Fluoride Concentration of Some Brands of Fermented Milks Available in the Market

Carolina Simonetti Lodi[a]
Michele Maurício Manareli[a]
Kikue Takebayashi Sassaki[b]
Alberto Carlos Botazzo Delbem[a]
Cleide Cristina Rodrigues Martinhon[a]

ABSTRACT

Objectives: To evaluate the fluoride ion concentration in some fermented milks present in the market.

Methods: Three brands of 6 fermented milks (Parmalat®-uva, Chamyto®, Paulista®, Batavito®, Yakult®, Vigor Club®) were analyzed. Fluoride concentration was evaluated after facilitated micro-diffusion by HDMS.

Results: Parmalat® products ranged from 0.022 µgF/g to 0.031 µgF/g, Chamyto® from 0.228 µgF/g to 0.272 µgF/g, Paulista® from 0.182 µgF/g to 0.220 µgF/g, Batavito® from 0.028 µgF/g to 0.030 µgF/g, Yakult® from 0.115 µgF/g to 0.206 µgF/g and Vigor Club® from 0.808 µgF/g to 1.171 µgF/g.

Conclusions: The presence of fluoride could be observed in all of the fermented milks analyzed which can contribute with the total fluoride daily intake. (Eur J Dent 2011;5:139-142)

Key words: Fluoride; Dental fluorosis; Milk–fermentation; Children.

[a] Department of Pediatric Dentistry, Araçatuba School of Dentistry, Paulista State University (UNESP), São Paulo, Brazil.
[b] Department of Basic Sciences, Araçatuba School of Dentistry, Paulista State University (UNESP), São Paulo, Brazil.

Corresponding author: Carolina Simonetti Lodi
Department of Pediatric Dentistry, Araçatuba School of Dentistry, Paulista State University (UNESP)
Rua José Bonifácio, 1193
16015-050-Araçatuba, São Paulo, Brazil.
Phone: +55 18 3636 3235
E-mail: carol_lodi@yahoo.com.br

INTRODUCTION

The role of fluoride in dental caries prevention is well established. However, ingestion of excessive fluoride during tooth development can cause dental fluorosis.[1]

Dental fluorosis is a deficiency in enamel mineralisation due to excessive daily fluoride intake during tooth development and its severity is directly related to the absorbed dose of this ion. Since the dose-effect relationship is not precisely known, the dose of 0.07 mg F/day/kg of body weight

has been accepted as the upper limit in terms of the clinically acceptable risk of dental fluorosis.[2]

The main sources of fluoride intake are fluoridated water, powdered milk reconstituted with fluoridated water, inadvertent ingestion of fluoridated toothpaste, inappropriate use of dietary supplements, as well as foods and beverages processed with fluoridated water.[3-5]

During infancy and childhood (36-48 months), the fluoride intake in diet deserves special attention. This period coincides with the calcification of different stages of the developing permanent teeth crowns. This is also a critical time for ensuring that the optimal levels of ingested fluoride are not exceeded.[3]

Several previous studies have determined the fluoride content of children's foods, such as milk,[6,7] dinners and desserts[8-11] and beverages.[5,12,13] However, the fluoride concentration in many child addressed products remains unknown. Thus, the aim of this study was to evaluate the fluoride ion concentration in some fermented milks present in the market.

MATERIALS AND METHODS

Three lots of six different brands of fermented milks, with 80 g each bottle, were analyzed: Parmalat®-uva, Chamyto®, Paulista®, Batavito®, Yakult®, Vigor Club®.

The products were opened on the day of the analysis and 2 mL of each fermented milk was used in this experiment. Fluoride concentrations were determined after overnight hexamethyldisiloxane (HMDS)-facilitated diffusion[14] as modified by Whitford, using a fluoride ion-specific electrode (model 9409, Thermo Electron Corporation, Beverly, MA, USA) and a miniature calomel reference electrode (Accumet, #13-620-79: Fischer Scientific, Pittsburgh, PN, USA), coupled to a potentiometer (290A, Orion Research Inc., Boston, MA, EUA). During the diffusion process, which was conducted at room temperature, the solutions in the nonwetable Petri dishes (J.Prolab Ind. e comércio de produtos para laboratório LTDA., São José dos Pinhais, PR, Brazil) were gently swirled on a rotary shaker. Fluoride standards (0.4, 0.8, 1.6, 3.2 and 6.4 µgF/mL) were prepared by serial dilution of a stock-standard containing 100 µgF/mL of fluoride (Orion 940907 – Thermo Orion, Beverly, MA, USA) in triplicate and diffused in the same manner as the samples. Comparison with identical non-diffused fluoride standards showed that recovery after diffusion was > 99%. The standard curve had a correlation coefficient 0.99. All samples were analyzed in duplicate. The mean repeatability of the fluoride readings, based on the duplicate samples was 94.9%.

RESULTS

Fluoride concentrations (µgF/g) in the different brands of fermented milk analyzed are shown in the Table 1. The fluoride concentration in the fermented milk of Parmalat® ranged from 0.022 µgF/g to 0.031 µgF/g, Nestlé® from 0.228 µgF/g to 0.272 µgF/g, Paulista® from 0.182 µgF/g to 0.220 µgF/g, Batavo® from 0.028 µgF/g to 0.030 µgF/g, Yakult® from 0.115 µgF/g to 0.206 µgF/g and Vigor® from 0.808 µgF/g to 1.171 µgF/g.

