

# ASSOCIATION BETWEEN THE EARLY USE OF TOOTHPASTE AND OTHER VARIABLES WITH DENTAL FLUOROSIS: A TRANSVERSAL RETROSPECTIVE STUDY

## *ASSOCIAÇÃO ENTRE O CONSUMO PRECOCE DE DENTIFRÍCIO E OUTRAS VARIÁVEIS COM FLUOROSE DENTÁRIA: UM ESTUDO TRANSVERSAL RETROSPECTIVO*

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**E**xcessive fluoride intake during the period of tooth development may cause dental fluorosis. For maxillary central incisors, the critical age of fluoride intake is considered to be between 15 and 30 months of age. Thus, the aim of this transversal retrospective study was to relate the prevalence of dental fluorosis (Dean index), in maxillary central incisors, to the sources of fluoride that 12-year-old children (n=101) had in their first 3 years of life. It was also analyzed the prevalence of dental caries (DMFT), the educational level and socioeconomic status of the parents, through questionnaires completed by the parents. The data were analyzed by descriptive statistics and correlation tests. The mean DMFT was 1.81 ( $\pm 2.02$ ). Of the examined children, 28.71% had very mild to mild fluorosis. A percentage of 42.57% of children began tooth brushing with fluoridated dentifrice at age 1 year and 35.64% at 2 years. The relationship between dental fluorosis and consumption of powdered milk, as well as the use of supplements, was not statistically significant ( $p > 0.05$ ). However, the early beginning of tooth brushing with fluoridated dentifrice had a positive correlation with the prevalence of dental fluorosis ( $p < 0.05$ ). It was concluded that parents and children should have a better instruction about the use of fluoridated dentifrice and other risk factors for dental fluorosis.

**UNITERMS:** Fluorides; Dental fluorosis; Milk; Dentifrices; Infant nutrition.

## INTRODUCTION

Excessive fluoride intake during the period of tooth development may cause dental fluorosis<sup>6, 8</sup>, resulting in an increased subsurface porosity of dental enamel. The prevalence of dental fluorosis has increased in both optimally fluoridated and non-fluoridated areas in many countries, as well as in Brazil<sup>6,23</sup>. This has been attributed to the excessive

fluoride intake from many sources<sup>3,5,15</sup>. The severity of dental fluorosis depends on the dose and duration of fluoride exposure to fluoride<sup>3</sup>. For maxillary central incisors, which have the greatest cosmetic importance, the critical age of fluoride ingestion was firstly considered to be 15 to 30 months of age<sup>10</sup>. In a subsequent study, Evans, Darvell<sup>11</sup>, (1995) refined this estimate and observed that the critical age would be between 15 and 24 months for males and

between 21 and 30 months of age for females. Thus, all fluoride sources for children at these ages are important.

Koparal, Ertugrul, Oztekin<sup>13</sup> (2000), related that the feeding habits influence the fluoride intake by infants. Breast-fed infants ingest lower fluoride amounts in contrast to bottle-fed, because human milk has a low fluoride concentration. Villa et al.<sup>24</sup> (1998) observed an inverse correlation between dental fluorosis in maxillary incisors and the breast-feeding duration. Several infant formulas have high fluoride amounts, especially the soy-based ones. In addition, when fluoridated water is used for their dilution, they may be important risk factors for dental fluorosis<sup>4, 14, 22</sup>.

Another recognized risk factor for dental fluorosis, both in fluoridated and in non-fluoridated communities, is the early use of fluoridated toothpaste<sup>2,12,15,16,19-21</sup>.

Thus, the aim of this transversal study was to relate the prevalence of dental fluorosis, in maxillary central incisors, to the sources of fluoride that 12-year-old children (n=101) had in their first 3 years of life. Other factors, like educational level and socioeconomic status of the parents were also considered.

## MATERIALS AND METHODS

Participated in this study, approved by the Local Ethics Committee, 101 12-year-old (55 females and 46 males) schoolchildren from Bauru, state of São Paulo, Brazil. Information about socioeconomic status and educational level of the parents, use of supplements, age when toothbrush began, frequency of toothbrushing, and consumption of powdered milk was obtained through a retrospective questionnaire, completed by the parents. In Bauru, the public water fluoridation started in 1975. The optimum water fluoride concentration is between 0.6-0.8 ppm<sup>1</sup>. The children were examined for dental caries and

fluorosis, using the diagnostic criteria of World Health Organization. Only one person (B.S.A.) made all the examinations. In respect to fluorosis, only the maxillary central incisors were examined, because of their aesthetics involvement. Clinical oral mirrors and Community Periodontal Index dental probes were used, at natural light and assistance of school desks. Children had their teeth dried with sterile cotton gauze, for better visibility, before the examination.

Statistical analysis was done using Spearman Rank Order Correlations and Mann-Whitney U Test.

