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Fluoride concentration in bottled water on the market in the municipality of São Paulo

ABSTRACT

The objective of the study was to evaluate the fluoride concentration in bottled water available on the market, in comparison with the values printed on the bottle label. Two hundred and twenty-nine water samples were collected from 35 brands available in several supermarkets, grocery stores and snack bars with high turnover in different regions of the municipality of São Paulo, Southeastern Brazil, in 2006. Fluoride concentrations were determined by duplicate analysis using an ion-specific electrode. The fluoride concentrations ranged from 0.01 to 2.04 mg/l, with significant differences between the values stipulated on labels and those found in the analyses. These results emphasize the importance of controls over fluoride levels in bottled water enforced by the sanitary surveillance agency.

KEY WORDS: Bottled water, analysis. Fluorine compounds. Product labeling. Food and beverages, standards. Health surveillance.

INTRODUCTION

Fluoridation of the public water supply was adopted in the municipality of São Paulo in 1985. In 1990, the municipal authorities instituted a municipal system for sanitary surveillance of fluoridation, with the aim of monitoring the fluoride levels added, such that the levels would be maintained between 0.6 and 0.8 mg/l.[a]

During the 1990s, as a result of increasing consumption, the need for more rigorous control over the fluoride concentration in bottled water arose. For this, Law No. 12,623/98 of May 6, 1998, which prohibits putting bottled water with fluoride levels of more than 0.8 mg/l on the market in the municipality of São Paulo, was sanctioned. This law also established that it was the responsibility of the Municipal Supply Department to carry out six-monthly tests to evaluate the fluoride levels present in bottled water.[b]

Between 1997 and 2000, there was a 52% expansion of the market for bottled water in the State of São Paulo. In the metropolitan area of the state capital, the expansion was 92%. In addition, the Family Budget Survey (POF) for 2002 and 2003, published by the Brazilian Institute for Geography and Statistics (IBGE) in 2004, revealed that mineral water was among the items of highest

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[a] Narvai PC. Vigilância Sanitária da fluoretação das águas de abastecimento público no município de São Paulo, Brasil, no período de 1990-1999 [full professorship thesis]. São Paulo: Faculdade de Saúde Pública da Universidade de São Paulo; 2001.

[b] Prefeitura Municipal de São Paulo. Lei Municipal no.12.623, de 6 de maio de 1998. Proíbe a comercialização de água mineral com teor de flúor acima de 0,8 mg/l no município e dá outras providências. Diário Oficial do Município. 13/5/1998.

consumption in the population's diet, and it was the only item that presented an increase of 3,011% based on the preceding years (1995 to 2003).[a]

Considering the increasing consumption of bottled water and the importance of controlling its fluoride concentration, the aim of the present study was to evaluate the fluoride concentration present in the different brands of bottled water on the market in the municipality of São Paulo and to compare this with the description on the bottle label.

METHODS

Several brands of bottled water were acquired from supermarkets, grocery stores and snack bars with high turnover in the municipality of São Paulo, in 2006. The samples were collected from commercial outlets with large sales of the product in the northern (71), southern (34), eastern (43), western (25) and central (56) regions of the municipality of São Paulo. There were 229 samples in total, from 35 different brands that were presented in the following forms: 200 ml and 300 ml plastic cups (46), 500 ml bottles (101) and 1.5 and 2-liter bottles (82).

The fluoride concentration present in the samples was determined in duplicate, using an ion-sensitive electrode (Orion 9609) coupled to a potentiometer (Procyon, model 720). The mean reproducibility of the readings, based on duplicate samples, was 98.2%. In addition, the validity of the results was checked by means of a new reading on 50% of the samples (intra-examiner error), with mean reproducibility of 92.9%.

RESULTS

The fluoride concentration in the water samples varied from 0.01 to 2.04 mg/l. Among these, 19% presented values greater than what is permitted by the municipal law, reaching values of up to 2.04 mg/l (samples 3, 18, 26 and 28). The highest values were found in 44 samples relating to four brands out of the 35 analyzed (Table).

The greatest variations were observed in the brands 8, 11-A, 26, 28 and 34-A (Table). With regard to brand 28, a difference of 1.14 mg/l was found between the minimum value (0.90 mg/l) and maximum value (2.04 mg/l).

The values found in the analysis were different from those stated on the labels in 88 samples (38%), of which 83 presented values that were higher than was stated on the packaging and five, lower. The most discrepant cases were observed in the samples from brands 3, 4, 8, 11-A, 18, 24, 26 and 28, which presented fluoride concentrations that were much above what was specified on their labels. The inverse was found for brands 12 and 16 (Table). Among the brands, 13 (37%) displayed the wording "fluoridated water" on their labels, even though they presented low values, close to 0.1 mg/l of fluoride.

DISCUSSION

Large variations in fluoride concentration (0.01 to 2.04 mg/l) were found for all the samples analyzed. This was in agreement with previous studies.[3,5] Notable variations in fluoride concentration were also found within the same brand or source. Variations like these were also observed in the study by Ramires et al,[5] in Bauru, State of São Paulo, in which variations between 0.07 and 1.51 mg/l of fluoride were found for the same brand.