DISCUSSION

It is important to know all sources of fluoride ingestion that contribute to the total intake once the dental fluorosis is systemic caused by the excessive fluoride ingestion. Although the exact relationship between the consumption of industrialized beverages and dental fluorosis is not clear their ingestion contribute for the total fluoride intake specially the high fluoride content products, which never always highlight its content in the labels.

Many studies have demonstrated that it is necessary to know the fluoride concentration of infant foods, foodstuffs and beverages to estimate the total fluoride ingestion by children.[8,12,15] Although the total fluorine intake from the diet is difficult to be precisely determined, it is clear that there is substantial variation on the intake of different foods, foodstuffs and beverages, and in the fluoride content of these products. Since products are not required to have their fluoride content displayed, only a fluoride assay is possible to determine the dietary fluoride intake.[3] All of the fermented milks analyzed in this study presented varied concentrations of fluoride, although none of the packages indicated that information.

The optimal level of systemic fluoride intake where it is believed to be active against caries and is not related to the development of dental fluorosis is not accurately known. Using rough estimative of the types and quantities of foods and drinks

ingested and a technique less sensitive than the fluoride electrode to measure levels of fluoride, McClure[16] estimated that the 'average daily diet' provided no more than 0.05 to 0.07 mg fluoride/kg body weight/day and that it did not exceed 0.10 mg fluoride/kg body weight/day for children aged 1 to 12 years. This figure has been extrapolated by some to be the 'optimal' level of intake,[9,17] while others[2,18] have considered it to be the 'threshold' level of intake beyond which dental fluorosis may occur.

In this study, most of the fermented milks analyzed presented low concentrations of fluoride, less than 0.3 µgF/g. However, the products of the brand Vigor® showed higher fluoride concentration ranged from 0.808 µgF/g to 1.171 µgF/g. Considering that the 'optimal' level of fluoride intake ranges from 0.05 to 0.07 mgF/Kg body weight, those analyzed products can contribute significantly to the total ingestion of fluoride increasing the risk of the dental fluorosis development. In this sense, the consumption of 80 g of a fermented milk containing 1.171 µgF/g a day can contribute with about 0.008 mgF/Kg body weight for a child weighing 12 Kg (approximately 2 years old). It is worth emphasizing that this dose (0.008 mgF/Kg) would be reached with the ingestion of only this beverage, without considering the other foods and beverages consumed during the day. Several reports have been showed high fluoride concentrations in foods typically consumed by children, such as powdered milks, ready-to-drink juices and chocolate milks, cereals and snacks.[3,5,6,19,20,21]

The variation in fluoride concentrations among the lots is another issue that should be observed. In the present study, the lots of different brands presented variations ranged 16% to 44%. In the brand Yakult®, it was observed the largest difference among the analyzed lots. For beverages with low fluoride concentrations, these variations may have little impact on total fluoride intake. However, for products with high fluoride levels, such as the lot 2 of the brand Vigor®, this variation can contribute significantly for the total intake of this ion. On the other hand, the bioavailability of milk is another point to be considered. Due to

Table 1. Fluoride concentration (µg/g) of the three lots in the different brands of fermented milk.

Manufacturer	Brand	Production site	Lot	Mean	Bottle total fluoride	SD*
Parmalat	Fermented Milk skimmed sweeten - grape	Carambeí-PR	T3	0.031	2.48	0.0043
			M1	0.029	2.32	0.0038
			N1	0.022	1.76	0.0012
Nestlé	Fermented Milk skimmed sweeten Chamyto- vanilla	Araras–SP	7078132315	0.228	18.24	0.0007
			7071132315	0.272	21.76	0.0114
			7068132312	0.238	19.04	0.0057
Paulista	Fermented Milk skimmed sweeten - vanilla	Poços de Caldas-MG	L 13:03 S3	0.185	14.80	0.0254
			L 15:48 S3	0.220	17.60	0.0046
			L04:52 S3	0.182	14.56	0.0060
Batavo	Fermented Milk skimmed sweeten Batavito - orange and citric fruits	Carambeí-PR	L094	0.030	2.40	0.0029
			L103	0.030	2.40	0.0007
			L063	0.028	2.24	0.0022
Yakult	Fermented Milk skimmed sweeten Yakult	São Paulo-SP	57	0.115	9.20	0.0024
			26	0.122	9.76	0.0040
			90	0.206	16.48	0.0089
Vigor	Fermented Milk skimmed sweeten Vigor Club - vanilla	Lorena-SP	3	0.808	64.64	0.0300
			2	1.171	93.68	0.0980
			4	0.894	71.52	0.0294

*: Standard Deviation

the high calcium concentrations in milk, there is a possibility of diminution of fluoride absorption from gastro-intestinal tract.[22,23] Thus, the calculations made for these products could be overestimated. Milk is also rich in fats, what are known to increase the lag time of the food or beverage in the stomach.[23] Although milk interferes with the rate of fluoride absorption, it was demonstrated that 67 to 82% of total fluoride in milk is absorbed.[24]

Another crucial factor when the association between fluorosis and infant foods is the critical period of fluoride exposure to develop fluorosis. Enamel fluorosis can occur following acute or chronic exposure to fluoride during tooth formation assuming a significant relevance and emphasizing the importance of monitoring fluoride intake by little children.

CONCLUSIONS

In this study the presence of fluoride could be observed in all of the fermented milks analyzed which can contribute with the total fluoride daily intake.

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