## RESULTS

Most of the parents had incomplete fundamental education, with a percentage of 29.70% for the fathers and 32.67% for the mothers. Most of the families (56.44%) had a low household income (between one and five minimal salaries). A percentage of 42.57% of the mothers related that their children began tooth brushing at the age of 1 year, and 35.64% at the age of 2 years (graph 1). The most common frequency of tooth brushing was 3 times a day (56.80% of the children, graph 2). Tooth brushing supervision was related by 93.07% of the parents.

Table 1 shows the kinds of milk consumed by the children. Parents did not answer if milk was cow or soy-based. From birth to 4 months of age, 64.36% of the children (n=65) were breast-fed. From 4 months to 1 year-old most of the children (35.64%) consumed powdered milk (n=36), while 23.76% (n=24) consumed cow's milk and 23.76% (n=24) were breast-fed. During the age of 1-2 year-old and 2-3 year-old most of children consumed cow's milk (39.60% (n=40) and 63.37% (n=64), respectively).

The parents related that 23 children (22.77%) had regularly consumed dietary fluoride supplements after birth.

A percentage of 70.30% (n=71) of children did not have dental fluorosis, and 28.71% (n=29) had

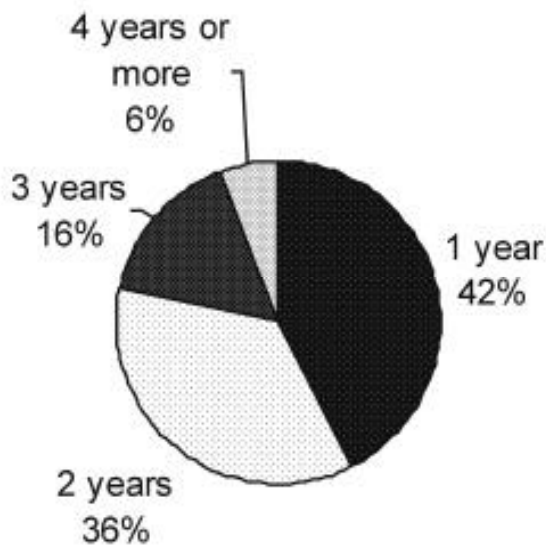
**TABLE 1-** Consumption of milk according to the age of the children\*

Milk	0-4 months	4 months-1 year-old	1-2 year-old	2-3 year-old
Breast	64.36% (n=65)	23.76% (n=24)	12.87% (n=13)	0
Cow	3.96% (n=4)	23.76% (n=24)	39.60% (n=40)	63.37% (n=64)
Powdered	9.90% (n=10)	35.64% (n=36)	20.79% (n=21)	21.78% (n=22)

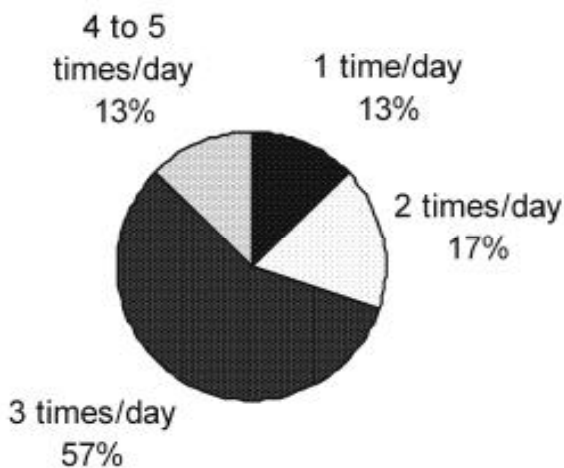
\* The n = 101 was not obtained for all the age groups because some questionnaires were not totally answered.

**TABLE 2-** Percentage of dental fluorosis according to Dean index

Score	n	%
0	71	70.30
1	18	17.82
2	7	6.93
3	4	3.96
4	1	0.99



**GRAPH 1-** Age of beginning tooth brushing



**GRAPH 2-** Frequency of tooth brushing

mild or very mild fluorosis (table 2). It was observed one case (0.99%) of moderate fluorosis. The mean DMFT was 1.81 ( $\pm 2.02$ ), and 34.65% (n=35) of the schoolchildren were caries-free. The association

between dental caries and fluorosis was not statistically significant ( $r = 0.12$ ;  $p = 0.228$ ).

There was not association between dental fluorosis and the level of the parents education, the household income, the consumption of powdered milk or dietary fluoride supplements ( $p > 0.05$ ). However, the earliest was the beginning of toothbrushing, the highest was the prevalence of dental fluorosis and this correlation was statistically significant ( $p = 0.008$ ).

