amount	Required Fluoridation
8.	Masjit near to Gangai Raiyat	94.6	2.83	Required De-Fluoridation
9.	Shri khermai Chhapara	47.8	less amount	Required Fluoridation
10.	Shri hanuman mandir main road Chhapara	43.6	less amount	Required Fluoridation
11.	Utkrishat aadiwasi balak chatrawas Chhapara	90.7	2.52	Required De-Fluoridation
12.	Abhyan shala Chhapara	51.5	less amount	Required Fluoridation
13.	Soni ward, near to rajababu house Chhapara	89.4	2.42	Required De-Fluoridation
14.	Jhanda chowk Chhapara	88.5	2.35	Required De-Fluoridation
		Seoni		
1.	Shri khairmai mandir berinala Seoni	50.4	less amount	Required Fluoridation
2.	Gorakh pur Seoni	93.7	2.76	Required De-Fluoridation
3.	Surtilal baakidhana Seoni	95.5	2.9	Required De-Fluoridation
4.	Shivlal admache baakidhana Seoni	96.4	2.97	Required De-Fluoridation
5.	Shskiya shala baakidhana Seoni	95.9	2.93	Required De-Fluoridation
6.	Near to hanuman mandir baakidhana Seoni	51.2	less amount	Required Fluoridation
7.	behind school baakidhana Seoni	50.2	less amount	Required Fluoridation
8.	Bineki jalyojna Seoni	56.2	less amount	Required Fluoridation
9.	Ghartiya Seoni	59.8	0.11	Required Fluoridation
10.	Durga chowk Seoni	53.1	less amount	Required Fluoridation
11.	Front of school jurtara Seoni	54.8	less amount	Required Fluoridation
12.	Ghartia Seoni	54.8	less amount	Required Fluoridation
13.	Oppossite to Aganwari Seoni	50.4	less amount	Required Fluoridation
14.	Tube well Naljal Yojana Seoni Baki	87.2	2.25	Required De-Fluoridation
15.	River side Gangi Seoni	55.6	less amount	Required Fluoridation
16.	Gangai Dayayaday House Seoni	52	less amount	Required Fluoridation
17.	Gangai Manmohan Upadhyay House Seoni	60.1	0.13	Required Fluoridation
18.	Road Side Cakhana down	52.6	less amount	Required Fluoridation
19.	Dhooma Shri Khermai	48.8	less amount	Required Fluoridation

use any other source of water which is safe.

–This was also found that maximum fluoride content was found in Mandla, Chappara in comparison to Seoni (Fig. 1-3) and we suggest government of India to take major remedial action for prevention of fluoride contamination in this region. Government of India should also innovate new method for treatment of fluoride in water which should be cost effective and easy to adopt.

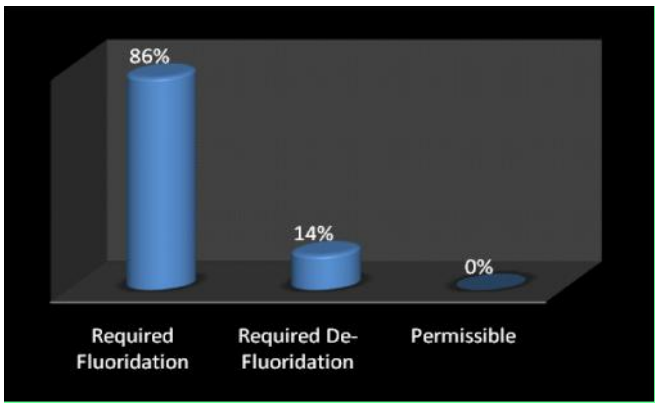

Fig. 1: Fluoride % in Mandala

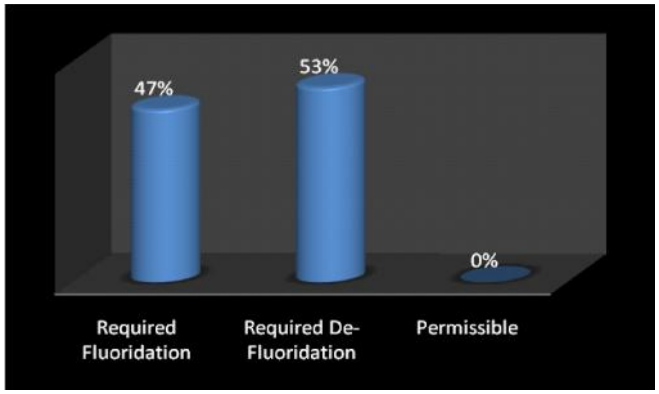

Fig. 2: Fluoride % in Chhapara

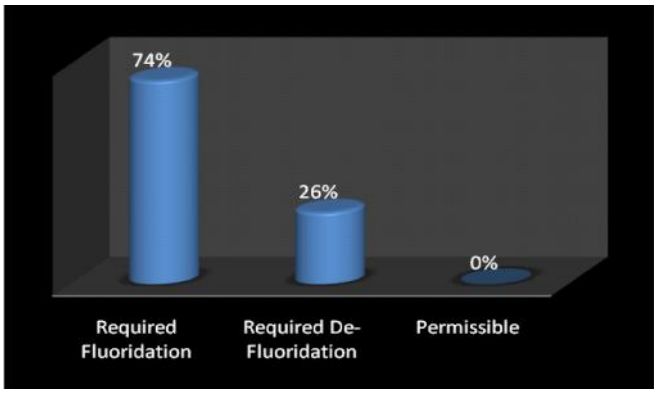

Fig. 3: Fluoride % in Seoni

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