A significant percentage of the samples analyzed in the present study (19%) exceeded the maximum limit of 0.8 mg/l of fluoride. This result indicates disrespect for the legislation of the municipality of São Paulo. Ramires et al[5] found values greater than 0.8 mg/l of fluoride in 9.2% of the samples from Bauru. Although that figure was lower than found in São Paulo, it deserves attention from the surveillance authorities.

The high concentrations of fluoride found in some brands of bottled water, together with the increasing consumption may constitute a risk factor for development of dental fluorosis. In addition to the consumption of "natural" water,[4] there may be a significant increase in intake of fluoride present in bottled water because of its use in preparing foods and drinks and reconstitution of baby formulae. In a study evaluating the fluoride concentrations in powdered milk and baby formula, Buzalaf et al[1,2] observed that the use of water with fluoride concentrations between 0.6 and 0.8 mg/l and greater than 0.9 mg/l, respectively for reconstitution of baby milk and formula, would give rise to daily fluoride intake higher than the limit that is considered acceptable (0.1 mg of fluoride per kg of body weight), for children up to one year of age.

With regard to the values stated on the packaging labels, only five (2%) did not specify the presence of fluoride on the label. However, in Araraquara in 1998, Brandão et al[3] found that most (75%) of the 32 water samples analyzed did not specify the fluoride concentration on the label. Although the difference in the number of samples does not allow direct comparison between the present study and the study by Brandão et al,[3] it may be inferred that there has been a tendency towards regularizing the labels, on the part of the water bottling industry.

[a] Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamento Familiares 2002-2003: Brasil e grandes regiões. Rio de Janeiro; 2004 [Accessed on: 7/10/2006]. Available from: www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pof/2002/pof2002.pdf

Table. Fluoride concentration in bottled water on the market in the municipality of São Paulo, 2005.

Brand	Total number of samples	Fluoride concentration specified on the label (mg/l)	Minimum and maximum fluoride concentrations found (mg/l)	Mean fluoride concentration (mg/l)
1	17	0.02	0.05 - 0.06	0.05
2	26	0.05	0.05 - 0.06	0.06
3	25	0.52	**0.88 - 0.92**	**0.90**
4	8	0.038	0.14 - 0.18	0.16
5	12	0.03	0.05 - 0.06	0.05
6	7	0.05	0.05 - 0.06	0.05
7	11	0.23	0.26 - 0.31	0.29
8	14	0.18	0.28 - 0.49	0.34
9	10	0.07	0.07 - 0.08	0.08
10	4	0.06	0.06 - 0.07	0.07
11 source A	3	0.18	0.14 - 0.35	0.24
11 source B	3	0.01	0.01 - 0.06	0.03
12	2	0.22	0.07	0.07
13	1	0.17	0.15	0.15
14	8	0.16	0.10 - 0.12	0.11
15	5	0.06	0.06	0.06
16	1	0.77	0.31	0.31
17	3	0.04	0.04 - 0.05	0.04
18	3	0.03	**0.96 - 1.01**	**0.94**
19	10	0.07	0.10 - 0.12	0.11
20	3	*	0.04 - 0.05	0.05
21	4	0.05	0.11	0.11
22	5	0.05	0.08 - 0.09	0.08
23	2	*	0.05	0.05
24	1	0.10	0.25	0.25
25	2	0.14	0.19 - 0.21	0.20
26	3	0.03	**1.42 - 1.71**	**1.60**
27	3	0.12	0.11 - 0.12	0.11
28	13	0.03	**0.90 - 2.04**	**1.19**
29	4	0.02	0.05 - 0.06	0.06
30	1	0.034	0.17	0.17
31	2	0.03	0.11	0.11
32	3	0.045	0.08 - 0.09	0.09
33	3	0.43	0.36 - 0.37	0.36
34 source A	2	0.06	0.08 - 0.19	0.14
34 source B	1	0.25	0.05	0.05
35	4	0.01 (300 ml) and 0.045 (500 ml)	0.05	0.05
Total	229	-	-	-

Values in bold exceeded the value permitted by the legislation
* No information given on the label

Discordance between the fluoride concentrations specified on the labels and those found in the laboratory analysis was observed. This situation constitutes an irregularity, since it may induce the public to consume the product with the intention of obtaining some benefit relating to caries control.

The bottled water on the market in the municipality of São Paulo presented great variation in fluoride concentration, with values greater than what is permitted and differing from what is printed on the labels. Therefore, there is an evident need for rigorous control over the composition of these products by the bodies

responsible for this, such that the legislation in force in the municipality is complied with.

Strategies such as direct periodic inspection of the producing plants and application of warning and penalization measures may cause regularization of the fluoride levels found in bottled water. The irregularity is caused both by fluoride concentrations outside of the recommended limits and imprecise information regarding this concentration. Furthermore, periodic sample collection from different points-of-sale for this water must be carried out in order to complement the monitoring of the industry that is done.

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