## DISCUSSION

In this study, a correlation between the early use of toothpaste and dental fluorosis was found. This has been extensively reported<sup>9, 15, 16, 18, 20, 21, 26</sup>. Thus, measures to reduce the fluoride intake from toothpaste by children at risk for dental fluorosis are needed. Two alternatives have been suggested. The first one would be to reduce the amount of toothpaste used. This is an appropriate measure, but we cannot forget that nowadays in most families both the parents work and people who take care of the children not always follow parents' instructions. In addition, the flavor of most children dentifrices encourages ingestion. Because of this, it has been proposed that toothpastes with lower fluoride concentrations should be developed and marketed for use by young children, as has been done in many countries<sup>2, 12</sup>. However, in Brazil, the sale of low fluoride dentifrices is not allowed until larger clinical trials have demonstrated safety and efficacy. It is possible that reducing the fluoride concentration of toothpastes would reduce the anti-caries effectiveness. Therefore, the ideal dentifrice should not only reduce fluoride ingestion, but also be equally effective in caries prevention as currently marketed formulations of 1,000-1,500 ppm fluoride. An apparently controversial fact is that, despite the low educational level of most parents, approximately 93% of them related they supervised their children tooth brushing. This may be explained by the retrospective nature of this work, as well as by the fact that the parents tend to overestimate the children care.

The results of this study did not show a correlation between dental fluorosis and powdered milk consumption, contradicting the findings of other authors. Walton, Messer<sup>25</sup> (1981) observed that the lowest scores of fluorosis were present in children breast-fed for three months or more and the highest scores for those bottle-fed for more than 12 months. Larsen et al.<sup>14</sup> (1988) observed that the prevalence

of fluorosis in the earliest formed teeth was higher for children that consumed powdered milk diluted with fluoridated water than for those that consumed cow's milk. The authors suggested that the frequent consumption of powdered milk is a factor of earlier exposure to fluoride intake during the infancy. However, we cannot forget that the fluoride concentration of the water used to reconstitute the powdered milk is more important than the fluoride concentration of the formula itself. According to Bastos, Freitas<sup>1</sup>, in 1990, the reach of fluoridated water (0.7-0.9 ppm fluoride) in Bauru was 90% of urban population. Then, new goals were established in order to obtain 100% of fluoridated water in Bauru<sup>7</sup>. However, fluctuations in water fluoride concentrations have been reported, and hypofluoridation is a common occurrence<sup>5,17</sup>. Hence, we suggest that these facts could be the reason for the lack of association between dental fluorosis and powdered milk consumption in infancy in our study. Other factors could be associated, like the use of non-fluoridated bottled water to dilute infant formulas or even the use of retrospective assessment of fluoride exposures. A longitudinal study is being conducted to clarify these findings.

## RESUMO

O consumo excessivo de flúor durante o período de formação dos dentes pode causar fluorose dentária. Para os incisivos centrais superiores, a idade crítica da ingestão do flúor é entre 15 e 30 meses de idade. O consumo de leite em pó durante a infância tem sido relatado como fator de risco para fluorose dentária. Assim, este estudo transversal retrospectivo teve como objetivo relacionar a prevalência de fluorose (índice de DEAN), em incisivos centrais superiores, de acordo com as várias fontes de flúor que crianças de 12 anos (n=101) estavam expostas nos seus primeiros três anos de vida. Também foram analisados prevalência de cárie dentária (CPOD), nível educacional e sócio-econômico dos pais e idade de início da escovação com dentifrício fluoretado, através de questionários completados pelos pais. Os dados foram analisados por estatística descritiva e de correlação. O CPOD médio foi de 1,81 ( $\pm 2,02$ ). Das crianças examinadas, 28,71% apresentaram fluorose muito leve a leve. Uma porcentagem de 42,57% das crianças iniciaram a escovação com dentifrício fluoretado com 1 ano de idade e 35,64% aos 2 anos. A relação entre fluorose e o consumo de leite em pó e de

suplementos não foi estatisticamente significante ( $p > 0,05$ ). Contudo, o início precoce da escovação com dentifrício fluoretado apresentou uma correlação positiva com a prevalência de fluorose dentária ( $p < 0,05$ ). Concluiu-se que deve haver um melhor esclarecimento de pais e crianças quanto ao uso de dentifrícios fluoretados e demais fatores de risco para fluorose dentária.

