# Consumption of Bottled Water by Children in the City of Bauru, State of São Paulo, Brazil – A Brief Communication

**Irene Ramires, DDS, MS; Roberto H. C. Grec, DDS; Patrícia G. Moura, DDS; Juliano P. Pessan, DDS, MS; José R. P. Lauris, PhD; Marília A. R. Buzalaf, DDS, PhD**

**Abstract**

***Objectives:*** *To determine the consumption of bottled water by children in the city of Bauru, State of São Paulo, Brazil.* ***Methods:*** *A stratified sample of the 17 areas established by the city plan was used to identify a total of 1,000 homes for visitation. Information was collected using a questionnaire concerning the type of water consumed and population demographics.* ***Results:*** *Overall, around 30 percent of all residences used bottled water. Among all households where bottled water was consumed, about 26 percent had children residing. For those with children and bottled water, 81 percent reported to use bottled water for the preparation of the children's foods and beverages.* ***Conclusions:*** *An important percentage of children consume bottled water in the city of Bauru, State of São Paulo, Brazil. Considering previous studies showing that fluoride concentrations vary in bottled water, public health measures should be implemented in order to guarantee adequate levels of fluoride in commercialized water.*

*Key Words: fluoride, fluorosis, bottled water, children*

## Introduction

Water fluoridation is recognized as an effective method for the prevention of dental caries. It is also a risk factor for dental fluorosis, especially if the fluoride concentration is higher than the level recommended for optimal oral health (1).

The main risk factors for dental fluorosis include all possible sources of fluoride exposure that may contribute to the total fluoride intake by children aged <8 years, such as fluoridated water, supplements, dentifrices, and infant formulas, besides other manufactured foods and beverages (2-4). Because the final concentration of fluoride in formula, with the exception of ready-to-feed products, depends substantially on the fluoride concentration of the water employed for reconstitution, and considering the variations in the fluoride concentrations of the commercially available bottled water in Brazil (2,3), this study aimed to verify the consumption of bottled water by children in the city of Bauru, State of São Paulo.

## Methods

**Sampling.** A stratified sample was used to identify houses in the city of Bauru to visit and collect information about the consumption of bottled water and population demographics. Sample size was established at 1,000 houses on the basis of a confidence interval of 3 percent for a confidence level of 95 percent. Thus, 1,000 homes were visited, in which a total of 3,586 people were residing (mean of 3.6 inhabitants per home).

**Data Collection.** This study was approved by the Institutional Review Board (IRB) of Bauru Dental School, University of São Paulo (Proc. 120/2002) and volunteers signed an IRB informed consent document prior to participating. A questionnaire was administered to residents by personal interview. The questionnaire contained specific questions on the number of residents and ages, family income per month, consumption (or nonconsumption) of bottled water by the family (only 20 L gallons), how long has the family consumed bottled water, whether the same brand of bottled water was always consumed, and preparation (or not) of children's food with bottled water. If people refused to answer the questionnaire or if there was nobody at home at the time of the visit, the interviewer was instructed to go to the neighbor's house to the right. If nobody was in that house, the neighbor's house to the left was visited. Water bottle labels were checked to record the brand, source of the water, and fluoride concentration. A water sample was collected in a 50-mL flask and analyzed for fluoride. The results of these analyses are described in a previous report (3).

**Statistical Analysis.** Information obtained through the questionnaire was analyzed by descriptive statistics, using absolute and relative frequencies.

