ASSESSMENT OF DENTAL FLUOROSIS IN CHILDREN OF JAIPUR DISTRICT, RAJASTHAN, INDIA

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INTRODUCTION

Fluorine is the most abundant electronegative element in nature, and about (96%) of fluoride (F) in the human body is found in bones and teeth [1]. In India, fluorosis is the most prevalent endemic disease which coexists in certain geographical regions in the country. Fluorosis is mainly of three type, namely, dental, skeletal fluorosis (SF), and non-skeletal fluorosis (NSF). Dental fluorosis (DF) is a global disease is not new to India, the reason being the shortage of good quality portable water and consumption of fluoridated water by people both in the rural and urban areas [2]. A higher level of F exerts a negative effect on the metabolic processes and an individual may suffer from SF, DF, and NSF problem or a combination of the all [3]. Fluoride (F) is toxic to all the systems and causes hyperlipemia, lipid peroxidation, and oxidative stress in various tissues of the human body [4]. In the human body, fluoride enters through the drinking water, food, beverages, tea, fish, dental products, etc [5]. Dentifrices contain 1000 parts per million (ppm) fluorides [6]. Risk of endemic fluorosis was the F level in source of drinking water is more than 1.0 ppm [7]. The available study data suggest that 15 States in India are endemic for fluorosis (F level in drinking water >1.5 ppm) and about (62 million) people in India consuming F-contaminated water in endemic fluorosis areas of Northern Rajasthan [23]. Ingestion of excess F-contaminated drinking water caused different types of fluorosis. Very few studies have been published in the field of fluorosis. Hence, the objective of the present study was to assess the DF in the children of Jaipur district, Rajasthan, India.

METHODS

Study areas

The study was conducted in the two blocks (a) Jamwa Ramgarh block in; Heerawala, Palera, Nayabas, Saipur and Birasana, (b) Amber block in; Jugalpura, Chitanukalan, Sunder ka bas, Peehwa and Sirsali of Jaipur district, Rajasthan, India were selected through a village-level survey was conducted. A pretested questionnaire regarding their socio-demographic, knowledge attitude and practices on defluoridation and fluorosis mitigation, source of drinking water was prepared.
All children were examined for DF using the Dean’s method [24]. According to specific clinical diagnostic criteria of development of fluorotic enamel opacities for DF was categorized as normal (Grade 0), questionable (Grade 1), very mild (Grade 2), mild (Grade 3), moderate (Grade 4), and severe (Grade 5). Children who were diagnosed as a Grade 0 or 1 classified as controls, whereas those who were diagnosed as Grade 2, 3, 4, or 5 DF cases.

**Collection of water sample and analysis**

Source of drinking water (Tube well and Hand pump) was collected in plastic tubes (Tarsons, India) and investigate for fluoride levels. Fluoride (F) concentration in each of the prepared solutions was estimated with the help of an F ion specific electrode (Thermo Scientific Orion Star AS29, USA). Deionized water was used for all measurements. 100 ppm fluoride stock (Thermo Scientific, USA) was used for calibration to prepare four standard solutions of different F concentration such as (10, 1, 0.1, and 0.01 ppm) by serial dilution.

1 mL of total ionic strength adjuster buffer III solution (Thermo Scientific, USA) was added to each 10 mL of standard solution and the instrument was calibrated. Fluoride estimation in the drinking water was carried out potentiometrically with a fluoride (F) ion specific electrode (Thermo Scientific Orion Star AS29, USA) using the method of Hall et al. [25].

**Ethical clearance**

This study protocol was approved by the Institutional Ethical Committee of Desert Medicine Research Centre, Jodhpur, Rajasthan, India. All the research work was performed according to the guidelines of the Indian Council of Medical Research, New Delhi, India for human experimentation in biomedical research. An informed and written consent were obtained from the each participant or their parents or legal guardians.

**RESULTS**

Fluorosis is a major problem in India as well as in Rajasthan. The study area is Jaipur district, Rajasthan, India. Age of the children ranged from (6-14 years) old were selected for the study.

**DISCUSSION**

Totally, 150 children were involved from the two blocks of the rural area of Jaipur district, Rajasthan, India. Each block was divided into 5 villages. Total 10 villages were involved in the study from each village 15 children were involved in this study protocol. The village wise household survey was also carried out to estimate the fluoride content in the source of drinking water in the both block of the Jaipur district, Rajasthan. The highest amount of the fluoride content was estimated in Birasana village which ranges from (2.5-15 ppm) followed by Saipur (2.20-9.50 ppm), Palera (1.00-2.80 ppm), Heerawala (0.8-2.70 ppm) and Nayabas (0.7-2.10 ppm) in Janwa Ramgarh block of the Jaipur district, Rajasthan. Table 1. Household survey was also carried out in Amber block of Jaipur district to estimate the fluoride content in the source of drinking water. The highest amount of the fluoride content was estimated in Sirsali village which ranges from (2.20-5.10 ppm) followed by Peelwa (0.80-3.50 ppm), Sunder ka bas (0.90-2.50 ppm); Jugalpara (0.80-2.50 ppm) and Chitanukalan (1.40-2.20 ppm) in Amber block of Jaipur district, Rajasthan Table 2.

