

Fluorosis in Children 6 to 12 years old from Erval Velho, SC, Brazil

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Abstract

The aim of this study was to evaluate the prevalence of dental fluorosis in a school group from 6 to 12 years in the city of Erval Velho (SC). In order to assist on the identification and prevention of fluorosis, assess the likely causes of the occurrence of the disease in a small group and emphasize the need for constant inspection of the fluoride concentration in the water available to the population we performed this study. Were examined 139 children, all of them studying in public schools of the city and between the ages of 6 to 12 years, the exclusion criterion was did not accept to participate in the research, and did not sign the informed consent form. Two previously calibrated examiners for the implementation of Dean Index made the evaluation. The examination was did below natural light and the aid of wood spatulas and gauze. From the children who agreed to be part of the investigation, 30.9% have some degree of fluorosis, with the majority of very mild degree, and only one with a severe degree. There was statistically significant difference in children who consume public water supplies and in age from 8 to 10 years. These results reinforce the need a constant monitoring of oral health conditions of the population and the accessibility to fluoride.

Indexing terms: Dental fluorosis. Oral Health. Fluoridation. Epidemiology.

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Introduction

The discovery of the anti-cariogenic properties of fluoride was one of the most important in the history of dentistry being used throughout the world in various ways such as fluoridation of drinking water sources, addition to cooking salt, by prescription or topical application of gels or solutions in community campaigns, in addition to fluoridated dentifrices. It has become responsible for the decline of dental caries in recent decades [1-2]. However, there was an increase in the number of studies related to the fluorosis index [3].

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WHO (World Health Organization) has recommended fluoridation of water since the 1950. The first Brazilian city to install the project was Baixo Guandu, in Espírito Santo, in 1953 [5] and the first state in which water fluoridation was established of supply was Rio Grande do Sul, in 1957 [6]. It became the collective method of fluoride application more effective, in terms of comprehensiveness. Federal Law No. 6050 of 24 May, 1974 [7] normalized fluoridation of water in supply systems, and it became mandatory to use sodium fluoride, fluorite, fluorsilic acid and sodium fluorosilicate, the last two being the most used [8]. Many improvements have been observed for the population's oral health, reducing the dental caries index. However, incorrect and concomitant use of fluoride products may result in disturbances in dental development [9].

There are reference concentrations for the amount of fluoride in the water to have an effective action against caries and that does not reach levels of risk for dental fluorosis. This value must be between 0.7 and 1.0 ppm and must be permanently controlled in order not to reach a negligible level nor levels so high as to cause dental fluorosis [2].

The eruption of permanent teeth occurs from 6 to 12 years, which is the period for the appearance of spots related to fluorosis in the teeth [10]. Dental fluorosis manifests mildly to more aggressive degrees. In very light degree clinical aspects are characterized by an aspect of changes that leaves thin white opaque lines that cross transversely the long axis of the crown of the tooth. In moderate and severe degrees, fluorosis presents pictures in which areas of the enamel are severely hypomineralized and rupture, leaving the remaining enamel pigmented leading to aesthetic compromise and morphological and functional impairment¹¹. The possible chronic intake of fluoride in childhood can lead to serious consequences in the formation of the tooth as demineralization of the enamel leading to the change in color and shape.

Observational studies in schoolchildren aged 6 to 12 years may assist in the identification and prevention of fluorosis, and thus lead to an evaluation of the most probable causes of the occurrence of the pathology in a small group, and later increase the area of study in order to determine and avoid other cases of fluorosis, since there has been increasing exposure to fluoride. In view of the above, the objective of this study is to evaluate the prevalence of dental fluorosis in a group of schoolchildren aged 6 to 12 years old in the city of Erval Velho, Midwestern region of Santa Catarina, Brazil.

Methods

A cross - sectional study related to the dental fluorosis index was carried out in the students of Erval Velho (SC) with descriptive, exploratory and field research objectives. To estimate the sample, data from the Education Department of the City of Erval Velho were used in 2016. 417 students were enrolled in the city's only municipal public college and 410 students in the state public school. All children aged 6 to 12 years were selected from schools (350 children in the age group).

