

Study of Fluorosis in Kavalkinaru Village of Nellai Kattabomman District of Tamilnadu, India

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The drinking water naturally contains excess of fluoride ion in the villages of Kavalkinaru Panchayat. As an outcome it affects the teeth of the people residing in these areas. Monthly changes in physico-chemical parameters such as temperature, pH, alkalinity, fluoride ion concentration, total hardness, calcium and magnesium were recorded by collecting twenty five samples of drinking water in these areas.

INTRODUCTION

Dental fluorosis and skeletal fluorosis are caused by excessive intake of fluoride ion in drinking water which are serious public health problems in many areas of the world.¹

Dental fluorosis has been reported sporadically from almost all parts of the world. In India this phenomenon is confirmed mainly in fifteen states. Andhra Pradesh, Punjab, Haryana, Rajasthan, Gujarat, Tamilnadu, Karnataka and Uttar Pradesh are highly affected among the fifteen states.^{2, 3}

Drinking water is considered to be the main source of fluorides and standards are fixed by various authorities for the permissible limit of fluorides. Fluoride in drinking water causing dental and skeletal fluorosis has been found through many surveys of villages in Vallioor block of Nellai Kattabomman District.

The authors are the first to study the extent of fluorosis attack in these villages, say Ganapathipuram, Perianayakipuram, Leppaikudieruppu and Kavalkinaru Panchayat.

EXPERIMENTAL

Situated in Nellai Kattabomman District, Kavalkinaru Panchayat is bounded by Vadakkankulam, Perungudi, Thandaiyarkulam and National Highways No. 7 on South-East, East, North and West respectively. All the villages under study are depending on ground water for drinking purpose. Collected in high density polythene bottles, twenty one samples of drinking water from all the four fluorotic areas and four samples from control area were analysed for fluoride content by using Fluorimeter Elico CL 352, working under the principle of colorimetry. During collection, the temperature of those areas was measured by 110°C thermometer. Physico-chemical parameters such as pH, total hardness, calcium, magnesium and alkalinity in drinking water were determined by way of pH-metry, complexometric^{4, 5} and usual titration methods respectively.

RESULTS AND DISCUSSION

Despite the closeness of every village to one another, the surveyed water

sources in these villages contained different amounts of fluoride. Wide variations have been observed in the distribution of fluoride in the endemic areas in Kavalkinaru Panchayat ranging from 1.1–6.4 ppm in water. On examination, it was revealed that dental and skeletal fluorosis in varying degrees of severity could be associated not only with the fluoride level in drinking water but also with alkalinity.⁶

On analysis of the problem, the economically backward people of these villages have been affected much by dental fluorosis and by skeletal fluorosis in some cases. The chemical analysis of the drinking water is presented in Table-1

TABLE-1
CHEMICAL ANALYSIS OF DRINKING WATER

Description of sources from which it was collected	Sample number	Fluoride ppm	pH	Alkalinity ppm	Total hardness	Calcium ppm	Magnesium ppm
FLUOROTIC AREA I							
Water from public well	1	2.0	7.72	365.850	265.66	148.0	117.66
Water from public bore well	2	2.3	7.52	501.621	240.83	141.66	105.83
FLUOROTIC AREA II							
Water from public well	3	2.36	7.55	823.569	248.330	140.66	107.66
Well water from Iruthyaraj' garden	4	2.63	7.67	871.536	192.330	109.00	83.33
Well water from Duraipandi's garden	5	4.51	7.76	845.520	183.166	105.66	77.50
FLUOROTIC AREA III							
Bore well water from Jeya Raj's garden	6	1.51	7.62	383.736	590.00	402.66	187.33
Water from public hand pump near bus stop	7	1.65	7.52	496.721	132.00	82.66	49.33
Bore well from Gandhi's house	8	1.85	7.09	399.183	1453.83	1143.16	310.66
Bore well from Muthu's garden	9	1.90	7.57	439.833	554.83	360.66	194.16
Water from hand pump, eastern side of Govt. High School	10	2.11	7.39	452.028	152.50	115.66	36.83
Bore well water from Rathinasamy's house	11	2.65	7.55	673.994	577.50	384.00	193.50
Water from hand pump, western side of High School	12	2.85	7.46	544.063	381.00	253.00	128.00
Well water near St. Antony's Church	13	3.0	7.59	529.263	460.66	332.33	128.33

