

FLUORIDE CONTENT OF SOME TEAS CONSUMED IN SÃO PAULO

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SUMMARY: Fluoride ion selective analyses of twelve different brands of tea sold in São Paulo, Brazil, supermarkets are reported. The fluoride content of the infusions ranged from 0.011 to 0.23 mg/L. On average, a person ingests about 0.089 mg of fluoride per day from these teas.

Key words: Fluoride determination; Ion selective electrode; Tea infusions.

Introduction

The determination of trace element content in beverages is important in order to assess any potential health hazards. Fluoride is an important element to consider due to its possible adverse effects on health.¹ In the last years several papers have been published on the fluoride content of tea leaves.²⁻⁴ However, the results obtained are often in poor agreement. The variations can be explained on the basis of the leaf age, maturity and genetics of the plant, rainfall, altitude, fertilizer, and type of soil.^{4,5} Discrepancies also exist over the fluoride levels found in tea infusions.

The quality of infused tea depends on the percent of extraction, which in turn is a function of type, strength, and duration of infusion.⁶ Boiling increases the fluoride extraction, but also affects the flavor of tea.⁴ Five minutes produces the best flavor with least extraction of unpleasant-tasting tannin.⁷

Estimates of the daily intake of fluoride in many countries lie between 0.2 and 2 mg per person; and often tea infusions are the main source of dietary fluoride. The amount of fluoride from tea however, can contribute to a disturbingly high total ingestion when added to other sources of fluoride (toothpaste, fluoride in water, wine *etc*).

The purpose of this study was to determine the fluoride levels in twelve brands of commercial tea sold in São Paulo supermarkets and to evaluate the potentiality of tea as a dietary contributor of fluoride.

Materials and Methods

In order to prepare the tea liquors, a sample bag of tea (1.7 - 2 g) was infused in 100 mL of boiling de-ionized water for 5 minutes. The flask was then gently swirled, the solution was filtered using a 0.45 μm Millipore filter and was bottled in polyethylene containers and analyzed immediately by the ion selective method (ISE) (Orion Model 94-04) and a single-junction reference electrode (Procyon, Model E-920) in order to minimize potential loss of fluoride. A TISAB solution containing 0.1 M citrate was used.

In order to validate the analytical procedure for fluoride, the precision and accuracy of the method was tested by analyzing Simulated Rainwater NIST-SRM-2694-II. The precision of the technique was demonstrated by the relative standard

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deviation (RSD) through five determinations. The accuracy was verified by the relative error (RE). The amount of fluoride in the SRM is $0.108 \pm 0.004 \mu\text{g/m}$ which is slightly higher than the found value, $0.103 \pm 0.005 \mu\text{g/mL}$ with a RSD 4.9% and RE -4.6%, indicating good precision and accuracy of the method.

Results and Discussion

The amount of fluoride found in various tea infusions is shown in the Table and represents the concentration of water-soluble fluoride that is contained in one bag of tea.

TABLE. Fluoride content in tea infusions, $n = 2$ (*)

Type of tea	Mass of fluoride (mg)	Type of tea	Mass of fluoride (mg)
Mate Canela	0.011	Mate	0.035
Yerba Mate	0.017	English Breakfast	0.078
Boldo do Chile	0.021	Ceylán	0.175
Capim Cidreira	0.021	Royal Ceylon	0.205
Mate Limão	0.029	Yellow Label	0.215
Flores & Frutas	0.033	Royal Blend	0.230

Range: 0.011 - 0.230 mg

Mean: 0.089 mg

(*) Infusion prepared from one tea bag (1.7-2.0 g of tea) per 100 mL of boiling water.

Infusion time: 5 min

The variations in the fluoride content in the brands analyzed are not very large, except for the last three, and could have been caused by wide fluctuations of fluoride concentration in the water and soils in which the plant was grown.

The degree of agitation and brewing time were kept identical for each sample in view of the discrepancies in the literature between the reported fluoride levels in tea infusions. Clearly, the actual amount of fluoride in a typical tea infusion may be expected to depend on the strength of tea, *i.e.* the infusion time and amount of dry tea per unit volume used to prepare the infusion, in addition to the fluoride content of water used to prepare the infusion. In this study the infusions were prepared with fluoride-free water.

Recently Pires *et al*⁸ determined fluoride from drinking water supply systems in 19 districts from the five geographical zones (North, South, East, West and Center) of São Paulo City. The authors found the fluoride concentration in tap water to range from 0.09 to 0.58 mg/L with a mean of 0.4 mg/L. If we consider the fluoride levels in a realistic cup of tea (240 mL) made with a commercially available tea bag containing between 1.7 to 2.0 g of finely chopped tea per bag infused for 5 minutes, the fluoride content of a typical infusion varies from 0.011 mg to 0.23 mg. Considering a consumption of 4 cups of tea each day, then an extreme consumer of tea would have a total fluoride intake of about 1.48 mg comprising of 0.56 mg from the water and 0.92 mg extracted from the tea leaves, without including that from the other sources. Intakes of 5 mg per day from tea infusions have been reported.⁵

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