

## Prevalence of Fluorosis among Ground Water Consumers

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### Abstract

The concentration of fluoride in drinking water influences many health issues both in optimistic as well depressing situation in many parts of India. There are no studies reported determining the fluoride levels in drinking water related to rural areas of Needamangalam. The aim of this study is to study the prevalence of fluorosis and to determine the fluoride level in drinking water samples from different areas of Needamangalam region. *Materials and Methods:* In an *in vitro* experimental study, water samples were collected from five randomly selected residential areas of Needamangalam region. A total of 15 water samples were analyzed for fluoride content using fluoride analysis kit (ORLAB HR - Fluoride Testing Kit). Results showed the mean concentration of fluoride level in water samples taken from well, household ground water tap and public distributed water supply system, in the five random residential areas was between the safe level of 0.7 mg/L (1 mg/L = 1 ppm). The fluoride level remained constant throughout from the source till the end consumer. Conclusion: There was no detrimental health effect observed throughout the study period due to fluoride content of selected water samples. Similarly, the fluoride content was constant in the distributed purified water to residential areas. In this study, it was observed that the fluoride levels in drinking water of studied areas were safe and below the recommended levels by the WHO as well as the Ministry of Health, Government of India.

**Key words:** Analysis, dental caries, fluorides, *in vitro*, prevention, water fluoridation

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### INTRODUCTION

Water is an indispensable element to all forms of life in earth. Though it does not provide enough calories, protein or any other organic nutrients, no life on earth could survive without water. Water plays an important role in body's mechanism all the way through digestion, transportation and elimination. Water in our body has been associated with the positive impact on health status. One such important endemic disease arises out of water source and often neglected topic of interest is fluorosis due to fluorine toxicity. The principal source of fluorine was drinking water and food such as sea fish, cheese and tea [Passmore *et al.*]. Jolly *et al.*, stated the recommended level of 0.5 to 0.8 mg/l of fluoride in drinking water in India.

India is one such country having high number of people suffering from fluorosis. This is because most of the Indians rely on groundwater for drinking purposes and water at many places in India is rich in fluoride [<http://www.novapublishers.com>]. In India 62 million people including 6 million children are estimated to

have serious health problems due to consumption of fluoride contaminated water [<http://articles.timesofindia.indiatimes.com>]. Fluorine is by far the most ample component in nature, and constitutes about 96% in the bones and teeth of human body. It is responsible for the normal mineralization of bones and formation of dental enamel [Park *et al.*, 2011].

Many studies were shown to have a optimistic health through fluoridation of water (6-9). The fluoride level in drinking water helped to prevent dental and skeletal fluorosis. Almost 200 million people from 25 countries are at risk of health problems for high concentration of fluoride in their drinking water. (Chandio, *et al.*, 2015; Amouei, *et al.*, 2012, Ayoob, 2016;) Vice versa many epidemiological studies have also shown that long-term consumption of drinking water with a high-fluoride concentration (>4 ppm or mg/L) leads to many adverse effects on human including dental and skeletal fluorosis, based on the facts the World Health Organization (WHO) has set the desirable level of fluoride in potable water as 0.5–1.5 ppm. (Meenakshi, 2006; Singh, *et al.*, 2007)

Having recorded the *pros* and *cons* of the effect of fluorine content, this study aimed to cram the

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prevalence of fluorosis and to determine the fluoride level in drinking water samples from different areas of Needamangalam region.

## MATERIALS AND METHODS

A quantitative based study with a descriptive and analytical approach for the collection of water sample was conducted from December to February 2017. The study was conducted at Needamangalam, a town panchayat in Thiruvavur district in the Cauvery Delta of Indian state of Tamil Nadu. The town is located 20 km east of Thanjavur. The study participants were the regional residents residing in and around Needamangalam. A study subsample of 50 respondents was enrolled in the study after prior consent letter received from them. All the subsample who voluntarily agreed to participate in the study was included.

After the consent letter received from the samples (50nos.) they were all subjected for basic intervening questions followed by a general physical examination pertaining to Fluorine toxicity. Great care was taken to ensure that the quality of the data collection met stringent standards.

### Basic intervening Questionnaire

It includes the details like dizziness, weakness, pallor, headache, Weakness and Aches in Muscles and Joints, cold hands and feet, weight gain, depression and heavy& irregular periods. unusual eating habits, hair falling, sleeping pattern, oral hygiene, dental care includes brushing habits and types/methods tobacco smoking /Chewing habits etc.

