

Study on Fluoride Toxicity in Parts of Upper Thirumanimuthar Sub Basin, Cauvery River, Salem District, Tamilnadu, India

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Abstract- The present paper reports the distribution pattern and effects of fluoride toxicity in the Upper Thirumanimuthar Sub-basin of Salem district, Tamil Nadu. Water samples from 51 drinking water bore wells were collected and analyzed for fluoride content. The problem is spatially considered to be more acute and at an alarming proportion, as 15.59% (Dental fluorides) and 31.22% (Skeleton Fluorides) of the area have the fluoride content in drinking waters in excess of the permissible limit and 53.19% of the samples have below the permissible limit.

The problem of excess fluoride in waters has been noticed in 15 States in India (Susheela, 1993 and Selvaraj, 2001). Prominent among them are Andhra Pradesh, Haryana, Bihar, Karnataka, Kerala, Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Punjab and Uttar Pradesh. In Tamilnadu, the fluoride problem is seen almost in all the districts and the worst hit are Dharmapuri, Salem, Erode, Coimbatore, Madurai, Trichy, Dindigul, Viruthunagar, Tuticorin, Thirunelveli, Pudukottai, North Arcot, Tiruvannamalai and Ramnad.

I. INTRODUCTION

The beneficial or harmful effects of fluorides on teeth and skeleton depending on their concentration have been widely studied. To avoid harmful effects, authorities set limits to fluoride levels especially in drinking water. In World Health Organization, the maximum acceptable concentration of fluorides in drinking water is 1.5 mg/l. The fluoride content in many regions of Tamil Nadu exceeds acceptable standards. In the Salem district (Upper Thirumanimuthar Sub-basin), the harmful effect of dental and skeleton fluorosis is widespread among the population supplied directly from wells.

Fluoride concentration in the groundwater was one of the specific problems considered by one and all. Fluoride may occur naturally in the water and therefore a detailed water quality survey with fluoride. As per the World Health Organization statement, fluoride is a health significant parameter and a level of more than 1.5 mg/l should not be permitted. The problem of fluoride concentration in groundwater resources has now become one of the most important toxicological and geo-environmental issues in India (Agrawal and Vaish, 1997).

According to Indian Council for Medical and Research. Consumption of higher fluoride ground water more than 1.5 mg/l can cause dental mottling and affects bones, soft tissues like skeletal muscles, erythrocytes, gastrointestinal tissues and ligaments.

II. SOURCES

In general, fluoride content in ground water increases with depth (Rajagopal and Tobin, 1991). As observed by Pandit *et al.* (1940), Short (1937) and Wadhvane and De (1952), waters from the rocky soils formed in the region of granitic and shale formations are usually found to have contained excessive fluorides. The common natural sources of fluoride are fluorspar, fluoroapatite, amphiboles such as hornblende, tremolite and some mica. Weathering of alkali silicate, igneous and sedimentary rocks, especially shales supply a major portion of fluoride to natural waters (McNeelay, 1979). Apart from natural waters, phosphate fertilizers, which may contain fluoride as an impurity, contribute considerable amount of fluoride and these may cause an increased level of fluoride in soils, which in turn may eventually result in leaching by percolating water and increase the level of fluoride in ground water.

The source of fluoride in ground water may be due to the presence of various fluoride bearing minerals in the country rocks. Fluoride generally occurs in natural water in most of the places in less than 1 ppm (Reddy *et al.*, 1999). During their interaction with water it dissolves fluoride ions. Some common fluoride bearing minerals are Biotite, Muscovite, Hornblende, Greater variability of fluoride ions was observed from litho units indicating the presence and accessibility of fluoride bearing minerals to water and weathering along with leaching process

III. STUDY AREA

The study area, lies between the latitudes 11°31'57" N to 11°48'05" N and longitudes 78°02'33" E to 78°21'13" E covering an area of 442.78 Km². In these, Plain area covers an area of 346.40 Km². The study area falls in Salem district of central Tamil Nadu, South India. The major source for recharge of water in this area is rainfall, during monsoon season. As the study area is underlain by the Archaean crystalline rock, groundwater may occur in the fractured rocks.

