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Mini Review

Concentration of Fluoride in Different Types of Common Tea and Tea Bag in Iran

Reza Sadeghnezhad[1*], Seyyed Abbas Hashemi[2], Mohammad Zahedi[3]

[1]Student Research Committee, Faculty of Health, Health Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran
[2]Immunogenetic Research Center, Faculty of Medicine, Mazandaran University of Medical Sciences, Sari, Iran
[3]Department of Laboratory Sciences, Student Research Committee, Mazandaran University of Medical Sciences, Sari, Iran

Corresponding Author: Reza Sadeghnezhad, MD, Environmental Health Engineering, Student Research Committee, Faculty of Health, Health Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran. Tel: +98-9114869810. Email: r.sadeghnejad@mazums.ac.ir

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Abstract

Introduction: Tea is one of the most popular/consumed beverages in the world, which is made from the dry leaves of *Camellia sinensis*. The fluoride content of tea has been reported at least 0.02 ppm to 4.65 ppm. If the tea has low level of fluoride or affected by factors, it can increase risk of tooth caries, and cause of premature loss of teeth, reduced buccal strength, nutritional disorders, and cosmetic imperfections. On the other hand, when fluoride systemic absorption is higher than normal level (0.05-0.07 mg fluoride/kg body weight/day), raise the risk of fluorosis and osteoarthritis.

Methods: The fluoride concentrations in different types of common tea in Iran, were collected through a literature search and published data publicly available. The literature sources used in this research mainly included, PubMed, Science direct, IranMedex, SID and Google scholar database from 1990 to 2017, as well as original research articles that reported fluoride concentrations in different types of tea Articles published in both Persian and English languages were also used in this research.

Results: In the first part of the study, we received about 53 updated articles, subsequently, these papers were distributed among the authors. After reading the articles and sharing their thoughts and opinions with each other. Eventually, 10 articles were selected that completely related to the topic. The quantitative data analysis and comparison were carried out on the fluoride concentrations in different types of common tea in Iran, as well as the values reported in the literature versus the allowable concentration level according to the WHO guideline. The minimum allowable concentration of fluoride (2-4 mg/L) is represented by, which also revealed that most of the selected different types of tea don't match the reference guideline. The fluoride concentrations for various types of tea were found to be less than 2 mg/L.

Conclusions: Considering that the World Health Organization recommends a maximum daily fluoride intake of 2 mg per day for children and 4 mg per day for adults the daily consumption of drinking water and the average fluoride of tea calculated in this study, the amount of daily tea consumption should be managed.

Keywords: Fluoride, Tea, Ambient Temperature, Iran

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Introduction

Tea is one of the most popular beverages in the world, which is made from the dry leaves of *Camellia sinensis*. Of tea produced in the world, 78% is black tea, which is commonly consumed in western countries, 20% is green tea, which is generally consumed in Asia. The tea plant can selectively absorb and store fluoride of the soil.[1,2] human fluoride intake is from drinking water and eating food.[3] The consumption of fluoride from tea depends on its concentration, altitude, temperature, and diet. Given that in tropical regions (such as Iran), people use more water because of the medium temperature, therefore the body receives more fluoride every day.[4] The concentration of fluoride in tea has been reported at least 0.02 ppm to 4.65 ppm.[2] If the tea has low level of fluoride or affected by factors, it can increase risk of tooth caries, and cause of premature loss of teeth, reduced buccal strength, nutritional disorders, and cosmetic imperfections.[5] On the other hand, when the fluoride systemic absorption is higher than normal level (0.05-0.07 mg fluoride/kg body weight/day), raise the risk of fluorosis and osteoarthritis.[6] Tea is rich source of fluoride, it seems therefore, people who drink a lot of tea or tea with high level fluoride concentration are at risk of dental and skeletal fluorosis.[7] This matters even more when, fluoride intake from tea consumption is concomitant with other fluoride resources,

including fluoride in drinking water.[8] Hence, controlling the quality of tea as an important source of fluoride is crucial. Given that, tea is most popular drink among Iranian people, and due to the lack of knowledge about fluoride consumption levels through tea in Iran, this study was conducted to review fluoride concentration in different types of consumed tea in Iran.

