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HIGH FLUORIDE LEVELS IN DRINKING WATER: A MAJOR DETRIMENTAL FACTOR AFFECTING HEALTH AND NUTRITIONAL STATUS AMONG SELECT AGE GROUPS OF CHILDREN IN ANANTHAPURAM DISTRICT

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ABSTRACT

Endemic fluorosis in India with dental and skeletal changes was mainly reflected by the ingestion of fluoride in drinking water. Most endemic fluorotic areas affecting the dental and skeletal health of the people since their childhood. This particular threatening issue required much attention to focus on childhood fluorosis and its effects. In view of present scenario, the current study is focused on analysis of fluoride levels in drinking water and the relation on the onset of fluorosis in children. The major source of drinking water in the selected habitats was bore wells. The fluoride content of the selected bore wells recorded to range from 2.4ppm to 5.3ppm which was above the permissible limit of 1.0 ppm. The observations clearly indicated that the children drinking bore well water were affected by 33.8% of dental fluorosis. The results thus obtain pointed out the bare need of preventing fluorosis on war foot basis. The findings of the current study highlighted the necessity of bringing awareness on the measures to minimize the fluorosis in the endemic areas and to bring healthy children to the society.

KEY WORDS

Endemic fluorosis, Childhood fluorosis effects, Fluoride content and Analysis of fluoride levels in drinking water.

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INTRODUCTION

Fluorosis is an endemic problem in India. Despite determine efforts, a large population still has no alternative but to drink water with high fluoride content. Endemic fluorosis has been recognize as a major public health problem in 18 states out of 33 constituents states and Union territories in India[1], around 62 million people including 6 million children suffer from flluorosis due to excessive

consumption of fluoride through water[2]. The effects are particularly evident in the bone deformation of children.

Even in areas where deflurodization was adopted, a large population had already developed toxic effects considered irreversible. Excessive fluoride intake causes fluorosis, paraplegia, arthritis, and other diseases[3,4]. Especially, children suffer from dental fluorosis and various skeletal deformities like genu valgum, genu varam, antero posterior bowing of tibia, and widening of the lower ends of long bones at the wrist.

Andhra Pradesh is one of the states severely affected with excess fluoride and salinity in ground water. Ananthapuram is one such district which is highly affected with fluorosis. The present study was undertaken to assess the fluoride status of people living in fluorotic area and to estimate the prevalence of dental and skeletal fluorosis in the selected fluorotic area of Gubanapalli, E. Kodipalli of Kalyandurgmandal, and Brahmasamudram and Y. Kondapuram villages of Brahmasamudrammandal of Ananthapuram district in Andhra Pradesh, India.

METHODOLOGY

Gubanapalli, E. Kodipalli, Brahmasamudram and Y. Kondapuram villages of Ananthapuram district were purposively selected as the villages reported as high endemic areas. Children in the age range of 7 to 15 years constituted the sample of the study. The sample size comprised of one thousand and eight children of different age groups *viz.*, 7-9, 10-12, and 13-15 years.

Water samples were collected from the drinking water sources from the selected village. The analysis for the fluoride level made by auto analyzer using a spectrophotometric method[5].

The presence of dental and skeletal fluorosis was done based on the symptoms as indicative of dental and skeletal fluorosis on detailed. The subjects were distributed into different categories depending on the degree of severity of both dental and skeletal fluorosis. During the present study overall prevalence was discussed.

RESULTS AND DISCUSSION

The World Health Organization had set guidelines limits on fluoride. The guidelines with 1.0 mg F/L as the upper limit of safe level are based on an average daily water consumption of 2 litres[4].

The analyzed fluoride contents from the drinking water sources were shown in the Table No.1.

The estimated fluoride levels from the drinking water sources local bore wells ranged from 2.4ppm to 5.3ppm (Table No.1). The analyzed water samples clearly indicated very high fluoride contents in the local drinking water samples which were more than the set WHO limits[4].

Many districts in Andhra Pradesh were identified as endemic fluorosis, where the fluoride levels ranged from 2 to 7 mg F/L. The fluoride levels in the present water samples were also fall within the specified range[2].

Dental Fluorosis in children

Dental fluorosis is a developmental disturbance of dental enamel caused by excessive exposure to high concentrations of fluoride during development. The risk of fluoride overexposure occurs between the ages of 3 months and 8 years[6]. In its mild forms, fluorosis often appears as unnoticeable, tiny white streaks or specks in the enamel of the teeth. In its most severe form, tooth appearance is marred by discoloration or brown markings. The enamel may be pitted, rough and hard to clean[2]. The spots and stains left by fluorosis are permanent and may darken over time.

A high prevalence of dental flurorosis was observed in the children in the study area. Dental fluorosis results from the ingestion of toxic amounts of fluroride during the period of calcification of the teeth in infancy and early childhood[2].The drinking water sources of the villages studied contained fluoride above 1 ppm, a level which is higher than the WHO cut off level. The hot and arid temperate climate with a temperatures range of 36^0C and 44^0C, which necessitates good amount of water consumption, could be considered as one of the causes of fluorosis seen in this area.

In the present study, among the children of the four study areas, it is noteworthy that infants and children below 7 years did not show any symptoms of dental

flurorosis. As the age is increased the prevalence and severity of dental fluorosis is also increased.

The prevalence of dental fluorosis observed in boys and girls in the three age groups of the selected village was represented in the Table No.2.

Data pertaining to age wise and sex wise prevalence and severity of dental fluorosis in the selected fluorotic areas are presented in the Table No.2. The prevalence and severity of dental fluorosis showed a marked variation among the different age groups of children (7-9 to 13-15 years) in two sex groups.

