Prevalence and Characteristics of Dental Fluorosis in a Group of Brazilian Children *

Prevalencia y características de la fluorosis dental en un grupo de niños brasileños

Prevalência e características da fluorose dentária em um grupo de crianças brasileiras

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ABSTRACT

Background: Dental fluorosis (DF) is characterized by hypomineralization of tooth enamel caused by ingestion of excessive fluoride during enamel formation. DF phenotype presents different severities, ranging from very mild to severe phenotypes according to the enamel alteration. This dental development alteration is a common disorder worldwide. It is important to understand the prevalence in certain populations as a preventive strategy for the child's aesthetic, functional and psychological impairment. **Purpose:** to evaluate a prevalence and characteristics of DF in a group of children from Brazil. **Methods:** Three hundred and fifty-three children, aged 8-11 years, were clinically evaluated according to the DF phenotype. Only erupted permanent teeth were assessed. **Results:** DF prevalence was 7.6 %. Boys showed a higher prevalence of DF than girls. Very mild DF phenotypes were more common than more severe phenotypes of DF. **Conclusion:** the prevalence of DF in this Brazilian population of children was low.
Keywords: Brazil; cross-sectional studies; dental enamel hypoplasia; dental fluorosis; dental epidemiology; dentistry; prevalence

RESUMEN

Antecedentes: La fluorosis dental (FD) se caracteriza por la hipomineralización del esmalte dental causada por la ingestión excesiva de fluoruro durante la formación del esmalte. El fenotipo del DF presenta diferentes severidades, que van desde fenotipos muy leves hasta severos según la alteración del esmalte. Esta alteración del desarrollo dental es un trastorno común a nivel mundial. Es importante entender la prevalencia en determinadas poblaciones como estrategia preventiva del deterioro estético, funcional y psicológico del niño. **Objetivo:** evaluar la prevalencia y características del DF en un grupo de niños de Brasil. **Métodos:** Se evaluaron clínicamente 353 niños, de 8 a 11 años, según el fenotipo del DF. Sólo se evaluaron los dientes permanentes erupcionados. **Resultados:** La prevalencia del DF fue de 7,6 %. Los niños mostraron una mayor prevalencia de DF que las niñas. Los fenotipos de DF muy leves fueron más comunes que los fenotipos de DF más graves. **Conclusión:** la prevalencia de DF en esta población de niños brasileños fue baja.
Palabras clave: Brasil; epidemiología oral; estudios transversales; fluorosis dental; hipoplasia del esmalte dental; odontología; prevalencia

RESUMO

Introdução: A fluorose dentária (DF) é caracterizada pela hipomineralização do esmalte dentário causada pela ingestão excessiva de flúor durante a formação do esmalte. O fenótipo DF apresenta diferentes gravidades, variando de fenótipos muito leves a graves de acordo com a alteração do esmalte. Essa alteração do desenvolvimento dentário é um distúrbio comum em todo o mundo. É importante entender a prevalência em determinadas populações como estratégia preventiva para o comprometimento estético, funcional e psicológico da criança. **Objetivos:** avaliar a prevalência e as características da DF em um grupo de crianças do Brasil. Métodos: Trezentas e cinquenta e três crianças, com idades entre 8 e 11 anos, foram avaliadas clinicamente de acordo com o fenótipo DF. Apenas dentes permanentes irrompidos foram avaliados. **Resultados:** A prevalência de FD foi de 7,6 %. Os meninos apresentaram maior prevalência de DF do que as meninas. Fenótipos de DF muito leves foram mais comuns do que fenótipos de DF mais graves. **Conclusão:** a prevalência de DF nesta população infantil brasileira foi baixa.
Palavras-chave: Brasil; epidemiologia oral; estudos transversais; fluorose dentária; hipoplasia do esmalte dentário; odontologia; prevalência

INTRODUCTION

Dental fluorosis (DF) is an enamel development defect caused by excessive intake of fluoride during tooth development, leading to an enamel with lower mineral content and increase porosity, characterizing enamel hypomineralization. Although the prevalence of DF varies in different countries, the incidence of DF is a current problem worldwide (1,2). Water fluoridation is the most common source of fluoride intake; however, fluoride can also come from ingestion of fluoridated toothpaste and fluoride supplements (3). The recommendation for fluoridation of public water supply is widely accepted due to the fact that the benefits of caries reduction are greater than the risks of DF (4). In Brazil, the first cities to adopt water fluoridation did it in the 1950s (5). Currently, water fluoridation is mandatory throughout the country. A safe level for daily fluoride intake is 0.05 to 0.07 mg F/Kg/day. Above this amount, the risk of developing DF due to chronic fluoride consumption will be evident (6,7). Therefore, it is interesting that public policies focus on controlling the fluoridation of water supplies, preventing excessive or insufficient fluoride intake by the population. Furthermore, although with less risk, it is interesting that professionals know how to advise children on fluoride intake in toothpastes and supplements.