The municipal secretariat of education and the school principals received a letter requesting authorization for the study to take place at the school. A Free and Informed Consent Form was sent to the parents and a Term of Assent for Minors sent to the students. Non-presentation of the terms was used as exclusion criterion for participation in the study. Of the 3,350 children in the study's age group, 139 returned with the terms of free and informed consent duly signed.

The Dean index, advocated by the World Health Organization, was the research tool used in this study to record dental fluorosis.

A questionnaire was provided to the parents of children evaluated with questions regarding the use and intake of fluoride and water. The answers obtained in the questionnaire were confidential and voluntary, the name of each participant was not associated with any of the answers given, which were only used for the purposes stated.

The data of collection was between May and June of 2016 by two students of the University of West Santa Catarina (UNOESC), previously calibrated (Kappa 85%), where one was the examiner and the other was a scorer. The examination was carried out in a school environment, with all the personal protective equipment (EPIs), under natural lighting, with the aid of a wooden spatula and gauze. After

the data collection, the data were entered in the Excel program and analyzed by the EPI info program for statistical and chi-square test evaluation.

The monthly assessments of the amount of fluoride present in the water of the Erval Velho (SC) distribution system from 2007 to 2010 were obtained by means of the Santa Catarina Water and Supply Company of Santa Catarina (CASAN), which were grouped in an annual average. Data for 2011 through 2016 were not used because they did not involve the ages related to the study.

This research was carried out respecting norms and guidelines that regulate the researches involving human beings, approved by Resolution n° 466/12 of the National Health Council, and was also approved by the Research Ethics Committee of the University of Western Santa Catarina (CEP/HUST) under number 1458354.

Results

Of the 139 schoolchildren who submitted the terms of Free and Informed Consent signed and the questionnaire answered, 30.9% presented some degree of fluorosis. Having the majority presented very slight degree. Regarding the frequency of fluorosis found, according to Dean’s classification, we have: normal 60.4%, questionable 8.6%, very mild 16.5%, mild 11.5%, moderate 2.2% and severe 0.7%. Only one child presented severe degree.

To verify the difference in the presence of fluorosis in relation to the questions in the questionnaire (Table 1), the chi-square test was performed considering 5% the degree of statistical significance. None of the evaluated questions had a statistically significant difference in the different categories in relation to the degree of fluorosis.

		No degree of fluorosis	Some degree of fluorosis	
Has your child ever had the habit of ingesting toothpaste?	Yes	23	7	0,309
	No	73	36	
Has any dentist ever applied fluoride to your child?	Yes	81	36	0,597
	No	12	7	
Does your child receive fluoride application at school?	Yes	48	22	0,701
	No	43	17	
Does your child drink water from the tap?	Yes	89	39	0,685
	No	7	4	

*chi-square

Erval Velho, 2016.

Table 1: Presence of fluorosis in relation to eating habits and dental hygiene. (n = 139).

When responding to topical use of fluoride, 86% of the students reported their use through the application by a dental surgeon and 53.8% received application at the school.

With the purpose of statistical testing, the fluorosis index was dichotomized in no degree of fluorosis and with some degree of fluorosis. Thus, in Table 2 it is possible to verify that there is a difference in the prevalence of fluorosis in the 8- and 9-year and 10 to 12-year age groups, that is, the mean age of the child. It was possible to observe that there is a statistically significant difference in the prevalence of fluorosis in relation to those that consume the water of public supply being this the group of greater age and greater prevalence.

In relation to water used for consumption, artesian well water was reported as the most consumed by students (59.4%) and consumption of water treated by the supply company was 40.6%. In addition, it was found that 92.1% drink tap water.

