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Fluorosis in Vallioor Union of Tirunelveli District, Tamilnadu, India

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Abnormal level of fluoride in ground water causes serious health hazards in human beings. The excessive intake of fluoride ion beyond the prescribed limit leads to dental and skeletal fluorosis. Fluorosis is a well defined clinical entity caused by ingesting excessive amount of fluoride, characterised by dental mottling, skeletal and other non-skeletal manifestations. This study reveals the fact that occurrence of fluoride is highly sporadic and localized in southern part of Vallioor Union of Tirunelveli District and the concentration of fluoride varies from 1.45 ppm to 5.37 ppm and it also shows the percentage of people affected by fluorosis.

INTRODUCTION

Ground water is an important resource for mankind's livelihood and his economic development. Due to the scarcity of surface water, the people of Vallioor Union have to depend on ground water resources to a larger extent. Ground water is the only resource for drinking and agricultural purposes in these regions. The drinking water naturally contains excess of fluoride ion in southern part of the villages of Vallioor Union.

The incidence and severity of fluorosis is related to the fluoride content in various components of environment, *viz.*, air, soil and water. Out of these, water particularly ground water is the major contributor to the problem[1]. The presence of fluoride in water and food is almost a universal phenomenon and therefore its intake in the diet virtually becomes inevitable[2].

Dental fluorosis or mottled enamel was first reported by Eager[3] in 1901, skeletal involvement owing to fluoride was reported by Moller and Gudjonsson[4]. Roholm[5] described industrial fluorosis in 1937. At the same time an attempt was made in India first by Shortt *et al.*[6] to describe skeletal fluorosis because of excessive intake of drinking water containing fluoride.

The toxicity of fluoride is also influenced by high ambient temperature, alkalinity, calcium and magnesium contents in the drinking water[6].

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EXPERIMENTAL

In view of finding out the total percentage of people affected by fluorosis, firstly a house to house survey in the villages comprising a strength of about 14,200 population was conducted by means of a specially prepared questionnaire. All the residents were brought under a thorough clinical investigation which was recorded in proforma sheets. Accordingly, evidence of dental mottling and traces of skeletal fluorosis were found. Secondly by using Orion ion selective electrode the concentration of fluoride in drinking water was determined. Alkalinity, calcium and magnesium were determined by the titration methods.

RESULTS AND DISCUSSION

The survey revealed that above 50% of people in these areas were affected by dental fluorosis. As the people residing at these villages are economically poor, they consume only the vegetables, fruits, food grains and water available within their localities. In consequence of this, there is the possibility of high prevalence of dental and skeletal fluorosis in the food items consumed by the economically poor residents of this area.

Table-1 explains the total number of people and percentage of people affected by fluorosis.

Table-2 reports the findings about the concentrations of fluoride, alkalinity, calcium and magnesium in ppm in the samples of drinking water. Alkalinity in all water samples ranges from 86.790 ppm to 499.043 ppm. The amount of calcium in all samples of water ranges from 55 ppm to 1705 ppm. Magnesium in all water samples ranges from 1.22 ppm to 68.32 ppm. On experimental analysis it is found that the concentrations of fluoride, alkalinity, calcium and magnesium are in higher values than prescribed by Indian Stardards Specification for drinking water[7].

Fluoride concentrations in drinking water ranging between 1 ppm and 5 ppm cause mottled enamel in teeth and in the case of exceeding the above range, the concentrations cause skeletal fluorosis. This range is applicable to the villages under investigation also. The concentrations of fluoride in these villages are in the range of 1.45 ppm to 5.37 ppm and so more than 50% of the people here have been affected with dental fluorosis and traces of skeletal fluorosis.

Conclusion

It is a common phenomenon that the intake of drinking water containing above 1 ppm and below 5 ppm fluoride leads to dental fluorosis and above 5 ppm leads to skeletal fluorosis. This is evident in the areas under study. Soochikulam is the village affected by fluorosis at the maximum level with 75.38% of people. Whereas Sanganapuram is affected by the same at the minimum level with 38.29% of people. The cases of skeletal fluorosis are rare in the areas under investigation. Since the drinking water contains appreciable amount of fluoride in these areas, the people were heavily affected by dental fluorosis.

