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C Vellathurai
Department of Chemistry, Sankar Polytechnic College, Tirunelveli – 627357

P Sri Renganathan
Department of Chemistry, Rani Anna Govt. College for Women, Tirunelveli -627008

V Selvaraj
Department of Chemistry, Morning Star Polytechnic College, Nagercoil - 629003

Correspondence
P Sri Renganathan
Department of Chemistry, Rani Anna Govt. College for Women, Tirunelveli -627008

Severity of dental fluorosis in association with socio - economic status among middle school children in Sivagiri taluk, Tirunelveli district, Tamilnadu, India

C Vellathurai, P Sri Renganathan, V Selvaraj

Abstract
To estimate the prevalence of dental fluorosis and socio - economic status of middle school children in the study area. A cross sectional survey was carried out on school children of sixth to eighth standard in Sivagiri taluk. Proportion of dental fluorosis was calculated by severity, gender and locality of school children using Dean's index. Out of 3632 children examined, 969 (26.68%) were affected by dental fluorosis. To identify water sources having fluoride levels beyond permissible limits and formulate guidelines to reduce exploitation of ground water.

Keywords: Dental fluorosis, Severity, Dean's index, Skeletal, Fluoride and Water

Introduction
Almost three fourth of the earth's surface is covered by water. But only 0.6% of water is available to us for drinking, domestic and agricultural purposes. Quality drinking water is very essential to human beings and other life forms. Access to safe drinking water has improved over the last decade in almost all parts of the world. But still one billion people lack access to safe drinking water. Drinking water contains many ions. Of these, fluoride is an important one. It has no colour but distinct bitter taste. Fluoride enters naturally into the environment due to the dissolution of sodium fluoride and fluoro silicates, by the anthropogenic activities of human beings and also through effluents from industries [1, 2]. It is present in the environment as fluorite (CaF_2 with small impurities) and fluorides [3]. Nearly 12 million of 18 million tons of fluoride deposits in the earth's crust is found in India [4, 5].
Fresh water contains 0.01 to 0.3mg/L of fluoride. Sea water contains fluoride in the range of 0.86 to 1.4 mg/L and an average of 1.1mg/L. The main dietary source of fluoride is drinking water. Fluoride in drinking water in India varies from 0.5 to 20mg/L [6]. Fluoride is an essential micronutrient for the health of an individual. Its deficiency leads to dental cavity and excess consumption results in health problems like dental and skeletal fluorosis [7]. Drinking water with more than 6mg/L fluoride results in multi- dimensional health manifestations like dental and skeletal fluorosis [8]. These problems are more acute in rural and urban communities particularly in third world countries [9]. Optimal carioprotective fluoride content in drinking water is approximately 1mg/L in temperate climate. In tropical countries where intake of water is more, desirable fluoride content of drinking water may be 0.5mg/L. The permissible and safe limit of fluoride in drinking water is 1mg/L in India and 1.5mg/L in the U.S. About 50% villages in India have more than 1mg/L fluoride in drinking water [10]. Prevalence of dental caries and dental fluorosis and its relation to fluoride in drinking water have been studied in many parts of India [11-13].
The aim of this study was to assess the prevalence and severity of dental fluorosis in a group of school children in association with their socio-economic status and locality [14] in Sivagiri Taluk, Tirunelveli District, Tamil Nadu in India. Sivagiri Taluk is located at 9.33^0 N and 77.43^0E with the elevation of 165meter. It includes a municipality, three townships and many village panchayats. Sivagiri Taluk has a population of two lakhs with 99,000 males and 1, 01,000 females. It has a literacy rate of 67.47%. Most of the students in this area were from educationally and economically backward families.

2. Materials and Methods

Drinking water and ground water samples were collected from 25 locations and tested for various factors including fluoride.

A pilot survey was conducted in Sivagiri taluk of Tirunelveli district pertaining to dental fluorosis. A pre-designed questionnaire was prepared to collect information from the school children. Dental examination was carried out with the help of teachers in broad day light to identify the severity of dental fluorosis. CFI was calculated using the individual scores and total sample size using Dean's index.

The survey was carried out between October 2013 and March 2014 among middle school children (age group 10-13) who were studying in five government schools and seven government aided schools. In this survey boys and girls were examined and interviewed.

3. Results

The survey revealed that out of 2774 middle school children studying in government aided schools (boys 1350 and girls 1424), 741 (26.71%) and in government schools (boys 457 and girls 401), 228 (26.57%) were affected by dental fluorosis. The prevalence is more in the northern part of the study area (30-43%) and less in the southern part (<10%). Overall prevalence of dental fluorosis was found to be almost equal in case of govt. aided (26.71%) and govt. schools (26.57%).This is shown in Figure: 1.