**UNITERMOS:** Flúor; Fluorose dentária; Leite; Dentifrício; Nutrição infantil.

## REFERENCES

- 1- Bastos JR de M, Freitas SFT. Declínio da cárie dentária em Bauru-SP após 15 anos de fluoretação de água de abastecimento público. *Odont capixaba* 1991; 19(20):9-12.
- 2- Beltran ED, Szpunar SM. Fluoride in toothpastes for children: suggestions for change. *Pediat. Dent* 1988; 10:185-8.
- 3- BURT BA. The changing patterns of systemic fluoride intake. *J Dent Res* 1992; 71(sp. Issue):1228-37, 1992.
- 4- Buzalaf MAR, Granjeiro JM, Damante CA, Ornelas F. Fluoride content in infant formulas prepared with deionized, bottled mineral and fluoridated drinking water. *ASDC J Dent Child* 2001; 68(1):37-41.
- 5- Buzalaf MAR, Granjeiro JM, Damante CA, Ornelas F. Fluctuations in public water fluoride concentrations in Bauru, Brazil. *J Public Health Dent* 2002; 62(3):173-6.
- 6- Correia Sampaio F, Ramm Von Der Fehr F, Arneberg P. Dental fluorosis and nutritional status of 6- to 11-year-old children living in rural areas of Paraíba, Brazil. *Caries Res* 1999; 33 (1): 66-71.
- 7- DAE- DEPARTAMENTO DE ÁGUA E ESGOTO DE BAURU. O desempenho do DAE na solução dos problemas de saneamento básico. Bauru, 10 jan. 1991, p.5.
- 8- Dean HT. Classification of mottled enamel diagnosis. *J Am Dent Ass* 1934; 21:1421-6.
- 9- Evans DJ. A study of developmental defects in enamel in 10-year-old high social class children residing in a non-fluoridated area. *Community Dent Health* 1991; 8(1):31-8.
- 10- Evans RW, Stamm JW. An epidemiologic estimate of the critical period during which maxillary central incisors are most susceptible to fluorosis. *J Public Health Dent* 1991; 51:251-9.
- 11- Evans RW, Darvell BW. Refining the estimate of the critical period for susceptibility to enamel fluorosis in human maxillary central incisors. *J Public Health Dent* 1995; 55(4):238-49.
- 12- Horowitz HS. The need for toothpastes with lower than conventional fluoride concentrations for preschool-aged children. *J Public Health Dent* 1992; 52:216-21.

13- Koparal E, Ertugrul F, Oztekin K. Fluoride levels in breast milk and infants foods. *J Clin Pediatr Dent* 2000; 24(4):299-302.

14- Larsen MJ, Senderovitz F, Kirkegaard E, Poulsen S, Fejerskov O. Dental fluorosis in the primary and the permanent dentition in fluoridated areas with consumption of either powdered milk or natural cow's milk. *J Dent Res* 1988; 67(5):822-5.

15- Mascarenhas AK, Burt BA. Fluorosis risk from early exposure to fluoride toothpaste. *Community Dent Oral Epidemiol* 1998; 26(4):241-8.

16- Milsom K, Mitropoulos CM. Enamel defects in 8-year-old children in fluoridated and non-fluoridated parts of Cheshire. *Caries Res* 1990; 24(4):286-9.

17- Nagem Filho H, Maria VS, Aragão HDN de, Leirião JA, Sato S, Sitanaka MH, Garcia MZ, Galhardia EC. Determinação da taxa de flúor da água de abastecimento da cidade de Bauru. Bauru, EDUSC, 1997.

18- Osuji OO, Leake JL, Chipman ML, Nikiforuk G, Locker D, Levine N. Risk factors for dental fluorosis in a fluoridated community. *J Dent Res* 1988; 67(12):1488-92.

19- Pendryz DG, Katz RV. Risk of enamel fluorosis associated with fluoride supplementation, infant formula, and fluoride dentifrice use. *Am J Epidemiol* 1989; 130:1199-208.

20- Pereira AC, Cunha FL, Meneguim MC, Werner CW. Dental caries and fluorosis prevalence study in a nonfluoridated Brazilian community: trend analysis and toothpaste association. *ASDC J Dent Child* 2000; 67(2):132-5.

21- Rock WP, Sabieha AM. The relationship between reported toothpaste usage in infancy and fluorosis of permanent incisors. *Br Dent J* 1997; 183(5): 165-70.

22- Silva M, Reynolds EC. Fluoride content of infant formulae in Australia. *Aust Dent J* 1996; 41(1):37-42.

23- US Department of Health and Human Resources: Report of the Ad Hoc Subcommittee on fluoride of the Committee to Coordinate Environmental Health and Related Programs. Public Health Services, US. Review of fluoride benefits and risks. Washington: Government Printing Office: 45-7, 1991.

24- Villa AE, Guerrero S, Icaza G, Villalobos J, Anabolón M. Dental fluorosis in Chilean children: evaluation of risk factors. *Community Dent Oral Epidemiol* 1998; 26(5):310-15.

25- Walton JL, Messer LB. Dental caries and fluorosis in breast-fed and bottle-fed children. *Caries Res* 1981; 15:124-37.

26- Wang NJ, Gropen AM, Ogaard B. Risk factors associated with fluorosis in a non-fluoridated population in Norway. *Community Dent Oral Epidemiol* 1997; 25(6):396-401.

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