Original article

Investigation of Fluoride Concentrations in Some Bottled Water in Iran

Reza Sadeghnezhad1*, Zohre Sadeghnezhad2, Seyedeh Saeede Kadkhodazade Khorasani3, Azita Sadeghnezhad2

1. Student of Environmental Health Engineering, student research committee, Faculty of Health, Health Sciences Research Center, Mazandaran university of Medical Sciences, Sari, Iran

2. Environmental Health Engineering, Faculty of Health, Mazandaran university of Medical Sciences, Sari, Iran

3. Student of Laboratory Science, Department of Laboratory Sciences, Faculty of Paramedicine, Student Research Committee, Mazandaran University of Medical Sciences, Sari, Iran

4. MS Student of Urban Environment, Faculty of Humanities, Payam Noor university, Babol, Iran.

*correspondence: **Reza Sadeghnezhad,** Student of Environmental Health Engineering, student research committee, Faculty of Health, Health Sciences Research Center, Mazandaran university of Medical Sciences, Sari, Iran. Email: Rezasadeghnezhad7@gmail.com

Abstract:

Nowadays, the use of bottled water has considerably increased due to especially safety. The purpose of this study was to evaluate the amount of fluoride in some bottled water consumed in the cities of Iran This cross-sectional descriptive study was conducted in 2017. In this study, 10 samples from several Brands of bottled Water were analyzed. The results showed that the minimum and maximum fluoride content in bottled water were 0.03 and 0.85 as mg/l, respectively. All samples had fluoride less than the standard values, there was a significant difference between the fluoride content of the bottled water and the average fluoride content based on the maximum average air temperature of the central cities of Iran and the standards of WHO and Iran. The manned fluoride was less than the Iranian standard and the world. Therefore, It is recommended to add or set fluoride in bottled water for preventing of dental caries.

Keywords: Fluoride, Bottled water, Iran.

Introduction:

Water accounts for nearly 65 percent of the livings' body weight and is undoubtedly a vital component for all creatures on the earth. (1) Drinking water is kind of water that has all its physical, chemical and microbial properties as standard. Consuming water for drinking is supplied from surface and ground water. Fluorine is generally found in some types of sedimentary or volcanic rocks and is rarely found to be abundant in surface waters and only in several geographical locations is in ground water. In the surface water, the mean concentration of fluorine is 2.0 mg/L (2, 3). In groundwater, this value is different in regards to the soil layers. This concentration exists in ground water in areas containing mineral rocks. The amount of fluorine present in the atmosphere is very small (0.5 mg/L), which is negligible regarding the total absorbed body fluorine (4).

The World Health Organization (WHO) estimated the range of fluoride, from 0.7 mg/L for tropical regions to 1.2 mg/L for cold regions to reduce dental caries and not to cause dental fluorosis (5). Fluoride is a component of the elements that are

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considered as essential elements for the human body and it is most to be absorbed through the water. At low concentrations, it is necessary and in high concentrations it can be toxic (6). There are many indications that certain fluoride values are beneficial in certain body tissues, which place this element in the ranks of the important elements for nutrition and health (7).

The weather in Iran is very diverse and its hot spots are as warm as around 50 ° C in summer and cold areas are as cold as 20 degrees below zero. However, in our country there is a scattered research in different cities to measure fluoride levels but the standard has not yet been given due to the specific weather features of each region. Today, due to various reasons such as hot weather, consumption of bottled water in different cities of Iran has increased. On the other hand, the study of bottled water fluoride is not carried out regularly by the relevant organizations during each year and In this regard, no research has been carried out in the country. This the aim of this research to study the amount of fluoride ion in some bottled in Iran.

Methods:

This descriptive cross-sectional study was to evaluate the fluoride concentration in 10 samples of some brands of bottled water. Sampled were randomly collected from markets in the sari city (north of Iran) the sampled Brand code as 1, 2, 3,… Fluoride was the measured standard method. The maximum average air temperature in the central cities of the Iranian provinces was obtained from the online reliable weather meteorology site (www.worldweatheronline.com) and, based on the AMMT equation ($F(mg/l)=0.022/(0.104+(0.000724\times AMMT))$), the average fluoride in drinking water of these cities was calculated according to the temperature of water (9). The amount of fluoride was compared to the standards of Iran and WHO (10). SPSS Vol. 11.5 software was used to analyze the results of the samples and descriptive statistics (percentage, mean, standard deviation) and analytical statistics (t-test and chi-square test) were used. As the fluoride concentration was reported in scientific researches with the AMM formula, average fluoride consumed with drinking water is calculated based on the maximum temperature of cities in the following equation (9).

Findings:

Table 1 shows the minimum and maximum amounts of fluoride in bottles water that are 0.03 and 0.85 as mg/l.

Comparing the amount of fluoride declared in the labels with the amount evaluated in the samples of bottled water of different brands, there was a significant difference between the evaluation and the declared content, which is based on the minimum and maximum of table 1, respectively, 0.03 and 0.85 as mg/l. The results of this study with other studies conducted in Saudi Arabia, the European Union, as well as studies conducted in our country have been presented. In this comparing, the quality of water bottles in regards to fluoride amount inside the country is less than European Union and Saudi Arabia(12,13,14).

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Optimum fluoride concentration (mg/L) in drinking water calculated with the formulas of Galgan and Vermillion and the average of maximum annual temperature of states (AMMT) (9,18,19,20,21).

