Dental Fluorosis: Concentration of Fluoride in Drinking Water and Consumption of Bottled Beverages in School Children

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Objective: *The purpose of the study was to identify dental fluorosis prevalence and to analyze its association with tap water fluoride concentration and beverage consumption in school children from the city of Oaxaca, who were receiving fluoridated salt.* ***Study design***: *A cross-sectional study was performed on elementary public school children. Dean's Index was applied to assess dental fluorosis. The parents of the children who were studied completed a questionnaire about socio-demographic characteristics and type of beverages consumed by their children. A total of 917 school children participated in this study.* ***Results***: *Dental fluorosis prevalence was 80.8%. The most frequent fluorosis category was very mild (41.0%), and 16.4% of the children were in the mild category. The mean water fluoride concentration was 0.43 ppm (±0.12). No association was detected between tap water fluoride concentration and fluorosis severity. The multinomial regression model showed an association among the mild fluorosis category and age (OR = 1.25, [95%CI 1.04, 1.50]) and better socio-economic status (OR = 1.78, [95%CI 1.21, 2.60]), controlling for fluoride concentration in water. Moderate and severe fluorosis were associated with soft drink consumption (OR = 2.26, [95%IC 1.01, 5.09]), controlling for age, socio-economic status, and water fluoride concentration.* ***Conclusions***: *The prevalence of fluorosis was high. Mild fluorosis was associated with higher socio-economic status, while higher fluorosis severity was associated with soft drink consumption.*

Key words: fluorosis, bottled water, salt fluoridation, school children, Oaxaca.

INTRODUCTION

Fluoride is an essential element of dental caries prevention programs. Since Dean's research in the U.S. in the 1940s, efforts have been made to maximize the caries preventive effects of fluoride and to minimize the risk of fluorosis. Identifying an "optimal" fluoride concentration in water is a difficult task, considering the increase in the availability of products with fluoride and the variation in concentrations of this element in such products. In addition to individuals' variation in metabolizing this element, these factors contribute to the complexity of creating guidelines for community fluoridation programs.[1]

Dental fluorosis has increased in a number of countries since initially being detected at the end of the 1980s in Canada and the United States.[2,3] It has also increased in regions that have community water fluoridation programs as well as areas where this type of program has not been implemented.[2 3 4] In 2011, in California, the United States government lowered the concentration of fluoride in the water public system to 0.7 mg F/L in general, substituting the range from 0.7 to 1.2 mg/L, depending on the regional temperature.[5]

In Mexico in 1993, salt fluoridation was legislated for implementation nationwide. The established fluoride concentration was 250 (±50) mg F/kg of salt, which was adjusted in 2003, when a range of 200 to 250 mg F/kg of salt was specified. The National Salt Fluoridation Program excludes 5 of the 32 entities that comprise the country and some municipalities in 11 states, which are also not included due to the elevated concentrations of fluoride in the water in these areas.[6 7]

Several studies have shown that bottled drinks can be an additional source of fluoride[8] adding up to what fluoridated salt provides. Children may receive fluoride from various sources including drinking water, bottled beverages, certain foods, and dental products.[9 10] Research in Mexico has shown that some beverages contain elevated fluoride levels.[9] In bottled beverages in at least three states (San Luis Potosí, Jalisco, and Zacatecas), amounts of up to 3.5 ppm fluoride were found in some soft drinks.[9] Epidemiological information is available that shows Mexican states with zones of endemic fluorosis;[11,12,13] however, no data on the state of Oaxaca are available regarding the prevalence and severity of dental fluorosis or its association with the consumption of beverages and other products. The lack of information about fluorosis levels complicates the administration of community prevention programs. For the

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dentist, prevention and health education should be given to patients to prevent dental fluorosis at levels that represent an aesthetic or functional problem.

The objectives of this study were to estimate the prevalence and severity of dental fluorosis and to analyze its possible association with the fluoride concentration of water and other beverages consumed by school children in the city of Oaxaca who had been receiving fluoridated salt.

