

FLUORIDE CONCENTRATION IN COMMERCIALY AVAILABLE DAIRY MILK IN IRAN

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ABSTRACT: The fluoride (F) concentrations of 10 brands of cow's milk sold in Iran were analyzed and the exposure to F from milk consumption was calculated. The mean F content of the samples was 0.023 mg/L with a range of 0.014 to 0.04 mg/L. The results of this study showed that the relatively low level of F in commercially available dairy milk in Iran would not be expected to cause a significant increase in the daily F intake.

Key words: Dairy milk; Daily fluoride intake; Iran.

INTRODUCTION

Cow's milk has long been associated with good health, making it one of the most consumed beverages around the world. It contains valuable nutrients and offers a rich source of calcium and vitamin D.^{1,2} Commercial brands of milk are consumed by a large percentage of children. A high intake of fluoride (F) is known to be toxic and able to cause a wide range of health problems.³ Thus knowing the F intake from milk consumption is relevant to health. An excessive consumption of F while teeth are developing can cause dental fluorosis, a form of hypo-mineralization of the tooth enamel and dentin.⁴ Carrying out research in Iran on fluoride, the anion of fluorine, is appropriate as, according to World Health Organization (WHO) reports, Iran is located in the global F belts. Many studies in Iran have reported on the F content of drinking water, air, fish, herbal distillates, sea water and ballast waters, and powdered and breast milk,⁵⁻¹⁴ as well as on its removal from water containing elevated levels of F.¹⁵⁻¹⁷

However, to the best of our knowledge, no reports have been published on the F content of commercially dairy milk in Iran. So the aims of this study were to determine: (i) the F level of cow's milk available in the customary Iranian supermarket and (ii) the estimated daily intakes of F from cow's milk consumption.

MATERIALS AND METHODS

The F concentration level was measured in 10 brands of pasteurized cow's milk. Three bottles of each brand were collected, between November 2017 and January 2018, from supermarkets in Bushehr. All the samples were kept at 4°C in a refrigerator in their original sealed bottles until the F analysis. The F concentration of

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the samples was measured by using a F ion selective electrode (Metrohm 781 ion/pH meter). Before measuring the F content, the milk was brought to 25°C temperature and the instrument was calibrated by using F standards containing TISAB III. After calibration, 50 mL of each milk sample was diluted 10:1, v:v, with TISAB III (5 mL TISAB III) which standardized the ionic strength and the pH of the medium. The solution was stirred at a uniform rate. Then the F concentration of each milk sample was measured 3 times and the readings were recorded from the ion meter in mg/L.^{18,19}

RESULTS AND DISCUSSION

The mean F content of the samples was 0.023 ± 0.008 mg/L with a range of 0.014–0.040 mg/L (Table). In the milk samples, Chooapan milk had the highest F content (0.040 mg/L) while Kalleh milk contained the lowest (0.014 mg/L).

Table. Fluoride content of various milk brands and the estimated daily intakes of F (μg per capita/day)

Milk brand	F mean \pm SD (mg/L)	Estimated daily F intake (μg) for various daily intakes of milk (L)			
		1 (L) ^a	0.5 (L)	0.25 (L)	0.1 (L)
Arzhan	0.021 ± 0.002	21	10.5	5.25	2.1
Kalleh	0.014 ± 0.006	14	7	3.5	1.4
Ramak	0.022 ± 0.008	22	11	5.5	2.2
Damdaran	0.019 ± 0.007	19	9.5	4.75	1.9
Pegah	0.016 ± 0.005	16	8	4	1.6
Mihan	0.020 ± 0.011	20	10	5	2.0
Haraz	0.023 ± 0.006	23	11.5	5.75	2.3
Masineh	0.038 ± 0.001	38	19	9.5	3.8
Chooapan	0.040 ± 0.004	40	20	10	4.0
Pazhan	0.019 ± 0.005	19	9.5	4.75	1.9
Mean	0.023 ± 0.008	23	11.5	5.75	2.3

^aThe average daily milk consumption.

According to the available evidence, the consumption of milk among Iranians is far less than the global rate of per capita consumption.²⁰ Some milk consumption related factors are age, parents' education, income, gender, personality, and environment.²¹ Despite the lack of comprehensive research on the daily usage of milk by different groups of society in Iran, we calculated that the mean daily F intakes for daily milk intake volumes of 1, 0.5, 0.25, and 0.1 L were 23, 11.5, 5.75, 2.3 $\mu\text{g F}$ per day, respectively (Table).

The range of F in cow's milk reported in previous studies from around the world of 0.007–0.18 mg/L^{22,23} is similar to the range that we found of 0.014–0.040 mg/L. The variation in the F concentration in the different milk brands might be a result of differences in the F content of the water consumed by cows, the grazing of cows on different soil types, differences in the fertilizers used on soil, the heat-treatment processes used for pasteurization, and the type of milk product.²⁴

The results of this study show that the consumption of milk alone is not likely to cause F-induced adverse health effects but a high intake of F and associated adverse health effects may occur when the intake of F from milk is combined with F from other sources such as drinking water (especially in areas with an elevated drinking water F content),²⁵ tea,²⁶ and other foods containing a high level of F.^{3,27-29}

This study provides the first data on the F content of commercially available dairy milk in Iran. It is highly recommended that dairy companies provide, on a label, information on the F content of all their dairy products to inform consumers. The results in the Table indicate that the daily F intake from drinking 1 L of milk daily, 14–40 $\mu\text{g F/day}$, is much less than the daily F intake consuming 1 L of drinking water (e.g., 1 L of water with 1 mg F/L [1 ppm] contains 1,000 $\mu\text{g F}$ and 1 L of water with 0.1 mg F/L [0.1 ppm] contains 100 $\mu\text{g F}$) and therefore, more attention should be given to the fluoride content of drinking water than to the fluoride content of cow's milk.

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