The common clinical characteristic of DF is an opacity line on enamel surface occurring in similar both teeth enamel (bilaterally). The number of teeth affected depends on the amount of fluoride ingested, exposure time, age, weight, nutritional status, and the persona's extracellular pH balance (6,8,9). The severity of loss of enamel minerals is determined by individual' s dose of fluoride, which may lead to different clinical characteristic of DF (3). The correct clinical diagnosis of DF requires inspection of dry and clean dental surfaces, under a good source of light. Clinically, mild DF is bilateral, diffuse (not sharply demarcated), opaque, and with white striations that run horizontally across the enamel. The opacities may coalesce to form white patches. In more severe forms, enamel may become discolored and/or pitted. During tooth eruption, enamel with fluorosis is not discolored; stains develop over time due to the diffusion of exogenous ions into the abnormal porous enamel (10). Clinical implications such as the negative impact on quality of life and increased risk/activity of dental caries can be mentioned in individuals affected by FD (11,12). In this way, FD stands out as a serious public health problem (13). Having evidence of DF in specific populations makes it possible to implement strategies for health promotion, disease prevention and optimized therapeutic protocols. Thus, the objective of the present study was to conduct a population-based study to determine the prevalence and characteristics of SCD in a population of Brazilian children.

MATERIALS AND METHODS

Ethical Aspects

The study was approved by the Human Ethics Committee of Federal University of Alfenas, Brazil (approval number of CAAE 78568217.7.0000.5142). Children's parents/caregivers signed informed consents after explanation of purposes and clarifications about the research.

Sample Characterization

This cross-sectional study included 353 children with age ranging from 8 to 11 years of age, both genders, recruited from elementary school in public schools in the municipality of Alfenas, State of Minas Gerais, Brazil. The sample was obtained for convenience. Children using orthodontic appliances, with history of any systemic disease, syndromes, cognitive disorders, oral cleft lip/palate and/or history of dental trauma were excluded.

Modified Dean's Index

Dental clinical examination for DF diagnosing was performed according to the criteria for Dean's Classification System for Dental Fluorosis (14) (Table 1). The children were seated in school chairs with natural light outdoors. Gauze and cotton rollers were used to clean the oral cavity. The examination was carried out with wooden spatulas, probe and flat mirror (nº 5) for indirect visualization in the maxillary arch. One trained dentist did the dental exams (Kappa intra-examiner=0.87). Only erupted permanent teeth were assessed.

TABLE 1
Criteria for Dean's Classification System for DF

Code	Classification	Criteria
0	Normal	The enamel represents the usual translucent semi vitriform type of structure. The surface is smooth, glossy and usually of pale creamy white color
1	Questionable	The enamel discloses slight aberrations from the translucency of normal enamel, ranging from a few white flecks to occasional white spots. This classification is utilized in those instances where a definite diagnosis is not warranted and a classification of 'normal' not justified
2	Very mild	Small, opaque, paper white areas scattered irregularly over the tooth but not involving as much as approximately 25 per cent of the tooth surface. Frequently included in this classification are teeth showing no more than about 1 – 2 mm of white opacity at the tip of the summit of the cusps, of the bicuspids or second molars
3	Mild	The white opaque areas in the enamel of the teeth are more extensive but do involve as much as 50 percent of the tooth
4	Moderate	All enamel surfaces of the teeth are affected and surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature
5	Severe	All enamel surfaces are affected, and hypoplasia is so marked that the general form of the tooth may be affected. The major diagnostic sign of this classification is discrete or confluent pitting. Brown stains are widespread, and teeth often present a corroded-like appearance

Adapted from Dean's index (1934).

Data Analysis

The data were submitted to descriptive analysis. Data were tabulated and evaluated using Excel 16.0 (Microsoft Corporation, Redmond, WA, USA).

RESULTS AND DISCUSSION

The mean age of the 353 evaluated children was 8.88 years (SD+= 0.89). 183 (51.84 %) were female children and 170 (48.16%) were male children. Children with mixed dentition (87.25 %) prevailed in the sample. Fourteen children with DF responded that they brush their teeth 3 times per day or more and 27 of them did it without the supervision of an adult. Additionally, 25 children reported using fluoride toothpaste. These data are not in line with current recommendations for: supervised brushing until 10 years of age, use of fluoridated toothpaste (minimum 1,100 ppm/F) in quantities defined according to age and brushing performed at least twice a day (15). It is also worth noting that our study presented confounding variable regarding the composition of fluoride dentifrice. Those responsible for describing the type of toothpaste were the legal guardians in a self-reported questionnaire. Such data were collected assuming habit entered in early childhood. Such data were collected suggesting habit entered in early childhood. Such data reinforce evidence that DF is more associated with the ingestion of fluoride in the water supply. However, oral health education strategies need to be reinforced among the population.