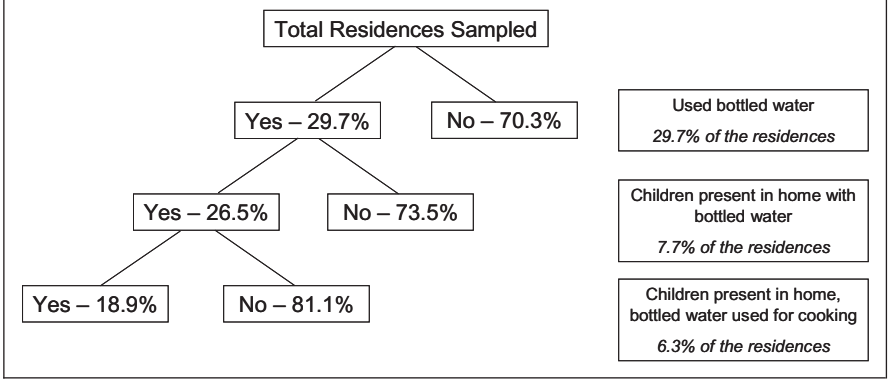
## Results

Four people (0.4 percent of the total) refused to answer the

Send correspondence and reprint requests to Marília Afonso Rabelo Buzalaf, Department of Biological Sciences, Area Biochemistry, University of São Paulo, Bauru, Brazil, Al. Dr. Octávio Pinheiro Brisolla, 9-75, Bauru-SP, Brazil 17012-901. Tel.: 14-3235-8346; Fax: 14-3227-1486; e-mail: mbuzalaf@fob.usp.br. Irene Ramires and José R. P. Lauris are with the Department of Pediatric Dentistry, Orthodontics and Public Health, Bauru Dental School, University of São Paulo, Brazil. Roberto H. C. Grec and Patrícia G. Moura are with the Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Brazil. Juliano P. Pessan is with the Department of Pediatric Dentistry and Public Health, Araçatuba Dental School, São Paulo State University, Brazil. Marília A. R. Buzalaf is with the Department of Biological Sciences, Bauru Dental School, University of São Paulo, Brazil. Manuscript received: 7/19/05; accepted for publication: 4/17/07.


DOI: 10.1111/j.1752-7325.2007.00039.x

**Figure 1**
**Consumption of bottled water by children in the city of Bauru, São Paulo, Brazil and the use of bottled water for cooking in these residences**




questionnaire. Bottled water was consumed in 312 of the 1,000 houses, corresponding to 29.7 percent of the city's population. Among these houses, 57 percent of the respondents reportedly always consumed the same brand of water. Of these users, 47.5 and 52.5 percent have used bottled water for 5 or more years and less than the last 5 years, respectively. Mean income per month for consumers and non-consumers of bottled water was US$650 and US$437, respectively. Children were residents of 26 percent of the houses where bottled water was consumed, and in 81 percent of these houses, bottled water was used for the preparation of the children's foods and beverages (Figure 1).

The results of the water fluoride levels, described in a previous study, are summarized in Table 1. A total of 29 brands of water were found in the houses of the volunteers. Significant differences were noticed between the fluoride concentration on the label and the level actually detected in laboratory analyses. In addition, some labels did not mention the presence of fluoride, even though the ion was detected (3).

**Table 1**
**Intervals of the Fluoride (F) Concentration in the 260 Samples (29 Brands) of Bottled Water (Bauru, Brazil, 2004)**

| F concentration (mg/L) | *n* | % |
|---|---|---|
| 0.045/-0.100 | 162 | 62.3 |
| 0.100/-0.600 | 64 | 24.6 |
| 0.600/-0.800 | 10 | 3.9 |
| 0.800/-1.515 | 24 | 9.2 |
| Total | 260 | 100.00 |

## Discussion

This study showed that 29.7 percent of the population of Bauru uses bottled water. This refers only to 20 L gallons (the most frequently type consumed by families). Of these users, 52.5 percent began consuming bottled water within the previous 5 years, demonstrating an increased prevalence of usage of more than 100 percent in this period. The mean income of the population consuming bottled water in Bauru is nearly 50 percent higher than the remaining 70 percent of the population not consuming bottled water (3). It would appear that children with potentially the most decay (lowest socioeconomic status) are more likely consuming public water and therefore getting some of the fluoride they need, as water fluoride levels in Bauru are in accordance with the values recommended for the control of dental caries (5).

This study also revealed that childrens live in about 26 percent of the houses where bottled water is consumed (7.7 percent of all residences), and this water is used for the preparation of their foods and beverages in 81 percent of these households (6.3 percent of all residences) (Figure 1).

The study is not without limitations. We did not have information on the percentage of children living in the homes using bottled water, nor the percentage of children using infant formula/ready-to-feed formula, or being breastfed. These limitations led to our restrictions of the purpose of the project (as stated) and led us to recommend the consideration of these other factors in research with an expanded focus.