IV. METHODOLOGY

The 51 groundwater samples from various locations in the upper Thirumanimuthar Sub- basin area were collected from open wells (Shallow depth). The groundwater samples were collected from open wells, which are being extensively utilized for drinking purposes. pH and Electrical Conductance were measured within a few hours by using Elico pH meter and conductivity meter. Ca and Mg were determined titrimetrically using standard EDTA method and chloride was determined by silver nitrate titration (Volgel, 1968) method. Carbonate and bicarbonate were estimated with standard sulphuric acid and sulphate was determined a gravimetrically by precipitating BaSO₄ from BaCl₂. Na and K were determined by Elico flame photometer (APHA, 1996). The determination of fluoride content adopting the Zirconium-Alizarin Method.

V. RESULTS AND DISCUSSION

Among 51 samples, only 34 (66.67 %) have the fluoride content within the permissible limit (1.5 mg/l) and 17 (33.33 %) samples above permissible limits. In taking of drinking water with more than permissible limit has resulted in staining of tooth enamel.

Excess Fluoride Consumption and Health Hazards

Fluoride when consumed or inhaled in excess [more than 1.5 ppm], can cause several different kinds of health problems. It affects young and old alike. Fluoride is also known to induce ageing. An individual may suffer from.

1. Dental Fluorosis
2. Skeletal Fluorosis

• Dental fluorosis:

Dental fluorosis is prevalent children who are born and brought up in an endemic area for fluorosis. Dental fluorosis can occur in milk teeth and permanent teeth (Fig 3).



Fig. 3. Dental Fluorosis

Symptoms:

- Yellowish white – Glistening teeth – becomes dull – loses its shine – develops yellow – while spots.
 - Yellow-White spot turn brown and presents in horizontal streaks.
 - The brown streak is at the tip of the teeth indicates that the child has been exposed to high fluoride either in food or in water or both up to the age of 2 year.
 - If the brown streaks are in middle of the teeth, it indicates that child has been exposed high fluoride in food or water or both from the age of 2 years up to 4 years.
 - If the brown streaks are in the upper part of the teeth, it denotes that the child has been exposed to high fluoride in food or water or both from the age of 4 years up to 6 years and after.
 - In late stages the whole teeth will become black. It will be pitted or perforated and may even get chipped off.
 - Dental fluorosis is not only a cosmetic problem but is also known to cause social problems.
- **Skeletal Fluorosis**

Affects young children as well as older individuals. Fluoride can also damage a fetus if the mother consumes water / food with high concentration of fluoride during pregnancy / breast feeding. Infant mortality due to calcification of blood vessels can also occur (Fig 4).



Fig. 4. Skeletal Fluorosis

Symptoms:

- Severe pain in the back bone.
- Severe pain in the joints.
- Severe pain in the hip region / pelvic girdle.
- Stiffness of the back-bone.
- Immobile joints.
- Constriction of vertebral canal and intervertebral foremen – pressure on nerves.
- Paralysis.

Preventive measures

- If the water has fluoride more than 1.00mg/l do not use for cooking and drinking.
- Expectant / lactating mother are advised to use defluoridated water to have a healthy baby.
- If any of the symptoms of fluorosis is detected; avoid the major source of fluoride intake.
- Intake of vitamin C in large amount is advisable vitamin C rich food items should be consumed.
- Diet should have adequate calcium. Drink more milk and consume calcium rich vegetables.
- Avoid all possible sources of high fluoride contain items.(water, food, drugs and tooth paste)
- Pain in the back, hip or joints should not be dismissed as casual hospital intervention should be sought.

VI. CONCLUSION

The problem of high fluoride concentration in ground waters is noticed in Salem district, particularly in Upper Thirumanimuthar Sub-basin, Cauvery River, The villages with fluoride concentration 1.12 to 3.24 mg/l, more than 1.5 mg/l. The fluorides have adverse effects on the health of the people. To safeguard this, ground water should be either defluoridised or an alternative supply arrangements should be made. The

short-term solution to minimize the fluoride level in drinking water would be the use of domestic defluoridation equipment or filters.

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