MATERIALS AND METHOD

A cross-sectional study was performed on a group of 11 schools that were selected through a convenience sampling of 106 (10.4%) public elementary schools located in the city of Oaxaca.[14] The geographical division of the city was used to select schools that were located in the northern, central, and southern sections of the city. The participation of 989 school children ranging in age from 8 to 14 years was solicited, of whom 965 (97.6%) met the criteria for study inclusion. The inclusion criteria consisted of having lived in the area since birth, not having lived outside the municipality for more than six months, being without any systemic health condition that would impede the revision of the oral cavity, and no presence of an orthodontic appliance that would obstruct the inspection of the surface of the teeth. Seventeen children were excluded for not having been born in the city of Oaxaca, and an additional 7 children were excluded because they were undergoing orthodontic treatment. The children were given a questionnaire for their parents to complete at home, and this instrument was then returned to the school upon completion. Of the 965 children who met the inclusion criteria, 917 (95.0%) returned the completed questionnaire.

The questionnaire asked for socio-demographic characteristics; information about each child's principal water consumption source (tap, bottled water, or other); his or her consumption of other beverages such as soft drinks, juice, tea; and his or her consistency of toothpaste use. In addition, the following question was posed: "Apart from water, what beverage does your child most frequently consume?" According to each child's place of residence, his or her socio-economic level was classified using the information provided by the National Population Council (NPC).[15] This governmental organization has constructed a classification of urban marginality, which is based on indicators of education (e.g., percentage of the population 6 -14 years-old that does not attend school, etc.), health (e.g., infant mortality rate, medical insurance, etc.), employment and housing (e.g., running water, drainage system, and materials in the house, etc.), and domestic appliance availability (e.g., refrigerator, etc.). The socio-economic indicators calculated to construct this marginality index are variables of lacking or deficit, i.e. this index depicts the level of deprivation or poverty of the families living in each urban census tract in the country. The indicators that comprise this index were constructed as percentages of deprivation levels to eliminate the effect of scale on the size of the population of each unit of analysis. This approach permits a direct comparison of the degree of occurrence of the specific levels of marginalization among urban areas. The NPC classification indicates that Oaxaca is among the poorest states in the country.[15] In the present study, we use the term "poverty" to refer to the "urban marginality index".

To estimate the prevalence and severity of dental fluorosis, the recommendation of the World Health Organization (WHO) was used, as the modified Dean Index was applied. The index contains five categories to determine fluorosis severity: no fluorosis, questionable, very mild, mild, moderate and severe. These categories were also used to construct the community fluorosis index (CFI). The CFI is a weighted average of the fluorosis levels that are present in the group studied. CFI values from 0.6 – 1.00 indicate the presence of a slight public health problem, and CFI ≥ 2 suggests a severe public health problem.[16] The participants in this study were assigned a category based upon the pair of teeth that was most affected by fluorosis. When no pair of teeth had the same level of fluorosis, the tooth with the least severity was chosen to classify the child.[17]

The school children were examined by three dentists who had previously been trained in the registration of the modified Dean's fluorosis index. The standardization of fluorosis criteria allowed for a kappa > 0.8 among the examiners. The permanent teeth present in each child's oral cavity were examined. The examinations were performed with the child placed in a supine position on a table that was located outside the classroom in an area with good natural lighting conditions, using a #5 plane mirror, a WHO type probe and gauze to eliminate detritus.

All the wells that provide water to the areas where the children live were included for fluoride concentration analysis. In cases where a child drank water from the well located at his/her house, a sample was obtained from this source. A total of 13 water wells were sampled for fluoride analysis. The water fluoride concentrations were determined using a potentiometer (Denver™ model 225) equipped with a specific electrode (Denver™ model 300729.1) for fluoride ion. All the measurements were performed twice, in accordance with the Mexican regulation (NMX-AA-077-SCFI-2001)[18].

Statistical Analysis

Analysis of the categorical variables was performed through a frequency distribution. To compare the categories, independence tests were used through X^2 and the Fisher exact test when appropriate. A multinomial logistical regression model was constructed for dental fluorosis as a dependent variable in three categories. The first category consisted of children with indices corresponding to the categories of no fluorosis, questionable, and very mild; the second category was comprised of children in the mild category; and the third category comprised those who showed moderate and severe indices. Independent variables included socio-demographics and the types of beverages that the children consumed. Due to the fact that the children were selected from schools, this strategy may violate the assumption of independence. Accordingly, robust standard errors were obtained, considering the school as a cluster. The hypothesis tests were performed for α=0.05, and the analysis was performed using the statistical package STATA, V10 (StataCorp LP, College Station, TX, USA).

