

FLUORIDE CONTENT OF MINERAL WATER AND TAP WATER IN CHAHARMAHAL AND BAKHTIARI PROVINCE, IRAN

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ABSTRACT

Poor quality of drinking water in many countries, people have recently changed to bottled water consumption. This study wanted to measure the fluoride (F) concentration of drinking water in comparison with commercial brands of mineral bottled water available in Chaharmahal and Bakhtiari province, Iran. 11 different brands of bottled mineral water and 90 samples of tap water were evaluated for fluoride concentration. The standard SPADNS method was used for analysis of Fluoride in the water (DR/5000s Spectrophotometer). The highest concentration of fluoride in a bottled water brand was found to be 0.41 mg/L. There was a significant difference between the average fluoride value of tap water (municipal) (0.20 ± 0.03 mg/L), tap water (rural) (0.13 ± 0.02 mg/L), and bottled water (0.24 ± 0.02 mg/L) ($P < 0.05$). The measured fluoride concentrations of bottled water were lower than those displayed on the labels. Results showed that the average fluoride value of both mineral bottled water and tap water samples contain fluoride below the maximum allowable level.

Keywords: Fluoride, Tap water; Water.

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INTRODUCTION

Recently there has been a great increase in the consumption of bottled water in Iran. One of the most common trends among consumers in recent years in various provinces of Iran, such as: Khuzestan, Hormozgan, Sistan and Baluchistan, and Busherhr is the replacement of their daily water drinking with bottled water, possibly due to anxiety about poor quality in natural water supplies secure and good quality drinking water is the basis for fine human health. Water provides essential elements, but when polluted it may become the source of objectionable substances dangerous to human health.¹ In human nutrition, the fluoride ion is a critical element for organism that is found mainly in skeleton. Fluorides can be fixed in bony and dental tissues and exercise their beneficial effects.² Indeed, the role of fluorides is very important in preventing tooth Fluoride in water has been found to have a significant effect against dental caries.³ Fluoride in little quantity is an essential component for normal mineralization of bones and formation of dental enamel Fluoride in water has both beneficial and harmful effects on the environment and the human.⁴ The mean fluoride concentration in bottled water was in many countries such as: Mexico, Turkish, Greece, Australia 0.34, 0.58, 0.35, 0.031 mg/L, respectively⁵⁻¹⁰. The present study aimed to evaluate the fluoride content of community tap water as well as available commercial brands of bottled water in Charharmahal and Bakhtiari province, Iran.

EXPERIMENTAL

Province Charharmahal and Bakhtiari is small province in southeast Iran, with a population of 857,910 people (2011) and an area of 16,403 km. The province is mainly active in the agriculture sector. The chemical compositions reported on the label of 33 bottled waters were used as data set for this study. This data was obtained generally by purchasing the bottled waters from different supermarkets in the Chaharmahal and Bakhtiari province. The chemical parameter determinations were carried out and certified by official laboratories of analysis and their accuracy and precision were not questioned in this

study. All bottles were stored in a dark place at room temperature in their original sealed plastic containers until the fluoride analysis was made. Samples of tap water were also collected from 4 city and 5 rural different residential areas of Chaharmahal and Bakhtiari province. The survey was conducted during the summer and winter of 2011-2012. The standard SPADNS method was used for analysis of Fluoride in the water (DR/5000s Spectrophotometer). Data was coded and analyzed using SPSS 11.5 software.