Although 57 percent of the population that uses bottled water reportedly always buys the same commercial brand, the water comes from several areas of the country. In the present study, 29 brands were found (all from Brazilian sources), with only one product per brand. Considering that the concentration of fluoride in the water varies depending upon the brand, the fluoride content of the water ingested must be known in order to assure the benefits of caries prevention and to minimize the risk of dental fluorosis (1-4,6).

Water samples were analyzed for fluoride level (3), showing that fluoride concentrations of the samples collected from 29 different brands of bottled water ranged from 0.045 to 1.515 mg/L (Table 1). A significant difference was observed between the fluoride concentration stated on the label and that observed for 18 out of the 29 different water brands. One brand showed a level (1.515 mg/L) more than five times the amount indicated in the label. Moreover, the labels of some brands did not specify the presence of fluoride, even though the analysis demonstrated fluoride concentrations in these waters of up to 0.924 mg F/L (3).

Regarding infant formulas, consumption patterns have increased for the three types – ready for consumption, concentrated liquids, or powdered products (2,3,7). Although some authorities have suggested the use of optimally fluoridated water to reconstitute formulas (8), it seems that the best option is to use bottled water with a low fluoride concentra-

tion for such purpose (2,7) in order to reduce fluoride intake and minimize the risk for the development of dental fluorosis.

The National Sanitary Surveillance Agency (NSSA) of Brazil has several goals, including the "promotion and protection of the population health by means of the sanitary control of the production and selling of products and services submitted to sanitary surveillance, including the manufacture, supplies and related activities" (9). In Brazil, bottled waters must state the presence of fluoride when this ion is present at a concentration of 0.1 mg/L or above, according to the current legislation (10). The Regulation n. 54 of June 15th 2000 of the NSSA directs that the label should necessarily state, in a clear and precise manner, information regarding fluoride concentration and safe use.

Considering the outcomes of this study and taking into account that all possible sources of fluoride intake should be considered when evaluating the risk for dental fluorosis, it is mandatory that the NSSA adequately inspect and verify the accuracy of the information stated on the labels. Improved reliability of the information presented on the labels would increase consumer safety and better enable health professionals to estimate the daily fluoride intake by children.

## References


1. WHO. Expert committee on oral health status and fluoride use. 2001. Disponível na Internet. [cited 24 June 2005]. Available from: http://www.edoc.co.za/dentalnet/whofluoride.html
2. Buzalaf MAR, Granjeiro JM, Damante CA, Ornelas F. Fluoride content of infant formulas prepared with deionized, bottled mineral and fluoridated drinking water. ASDC J Dent Child. 2001;68:37-41.
3. Ramires I, Cattani L, Grec RHC, Moura PG, Lauris JRP, Buzalaf MAR. Avaliação da concentração de flúor e consumo de água mineral. Rev Saúde Pública. 2004; 38:459-65.
4. Rojas-Sanchez F, Kelly AS, Drake KM, Eckert GJ, Stookey GK, Dunipace AJ. Fluoride intake from foods, beverages and dentifrice by young children in communities with negligible and optimally fluoridated water: a pilot study. Community Dent Oral Epidemiol. 1999;27:288-97.
5. Ramires I, Maia LP, Rigolizzo DS, Lauris JRP, Buzalaf MAR. External control over the fluoridation of the public water supply in Bauru, SP, Brazil. Rev Saúde Pública. 2006;40:883-9.
6. Featherstone JDB. Prevention and reversal of dental caries: role of low level fluoride. Community Dent Oral Epidemiol. 1999;27:31-40.
7. Silva M, Reynolds EC. Fluoride content of infant formula in Australia. Aust Dent J. 1996;41:37-42.
8. Australian Research Centre for Population Oral Health. The use of fluorides in Australia: guidelines. Aust Dent J. 2006; 51(2):195-9.
9. [Anvisa] Agência Nacional de Vigilância Sanitária. História da vigilância sanitária no Brasil. 1998. Disponível no URL. [cited 24 June 2005]. Available from: http://www.anvisa.gov.br/institucional/historia.htm
10. Brasil. Decreto-Lei n. 7841 de 8 de Agosto de 1945. Código das águas minerais. Diário Oficial da União. 1945 Ago 20;p. 194.