This study was approved by the research committee at Autonomous Metropolitan University-Xochimilco and by the Southeastern Regional University in Oaxaca México, where the ethical aspects of the work were reviewed.

RESULTS

Included in the study group were 917 children, of whom 466 were girls (50.8%) and 451 were boys (49.2%) ranging in age from 8 to 14 years with an average age of 10.29 (±1.10). The prevalence of fluorosis in these school children was 81.0%. The distribution of the children in terms of their dental fluorosis levels showed that

19.0% were in the normal category and 19.7% were in the questionable category. The most common was the very mild category (41.0%), followed by the mild category (16.4%). The moderate category included 3.5% of the children, and only 0.4% were in the severe category. The community index of fluorosis was 0.96.

The levels of fluoride observed in the water of the wells showed an average of 0.43 (± 0.12) ppm (minimal 0.18, maximum 0.77) and a median of 0.48 ppm. Table 1 presents the distribution of the children according to the water fluoride concentration of the well that supplied their neighborhoods or the well located at their residence. The table shows that 24.6% of the children lived in zones with F<0.33 ppm, 63.9% of the children in zones with a fluoride concentration between 0.33≤ F≤0.50 ppm, and only 3.4% of the children lived in zones with slightly higher than F≥0.75 ppm water fluoride concentrations. The percentage of children drinking water from a well on their own property was 4.7%, and the mean water fluoride concentration of these wells was 0.48 ppm. Regarding the socio-economic status of these children, 17.2% lived in zones showing low poverty levels, and the remaining 80.2% lived in more deprived neighborhoods, based on the government's urban marginality index.

Table 2 presents socio-demographic characteristics and beverage consumption by dental fluorosis status of the participants. Fluorosis scores were dichotomized into those in a low category (no fluorosis, questionable, or very mild) and those in a high category (mild, moderate or severe). No statistically significant association was detected between the fluorosis category of the children and the water fluoride concentration of the wells (p=0.257). More than two-thirds (70.6%) of the children's main water source was that sold in 20 L water bottles; 24.7% consumed tap water, and the remaining 4.7% drank from a well located at their residence. Table 2 also shows the distribution of the school children according to the type of beverage that their parents indicated was consumed most frequently by each child. The most frequently consumed products were juices (36.1%) followed by soft drinks (27.1%). According to the information obtained from the survey, all of the children used toothpaste to brush their teeth. The results also showed that age and poverty level were associated with the level of dental fluorosis: older children showed a higher level of this condition (OR=1.28 IC 95% [1.11, 1.47]), and less poor children showed a higher probability of having fluorosis at mild or higher levels than those living in more economically deprived neighborhoods (OR=1.72, [IC 95%1.17, 2.56]) (Table 2). No association between the sources of a child's drinking water and his/her fluorosis status was detected when tap water consumption was compared with bottled water consumption. With respect to the level of fluorosis and the consumption of other beverages, no association was found among juices, teas, or flavored water beverages. Regarding soft drinks, a higher likelihood of mild or higher fluorosis was found in school children who consume these products (OR=1.60, [IC 95% 1.13, 2.27]).

A multinomial logistic regression model for fluorosis levels was constructed considering the following three groups: the base group consisted of children at the lower or very mild levels, the second group included those of the mild category, and the third group consisted of those with moderate or severe levels (Table 3). In the mild category, the results showed that age was associated with fluorosis level (OR= 1.25, [IC 95% 1.04, 1.50]) in addition to being at a lower poverty level, that is a better socio-economic status (OR=1.78, [IC 95% 1.21, 2.60]). Additionally, in the moderate and severe categories, an association was observed only in terms of soft drink consumption (2.26, [IC 95% 1.01, 5.09]), while age, the concentration of fluoride in tap water, and poverty level were not significant (Table 3). No interactions between these variables and the fluorosis level were detected.

