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Status of fluoride in ground water of several villages of Modasa Taluka, North Gujarat for drinking purpose

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Abstract

Fluoride concentration of ground water samples from several villages of Modasa taluka, Dist-Sabarkantha (N.G.) was determined. Out of 88 sources of 23 villages 34 sources were found to have fluoride concentration 1.0 mg / l. 52 sources were found to have fluoride concentration 1.0 to 1.5 mg/l. Which is maximum desirable limit of drinking water standards. 2 sources were found to have fluoride concentration between 1.5 to 3.0 mg/l. In these villages there are maximum possibilities of dental and skeletal fluorosis.

INTRODUCTION

Fluoride is found in all natural water at some concentration. In ground water however low and high concentration of fluoride can occur depending upon the nature of the rocks and the occurrence of the fluoride – bearing minerals. Fluorosis has been described as an endemic of tropical climate[1].The main sources of fluoride intake is water[2].

In low concentration of fluoride prevent dental caries. However it has been observed that when fluoride intake through water, food and air increases to a specific level (1.0-1.5 mg/l.)The beneficial effect is lost and in fact harmful effect being to show with increasing concentration (above 1.5 mg/l). Excess intake of fluoride beyond permissible limit bring out dental and skeleton fluorosis along with some neurological disorder. Higher concentration of fluoride also causes respiratory failure, fall of blood pressure and genera paralysis. Continuous investigation nonfatal dose of fluoride causes permanent inhibition of growth. Fluoride ions inhibit a variety of enzymes often by forming complexes with magnesium ion and other metal ions[3].

According to Water and River Commission Western Australia ground water occupies the pores and crevices in sand, sand stone and other rocks[4]. The crucial role which ground water plays as decentralized sources of drinking water for millions of rural and urban families can not be overstated[5]. Rao et al. reported that about 80 percentage of the diseases in the world are created because of poor quality of drinking water[6]. The quality of the ground water can not be restored by stopping the pollution if it is contaminated once. Water quality index is very important tool for the information on water quality[7-10].Some importat ratings are given below:

Table 1

Parameter	Desirable Limit	Permissible Limit	Moderately safe	Unsafe
Fluoride (ppm)	1.0	1.5	1.5-2.0	> 2.0
RSC (Meq./L)	1.0	< 1.25	-	> 2.50
SAR	5.0	< 10	10-18	> 26
EC m moh/cm	0.0-0.5	0.0-0.75	0.25-0.75	> 2.25

RESULTS AND DISCUSSION

Fluoride concentration in ground water of 88 sources of 23 villages of Modasa Taluka was examined. The source code was concentration of fluoride is shown in figure – 1. All the villages as wells sources were categorized according to following concentration range;

1. Category I : Fluoride concentration below 1.0 mg / l.
2. Category II: Fluoride concentration between 1.0 mg / l. and 1.5 mg / l.
3. Category III: Fluoride concentration between 1.5 mg / l. and 3.0 mg / l.

