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Fluoride Content in Water Bodies Near Velliangiri Hills

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Abstract: Water is an essential natural resource for sustaining life. However, chemical composition has to be balanced in the available water to make it useful, in the current era of economic growth many natural and man made water bodies are getting polluted and becoming unfit for human use. Traces of fluorides are present in many waters; higher concentrations are often associated with underground sources. In areas rich in fluoride-containing minerals, well water may contain up to about 10 mg of fluoride per litre. The highest natural level reported is 2800 mg/litre.Many epidemiological studies of possible adverse effects of the long-term ingestion of fluoride via drinking-water have been carried out. These studies clearly establish that fluoride primarily produces effects on skeletal tissues (bones and teeth). Low concentrations provide protection against dental caries, especially in children. Fluoride being one of the most abundant anions present in naturally existing water bodies, its benefits or demerits in water depends on the amount/concentration, the results on comparing the samples from drinking water and collected river water the total dissolved salts concentration is almost double in collected water than that of drinking water,therefore it's not completely safe for drinking. Thus the tested sample is unfit for drinking purposes.

Keywords: Fluoride; Total dissolved salts; dissolved oxygen.

INTRODUCTION

Water is an essential natural resource for sustaining life. However, chemical composition has to be balanced in the available water to make it useful, in the current era of economic growth many natural and man made water bodies are getting polluted and becoming unfit for human use(Pandey *et al.*, 2015). Fluoride being one of the most abundant anions present in naturally existing water bodies, its benefits or demerits in water depends on the amount/concentration present as excess of fluoride may cause skeletal and dental fluorosis(Dhanuthai and Thangpisityotin, 2011; Gupta and Ayoob, 2016). Fluoride is the simplest fluorine anion. In terms of charge and size, the fluoride ion resembles the hydroxide ion. Traces of fluorides are present in many waters; higher concentrations are often associated with underground sources. In areas rich in fluoride-containing minerals, well water may contain up to about 10 mg of fluoride per litre. The highest natural level reported is 2800 mg/litre. Fluoride ions occur on earth in several minerals, particularly fluorite, but are present only in trace quantities in bodies of water in nature(Curcic *et al.*, 2010). Even though fluoride is generally present in our everyday life, we consume it in small amounts. In general, it can be found in meat, fish, and cereals. In higher concentrations, it can also be found in canned anchovies, canned fruits, ground chicken meat products, with a higher percentage of ground bones, chocolate milk and some baby dietary supplements. Fluoride content in food can also depend on materials used in food preparation(Rajkovic and Novakovic, 2007; Curcic *et al.*, 2010). For instance, Teflon cookware is a great source of fluoride ions. The most important factor for fluoride presence in alimentation is fluoridated water.

Dental fluorosis is a developmental disturbance of enamel which occurs during enamel forming. It is caused by systemic overexposure to fluoride during the first six years of life, when the enamel of the crowns of permanent teeth is formed. The enamel contains more protein, is porous, opaque and less transparent(Chandrashekar, Thankappan and Sundaram, 2010). Clinical manifestations vary from (quantitative) narrow, white horizontally running lines, larger patches or yellow to light brown colored areas of porous enamel, to (qualitative) loss of enamel in varying degrees. For the optimal effect of fluoride toothpaste, it is important to follow recommended guidelines for the use of products containing fluorides. In this way, the probability for fluorosis is decreased and the protective effect of fluoride on the development of caries is significantly important. Just like any other

substance we are exposed to in our everyday lives (oxygen, water, table salt), fluoride can be toxic in certain quantities. Acute toxicity can occur after ingesting one or more doses of fluoride over a short time period which then leads to poisoning(Myers, 1978). The stomach is the first organ that is affected(Brignardello-Petersen, 2020; Das *et al.*, 2020). First signs and symptoms are nausea, abdominal pain, bloody vomiting and diarrhea. This is followed by a collapse with paleness, weakness, shallow breathing, weak heart sounds, wet, cold skin, cyanosis, dilated pupils, hypocalcaemia and hyperkalemia, and in two to four hours even death. Other possible effects include muscle paralysis, carpopedal spasms and extremity spasms. Previously our department has published extensive research on various aspects of prosthetic dentistry ('Evaluation of Corrosive Behavior of Four Nickel–chromium Alloys in Artificial Saliva by Cyclic Polarization Test:An in vitro Study', 2017; Ganapathy, Kannan and Venugopalan, 2017; Jain, 2017a, 2017b; Ranganathan, Ganapathy and Jain, 2017; Ariga *et al.*, 2018; Gupta, Ariga and Deogade, 2018; Anbu *et al.*, 2019; Ashok and Ganapathy, 2019; Duraisamy *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; St-Louis, 2020), this vast research experience has inspired us to research about the assessment of fluoride content in water bodies near Velliangiri hills.Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Gupta, Ariga and Deogade, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

The present study aims to assess fluoride content in water bodies near Velliangiri hills.