Discussion:

In the same study in the cities of Kerman, Rafsanjan, Zarand and Tehran, the amount of fluoride in bottled water was 0.17, 0.39, 0.47 and 0.2 mg/L respectively (14,15,16,17), which is more than the amount obtained in the present study. In the study conducted in Birjand, the fluoride content in 73.3% of the samples was outside the standard range. Also, considering the amount of fluoride declared on the label of different brands by comparing the recommended fluoride in drinking water by the WHO with declared values of different brands of the present study show a great deal of difference, which seems to be due to the lack of standards for the presence of the minimum amount of fluoride in bottled water. Also, bottled water in Iran contains different concentrations of fluoride, meanwhile the amount stated in the different labels may be incorrect. Due to the low level of fluoride in most of the analyzed waters and also considering the maximum average temperature of the central cities of Iran and according to the standard AAMT formula in calculating the expected average fluoride in drinking water and low fluoride in consuming water and expected estimated fluoride consumption based on average annual temperature, it is recommended to avoid the use of these waters repeatedly. The importance of fluoride in water and food as the most important way to achieve the body's fluoride needs to strengthen the tooth enamel and prevent it from rotting, it is recommended that even up to 7 years old be treated with fluoride for teeth. Considering the results of this study and the significant differences observed, also considering the use of plastic containers containing polyethylene tri-phthalate (PET) and the possibility of changing it in the vicinity of direct sunlight to carcinogenic compounds and contaminated bottled water, needs for investigation in this regard is necessary.

Conclusion:

Because of the importance of the presence of fluoride in bottled waters, monitoring of these waters is of great importance in terms of health and quality and in this regard, it is recommended to develop guidelines and requirements of different companies to comply with them.

Acknowledgements:

The authors would like to appreciate the Health science Research Center, Student Research Committee, and the Mazandaran University of Medical Sciences.

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Tables and Charts:

Table 1: The fluoride concentrations (mg/l) of some bottled water.

Brand Code	Fluorine on the bottle label Mg/L	Maximum	Minimum
1	0.04	0.06	0.02
2	0.85	0.95	0.75
3	0.6	0.85	0.35
4	0.28	0.45	0.11
5	0.1	0.12	0.08
6	0.06	0.09	0.03
7	0.1	0.15	0.05
8	0.1	0.13	0.07
9	0.03	0.05	0.01
10	0.1	0.18	0.02

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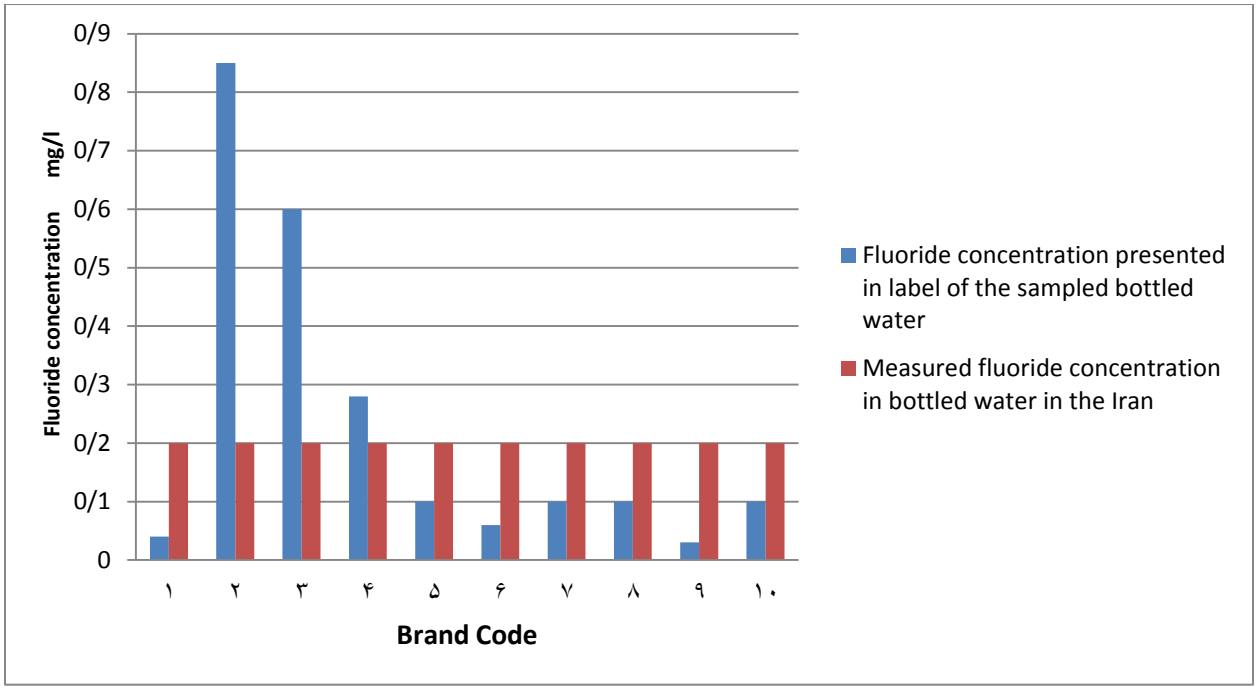
Fig 1: Comparing of the measured fluoride concentration in bottled water and written in labels.



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