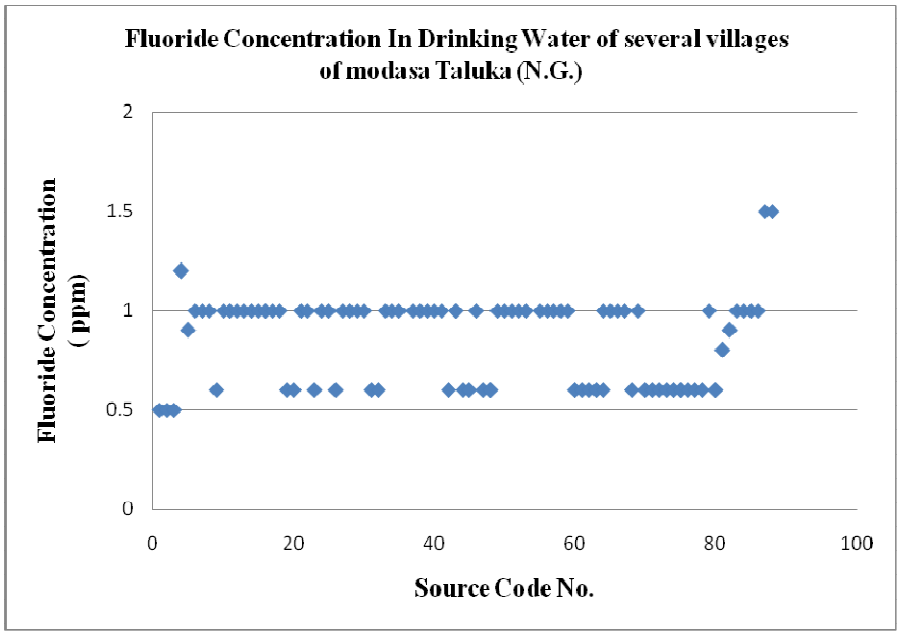
Out of these 88 sources of 23 villages, 34 sources (category – I) were found to have fluoride concentration below 1.0 mg / l., 52 sources (category – II) were found to have fluoride concentration between 1.0 to 1.5 mg / l. which is maximum desirable limit of drinking water standards. 2 sources (category –III) were found to have fluoride concentration between 1.5 – 3.0 mg / l. In these villages there are maximum possibilities of dental and skeletal fluorosis.

The disease and how it affects people

Investigation of excess fluoride, most commonly in drinking water, can cause fluorosis which affects the teeth and bones. Moderate amounts lead to dental effects but long-term ingestion of large amounts can lead to potentially severe skeletal problems. Paradoxically, low levels of fluoride intake help to prevent dental caries. The control of drinking water quality is therefore critical in preventing fluorosis. The condition and its effect on people fluorosis is caused by excessive intake of fluoride. The dental effect of fluorosis develop much erlier than the skeletal effects in people exposed to large amount of fluoride. Clinical der al fluorosis is characterised by staining and pitting of the teeth. In more severe cases all the enamel may be damaged. However fluoride may not be the only cause of dental enamel defects. Enamel opacities similar to dental fluorosis are associated with other conditions such as malnutrition with deficiency of vitamins D

and A or a low protein-energy diet. Ingestion of fluoride after six years of age will not cause dental fluorosis.

Figure 1



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Chronic high level exposure to fluoride can lead to skeletal fluorosis. In skeletal; fluorosis fluoride accumulate 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 be change and ligaments may calcify with resulting impairment of muscles pain. Acute high level exposure to fluoride causes immediate effects of abdominal pain, excessive saliva, nausea and vomiting. Seizures and muscle spasms may also occur.

The cause

Acute high level exposure to fluoride is rare and usually due to accidental pain contamination of drinking water or due to fires or explosions. Moderate level chronic exposure (above 1.5 mg/lit. of water*) is more common. People affected by fluorosis are often exposed to multiple sources of fluoride, such as in food, water, air and excessive use of toothpaste. However drinking water is typically the most significant source. A person's diet, general state of health as well as the body's ability to dispose of fluoride all affect how the exposure to fluoride manifests itself.

Distribution

Fluoride in ground water is mostly of geological origin. Waters with high level of fluoride content are mostly found at the foot of high mountains and in the 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 America and Japan. In these areas fluorosis has been reported.

Scope of the problem

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 dental fluorosis the very mild or mild forms are the most frequent.

Intervention

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 level. Where access to safe is already limited defluoridation may be only the solution. Method include; use of bone charcoal, contact precipitation, use of Nalgonda or activated alumina. Since all methods produce a 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 fluoride. Mothers in affected areas should be encouraged to breastfeed since breast milk is usually low in fluoride.

MATERIALS AND METHODS

The main objective was to assess the fluoride contamination in drinking water sources under Drinking water Quality Monitoring and surveillance programme in rural areas of Modasa Taluka, Sabarkantha district. To fulfil the study first we visited the villages and identify the drinking water sources with the help of local persons. Samples were collected and analyzed on the spot with the help of Jal-Tara water testing kit. The obtained results for drinking water were compared with the results of WHO and BIS.

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