DF cases are higher in Birasana village according to Deans classification grading (Fig. 1) normal (2), questionable (3), very mild (2), mild (3), Moderate (3) and severe (2) village followed by Saipur, normal (3), questionable (5), very mild (3), mild (3) and moderate (1) Palera normal (4), questionable (6), very mild (2) and mild (3), Heerawala normal (8), questionable (4), very mild (2) and mild (1), and Nayabas normal (10), questionable (3), very mild (2) and over all the prevalence of DF 27 (36%) in Jamwa Ramgarh block out of 75 children were examined (Table 3). DF cases are also high in Sirsali village according to Deans classification grading normal (2), questionable (4), very mild (4), mild (3) and moderate (2) village followed by Peelwa, normal (5), questionable (4), very mild (2), mild (3) and moderate (1).

The fluoride (F) concentration was estimated in source of drinking water which ranges from (0.7 to 15 ppm) in Jamwa Ramgarh block and (1.40 to 5.10 ppm) in Amber block of Jaipur district, Rajasthan has shown in (Tables 1 and 2). The fluoride content in drinking water 1.5 ppm was prescribed by the WHO [26]. This indicates that the occurrence of fluorosis in an area can be affected by so many other factors such as different life styles, nutritional status, climate, altitude, individual susceptibility and biological response, duration of F exposure and dissolves salts in drinking water [27]. Inorganic pollutants in ground water are hazardous for human health [28]. In Rajasthan, Indigenous rocks are rich source of fluoride contaminated water and ground water around the mica mines, Rajasthan has rich sources of mica.

**Table 1:** Fluoride concentration in drinking water sources of the selected five villages

| S. No. | Name of village | Fluoride concentration in drinking water sources Range (ppm)* |
|--------|----------------|-------------------------------------------------------------|
| 1      | Nayabas        | 0.7-2.10                                                    |
| 2      | Heerawala      | 0.8-2.70                                                    |
| 3      | Palera         | 1.00-2.80                                                   |
| 4      | Saipur         | 2.20-9.50                                                   |
| 5      | Birasana       | 2.50-15.00                                                  |

*Drinking water sources: Hand pump, Tube well, ppm: Parts per million

**Table 2:** Fluoride concentration in drinking water sources of the selected five villages

| S. No. | Name of village | Fluoride concentration in drinking water sources Range (ppm)* |
|--------|----------------|-------------------------------------------------------------|
| 1      | Chitanukalan   | 1.40-2.20                                                   |
| 2      | Jugalpara      | 0.80-2.50                                                   |
| 3      | Sunder ka bas  | 0.90-2.50                                                   |
| 4      | Peelwa         | 0.80-3.50                                                   |
| 5      | Sirsali        | 2.20-5.10                                                   |

*Drinking water sources: Hand pump, Tube well, ppm: Parts per million

**Fig. 1:** Dental fluorosis (Dean's grading), (a) normal (Grade 0), (b) questionable (Grade 1), (c) very mild (Grade 2), (d) mild (Grade 3), (e) moderate (Grade 4) and (f) severe (Grade 5)
The prevalence of DF 27 (36%) in Jamwa Ramgarh block and 26 (34.66%) in Amber block out of 75 children were examined in each block as shown in (Tables 3 and 4). Our study finding data shows the DF cases are higher in the Jamwa Ramgarh block as compare to Amber block. Many studies in the past have proved the direct link between the concentration of fluoride in source of drinking water and degree of dental fluorosis in the many communities and countries [29-32].

In India, previous study of DF has been reported in human’s intake of fluoride (F) concentration which ranges from (0.5 to 1.0 ppm) in drinking water [13,33]. Hundred percentage of DF has been reported where fluoride concentrations of 3.4-3.8 ppm in drinking water [14,34]. The present study revealed that the drinking water of the investigated region was contaminated with fluoride and the children of the study area were chronically exposed to higher levels of F from drinking water sources. In the present investigation, in summary, as well as the water F levels being positively correlated with the severity of DF in the children. However, due to the many limitations in this study, more research with larger sample sizes is needed to arrive at any conclusion.

CONCLUSION

This study data shows the prevalence of DF 27 (36%) in Jamwa Ramgarh block and 26 (34.66%) in Amber block of Jaipur district. A higher level of F in source of drinking water is a major risk factor for DF in the children. Hence, it is important to control the F content in the drinking water by establishing defluoridation unit. This study also provides the baseline data and information to public health authorities and significant use in planning of appropriate preventive strategies to control the DF problem in the children of Jaipur district, Rajasthan, India.

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