

Awareness, Knowledge and attitude towards dental fluorosis among the public living in Dharmapuri district, Tamilnadu, India after implementation of fluorosis mitigation project.

*Dr. Kavitha Nanjundan. M.D.S¹, Dr. Balasundaram Ramalingam. M.D.S²

¹ Senior Assistant Professor, Government Dharmapuri Medical college and Hospital, Dharmapuri-636701, Tamilnadu, India.

² Associate Professor, Government Dharmapuri Medical college and Hospital, Dharmapuri-636701, Tamilnadu, India.)

*Corresponding author: Dr. Kavitha Nanjundan. M.D.S

Abstract: A well known endemic fluorosis area Dharmapuri district in Tamilnadu, India with most of the people are suffering from various degrees of skeletal, dental and non skeletal fluorosis, knowledge and attitude towards dental fluorosis necessary in prevention and early intervention after implementation of fluorosis mitigation project were not studied before.

Objective: to study the awareness, knowledge and attitude towards dental fluorosis among Dharmapuri public aged 12-25 years living in Dharmapuri district, Tamilnadu, India after implementation of fluorosis mitigation project.

Methods: A cross-sectional study random sample of 1000 aged 12-25 years. Data of awareness, knowledge and attitude toward dental fluorosis was collected through interview questionnaires.

Result: Among the participants 21% know about the dental fluorosis, 20% know about its signs, 18% believed that it could result from highly fluoridated ground water consumption, 12% aware preventable method. Furthermore, approximately 42% of participants aware of Hogenakkal water supply project. 54% think that project is for water scarcity management, only 7% aware the main reason behind the project is eradication of fluorosis and 52% embarrassed with their teeth colour.

Conclusion: Though Hogenakkal water supply and fluorosis mitigation project implemented in Dharmapuri and Kirshnagiri districts since from 2008, poor knowledge about cause and unaware of prevention methods about dental fluorosis are relatively high in Dharmapuri people will leads to poor quality of life and ultimately failure of this entire mitigation project. So, it's become imperative to provide sustainable and reliable Cauvery river water supply with appropriate extended fluorosis mitigation measures to all the remote areas, may likely to prevent dental fluorosis in future and improve the quality of life.

Keywords: Dental fluorosis, awareness, knowledge, attitude, Dharmapuri, Hogenakkal water supply and fluorosis mitigation project.

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I. Introduction:

Excessive, long term consumption of fluoride (> 1ppm) during the developmental period of teeth results in Dental fluorosis (Moller et al 1970) or mottled enamel (Akpata and Jacso 1976) or opacities (Murray et al 1984) which appears as symmetrically distributed barely noticeable white flecks to confluent pits in enamel and unsightly dark brown stains. When the condition of dental fluorosis is severe, the appearance can cause the esthetic concerns.¹ In 1934 Dean first proposed his classification of dental fluorosis which ranged from questionable, mild, moderate and severe (Fig 1 & 2). Moderate or severe dental fluorosis was unacceptable and can be detrimental to dentition.^{2,3}

Water is the main source of fluoride and other minerals. Severity of fluorosis depends on amount of consumption of high fluoride water. 80% of domestic needs in rural India are met by groundwater.⁴ The global burden of disease due to fluoride in drinking water was estimated by Fewtrell et al in 2006 that in India, about 1,81,97,000 are affected with dental fluorosis and 78,89,000 are affected with skeletal fluorosis.⁵ Dental fluorosis is endemic in 150,000 villages in India. In Tamil Nadu, the high concentration of fluoride in groundwater is found to be in Dharmapuri and Salem district, closely followed by Coimbatore, Madurai, Trichy, Dindugal and Chidambaram district. The districts having low fluoride level are Thirunelveli, Pudukottai, North Arcot, and Ramnad districts.⁶

Dharmapuri and Kirshnagiri districts are well known endemic fluorosis areas of north Tamilnadu, where groundwater is contaminated with high levels of fluoride i.e. 2ppm to 12ppm/ liter. 52% of habitants have excess fluoride and most of the people are suffering from various degrees of skeletal, dental and non skeletal fluorosis.

