

Endemic Fluorosis in Azhagappapuram Village of Kanyakumari District of Tamil Nadu, India

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A door to door survey was undertaken in the title area to have a first hand information about the intensity of dental and skeletal fluorosis prevailing in the area. Water samples were collected from the non-endemic and endemic areas and analysed for fluoride and other parameters. Relationships between fluoride concentration and fluorosis, fluoride concentration with hardness and alkalinity were also observed.

INTRODUCTION

Endemic fluorosis is a form of chronic fluoride intoxication resulting from ingestion of excessive quantities of fluoride through drinking water, beverages, food etc.

Dental fluorosis was first described by Eager in 1901 among the emigrants from Italy¹ and in 1937 in India.^{2,3} Cases of endemic dental fluorosis have been reported sporadically from almost all the parts of the world.

Dental fluorosis or mottled enamel is a well recognized entity and one of the visible signs of excessive intake of fluoride. Endemic fluorosis had been detected in fifteen states of India, where due to hot climate large quantities of water containing comparatively high levels of fluoride are consumed.⁴

Dental fluorosis is the earliest sign of fluoride toxicity. Prolonged exposure to excessive fluoride may damage the enzyme involved in the processes related to enamel mineralisation. This damage creates porotic teeth susceptible to caries as debris and plaque are entrapped in hypoplastic area.⁵

Any substance able to combine or complex with fluoride and render it insoluble hinders fluoride absorption from the gastrointestinal tract. Thus calcium and magnesium in large amounts reduce the absorption of fluoride owing to the formation of less soluble fluorides. Vitamin C intake also is found to reduce fluoride toxicity.⁶

EXPERIMENTAL

The study has been conducted in Azhagappapuram village of Kanyakumari District, India.

A survey was conducted using a specially designed form to record data regarding age, sex, occupation, source of drinking water, food habits, health complaints etc. The house to house survey and personal interviews covered 311 people belonging to all age groups.

The data collected during survey helped to fix the control area and fluorotic area.

The control area was fixed with respect to water containing low fluoride level. Three fluorotic areas had been fixed with respect to the amount of fluoride in water.

Drinking water sources in this village are mostly bore wells. Water samples from all these sources were analysed for the fluoride content and other chemical parameters such as pH, alkalinity, total hardness, calcium and magnesium.

Fluoride estimation was carried out by calorimetric method using Elico-Fluoride Meter CL-352. Other parameters were analysed by standard procedures.⁷

RESULTS AND DISCUSSION

From the survey, it was found that out of the 311 people interviewed, 234 people were found to be affected by dental fluorosis *i.e.* 75.24% and 25 people were found to be affected by both dental and skeletal fluorosis *i.e.* 8.04%.

During the analysis of drinking water samples it was observed that the mean fluoride value in the control area was below the level prescribed by WHO, *i.e.* less than 1.0 ppm,⁸ whereas in the fluorotic area it was greater than 1.0 ppm.

It was recorded that the mean fluoride value in the fluorotic area I was 1.46 ppm and the extent to which the people exposed to dental fluorosis was 73.46%; in the fluorotic area II, the mean fluorotic value was 2.53 ppm and the extend of dental fluorosis was 77.48%; and in the fluorotic area III, the mean fluoride value was 3.21 ppm and the extent of dental damage was 74.5%.

In the fluorotic area I there was no case of skeletal fluorosis, whereas in the fluorotic areas II and III, 5 and 20 cases *i.e.* 4.6% and 19.6% respectively were found to be affected with skeletal deformities.

The extent of the toxic effect of fluoride on human beings largely depends upon the fluoride concentration in the drinking water. The severity of the disease on the above said area could be explained on the basis of fluoride level in the drinking water.

Since the fluoride value in fluorotic area III was higher than the other two areas, it was exposed to higher degree of skeletal fluorosis.

Relationship between fluoride and alkalinity

It was found that with the increase in alkalinity, the fluoride concentration also increases. alkalinity was usually related to both the incidences of fluorosis (dental and skeletal) and severity of symptoms.

In the fluorotic areas I, II and III the mean alkalinity levels were 276.3, 339.5 and 422.2 ppm respectively.

According to a report by Rajalakshmi *et al.*⁹ the mean fluoride value, alkalinity and incidence of skeletal fluorosis at Nalgonda District in Andhra Pradesh were 4.8, 6.9, 7.8 ppm; 536, 530, 720 ppm and 32.5, 35 and 71.6% respectively.

With the increase in the mean fluoride value and with no reasonable change in alkalinity, the incidence of skeletal fluorosis also varied.

In the present study also the same type of findings were observed.

Relationship between fluoride level and total hardness

It was observed that with the decrease in total hardness, the fluoride concentra-

tion in water increases. The levels of total hardness in the three fluorotic areas were 204.62, 153.66 and 142.59 ppm respectively.

It is in agreement with many reports^{10,11}. Generally fluoridated water is associated with low hardness.

Relationship between fluoride level and calcium and magnesium hardness

During water containing high fluoride level associates with low calcium and magnesium. The level of magnesium is always higher than calcium. The levels of calcium in the three fluorotic areas were 84.56, 54.56 and 53.14 ppm respectively. The level of magnesium was 120.06, 99.10 and 84.45 ppm respectively. It also very well agrees with earlier studies.¹⁰

Conclusion

The survey revealed the prevalence of fluorosis in the area. The intensity of the disease is related to fluoride concentration in the drinking water. Despite slight changes in the fluoride concentration, the significant increase in alkalinity enhances the intensity of fluorosis, that is both dental and skeletal. It was also observed that as fluoride concentration increases, the hardness decreases (both calcium and magnesium hardness).

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