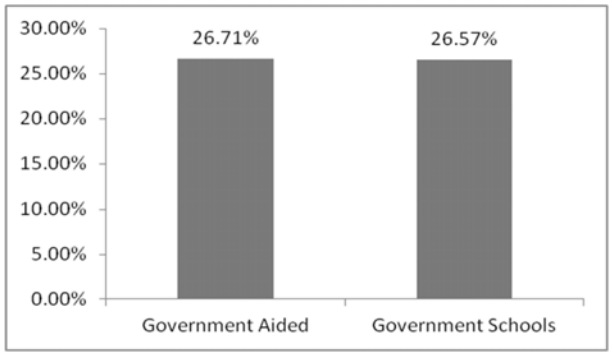

Fig 1: Prevalence of Fluorosis in schools

It was also observed that out of 969 children who were affected by dental fluorosis, 569 were boys (15.67%) and 400 were girls (11.01%). This is shown in Figure: 2

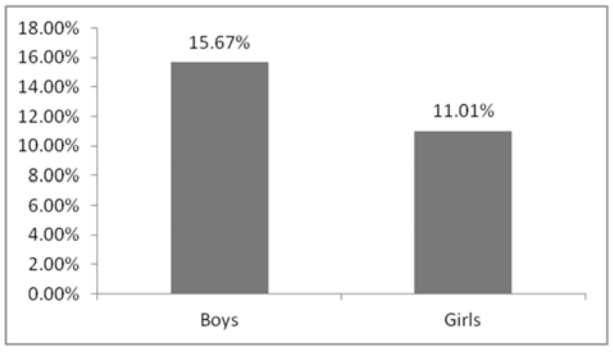

Fig 2: Prevalence of Fluorosis in endemic area

Of 569 boys, 440 (59.38%) were from govt. aided schools and 129 (56.58%) were from govt. schools. Of 400 girls, 301 (40.62%) were from govt. aided schools, 99 (43.42%) were from government schools (Table - 1).

It shows that the prevalence of fluorosis is more among boys than girls in both govt. aided and govt. schools. It is attributed to the fact that boys generally take drinking water from multiple sources. In the affected area amount of fluoride varies from 0.56mg/l to 2.53mg/L. The most endemic area was Keelapudur with fluoride 2.53mg/L [15-17]. Out of 25 locations in Sivagiri Taluk, 10 locations have drinking water with more than 1mg/L of fluoride which attributed to the prevalence of dental fluorosis. Most of the students affected by dental fluorosis were from endemic fluoride area with fluoride level around 1.5mg/L.

Among affected (969), the overall prevalence of questionable fluorosis in boys (189) was found to be 19.5%, very mild fluorosis (183)was found to be 18.9%, mild fluorosis (69) was 7.12%, moderate fluorosis (95) was 9.8%, moderately severe (27) was 2.79% and severe fluorosis (6) was 0.62%. This is shown in Figures 3 and 4.

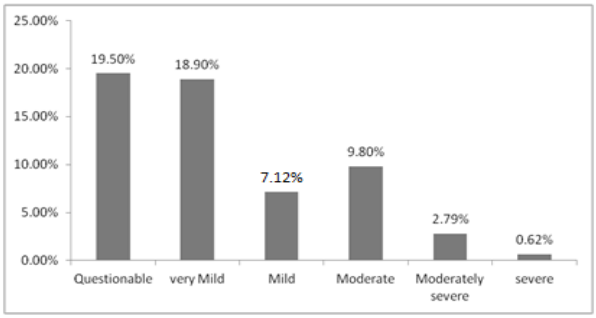

Fig 3: Categories of Fluorosis among Boys

Among girls, the order of fluorosis was 13.72%, 14.96%, 5.37%, 5.78%, 1.44% and 0 % respectively.

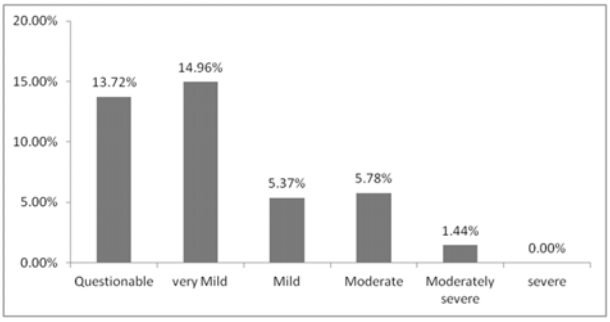

Fig 4: Categories of Fluorosis among Girls

4. Discussion

In this study the prevalence of dental fluorosis was found to be 26.68%. It is very close to findings (31.4%) in rural primary school children of Chidambaram taluk, Tamil Nadu [18, 19] (fluoride level 3.5 mg/L) and close to (36.36%) in school children of rural areas of Udaipur, Rajasthan [20] (fluoride level 1.5 to 4.0 mg/L) It is also in accordance with work done in Alappuzha District, Kerala [21] (Fluoride level 2.6 mg/L).