To combat fluorosis on a large scale, Hogenakkal Water Supply and Fluorosis Mitigation Project by Tamilnadu Water supply and Drainage Board by the government of India implemented in 2008.⁵ Though district level fluorosis prevalence study on school children and on adults by household health survey, school teachers and doctors training, awareness campaign conducted and optimum fluoride Cauvery river water provided through this project, fluorosis oriented health awareness at public level and management of dental fluorosis at hospital level in prevalent cases are not effectively implemented.

So making this mitigation project successful the baseline information is necessary to develop effective training methods for the public. Hence, the study was conducted to determine the baseline dental fluorosis awareness, knowledge and attitude among the general public of Dharmapuri district after implementation of Hogenakkal Water Supply and Fluorosis Mitigation Project.

II. Method:

A cross-sectional study, random sample of 1000 aged 12-25 years school and college students were included. Average fluoride concentration in 57.1% of municipal wells of drinking water was more than 1ppm. The highest fluoride concentration in municipal wells of drinking water 7.5ppm/liter and it was found in Aavarankattur. Awareness, knowledge and attitude were assessed through direct interview with questionnaire in Tamil language (mother tongue) about fluorosis and sources of information, signs, symptoms and causes of dental fluorosis, age and gender predispositions, prevention methods, interest in learning mode, and their preferred mode of learning. The study questionnaire was revised and validated by experts in dental public health specialties. Informed consent was obtained from the participants. Participation in the study was voluntary.



Fig : 1 Grades of Dental fluorosis : a. mild. b. moderate. c. severe.



Fig : 2 Skeletal fluorosis (a & b : knock knee).

III. Results:

The Awareness, knowledge of the people of Dharmapuri about dental fluorosis is illustrated in Table 1. Most of the participants approximately 79% do not know about dental fluorosis, only 21% aware of its signs and symptoms. Furthermore, approximately 82% don't know the cause and 87% don't aware of the prevention methods of dental fluorosis. Just 12% of the participants aware of prevention methods and very few i.e only 5% know about the treatment methodology for dental fluorosis.

Approximately 42% of participants aware of Hogenakkal water supply project, but 54% think that project is for water scarcity management, only 7% aware the main reason behind the project is eradication of fluorosis.

Approximately 68% of participants not satisfied with their colour of the teeth, 52% ashamed/ embarrassed/ worried about their tooth colour and 38% said their teeth colour affects social well being. Furthermore 73% showed interest in learning about dental fluorosis and 55% interested in undergoing treatment for their stained teeth.

Table 1: Awareness, knowledge and attitude about the dental fluorosis & Hogenakkal water supply and fluorosis mitigation project among 1000 participants.

S.no	Variables	Yes	No
1	I know, what dental fluorosis is.	211 (21%)	789 (79%)
2	I know how the fluorosis tooth will appear, (i.e. white opaque patches to brown pits)	204 (20%)	796 (80%)
3	I know what are the causes for dental fluorosis	182 (18%)	818 (82%)
4	I know how to prevent dental fluorosis	126 (12%)	874 (87%)
5	I know the treatment methods for dental fluorosis (i.e. bleaching, veneering & crown)	54 (5%)	946 (95%)
6	I know about Hogenakkal water supply and fluorosis mitigation project.	423 (42%)	577 (58%)
7	I know about Hogenakkal water supply and fluorosis mitigation project is for fluorosis eradication.	74 (7%)	926 (93%)
8	I know about Hogenakkal water supply and fluorosis mitigation project is for the management of water scarcity.	543 (54%)	457 (46%)
9	I use Cauvery river (Hoggenakkal) water for cooking and drinking now.	348 (35%)	652 (65%)
10	I am satisfied with the colour of my teeth	323 (32%)	677 (68%)
11	I am ashamed/ embarrassed/ worried about your tooth colour	523 (52%)	477 (48%)
12	My teeth colour affects my social wellbeing.	380 (38%)	620 (62%)
13	I am interested in learning about fluorosis.	729 (73%)	271 (27%)
14	I am interested to undergo treatment for my yellow or brown stains.	550(55%)	450(45%)

Table 2 illustrates all the participants in this study were 62% school and 38% college students of 12-25years. Among that 42% were males and 58% participants were females.