DF was registered in 27 children and DF prevalence was 7.6 %. The prevalence in the present study was low compared to other studies performed in Brazilian children, in which the DF prevalence is about 58.9 % (16-18). However, besides fluoridation water, other factors were also associated with DF susceptibility, such as genetic factor, malnutrition, and kidney failure (10,19,20). Studies investigating DF susceptibility using animal models have shown that genes could be involved in DF susceptibility and resistance (21). In the City of Alfenas, the Companhia de Saneamento de Minas Gerais (COPASA) conducts the fluoridation of drinking water. A study developed by Aguiar (22) indicated that the public water in Alfenas has been receiving adequate levels of fluoride. Fluoridation followed a recommendation according to which fluoride levels can vary between 0.6 and 0.9 parts per million (ppm/F) (23). It is also important to highlight that secondary sources of fluoride could be in different sources and contribute to developing DF. Long-time ingestion of products with high fluoride concentration (e.g., toothpaste and mouthwashes) and foods, during early childhood, as long as fluoridated drinking-water can lead to an overexposure to fluoride, leading to the common defects DF (24,25). On the other hand, the facts suggest that the government of the City of Alfenas can offer effective strategies for dental caries prevention and control to its population. In addition, there are two dental schools that participate in oral health education programs among elementary schools in Alfenas. In health promotion strategies conducted in the municipality of Alfenas, those responsible are encouraged to place and/or supervise the amount of toothpaste made available during brushing. A "pea-sized" number of toothpastes with a minimum of 1,100 ppm/F is encouraged. However, it was a limitation of this study that it did not question parents and guardians about participation in oral health guidance strategies and the use of toothpastes during early childhood.

The DF prevalence was higher in boys 14 (8.24 %) than in girls 13 (7.10 %). Other studies in different populations found that boys are more affected than girls (16,26,27). In studies performed in Brazil, a higher DF prevalence in girls was noted (7,28). It is worth highlighting that there has been an increase in the prevalence of FD in Brazil in recent years; This data was also associated with the genetic factor. Girls were more predisposed to SCD due to genetic polymorphisms in estrogen receptors (20). It is suggested that further studies be conducted (16,29,30). It is noteworthy that other data would also be interesting in the present study in relation to the investigation of water consumption in early childhood,

strategies adopted to clean the oral cavity as well as supplementation used during this period. The sample characteristics are described in table 2.

TABLE 2
Characteristics of the sample and a prevalence of DF in a Brazilian population

Variables	DF Free	DF	Total of subjects
Age - Mean (SD)	8.89 (0.89)	8.85 (0.86)	8.88 (0.89)
Gender n (%)			
Female	170 (92.90)	13 (7.10)	183 (51.84)
Male	156 (91.76)	14 (8.24)	170 (48.16)
Dentition n (%)			
Mixed	285 (92.53)	23 (7.47)	308 (87.25)
Permanent	41 (91.11)	4 (8.89)	45 (12.75)
Tooth brushing frequency n (%) - n=342			
1x	38 (88.37)	5 (11.63)	43 (12.57)
2x	129 (94.85)	7 (5.15)	136 (39.77)
3x or more	149 (91.41)	14 (8.59)	163 (47.66)
Who does the child's brush n (%) - n=349			
Child	272 (90.97)	27 (9.03)	299 (85.67)
Guardian	4 (100.00)	0 (0)	4 (1.15)
Both	46 (100.00)	0 (0)	46 (13.18)
Use of toothpaste n (%) - n=349			
Fluoride toothpaste	288 (92.01)	25 (7.99)	313 (89.68)
Fluoride-free toothpaste	34 (94.44)	2 (5.56)	36 (10.32)
Report of toothpaste ingestion n (%) - n=339			
Yes	30 (93.75)	2 (6.25)	32 (9.44)
No	282 (91.86)	25 (8.14)	307 (90.56)

Among the children diagnosed with DF according to Dean´s index (14), 36 (10.2 %) were classified as questionable DF, 26 (7.4 %) presented a very mild level, and only 1 (0.2 %) was qualified a mild DF (Table 3). There was a relevant number of children with questionable DF (36 cases - 10.2 %). In our study, we used the Dean's Index (14) for evaluation due to its simplicity and widespread use in other studies (31-33). Moreover, the Dean's Index (14) is also recommended by the World Health Organization (34) and has its recommended applicability in populations that the fluoride level in the water supply is less than 5 ppm F. Dean's Index (14) is established by the color and extent of discolored enamel and enamel defects. However, there is a limitation regarding the sensitivity in certain enamel defects.

TABLE 3
Distribution on the children examined in a Brazilian population, according to the modified Dean index.

	DF Free		DF			
Modified Dean's index	Normal	Questionable	Very mild	Mild	Moderate	Severe
Children n (%)	290 (82.2)	36 (10.2)	26 (7.4)	1 (0.2)	0 (0)	0 (0)
Total n (%)	326 (92.2)		27 (7.6)			

CONCLUSIONS

The prevalence of DF in a population sample from the municipality of Alfenas is low. Boys were more affected and milder phenotypes were observed. It is estimated that the population needs other strategies in relation to oral health education. Such data reinforce evidence that DF is more associated with the ingestion of fluoride in the water supply.

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