MATERIALS AND METHODS

In the present study the water samples from the water bodies near Velliangiri hills were collected and the samples were sent to a water testing laboratory to assess the levels of fluoride content, dissolved oxygen value and the composition of total dissolved salts. These results were compared with that of samples from packaged drinking water to check whether the water is safe for drinking purposes.

RESULTS AND DISCUSSION

The results of the tests of samples were compared to packaged drinking water, represented in the following tables. (Table-1 and Table-2)

Table 1 shows the property of the water samples collected front he natural water sources, where the samples were tested for dissolved salts (mg/l), oxygen (mg/l) and Fluoride content (ppm), where sample 1 shows dissolved salts (590 mg/l), oxygen (0.2mg/l) and Fluoride content (3.12 ppm), sample 3 shows dissolved salts (610 mg/l), oxygen (0.2mg/l) and Fluoride content (3.05 ppm), sample 1 shows dissolved salts (598 mg/l), oxygen (0.3mg/l) and Fluoride content (3.17 ppm)

Table 2 shows the property of the water samples collected front he Packed water, where the samples were tested for dissolved salts (mg/l), oxygen (mg/l) and Fluoride content (ppm), where sample 1 shows dissolved salts (250 mg/l), oxygen (0 mg/l) and Fluoride content (1.24 ppm), sample 3 shows dissolved salts (190 mg/l), oxygen (0 mg/l) and Fluoride content (1.18 ppm), sample 1 shows dissolved salts (210 mg/l), oxygen (0 mg/l) and Fluoride content (1.16 ppm)

On comparing the samples from drinking water and collected river water the total dissolved salts concentration is almost double in collected water than that of drinking water,ie, 550 ppm which is more than optimum level, therefore it's not completely safe for drinking (Akpata, 2001; Institute and National Cancer Institute, 2020). Whereas in the case of dissolved oxygen content natural water has more concentration of dissolved oxygen than drinking water, which is beneficial for supporting aquatic life in the respective water bodies, as far for fluoride

content obviously drinking water has lesser concentration thus making it more safer for drinking purpose and river water has fluoride content more than optimum level ie,more than 1.7ppm, Thus possessing higher risk of fluorosis.

There were many studies done to know the groundwater fluoride levels in India, many investigators have collected water and tested for fluoride levels. Annadurai et al 2014 published a study collecting from the available investigation resources, the review study shows that there was extensive research done on the fluoride levels in drinking water and natural water resources in Tamil Nadu. The previous research states that the high concentration of fluoride in groundwater was found to be in Dharmapuri, and Krishnagiri, Salem, followed by Coimbatore, Madurai, Trichy, Dindugal and Chidambaram district, and the areas or districts with low fluoride levels are Tirunelveli, pudukottai, North Arcot, and Ramnad district. In Dharmapuri, the region of karimangalam where the groundwater fluoride levels range from 0 to 2mg/l.

In a study by Arumugam in 2009, where the investigator tested the fluoride concentration in groundwater of the Tirupur and Coimbatore area varies between 0 to 2 mg/l with an average value of 0.9 and median was 0.6 mg/l. The concentration was higher than 1.5 mg/l in eight locations of Tirupur and Coimbatore. Certain areas in the Western part of the study area of Coimbatore district, were found to contain 0.18 to 2,6 ml/L F, but the present study carried out on the fluoride levels shows much higher content than previous studies which is in contrast. The fluoride levels were ranging from 3.5 - 3.17 ml/L F which is much higher than the fluoride levels tested in previous studies.

Although the study was conducted with recommended protocols there are certain limitations as the samples were collected at only one point of time. In future studies samples can be collected in different seasons to test the levels of fluoride in groundwater available which gives proper insights into the fluoride levels and will be helpful in providing drinking water with optimum fluoride concentrations for the residents of the Velliangiri Hills Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

CONCLUSION

Since the collected samples have fluoride content greater than optimum level this water is not completely safe for drinking as it poses high risk of fluorosis though dissolved oxygen is more in it than drinking water.

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CONFLICT OF INTEREST

The authors have none to declare.

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Table 1: Sample from the respective water bodies

SNO	Property	Sample 1	Sample 2	Sample 3
1	Total dissolved salts (mg/l)	590	610	598
2	Dissolved oxygen (mg/l)	0.2	0.2	0.3
3	Fluoride content (ppm)	3.12	3.05	3.17

Table 2: Sample of packaged drinking water

Sno	Property	Sample 1	Sample 2	Sample 3
1	Total dissolved salts(mg/l)	250	190	210
2	Dissolved oxygen (mg/l)	0	0	0
3	Fluoride content(ppm)	1.24	1.18	1.16