Table 2 : Demographic characteristics of the participants.

Age	Gender		Total (n)
	Male	Female	
12-18	258	361	619
18-25	164	217	381
Total (n)	422	578	1000
(n) %	42%	58%	

IV. Discussion:

Fluoride (F) is probably an essential element (less than 1ppm F/ liter) for both animals and humans. Fluoride & Iodine is often called as a double edged sword. Because prolonged ingestion of fluorides through drinking water in excess of the daily requirement is associated with dental (1-2ppm F/liter) and skeletal fluorosis (2-6ppm F/liter) and inadequate intake with dental caries. Crippling skeletal Fluorosis develops when drinking water contains over 10ppmF/ liter.

More than 90% of the rural Indian population uses groundwater for domestic purposes. Dental fluorosis is a not only a cosmetic problem that impairs social well being, and also affects the oral health related quality of life. The maintenance of oral health requires an informed public as well as self-awareness of the disease to motivate the sufferer into play role in the prevention and control of the disease through self-care and professional assistance.

Government also has a key role to play in control of fluorosis. One such project i.e. Hogenakkal Integrated Drinking Water Project for fluorosis mitigation has been undertaken by Govt. of Tamil Nadu, with funding from Japan Bank for International Cooperation (JBIC) using TamilNadu's share of Cauvery river water. Dentists as well as public health dentists are at the center of this problem. Dentists, who come across fluorosis patients in their routine clinical practices, can educate and motivate these people to adapt to practices regarding safe drinking water.⁷

As of 2006, 2.98 million live in Krishnagiri and Dharmapuri Districts, located in North West of Tamil Nadu, which are the two areas targeted by this project, and about 1.1 million are living below the poverty line there. Despite the increasing demand for water due to population growth, because of the less annual rainfall in the two districts at 815 mm than the national average (1,170 mm) and the average for Tamil Nadu (977 mm) and no surface water usable all year round, people are forced to use more groundwater than they should, resulting in depletion of groundwater and chronic surface water shortages. Also, a large amount of fluoride, which is harmful to the human body, is contained in the rock ground that forms the Deccan Plateau and is transferred to the groundwater, and when people drink the groundwater contaminated by fluoride, they often suffer from such

forms of dental fluorosis and skeletal fluorosis. Supplying safe surface water by drawing water from a point of Hogenakkal in Cauvery River, 45 km from Dharmapuri, was the urgently needed to solve the problem of water shortage and contamination of drinking water by fluoride. Thus this project is highly necessary and relevant.

The prevalence of overall dental mottling among the total population ranged from a low of 17% in Vellore district to a high of 36% in Dharmapuri district. The prevalence of dental fluorosis expressed high in the districts with high mean fluoride level, no strong association was noted between the fluoride content and prevalence of dental fluorosis. This may be due to heterogeneous nature of the population, in terms of differences in socio-economic status and dietary habits like consumption of "Ragi" millet (rich in calcium) by the population in the district of Krishnagiri. Variations in intake of foods like Jowar, Ragi and milk are known to alter the clinical manifestations of fluorosis.⁸

The results of the present study showed that only 21% of the subjects were aware of the term dental fluorosis an 12% subjects aware of prevention method, 7% only know eradication of fluorosis is the main motive behind the Hogenakkal water supply and water supply and fluorosis mitigation project. Because of the poor or no knowledge of dental fluorosis among the public 52% embarrassed with the colour of teeth and cover the teeth while smile.