Description of sources from which it was collected	Sample number	Fluoride ppm	pH	Alkalinity ppm	Total hardness	Calcium ppm	Magnesium ppm
FLUOROTIC AREA IV							
Bore well water from Iyyapalam's house	14	2.36	7.64	596.742	534.66	370.33	165.00
Well water from Rathinasamy's garden	15	2.61	7.73	634.140	213.50	123.33	90.16
Well water from Amman temple	16	2.76	7.89	599.107	369.50	235.00	134.50
Bore well water from Rajadurai's house	17	2.81	7.91	562.592	449.66	271.33	177.50
Bore well water from Ramaswamy's house	18	2.90	7.79	608.937	671.66	504.66	167.00
Bore well water from Ramanathan's house	19	3.06	7.71	773.163	205.83	110.66	95.16
Water from public hand pump	20	3.51	7.89	642.270	219.66	102.33	117.33
Bore well water from Arumai Nayagam's house	21	4.38	8.32	689.820	157.66	92.33	65.33
CONTROL AREA V							
Public hand pump, southern side of Kavalkinaru outer	22	0.35	7.04	268.250	264.66	190.66	74.00
Bore well water from Femi Printers	23	0.56	7.55	321.948	265.66	194.00	71.66
CONTROL AREA VI							
Well water from Fatimagiri Ashram	24	0.51	7.92	257.721	89.33	59.00	30.33
Well water from Luthern Church	25	0.60	7.70	246.339	101.83	51.66	50.16

According to the investigations of Teotia *et al.*³ with increasing content of fluoride in water, there was an increase in alkalinity but a decrease in hardness and decrease in concentrations of calcium and magnesium. This result confirmed the author's finding that whenever fluoride level becomes higher, the water becomes more alkaline and softer also. Increase in alkalinity is associated with higher degrees of mottling at identical concentration of fluoride. Besides the fluoride concentration of drinking water, the degree of skeletal fluorosis is correlated with the calcium content and alkalinity of water. The deficiency of calcium and alkalinity in water leads to fluoride toxicity.

In these villages the daily intake of fluoride depends on^{3,8}

- (i) Concentration of fluoride in drinking water.
- (ii) Total intake of water per day.

The amount of water ingested itself depends upon a number of variables such as body size, food habit, environmental temperature and extent of physical

activity. Hot climate and sweating promote increased consumption of large quantity of water.

Fluoride concentrations in drinking water ranging between 1 ppm and 5 ppm cause 'mottled enamel' in teeth and above 5 ppm cause skeletal fluorosis.⁴ This applies to the village under investigation. Despite the concentrations of fluoride in the range of 1 ppm to 5 ppm in Kavalkinaru and Ganapathiapuram 61.66% and 55.9% of people respectively have been affected with dental fluorosis. In Leppaikudieruppu and Periyannayakipuram where the fluoride concentrations are above 5 ppm, 67% and 56.62% of people respectively have been affected with dental and traces of skeletal fluorosis.

Conclusion

1 ppm of fluoride present in drinking water has been found to be the safe limit prescribed by Indian Council of Medical Research and Committee on Public Health Engineering Manual and Code of Practice. In Kavalkinaru Panchayat, fluoride concentration in drinking water is ranging between 1.1 ppm and 6.4 ppm. This causes dental and traces of skeletal fluorosis.

In view of preventing these health problems it is suggested that the drinking water of the fluorotic villages may be boiled with carbon powder, cooled and then filtered. The filtered water may be consumed so that the fluoride content is slightly decreased.⁹ Another way to prevent the dental fluorosis is to consume water derived from control areas, where fluoride concentration is less than 1 ppm.

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