RESULTS AND DISCUSSION

The highest concentration of F was found in tap water (municipal) with a value of 0.26 ± 0.03 mg/L, tap water (rural) with a value of 0.20 ± 0.03 mg/L, and in mineral water with a value of 0.41 ± 0.02 mg/L (Table 1). All of the waters was found to contain less than 0.41 mg/L fluoride (Table 1). The results indicated that the fluoride concentrations on the labels were higher than the levels measured in this study. The results indicated that the fluoride concentrations on the labels were higher than the levels measured in this study. There was a significant difference between the average fluoride value of tap water (municipal) (0.20 ± 0.03 mg/L), tap water (rural) (0.13 ± 0.02 mg/L), and bottled water (0.24 ± 0.02 mg/L) ($P < 0.05$) (Table 2). The results obtained in this study are similar to research done in Fiji (0.09 ± 0.05 mg/L)¹¹. Findings from another study done in Mexico showed higher value for mean concentration of fluoride in bottled water (0.35 ± 1 mg/L)¹² in comparison to the present study (0.41 ± 0.02 mg/L). Our results are similar to those obtained by Cidu et al.¹³ and Guler⁶ who analyzed bottled water and tap water in the Italian and Turkish, respectively. They found a mean fluoride concentration in bottled waters and tap water below 0.5 mg/L compared to our study.

Table-1: Fluoride concentrations of bottled waters and tap water from rural and municipal area.

Type of water	Fluoride Mean \pm SD (mg/L)	Number	Labeled content
Tap water (Municipal)			
Shahrekord	0.14 ± 0.01	10	N/A
Favroshshahr	0.18 ± 0.02	10	N/A
Taqanak	0.25 ± 0.03	10	N/A
Hafshejan	0.26 ± 0.03	10	N/A
Tap water (Rural)			
Kharaji	0.12 ± 0.01	10	N/A
Dezak	0.10 ± 0.01	10	N/A
Harchaghan	0.11 ± 0.02	10	N/A
Howrah	0.20 ± 0.03	10	N/A
Vardanjani	0.11 ± 0.01	10	N/A
Bottled mineral water			
Gholh	0.28 ± 0.02	3	0.30
Zamzam	0.06 ± 0.02	3	Not labeled
Kohrang	0.21 ± 0.02	3	0.23
Sapidan	0.38 ± 0.02	3	0.4
Arvand	0.28 ± 0.02	3	Not labeled
Demah	0.28 ± 0.02	3	0.3
Caristal	0.31 ± 0.02	3	Not labeled
Poolor	0.22 ± 0.02	3	0.3
Vata	0.10 ± 0.02	3	0.11
Dalahoo	0.41 ± 0.02	3	0.5
Damavand	0.20 ± 0.02	3	0.2

The F concentration of the type waters in the present study was below several standards such as: European Economic Community (EEC), World Health Organization (WHO), US Environmental

Protection Agency (EPA), International Bottled Water Association (IBWA) and US Food and Drug Administration (FDA)¹⁰. The maximum concentration allowed for fluoride are EEC (1.5 mg/ L), WHO (1.5 mg/ L), EPA (2 mg/ L), IBWA (1.7 mg/ L) and FDA (2.4 mg/ L). The F concentration of both mineral water and tap water (municipal and rural) samples in the present study was measured below the maximum allowable level. This might be attributed to the type of local soil and its mineral content, seasonal variations and possible presence of volcanic sediments in underground water reservoirs^{8,14}. This low fluoride content of groundwater resources in Iran was also observed by Mesdaghinia et al. (2010) and Mohebbi et al. (2013)^{15,16} wherein the nationwide mean fluoride concentration in groundwater resources was found to be 0.47 ± 0.28 mg/L (\pm standard deviation). Similar studies have been conducted in Iran and other parts of the world. For example, Poureslami and colleagues in 2007 studied the fluoride content in drinking water of various cities in Kerman province, southeastern Iran and reported that all samples had fluoride levels below the minimum acceptable value¹⁷. In another study conducted in northern India, it was shown that the fluoride concentration in almost half of the studied water samples was within the optimum range¹⁸.

Table-2: Fluoride concentration at different waters

Type of water	Number	Fluoride Mean \pm SD(mg/L)
Tap water(Municipal)	40	0.20 \pm 0.03
Tap water(Rural)	50	0.13 \pm 0.02
Bottled mineral water	33	0.24 \pm 0.02

CONCLUSION

Results showed that the fluoride content of mineral bottled water and local tap water in Chaharmahal and Bakhtiari province below the maximum allowable level. Moreover, mean concentration of fluoride in mineral bottled water is significantly higher than public tap water. The real fluoride content of mineral bottled waters was lower than the information on their labels.

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