From this study results, though Hogenakkal water supply and fluorosis mitigation project implemented in Dharmapuri and Kirshnagiri districts, there existed a poor awareness of etiology, age and gender predispositions, manifestation, complications, and the preventable nature of dental fluorosis among the participants. Most of the participants aware of some salt in ground water, less aware of excessive fluoride, dental fluorosis and come from low socioeconomic family considered it as an aesthetic problem caused by some food. This clearly indicates that it's the time for the health department of Tamilnadu should take over this mitigation part of this project from the hands of Tamilnadu water supply and drainage board. The dissemination and education about dental fluorosis are urgently needed and that should be tailored to reach this population to make this mitigation project successful.

The expressed interest in learning about dental fluorosis by the majority of the participants is an opportunity that should be tapped by the dental surgeons to improve their knowledge, clarify misbelieves and motivate them into committed participation, and involvement in maintenance of health.

The most preferred methods of learning about the fluorosis identified as multimedia ads, talk shows, street play, and facebook, whatsapp memes, twitter should be employed to achieve an optimal result. The knowledge about sources of fluoride and its effect on dental fluorosis should be introduced in the children's education system because of the magnitude of the problem.⁹ The Rajasthan Government has added a chapter on Fluorosis mitigation in the curriculum of Class VIII students. Government should make way for public private partnership in the process of mitigation.⁷

It is clear that establishment of water quality standard of 1.0 to 1.5mg/L for fluoride consumption through drinking water alone is not enough to mitigate the adverse health effects of fluoride. Literature provides convincing evidence to justify the important role of malnutrition and dietary habits on severity of fluorosis. Jolly et al in 1974 highlighted the role of nutritional factors relative to different clinical patterns of fluorosis seen in India.⁵

V. Preventive Measures:

1. Even though various defluoridation techniques for ground water exist, providing fluoride free surface water (Cauvery) through Hogenakkal water project will give long time benefit for the people of Dharmapuri. In addition, effective communications through mass social media talk shows, ads, dramas, whatsapp and facebook memes etc to make the patient understand the importance of using fluoride free water for drinking and cooking.
2. Dietary Habits: To change the Dietary habits to exclude fluoride rich foods and to avoid usage of fluoride containing drugs and cosmetics and to change their routine habits of chewing, paan, areca nut, tobacco...etc. To avoid black rock salt smeared pickles, canned fish, preserved beverages, black tea without milk, lemon tea, canned juices and fluoride containing tooth paste.
3. Nutritional Supplementation: Usage of calcium and vitamin C & E rich food items will reduce or nullify the toxicity.⁵
4. The use of fluoride degradation agent to fluoride fungi isolated from fluoride contaminated water and soil area, which can be implemented for fluoride degradation in an environmentally safe mode. Fluoride degradation was maximum in *Aspergillus* sp.⁵ from the soil sample of Dharmapuri and minimum in *Rhizopus* sp. from the water sample of Pennagaram.¹⁰
5. Fluorosis starts as early as enamel formation early in utero. Hence all the general public of Dharmapuri must be educated as early as possible about the importance of using optimum fluoride Cauvery river water for cooking and drinking, so that this problem can be prevented in fourth coming generations.

6. Adequate manpower, material power, infrastructure should be provided to combat prevalent dental fluorosis. Continuing health education will have great impact in early detection, prompt treatment and disability limitation of fluorosis.
7. Need for long time follow up studies to ensure utilization of safe level fluoride water by the Dharmapuri and prevention of fluorosis in future.

VI. Conclusion:

Though Hogenakkal water supply and fluorosis mitigation project implemented in Dharmapuri and Kirshnagiri districts since from 2008, poor knowledge about cause and unaware of prevention methods about dental fluorosis are relatively high in Dharmapuri people will leads to poor quality of life and ultimately failure of this entire mitigation project. So, it's become imperative to provide sustainable and reliable Cauvery river water supply with appropriate extended fluorosis mitigation measures to all the remote areas, may likely to prevent dental fluorosis in future and improve the quality of life.

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