Bulletin of Environment, Pharmacology and Life Sciences Bull. Env. Pharmacol. Life Sci., Special Issue [1]2022 : 892-895 ©2022 Academy for Environment and Life Sciences, India Online ISSN 2277-1808 Journal's URL:http://www.bepls.com CODEN: BEPLAD ORIGINAL ARTICLE



# Fluoride exposure from groundwater as reflected in children dental fluorosis in the Haryana, India

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### ABSTRACT

Considering the impact of high groundwater fluoride on children health in terms of dental fluorosis, the current study was explored in central parts of Haryana. As per Dean Index, the dental fluorosis prevalence was assessed and observed in 45% school going children. According to gender wise distribution, 469 (50.6%) male students have fluorosis, while 327 (48.6%) female students have fluorosis. More frequency of moderate-severe fluorosis was observed among males as compared to females due to more consumption of fluoride through water, food, dentrifice etc. Locationwise, higher fluorosis affected students (51.5%) observed in Dhani Garn (Hisar), while in Pauli (Rohtak) 31% students (least) have been affected with fluorosis. This may be due to more dependency on groundwater resource for drinking purpose. To fight this epidemic of dental fluorosis, proper management of drinking water resources through treatment of groundwater needs to be implemented by public health authorities. **Keywords:** Dental fluorosis, Epidemic, Groundwater, Health, School children.

Received 21.02.2022

Revised 23.03.2022

Accepted 12.04.2022

## INTRODUCTION

In India, it is estimated that 62 million people including 6 million children are suffering from fluorosis [1]. As per reports of Central Groundwater Board [2]; more than 17 states in India have been identified as endemic for fluorosis and Harvana is one of them. Though fluoride enters the body through food, water. industrial exposure, drugs, cosmetics, etc., drinking water is the major contributor (75-90% of daily intake). World Health Organization (WHO) prescribed drinking water fluoride levels at 0.5 mg/l (optimum) and 1.5 mg/l at the higher end [3]. As per Bureau of Indian Standards 10500 [4] desirable limits of fluoride in drinking water is 1.0 mg/l. But in many study areas concentration of fluoride in ground water is very high and subsequent problem of fluorosis (Table 1). Due to its strong affinity, fluoride is attracted by calcium & potassium in teeth and bones causing dental fluorosis, teeth mottling, skeletal fluorosis and deformation of bones in children as well as in adults [5]. Dental fluorosis, which is characterized by discolored, blackened, mottled or chalky white teeth, is a clear indication of overexposure to fluoride during childhood when the teeth were developing. Whether dental or skeletal, fluorosis is irreversible and no treatment exists [6]. The Hazard Ouotient index with respect to fluorosis among children (55%) and teenagers (32%) was found above safety level [HQ >1] in many regions of world as per Yousefi et al. [7]. Haritash et al [8] observes severe dental fluorosis (44%) among boys compared to girls (29% cases of moderate to severe dental fluorosis) in Bass area of Haryana, India. Hence considering the health hazard of fluorosis among young population, the current study was explored to assess the prevalence of fluorosis in Haryana state, India.

## METHODOLOGY

The study area of Haryana (India) is situated between 27.37' to 30.35' N latitude and 74.28' to 77.36' E longitude. The study was undertaken in 08 sampling sites of central Haryana (Figure 1). Observing the impact of fluorosis on youth, school going children (N = 1600) were assessed for the current work; out of which 783 children belongs to the 8-12 years age-class, 817 related to the age-class of 13-16 years. After gaining due consent from the school's ethics committee and parents of students, a questionnaire based survey was conducted to examine fluorosis. Dental examination was carried in natural sunlight by the investigators in the presence of 2 dental surgeons by adopting WHO (2002) & Dean's Index (1942) [9, 10]

Table 1: Concentration of fluoride in groundwater and dental fluorosis in different regions.							
Sr.	Region	Age group	Fluoride in Drinking	Prevalence of	Reference		
No		(Years)	water (mg/l)	fluorosis (%)			
1	Bahadurgarh (Haryana) India	7-15	1.5 – 3.5	66	Yadav <i>et al</i> , [12]		
2	Jhajjar (Haryana) India	8-15	1.9 - 3.3	58	Kumar et al, [13]		
3	Bass (Haryana) India	15-18	0.1 - 2.4	72	Haritash <i>et al</i> , [8]		
4	Haryana State, India	11-14		30-94	Shyam et al [14]		
5	Central Haryana,		0.19 - 2.87		Bhardwaj P. et al,		
	India				[15]		

methods on the evaluation form prescribed by world health organization (Saravanan *et al*) [11]. The data was further subjected to analysis for gaining statistical significance.