Boys

Among the three different groups of boys studied, the prevalence of dental fluorosis was lower in the age group of 7-9 years i.e., 32.9% and in the age group of 10-12 years it was 36.2%, while it was highest in the age group of 13-15 years i.e., 43%. However variation in the severity was observed across the age groups, with regard to the grades of severity, the age group of 4-9 years showed the highest prevalence 45.3% of 'questionable' fluorosis (grade I), very mild fluorosis is observed among 40.6%. None of the individuals surveyed showed 'severe' fluorosis in this age group. An increase in incidence and severity of fluorosis is evident in the next age group of 10-12 years, apart from showing the highest incidence of 40.8% of very mild fluorosis(grade II), this age group showed 35.2, 21.1 and 2.81 percentages of questionable, mild and moderate fluorosis respectively. In the age group of 13-15 years the children showed the highest prevalence of the severity of the disease with 'very mild' fluorosis (grade II) i.e., 34.2%. 31.6% and 15.2% questionable and mild fluorosis was observed and 7.6% of moderate fluorosis is recorded.

Girls

The prevalence of dental fluorosis in girls was highest in the age group of 13-15 years followed by 10-12 years i.e. 36.2% and 7-9 years i.e., 32.9%. with regard to grades of severity of the disease, the age group of 7-9 years showed the highest prevalence of 52.9 % of questionable fluorosis (grade I) and the lowest prevalence of 'mild' fluorosis(grade III) i.e., 11.7% and 'very mild' levels were found in 35.2% of the children. In the age group of 10-12 years, the children showed the prevalence of 36.2%. The highest prevalence of the severity of the disease was 46% in very mild (grade II) fluorosis and lowest prevalence in 'moderate' fluorosis (grade IV) i.e., 1.5%. 'Questionable' and 'mild' fluorosis was found in 41.2% and 11.1% of the children. In the age group of 12-15 years, the children showed the highest prevalence of 43.1 % of questionable fluorosis (grade II) and lowest prevalence was observed in moderate fluorosis(grade IV) i.e., 5.17 % of the children. 'Questionable' and 'mild' fluorosis was found in 36.2 and 15.5% of the children. 'Severe' fluorosis (grade V) fluorosis was not seen in any of the three age groups studied.

Comparision between genders

Boys showed higher prevalence of 36% dental fluorosis among the age group of 7-9 years than girls i.e., 32.9%. In the age group of 10-12 years also boys showed higher prevalence of dental fluorosis i.e., 41% than girls i.e., 36.2% and in the age group of 13-15 years boys showed highest prevalence of dental fluorosis ie., 43% than girls i.e., 38.5%. Both boys and girls showed highest prevalence of moderate fluorosis in the age groups of 10-12 and 13-15 age groups.

The findings of the present study indicated higher risk in the age range of 10-15 years. The research carried out in Ethiopian Rift valley also revealed that dental fluorosis was wide spread among children in the age group of 10-14 years[7]. Another study conducted in endemic areas of Madanapalli division, chittoor district of Andhra Pradesh also revealed similar results of prevalence rates of dental fluorosis i.e., 33.3%, 33.3% and 42.1% for boys and 27.5%, 30.4% and 31.5% respectively for girls of similar age groups selected for the present study[8]. One of the base line study conducted from the district of Nalagonda showed very high prevalence of 96-97 percent of dental fluorosis[9].

Skeletal Fluorosis in children

In the present study none of the children below 16 years showed skeletal fluorosis and it was observed in the age group of 25 years and above. In the study of AlkaPareek (1994)on skeletal deformities due to fluorosis also showed no prevalence of skeletal fluororsis in children of 1-6 years of age group, because at early ages the teeth affected first before

the skeletal system was affected. As the age increased prevalence of skeletal fluorosis also increased in association with the increase in the length of residence in the fluorotic areas.

Consumption of fluoride at levels beyond those used in fluoridated water for a long period of time causes skeletal fluorosis. With the resulting fluoride concentration in the body, the bone was hardened and thus less elastic with an increased frequency of fractures. Thus as in advance case, skeletal fluorosis causes pain and damage to bones and joints[10].

Table No.1: Fluoride estimated from drinking water sourcesin selected villages

S.No	Village	Water Source	Fluoride (ppm)
1	E. Kodipalli	Bore Well-I	4.6
		Bore well-II	5.3
2	Gubanapalli	Bore Well-I	3.00
		Bore well-II	3.8
3	Y. Kondapuram	Bore Well-I	4.1
4	Brahmasamudram	Bore Well-I	2.4
		Bore well-II	3.3

Table No.2: Children with dental fluorosis

S.No	Age group(yrs)	Number of individuals Examined	Number of individuals Affected	Number of individuals affected				
				Grades				
				I	II	III	IV	V
BOYS								
1	7-9	176	64(36)	29(45.3)	26(40.6)	9(14)	-	-
2	10-12	172	71(41)	25(35.2)	29(40.8)	15(21.1)	2(2.8)	-
3	13-15	183	79(43)	25(31.6)	27(34.2)	12(15.2)	9(11.4)	6(7.6)
GIRLS								
1	7-9	155	51(32.9)	27(52.9)	15(35.2)	6(11.7)	3(5.8)	-
2	10-12	174	63(36.2)	26(41.2)	29(46)	7(11.1)	1(1.5)	-
3	13-15	148	58(38.5)	21(36.2)	25(43.1)	9(15.5)	3(5.17)	-
Total		**1008**	**386**	**153**	**151**	**58**	**18**	**6**

CONCLUSION

In conclusion, the high fluoride level in the drinking water greatly affects the child growth which necessitates more attention on the health care and to make them strong and sturdy. Serious action and implementation of defluoridation techniques might improve water quality and reduce the risk in endemic fluorosis.

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