TABLE-1
PRELIMINARY SURVEY REPORT OF FLUOROTIC VILLAGES

Sl. No.	Names of the villages surveyed	Total number of people surveyed	Total number of people affected by fluorosis	% of people affected	Total number of males affected	% of males affected	Total number of females affected	% of females affected
1.	Sivagamipuram	313	159	50.80	70	23.00	83	27.80
2.	Rajiv Gandhi Nagar	148	65	43.92	33	22.30	32	21.62
3.	Leppaikudieruppu	597	368	61.64	201	33.67	167	27.97
4.	Periyanayakipuram	342	180	52.63	84	25.56	96	28.07
5.	Ganapathiapuram	176	98	55.68	43	24.43	55	31.25
6.	Alagianambiyapuram	280	146	52.14	69	24.64	77	27.50
7.	Kavalkinaru puthoor	429	217	50.58	102	23.78	115	26.80
8.	Kavalkinaru devakottai	190	73	38.42	44	23.16	29	15.26
9.	Kavalkinaru	1080	651	60.28	312	28.89	339	31.39
10.	Perunkaliapuram	129	61	47.29	36	27.91	25	19.38
11.	North Perungudi	261	126	48.28	64	24.52	62	23.76
12.	South Perungudi	205	76	37.07	32	15.61	44	21.46
13.	Shunmugapuram	54	21	38.89	9	16.67	12	22.22
14.	Sounderlingapuram	425	243	57.18	110	25.88	133	31.30
15.	Avaraikulam	1120	588	52.50	317	28.30	271	24.20
16.	Sivagnanapuram	270	106	39.26	47	17.41	59	21.85
17.	Ambalavanapuram	547	243	44.42	131	23.95	112	20.47

Sl. No.	Names of the villages surveyed	Total number of people surveyed	Total number of people affected by fluorosis	% of people affected	Total number of males affected	% of males affected	Total number of females affected	% of females affected
18.	Pillaiyarkudieruppu	313	136	43.45	62	18.81	74	23.64
19.	Adankarkulam	358	247	68.99	127	35.47	120	33.52
20.	Uralvoymoli	486	298	61.32	148	30.46	150	30.86
21.	Uralvoymoli Colony	127	79	62.20	40	31.50	39	30.70
22.	Soochikulam	130	98	75.38	50	38.46	48	36.92
23.	Kelkulam	319	174	54.54	90	28.21	84	26.33
24.	Kelkulam Colony	55	25	45.45	14	25.45	11	20.00
25.	Marankulam	248	162	65.32	75	30.24	87	35.08
26.	Kottankulam	113	75	66.37	39	34.51	36	31.86
27.	Perumanal	475	297	62.53	169	35.58	128	26.95
28.	Srirenganarayanapuram	455	182	40.00	101	22.20	81	17.80
29.	Chettikulam pudumanai	414	183	44.20	87	21.01	96	23.19
30.	Chettikulam	1505	826	54.88	384	25.51	442	29.37
31.	Sanganapuram	645	247	38.29	119	18.45	128	19.84
32.	Palavoor	154	89	57.79	42	27.27	47	30.52
33.	KC Palavoor	322	175	54.35	89	27.64	86	26.71
34.	KC Palavoor Colony	98	48	48.98	20	20.41	28	28.57
35.	Terkku Karunkulam	451	247	54.77	121	26.83	126	27.94
36.	Madanpillaitharmam	931	468	50.21	239	25.64	229	24.57

TABLE-2
CONCENTRATIONS OF FLUORIDE, ALKALINITY, CALCIUM AND MAGNESIUM IN PPM OF DRINKING WATER SAMPLES

Sample No.	Fluoride (ppm)	Alkalinity (ppm)	Calcium (ppm)	Magnesium (ppm)
1.	3.53	499.043	110	4.88
2.	2.78	433.950	115	3.66
3.	3.79	347.160	90	4.88
4.	4.66	412.253	110	6.10
5.	4.87	260.370	140	9.76
6.	4.47	238.673	175	6.10
7.	3.22	195.278	500	19.52
8.	2.56	325.463	125	6.10
9.	3.01	151.883	130	2.44
10.	3.91	282.068	1060	31.72
11.	4.76	303.765	175	3.66
12.	3.79	151.883	705	35.38
13.	4.31	412.253	395	10.98
14.	4.24	238.673	520	9.76
15.	3.37	173.580	1705	50.02
16.	3.86	86.790	1130	68.32
17.	4.58	303.765	330	12.20
18.	3.41	282.068	135	6.10
19.	3.68	325.463	165	4.88
20.	4.10	108.488	60	4.88
21.	4.48	130.185	70	1.22
22.	2.34	282.068	75	1.22
23.	2.72	260.370	55	2.44
24.	2.86	216.975	55	3.66
25.	3.55	260.370	720	19.52
26.	3.51	238.673	160	41.48
27.	3.86	108.488	265	13.42
28.	4.52	325.463	150	14.64
29.	1.45	303.765	85	6.10
30.	2.62	260.370	255	17.08
31.	5.37	282.068	1080	8.54
32.	2.56	347.160	215	6.10
33.	4.11	173.580	110	7.32
34.	3.29	195.278	110	6.10
35.	2.75	368.858	295	12.20
36.	3.22	390.555	360	19.52

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