Figure 1: Sampling sites in the map of Haryana state.

# **RESULTS AND DISCUSSION**

The work carried out signifies the impression of fluorosis on young population in the study area. Out of total 1600; 879 students depict no sign of fluorosis while 407 students had questionable fluorosis. 6 students suffer from severe fluorosis, while other school going children were in the category of mild to moderate fluorosis. Age group 13-16 years is more affected as compared to 8-12 years (Table 2). Research work carried out by Del Carmen *et al.* [16] also scrutinizes the fluorosis prevalence enhance with age among young people (12–15 years).

In gender wise distribution, 469 (50.6%) male students suffer from fluorosis, while 327 (48.6%) female students were suffered (Table 3). Male children had more ingestion of fluoride through milk, food and water, hence more frequency of moderate-severe fluorosis is observed among males as compared to females. The results are also favoured by Haritash *et al.* [8]; while observing more urinary fluoride content in boys as compared to girls and observed stronger correlation for boys (0.64) than the girls (0.44) (p-value > 0.01). Further strengthened by studies conducted by Ravi Kiran & Vijaya [17] observing more occurrences in male samples with moderate-severe fluorosis in contrast to female samples. During location wise distribution, Dhani Garn (Hisar) is most affected with 51.5 % cases, while in Pauli (Rohtak) 31% children (least) have been affected with fluorosis (Figure 2). This may be attributed to more groundwater supply (Public health department) for domestic use in Hisar.

In this study, the accurate exposure of the children to drinking water fluoride cannot be measured due to various confounding variables (Milk, Food etc.) hence; it is presumed that ground water sources are major cause for fluorosis with constant fluoride content in the past 10-15 years.

Age Class (Yrs)	Normal	Question- able	Very mild	Mild	Moderate	Severe	Total
08-12	416	212	46	49	58	2	783
							(48.9%)
13-16	463	195	37	57	61	4	817
							(51.1%)
Total	879	407 (25.4%)	83	106	119	6	1600
	(54.9%)		(5.1%)	(6.6%)	(7.4%)	(0.3%)	(100%)

Table 2: Age group-based fluorosis prevalence among school children.

# Table 3: Gender wise Fluorosis presence among school children.

Gender	Dental F	Total (%)	
	Present (%)	Absent (%)	
Boys	469 (50.6)	458 (49.4)	927 (100)
Girls	327 (48.6)	346 (51.4)	673 (100)
Total	796 (49.7)	804 (50.3)	1600 (100)



Figure 2: Location wise distribution of fluorosis cases.

# CONCLUSION

Dental fluorosis pervasiveness in young generation of the study area is primarily concerned with consumption of high fluoride content underground drinking water supplied by public health department. To control this menace, the provision of safe, low fluoride water from alternative sources (surface waterbody) should be ensured as the first option otherwise various defluoridation methods can be employed to mitigate the problem. Groundwater of a source should be thoroughly studied before its use for domestic purposes and accordingly a suitable method can be chosen for its treatment. Public health authorities must take cognizance for eradicating the menace of fluorosis in the affected areas.

## ACKNOWLEDGMENT

The authors would like to thank Er. Sudhir Sharma for his continuous support and encouragement during field studies. Further, authors extend their gratitude to school staff, parents and dentist for their cooperation in this study.

#### **CONFLICT OF INTEREST**

The authors declare that they have no conflict of interest.

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#### **CITATION OF THIS ARTICLE**

Pooja, A Awasthi, J Singh. Fluoride exposure from groundwater as reflected in children dental fluorosis in the Haryana, India. Bull. Env.Pharmacol. Life Sci., Spl Issue [1] 2022: 892-895