Table 1. Distribution of schoolchildren according to the Dean´s fluorosis index grouped in two categories by fluoride concentration in water wells

	Fluorosis category					
F concentration ppm[1]	Very mild or lower n = 734	(%)	Mild or higher[2] n= 183	(%)	n = 917	(%)
0.15 - 0.20	22	(73.3)	8	(26.7)	30	(3.3)
0.21 - 0.26	80	(79.2)	21	(20.8)	101	(11.0)
0.27 - 0.32	79	(84.0)	15	(16.0)	94	(10.3)
0.33 - 0.38	45	(73.8)	16	(26.2)	61	(6.7)
0.39 - 0.44	-	-	-	-	-	-
0.45 - 0.50	425	(81.0)	100	(19.0)	525	(57.2)
0.51 - 0.56	37	(75.5)	12	(24.5)	49	(5.3)
0.57- 0.62	9	(75.0)	3	(25.0)	12	(1.3)
0.63 - 0.68	12	(85.7)	2	(14.3)	14	(1.5)
0.69 - 0.74	-	-	-	-	-	-
0.75- 0.80	25	(80.6)	6	(19.4)	31	(3.4)

[1] ppm: parts per million, [2] No statistically significant difference between categories, p=0.11,
– no wells with this water fluoride concentration were found

Table 2. Socio-demographic characteristics and beverages consumption by dental fluorosis status of school children in the city of Oaxaca, Mexico

	Fluorosis very mild or lower level	Fluorosis mild of higher level	Total	OR (95%CI)[1]	p
	n 734 (80.0%)	n 183 20.0%	n 917		
Age mean (ds)	10.24 (1.07)	10.54 (1.24)	10.3 (1.11)	1.28 (1.11,1.47)	0.001
Sex					
Females n (%)	368 (49.9)	98 (53.6)	466 (50.8)	1.15 (0.83,1.59)	0.408
Males n (%)	366 (50.1)	85 (46.5)	451 (49.2)	reference [2]	
Poverty status					
Low n (%)	114 (72.2)	44 (27.8)	158 (17.2)	1.72 (1.17, 2.56)	0.006
High n (%)	621 (81.8)	138 (18.2)	759 (82.7)	reference [2]	
Water F^- concentration					
F≤0.50 n (%)	652 (88.6)	161 (88.0)	813 (88.5)	0.72 (0.41, 1.27)	0.257
F>0.50 n (%)	84 (11.4)	22 (12.0)	106 (11.5)	reference [2]	
Drinking water source					
Tap n (%)	182 (24.7)	45 (24.6)	227 (24.7)	1.00 (0.69, 1.47)	0.974
Well n (%)	33 (4.5)	10 (5.5)	43 (4.7)	1.23 (0.59, 2.57)	0.575
Bottle n (%)	521 (70.8)	128 (70.0)	649 (70.6)	reference [2]	
		Other beverages			
Powder flavored water					
Yes n (%)	167 (25.1)	16 (8.7)	102 (11.1)	0.72 (0.41 1.27)	0.256
No n (%)	650 (88.3)	167 (91.3)	817 (88.9)	reference [2]	
Juice					
Yes n (%)	274 (37.2)	58 (31.7)	332 (36.1)	0.78 (0.55, 1.11)	0.163
No n (%)	462 (62.8)	125 (68.3)	578 (63.9)	reference [2]	
Tea					
Yes n (%)	138 (25.1)	45 (24.6)	236 (25.7)	0.93 (0.64, 1.35)	0.706
No n (%)	545 (88.3)	138 (75.4)	683 (74.3)	reference [2]	
Soft drinks					
Yes n (%)	185 (25.1)	64 (35.0)	249 (27.1)	1.60 (1.13, 2.27)	0.007
No n (%)	551 (74.9)	119 (65.0)	670 (72.9)	reference [2]	

[1]OR (95% CI): odds ratios, (95% confidence intervals), [2]reference category.

Table 3. Results of multinominal logistical regression model of dental fluorosis and age, poverty status, tap water fluoride concentration, soft drinks consumption of schoolchildren living in the city of Oaxaca, Mexico

Mild category	**OR**	**Adj stand err[1]**	**p**	**(95% CI)**
Age	1.25	0.12	0.018	(1.04, 1.50)
Poverty level (low)[2]	1.78	0.34	0.003	(1.21, 2.60)
Water fluoride (F>0.7ppm)[3]	0.87	0.41	0.767	(0.34, 2.21)
Soft drinks (yes)[4]	1.37	0.25	0.084	(1.19, 1.95)
Moderate-severe category	**OR**	**Adj stand err[1]**	**p**	**(95% CI)**
Age	1.31	0.25	0.155	(0.90, 1.93)
Poverty level (low)[2]	1.39	0.48	0.340	(0.71, 2.75)
Water fluoride (F>0.7 ppm)[3]	1.89	0.84	0.391	(0.43, 8.32)
Soft drinks (yes)[4]	2.26	0.96	0.042	(1.01, 5.09)

[1]Base outcome: children with Dean´s score lower than mild category. Standard error adjusted for clusters (schools). Reference category: poverty level: high[2]; water fluoride: lower or equal to 0.7 ppm[3]; soft drinks: not the most frequent beverage consumed [4].