Prevalence of dental fluorosis among boys in govt. aided and govt. schools was found to be 15.86% and 15.03% and that of girls was 10.85% and 11.54% respectively. It implied that boys have more prevalence than girls in both the cases.

The trend in questionable fluorosis among boys and girls was 21.05% and 14.57% in govt. aided schools. In govt. schools it was 14.47% and 10.96%. Very mild fluorosis in govt. aided schools among boys and girls was 17.14% and 14.98%

and in govt. schools 24.56% and 14.91%. In all these cases, the prevalence is more among boys than girls. The same trend was found in other categories also. But mild dental fluorosis was found to be more among girls (12.28%) than boys (9.65%) in government schools. Severe fluorosis was noted in boys only with minimum prevalence (0.54% and 0.88%) in govt. aided and govt. schools. (Table - 2 and 3).

From the informations collected 99% of the students have same type of food and hygienic habits. But a part of students (southern) had drinking water from a single source (Kottaimalai) with fluoride level less than 1 mg/L. But students with more prevalence of dental fluorosis had drinking water from multiple sources. (Bore well and Panchayat water) with fluoride level 1.5mg/L.

5. Conclusion

The present study gives us an insight into the problem of dental fluorosis among high school children in a rural area of Sivagiri taluk, Tirunelveli district, where fluorosis is a public health problem of 'slight significance'. To overcome the severity of dental fluorosis, defluorinated drinking water is to be supplied to the affected area and also to educate the people to use safe sources of water for drinking. Training camps should be arranged in schools to screen, treat and educate school children, Teachers and Parents. Further studies are also needed to find out any other reasons and to solve the problem.

MIDDLE SCHOOLS

Preliminary Survey Report of Fluorosis (Age group 10-13)

Table - 1 Govt. aided schools

Sl.No	Name of school	Total Surveyed	Boys	Girls	Affected	% of Children affected	Boys	%	Girls	%
1	NCHSS Ramanathapuram	846	490	356	366	43.26	229	27.07	137	16.19
2	NCHSS Puliangudi	794	364	430	82	10.33	41	5.16	41	5.16
3	ST HSS Sivagiri	421	212	209	141	33.49	88	20.9	53	12.59
4	BV HS. Sivagiri	336	156	180	100	29.76	54	16.07	46	13.69
5	KHSS Puliangudi (girls)	153	....	153	11	7.19	.....	....	11	7.19
6	ST HSS Puliangudi	63	42	21	5	7.94	5	7.94	....	....
7	SHS Chinthamani	161	86	75	36	22.36	23	14.28	13	8.07
		2774	**1350**	**1424**	**741**	**26.71%**	**440**	**15.86%**	**301**	**10.85%**

Table -2 Govt. Schools

Sl.No	Name of school	Total Surveyed	Boys	Girls	Affected	% of Children affected	Boys	%	Girls	%
1	GHSS. Vasudevanallur	253	189	64	68	26.88	50	19.76	18	7.11
2	PK. HSS Mullikulam	96	49	47	9	9.37	6	6.25	3	3.12
3	MPT HSS Nelkattumseval	257	119	138	107	41.63	57	22.18	50	19.45
4	GHSS. (Girls) Puliangudi	74	....	74	15	20.27	....	....	15	20.27
5	GHSS Thenmalai	178	100	78	29	16.59	16	8.99	13	7.3
		858	**457**	**401**	**228**	**26.57%**	**129**	**15.03%**	**99**	**11.54%**

Table - 3 Prevalence of various categories of fluorosis

Govt. aided School

Affected		Questionable	very Mild	Mild	Moderate	Moderately severe	severe
741	**Boys 440 (59.38%)**	156 (21.05%)	127 (17.14%)	47 (6.34%)	82 (11.07%)	24 (3.24%)	4 (0.54%)
	Girls 301 (40.62%)	108 (14.57%)	111(14.98%)	24 (3.24%)	46 (6.21%)	12 (1.62%)	.....
Govt. School							
228	**Boys 129 (56.58%)**	33 (14.47%)	56 (24.56%)	22 (9.65%)	13 (5.7%)	3 (1.31%)	2 (0.88%)
	Girls 99 (43.42%)	25(10.96%)	34 (14.91%)	28 (12.28%)	10 (4.38%)	2 (0.87%)	....

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