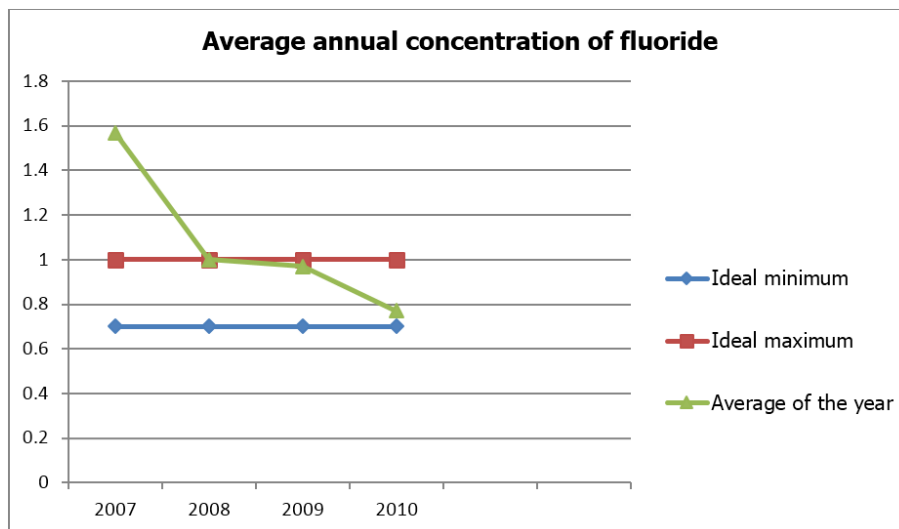
		Dichotomized fluorosis		p*
		No degree of fluorosis	Some degree of fluorosis	
Categorical age	6 and 7 years	30	5	0,048
	8 and 9 years	38	22	
	10 and 12 years	28	16	
Consumed Water	Supply company	30	26	0,001
	Water well or natural source	65	17	

*chi-square

Erval Velho, 2016

Table 2: Presence of fluorosis in relation to age and water used for consumption. (n = 139).

The readings of the fluoride content in the public water supply of Erval Velho can be observed in Figure 1.



Graph 1: Graphical distribution of the annual average fluoride of the public water supply of Erval Velho/SC.

Discussion

The control of the fluoride concentration in the public water supply is important since in recent years the intake of this ion has been increased through other sources in the child population. As for the concentration of fluoride in the water, there is a disagreement where some say it should be between 0.7 and 1.0 ppm², while others say that this value should be a maximum of 1.5 ppm, and in most of the Brazilian territory the ideal fluoride value is 0.7 ppm and in the southern region the ideal content is 0.8 ppm [6]. In Erval Velho, the annual averages from 2007 to 2010 range from 0.53 ppm to 1.57 ppm [12].

After the fluoridation of the public water supply, it is possible to observe that there was a significant decline in dental caries, but in parallel with this decline we also noticed an increase in the prevalence of fluorosis. In the last years, the subject has been gaining prominence and several epidemiological studies have appeared that debate the subject [1-3-9-13-14-15].

In the present study, the ages most affected by fluorosis were 8 and 9 years, that is, the ones who were born in 2007 and 2008, the fluoride index in Erval Velho of these years are respectively 1.57 and 1.0 ppm, a considerably high value, taking into account that the Guide to Recommendations for the Use of Fluorides in Brazil recommends 0.8 ppm as the ideal content in the southern region. Regarding the relationship between fluorosis and ingested water, there is a difference in fluorosis rates between children using public water supply and those using another source. However, when we eliminate children without fluorosis who drink water from the public supply, the sample is small and then we did not find significance in the correlation of the hypothesis.

In only 10 intrauterine weeks, the formation of the first buds of the permanent teeth is already beginning [16]. The Ministry of Health states that fluoride crosses the placental barrier, with almost equal fetal and maternal blood levels, so it must be taken into account that fluoride that causes fluorosis may have been ingested before birth [16].

Fujibayashi [2] analyzed 362 children regarding the presence of fluorosis, 90 children, that is, 24.86% presented some degree of fluorosis, a value below that found in Erval Velho (39.5%) when considering the questionable degree. Of these 90 children, only 40 returned with the informed consent form completed for participation in the research. Concerning the fluoride levels found in the supply water of Teniente Field from January to December 2004, they presented an average of 1.7 ppm of fluoride, with a minimum of 1.2 ppm and a maximum of 2.00 ppm. Regarding the Dean's index, 15% were questionable, 7.5% very mild, 42.5% mild, 32.5% moderate and 2.5% severe. These results show a greater severity compared to Erval Velho's results, where 55 children were found to be between questionable and severe, 21.8% questionable, 41.8% mild, 29.09% mild, 5.4% moderate and 1.8% severe.