DISCUSSION

The prevalence of dental fluorosis in the children studied in Oaxaca was above 80%. The lower categories of fluorosis were detected most frequently; nevertheless, one fifth of school children showed fluorosis levels that were considered to be objectionable from an aesthetic point of view. The CFI score indicated that in the group examined, the level of dental fluorosis can be considered a slight public health problem.[16]

The consumption of soft drinks was associated with moderate and severe forms of fluorosis. Consistent with this observation, research performed in a state in the north-central region of Mexico (Guanajuato) in children from 6 to 15 years of age found a significant association between the consumption of carbonated beverages and the presence of dental fluorosis.[19] Furthermore, in a suburb of Mexico City, among children 6 to 13 years old, an OR of 1.55 was obtained between the consumption of bottled beverages and dental fluorosis.[20] Additionally, studies performed in the northern region of the country found that the concentration of fluoride in the major brands of soft drinks sold in Mexico showed a wide variation (0.40 to 3.52 ppm) and that even soft drinks of the same brand had differing concentrations of fluoride depending on where they were bottled.[9] Research performed in Mexico City also showed that soft drinks contained concentrations of fluoride between 0.09 to 1.70 ppm.[1, 21] It is possible that the children examined in Oaxaca who consumed soft drinks were exposed in their first years of life to these types of beverages with elevated concentrations of fluoride. The high fluoride content of soft drinks in Mexico is of particular importance considering that Mexico is the country with the highest per capita consumption of these beverages in the world, with a mean of 163 liters per person per year. [22]

Studies regarding the concentration of fluoride in different types of beverages have been performed in several countries, and some of these studies detected high levels of fluoride that could contribute to the risk of dental fluorosis. A study in the USA analyzing 43 ready-to-drink fruit juices found that 42% of these beverages had more than 1 ppm of fluoride with a range of 0.15 to 6.80.[23] Also in the USA, in the state of Iowa, fluoride levels of soft drinks were found to range from 0.02 to 1.28 ppm, and 71% of these products had a fluoride concentration higher than 0.60 ppm.[24] The authors concluded that without labels providing fluoride concentration in soft drinks, it is difficult to identify the adequate dosage of fluoride supplements that dentists or physicians should prescribe to preschool children. In Brazil, 98 brands of drinks were studied, and soft drinks showed a fluoride concentration lower than 0.20 ppm. However, black tea tangerine and lemon flavored had more than 0.80 ppm.[25] In Davangere, India, bottled drinking water had between 0.06 to 1.05 ppm fluoride concentration, and soft drinks had a fluoride concentration between 0.19 – 0.42 ppm. None of the drinks had labels that included the fluoride concentration. [26] In Portugal, 183 soft drink samples were measured, and the mean fluoride concentration found in this type of beverage was 0.86 ppm.[27] A study of 6-7 year-old English children aimed to identify the relative contributions of different sources to dietary fluoride. That study found that among children residing in optimally artificially fluoridated, sub-optimally artificially fluoridated, and non-fluoridated areas, drinks provided 59%, 55% and 32% of the total dietary fluoride intake in optimally, sub-optimally, and non-fluoridated areas, respectively. The main contributory sources to dietary fluoride differ between fluoridated and non-fluoridated areas.[28] A similar conclusion was recognized in a study in New Zealand comparing the dietary fluoride intake of children and adolescents living in areas with 0.01 ppm and 1.0 ppm.[29] Estimating total fluoride intake from levels of fluoride in tap water alone is unlikely to provide a reliable quantitative measure of fluoride intake, particularly in areas with other important sources of dietary fluoride consumed by young children.