### General physical examination

It was performed by the researcher with the help of Village health nurse to observe the changes like enamel colour and condition for smooth and glossiness etc. was carefully recorded and noted

### Fluoride Analysis

Fifteen 100ml, clear, flint glass bottles were used to collect water from each site viz Well, Household ground water and Public water supply from five different location of Needamangalam Panchayat. Prior to fluoride analysis, the second sample from each site was evaluated visually for sediment, turbidity, and colour by the investigator and results were recorded. The water collected from the residential areas was not allowed to pass through any filtration process before collection. The fluoride content was analyzed in total 15 water samples. This was done using fluoride analysis kit based on the Zirconium xylinol orange method developed by BARC technologies (ORLAB HR - Fluoride Testing Kit). The analysis of fluoride level

in drinking water was done at the food and nutrition laboratory, Department of Nutrition and Dietetics, STET Women's College, Mannargudi. The procedure for fluoride content analysis using ORLAB HR - Fluoride Testing Kit was as follows

The provided test tube (supplied with kit) was filled with 10 ml of collected sample. To that added five drops of reagent 012A. Mixed the contents well and allow it to stand for 4–5 minutes for colour development. The developed colour of the sample was compared with colour comparator chart provided with the kit. The colour chart had readings from 0 ppm to 3 ppm (Range: 0, 0.5, 1.0, 1.5, 2.0, and 3 ppm). Each fluoride level had a separate colour comparator represented on the chart. To eliminate bias, the samples were collected in a labeled sterile container. The labeling was done for five different locations from A to C

The collected data were entered and statistically analyzed using Ms Excel software 2010 software. The mean concentration of fluoride level in water samples from each site was calculated.

## RESULTS AND DISCUSSION

### Water sample

It was observed that the mean concentration of fluoride level in water samples from dam, water purification plant, as well as the five random residential areas was mostly 0.5 mg/L except (1 mg/L = 1 ppm) [Table 1]. The mean concentration of fluoride level was calculated based on the comparison of final color of water samples after mixing with the reagents of ORLAB HR Fluoride Testing Kit- with the color comparator chart provided inside the kit. The fluoride level remained constant throughout from the source till the end consumer.

**Table 1.** The mean concentration of fluoride level (in ppm) from five different locations

S. No.	Location	Total No. of Sample			Mean concentration of fluoride level (in ppm)
		A*	B*	C*	
1	Chettichathram	1	1	-	0.5
2	Koilvenni	1	1	2	0.5
3	Chithiraiyur	1	1	1	0.5
4	Athangudi	1	1	1	0.5
5	Manakarai	1	1	1	0.5

\*A= well B= household ground water C = Public water supply

### Prevalence of dental fluorosis and associated risk factors

The study sample comprised of 50 students (Male = 28; Female = 22) in the age group of 10-45 years. More than half the study sample lived in rural areas. 58% of the study population belonged to the lower socioeconomic strata. Oral hygiene habits were analyzed and it was found that Colgate was the most popular brand of toothpaste. 85% of the studied populace used toothbrushes and majority of them brushed once daily.

Pipe water from ground source was the major source of drinking water for the villages. The source of drinking water for about 60% of the study sample was pipe water and the rest of 40% through ground water. Majority of them had a mixed diet with regular habit of consuming at least weekly once non vegetarian mainly of seafood intake and nearly 78% of them drank up to two glasses of tea/day.

A meager of 3% of them was suffering from hypothyroidism disorder. And 6% of them were having joint pain and muscle ache due to age and weight related disorders.

None of them were noticed for any moderate to severe signs of dental or skeletal form of fluorosis. Few of them of about 19% were noticed with dull and colored tooth due to the tobacco chewing habit.

### CONCLUSION

The mean concentration of fluoride level in water samples from pipe water, ground water and public water distribution plant, in five random residential areas was mostly 0.5 mg/L. There was no effect on fluoride content of water samples before and after application of any treatment (Boiling) to the water used in the residential areas. The observed fluoride level in drinking water from all the sources was less than that of WHO recommendation as well as the Ministry of Health, Government of India. There is low evidence on the fluorine toxicity in the observed area. Although it is not possible to directly establish an underlying association from a study like this with any possible ill health recorded, as the results from this study showed a low level of fluoridated drinking water. Though there are some signs and symptoms observed in this study were partially related to skeletal and dental fluorosis, no conclusive evidence is being attempted to prove as the level of fluoride is low.

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