In Passo Fundo, Rio Grande do Sul, 633 schoolchildren were analyzed. A fluorosis prevalence of 32.9% was found, a value very close to that found in Erval Velho. The majority had a very mild degree of severity, followed by mild, questionable degree and only 4 with moderate degree. None of the students presented a severe degree. They also verified the correlation of fluorosis with the variables gender, ethnicity and geographical location of the school, but there was no statistically significant association. As for age, there was statistical significance in the 12-year-old age group [18].

In the city of Aracaju (SE), 196 students with ages between 5 and 15 years were studied. The prevalence of dental fluorosis, from very mild to severe, was 8.16%. At grade 0 (normal) and 1 (questionable), the prevalence was 71.94% and 19.9%, respectively. In Erval Velho, the prevalence of fluorosis was 30.9%, from very mild to severe, a considerably higher value [1].

In this study, when the questionable degree is considered, the prevalence increases to 39.5%, being very close to that found in a public network in Belém (PA), where a prevalence of 40% fluorosis was found, being 27% very mild, 7% mild, 5% questionable and 1% moderate in 124 students aged 12 years. Regarding water supply, there was no parallel between the occurrence of dental fluorosis and the type of water used by schoolchildren, showing that the prevalence of fluorosis found should have other associated etiological factors other than drinking water. In contrast to the present study, a correlation was found between the use of public water supply and the presence of fluorosis [9].

In Ethiopia, Kravchenko, *et al.* (2014) a prevalence study of fluorosis was conducted with 1094 inhabitants of rural communities in the Ziway-Shala Lake basin. Approximately 90% of participants drank well water with amounts of fluoride above that recommended by WHO. Fluorosis occurred in more than 62% of the population [19]. Although the source of water that causes fluorosis to be artesian wells, other than this work, which is public water supply, the main factor associated with the prevalence of fluorosis in both studies was the high fluoride levels in drinking water, Kravchenko's study were also associated with other factors such as age, sex and milk consumption.

In the city of São Francisco do Conde (BA), 1474 students from first to fifth grade evaluated. A prevalence of 39.80% of fluorosis was found at any level of severity, of which the majority was framed at the very light level and no case of severe fluorosis was found. In relation to age, it was observed that, in the 10-year age group, the participants had a greater involvement of the fluorosis and with the

more severe levels. No statistically significant difference was found in the occurrence of fluorosis between urban and rural areas [3]. Some findings in São Francisco do Conde (BA) are very similar to those of the present study, such as the fact that the sample is from 1 to 5 years, the age group most affected by fluorosis is close to 10 years and the prevalence of 39, 80%, while in Erval Velho was 30.9%.

The increase of dental fluorosis should not lead to a discouragement to the use of this element in dental caries prevention and control programs, since its use is one of the factors responsible for the decline in caries index widely observed in the last decades [1].

The occurrence of dental fluorosis is not only associated with fluoride consumption through water supply, but also with other means such as fluoride dentifrices, mouthwash solutions, topical gels and dental materials, as well as supplements and diet, for industrialized foods and beverages. However, in the data of this research the information collected through the questionnaire, on the intake of fluoride through other sources, were not statistically significant [2-13-20].

Conclusion

In Erval Velho, there was a statistically significant prevalence of fluorosis in schoolchildren aged 6 to 12 years, where 30.9% of the sample presented some degree of fluorosis (very mild, mild, moderate or severe). This result, despite being high, does not represent a public health problem for the municipality of Erval Velho, but this condition must be constantly inspected, always considering the importance and benefits of adding fluoride in public supply systems. Considering that some cases of moderate and severe fluorosis have been observed, a more detailed and larger sample investigation is necessary to identify the possible sources of exposure that these children have undergone and, if necessary, intervene to prevent new cases to appear.

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