Evaluation of Correlation of Dental Fluorosis and Cognitive Status.

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ABSTRACT

Background: Fluoride in groundwater is more common in crystalline igneous rocks and alkaline soils located in semiarid climate, which exist in the northwestern parts of the Jharkhand state in the district of Garhwa and Palamu. The present study was undertaken to evaluate the intelligent quotient among children affected with and without dental fluorosis visiting dental college in the Garhwa district. **Methods:** The present prospective study comprised of 30 subjects selected randomly in the age group of 6-12 years visiting Vananchal dental college & hospital, Garhwa. The study compared IQ levels of children of study and control groups by means of Seguin Form Board Test. Data so obtained was statistically analyzed using Student 't' test with p value <0.05 as significant value. **Results:** Regarding drinking water source, 45% was drinking groundwater among study group. Mean scores for average timing category was found to be significantly higher (P<0.05) among children with dental fluorosis (29±2.87) than among children without dental fluorosis (27±3.02). **Conclusion:** The present study concludes that children with dental fluorosis have low Intelligence Quotient (IQ) than children without dental fluorosis. About half of the patients suffering from dental fluorosis were dependent on groundwater for drinking purposes. Fluoride water level of villages located in these regions should be selected in priority for application of defluoridation measures.

Keywords: Dental Fluorosis, Fluoride; Intelligent Quotient; Groundwater.

INTRODUCTION

The global prevalence of fluorosis has been reported to be about 32%. There are several million people in India exposed to drinking water sources with high fluoride content. Excess fluoride ingestion is a major health problem, 20 of the 30 states and Union territories in India being endemic for fluorosis.[1] The health effects that includes skeletal and dental fluorosis and reproductive effects in humans associated with exposure to more than permissible levels of fluoride (F) are well documented in literature.

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Data also reveals neurological consequences associated with exposure to F in children, the most reported effect is on cognitive capacities, particularly intelligence reduction.[2]

Fluoride, a double-edged sword, embraces beneficial effect, but excessive exposure can give rise to number of adverse effects.[3] In India, due to scarcity of suitable potable water resources, especially in hard rock terrain, almost 60–65 million people drink fluoride contaminated groundwater. Due to this an estimated population of about 2.5 to 3 million people mainly in the state of Andhra Pradesh, Jharkhand, Gujarat, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh are affected by fluorosis.[4] Thus, the present study was undertaken to evaluate the intelligent quotient among children affected with and without dental fluorosis residing in the Garhwa district.

MATERIALS AND METHODS

The present prospective study comprised of 30 subjects selected randomly in the age group of 6-12

years visiting Vananchal dental college & hospital, Garhwa. The study group comprised of 15 patients diagnosed with dental fluorosis and control group comprised of 15 healthy subjects visiting to dental college for any other dental treatment i.e. patients without dental fluorosis. This study was approved by ethical committee of the institute and written informed consent was obtained from children and their guardians. A self-administered questionnaire was used to obtain information regarding drinking source of water, demographic details and time of residing in the present area or if migrated from any other area. Dean's fluorosis index[5] was used for clinical assessment of dental fluorosis. The study compared IQ levels of children of both the groups by means of Seguin Form Board Test.[3,6] Data so obtained were analyzed using SPSS-version 22 and statistical analysis was carried out using Student t test with p value <0.05 as significant value.

RESULTS

Among 30 participants, there were 16 males and 14 females. Among study group 8 were males, 7 females and in control group 9 were males, 6 females. [Table 1] shows the distribution of study subjects by gender, residential area, drinking water source, Dean's fluorosis index and family history of fluorosis. 2 were residents of urban area and 13 belonged to rural area among study group. 4 were residents of urban area and 11 belonged to rural area among control group. Regarding drinking water source, 45% was drinking groundwater, 26% aquaguard and 26% tap water supplied by government water works among study group.

Table 1: Distribution of study participants according to demographic variables and Dean's fluorosis index.

Variables	Study group with Dental Fluorosis (n=15)	Study group without Dental Fluorosis (n=15)
Gender		
Male	8	9
Female	7	6
Residential Area		
Urban	2	4
Rural	13	11
Drinking water source		
Groundwater	7 (46%)	1 (6%)
Aquaguard	4 (26%)	4 (26%)
Reverse Osmosis	0	4 (26%)
Tap water (Water supply)	4 (26%)	6 (40%)
Dean's fluorosis index		
Normal	0	15
Questionable	4	
Very mild	5	
Moderate	5	
Severe	1	
Family history of fluorosis	3	1

Table 2: Mean score for average timing in males and females.