In the present Mexican study, no association between the concentration of fluoride in tap water and the level of fluorosis was found. This outcome is most likely due to the fact that the fluoride concentrations in the water did not show wide variations, and only 3.4% of the school children studied lived in zones with more than 0.75 ppm of fluoride in tap water. It is also possible that during the period of tooth formation, the children ingested water from other sources that were not included in the present study. Total dose of fluoride, time, and exposure period are all determining factors in the development of fluorosis. Similarly, in this study, no significant difference was observed between the source of water consumed (bottled versus tap) and the level of fluorosis; a follow-up study performed in Indiana in the United States similarly did not detect a significant difference between the levels of dental cavities and the consumption of bottled or tap water. [30]

The prevalence of fluorosis in children in the city of Oaxaca was similar to that observed in other states in the central region of the country with comparable concentrations of fluoride in the water. In adolescents exposed to concentrations between 0.50 and 0.70 F ppm through water, a fluorosis prevalence of 89.5% was detected.[31] In Mexico City, which has a lower concentration of fluoride ($F \leq 0.3$ ppm), a lower level of fluorosis was accordingly detected; nevertheless, an increment in the prevalence of this condition was reported in the population of school children in this city.[32, 33, 34]

The regression model showed an association between poverty and the likelihood of presenting fluorosis. The school children with the lowest poverty statuses—that is, children living in areas with better public services, education, employment and health indicators—showed a higher prevalence of mild fluorosis compared to those living in more deprived areas of the city. It is possible that in families with more economic resources, toothpaste is used at an earlier age, which has been shown to be a risk factor of dental fluorosis.[10] One study conducted in Chile showed that kindergarteners at private schools had a higher probability of using toothpaste than their public school peers.[35] Another study performed in Brazil that examined children from 1 to 3 years of age showed that 81.5% of all fluoride ingested was acquired through fluoride toothpastes.[36] Additionally, research conducted on children in Veracruz and Mexico City showed that fluoride toothpaste was responsible for the majority of the daily fluoride intake.[10]

The relationship between socio-economic status and the presence of different levels of fluorosis is complex, and the information available is not conclusive. Some studies show a higher level of fluorosis in groups with fewer economic resources, while other studies show an inverse relationship. [37, 38] Further studies are required on the roles of the different variables that determine the impact of socio-economic level and the risk of fluorosis in children.

In the present study, low severity forms of fluorosis were associated with better socio-economic status; however, no association between poverty level and moderate or severe fluorosis was observed. It is possible that the small number of school children at this level identified in the group study did not allow for the detection of a significant difference or that other factors, such as diet and genetic susceptibility to fluorosis, contribute to explaining the presence of this condition in this group of school children.[39, 40]

Furthermore, the wide variation of fluoride concentration in different beverages together with the high consumption of these drinks complicate for the clinician the identification of the doses that are being consumed by the child in the different stages of odontogenesis. The official Mexican norm for packaged water and ice indicates that the limit for the concentration of fluoride be 1.5 ppm,[41] although this level could be high considering the quantity of fluoride sources to which the population is exposed. In the United States, the Food and Drug Administration indicates that the concentration of fluoride in bottled water can fall between 1.4 and 2.4 mg/L, depending on the temperature of the zone in which the product is sold.[42] Neither North American nor Mexican legislation stipulates that the label on a beverage indicate the concentration of fluoride, meaning that consumers are unaware of the amount of fluoride they are ingesting. This issue is particularly important if bottled water is used to prepare milk formula administered to infants.

Within the limitations of the study are those related to its cross-sectional design, which does not allow for establishing causal relationships. Furthermore, no data are available that show the fluoride concentrations in bottled beverages or the type of toothpaste used during this period, and both of these factors could place the school children in Oaxaca at risk of dental fluorosis. Studies are required that identify the concentration of fluoride in the diverse beverages available to the population in the various regions of the country.

CONCLUSION

A high prevalence of fluorosis was detected in the children of Oaxaca City. Children consuming soft drinks had a higher probability of showing dental fluorosis in levels aesthetically compromised. Public health policy makers should modify the labels on bottles of different beverages to include the concentration of fluoride. Moreover, the fluoride concentration in drinking water and fluoridated salt should be monitored to avoid exceeding the norms. Controlling the concentration of fluoride in bottled beverages is important, especially in countries with a high consumption of soft drinks that also have community fluoridation programs so that bottled beverages do not contribute significantly to an increased risk of dental fluorosis.

It is important that general dentists and pediatric dentists in particular have sufficient information of the fluoride content of beverages, drinking water, and food. With this knowledge, they can instruct parents to provide appropriate doses of fluoride to their children according to their age and diet to reduce their risk of fluorosis.

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