Variables	Mean score for average timing in second		P value
	Study group	Control group	
Overall group	29±2.87	27±3.02	<0.05 (Sig*
Males	30±3.21	29±2.45	>0.05 NS**
Females	29±2.15	28±0.41	

Among the control group was 6% drinking groundwater, 26% aquaguard, 26% reverse osmosis and 40% tap water supplied by government water works among study group.

Mean scores for average timing of males and females at Garhwa were 30±3.21 and 29±2.15 respectively with insignificant P value (P>0.05) [Table 2]. Mean scores for average timing category was found to be significantly higher (P<0.05) among children with dental fluorosis (29±2.87) than among children without dental fluorosis (27±3.02) [Table 2].

DISCUSSION

Safe drinking water is a constitutional mandate in India. However, 30% of urban and 90% of rural population of India is drinking untreated water, of which 80% is groundwater. This groundwater consumed for drinking has various toxic effects like it causes increased hepatic cell size, nephrosis, myocardial mineralization and degeneration of seminiferous tubules in testes and excess fluoride in groundwater of fluoride endemic areas has been found to be neurotoxic.[7] The present study found that 46% among patients suffering from dental fluorosis were dependent on groundwater for drinking purposes.

The Seguin Form Board Test is based on the single factor theory of intelligence, measures speed and accuracy. It is useful in evaluating a child's eye-hand co-ordination, shape-concept, visual perception and cognitive ability. The test primarily used to assess visuomotor skills. It includes Gesell figures where in the child is ask to copy ten geometrical figures to evaluate visuomotor ability. Test materials consist of ten differently shaped wooden blocks and a large form board with recessed corresponding shapes.[8] The present study found that mean scores for average timing category was found to be significantly higher among children with dental fluorosis than among children without dental fluorosis. Shekhar S et al[4] evaluated fluoride concentration in groundwater of Garhwa district and found ranging from 0.01mg/L to a maximum of 5.92 mg/L. It is clearly observed that the spatial distribution pattern of fluoride concentration varies from place to place. Fluoride in groundwater is more common in crystalline

igneous rocks and alkaline soils located in semiarid climate, which exist in the northwestern parts of the Jharkhand state in the district of Garhwa and Palamu. The main source of fluoride in groundwater is considered to be fluoride-bearing minerals such as fluorspar (CaF_2), fluorapatite [$Ca_5(PO_4)_3F$], cryolite, and hydroxylapatite in rocks.[4]

Shivaprakash PK et al[7] carried a study to find out relation between dental fluorosis status and Intelligence Quotient and noticed that the percentage of children with dental fluorosis was more in Extremely Low and Low IQ categories whereas the percentage of children without dental fluorosis was more in Average and High Average IQ categories. Assawa K et al[6] assessed the intelligence quotient and suggested a low IQ among fishermen schoolchildren community of Kutch, Gujarat, India and reported dental fluorosis, low SES, low education level of parents and high body mass index. Similarly, Q Xiang et al[9] measured Intelligence Quotient (IQ) in children, aged 8–13 years, living in two villages in China differing in the level of fluoride in their drinking water and found that in the high fluoride having water fluoride 2.47±0.79 mg/L (range: 0.57–4.50 mg/L), the mean IQ of children was significantly lower (92.02±13.00; range: 54–126) than in the low-fluoride village with water fluoride 0.36±0.15 mg/L (range: 0.18–0.76 mg/L), where the mean IQ of children was higher (100.41±13.21; range: 60–128).

The negative effect of fluoride on children in the high fluoride area is mainly due to: (i) disruption of proper development in the womb due to the mother's in-take of fluoride being passed to the fetus through the placenta, or (ii) childhood in a high fluoride environment. Either or both of these could lead to neuron damage, developmental difficulties, or neurotransmitter dysfunction. In children, the most reported effect is on cognitive capacities, particularly intelligence reduction. Children who live in a fluorosis area were found to have five times higher odds of developing low IQ than those who live in a non-fluorosis area or a slight fluorosis area.[3]

Lack of awareness about hazardous effects of drinking water with higher fluoride concentration then prescribed limit, poor knowledge about appropriate preventive measures and poor access to safe drinking water could be some factors forcing people to use these contaminated water sources with excess fluoride concentration.[4]

CONCLUSION

The present study concludes that with children with dental fluorosis have low Intelligence Quotient (IQ) than children without dental fluorosis. About 50% of the patients suffering from dental fluorosis were dependent on groundwater for drinking purposes. Fluoride water level of villages located in these regions should be selected in priority for application of defluoridation measures.

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