Methods

Literature Search

In this article, the fluoride concentrations in different types of common tea and tea bag in Iran were collected through a literature review and published data publicly available. The literature sources used in this research mainly included, PubMed, Science direct, IranMedex, SID and Google scholar database from 1990 to 2017, as well as original research articles that reported fluoride concentrations in different types of tea.

Articles published in both Persian and English languages were also used in this research (Figure 1).

Data categorization and analysis of subgroups were carried out to decrease the impact of confounding factors such as consumption of fluoride-containing supplements that can affect the fluoride concentrations in different types of tea.[9] In the first part of the study, we received about 53 updated articles, subsequently, these papers were distributed among the authors. After reading the articles and sharing their thoughts and opinions with each other, eventually 10 articles were selected that completely related to the topic and limited to the articles published as references. The maximum average air temperature in the central cities of the Iranian provinces was obtained from the online reliable weather meteorology site (https://www.worldweatheronline.com/). According to the recommended formula which is widely accepted by Gallegan DJ and Vermillion JR in 1957, by using mean maximum temperature of various climates we can calculate the optimal concentration of fluoride in potable water.

FX=0.34/0.038+0.062AMMT. Op=”optimal” amount of fluoride in mg F/L AMMT. F°= average maximum temperature in Fahrenheit degree based on the AMMT equation (F(mg/L)=0.022/(0.104+(0.000724×AMMT)), the average fluoride in drinking water of these cities was calculated according to the temperature of water.[10]

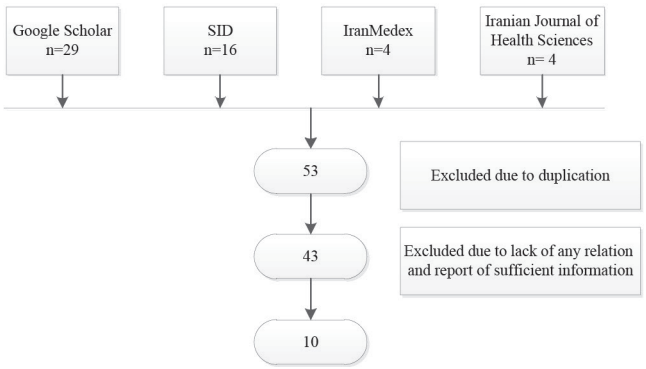

Figure 1. Flowchart Showing the Data Selection Process During the Literature Review.

Results

Table 1 shows data obtained through the literature review and calculated using the method described above. Table 1 and Table 2 show fluoride concentration in tea and tea bag supplies in different types of common tea in Iran. The results of Table 1 indicate that the reported fluoride concentrations of most different types of tea in Iran are less than the calculated values reported previously. However, some types of tea have higher fluoride concentrations than values calculated using to be than 2-4 mg/L.

Figure 2 and Figure 3 show the comparison of the searched fluoride concentrations in different types of common tea in Iran as well as the values reported in the literature versus the allowable concentration level according to the World Health Organization (WHO) guideline. The minimum allowable concentration of fluoride (2-4 mg/L) is represented by the red column in Figure 2 and Figure 3, which also reveals that most of the selected various types of tea don't match the reference guideline. The fluoride concentrations for these different types of tea and tea bag were found to be less than 2 mg/L.

Discussion and Conclusions

Based on the results of the study, the concentration of fluoride in different types of common tea and tea bag were lower than the national and WHO standards. Furthermore, the comparison between WHO standard and calculated data revealed that fluoride concentrations in all of the brands are lower than the accepted standard.

Table 1. Fluoride Concentrations (mg/L) Various Types of Common Tea Bag in Iran

Type and Brand of Tea	Fluoride mg/L	References
Tea Bag-Golestan	1.27	11
Tea Bag-Mahmoud	1.11	11
Tea Bag-Lipton	1.37	11
Tea Bag-Ahmad	1.44	11
Tea Bag-Do Ghazal	0.77	12
Tea Bag-Ahmad	3.27	13
Tea Bag-Lipton	3.1	13
Tea Bag-Do Ghazal	1.07	13
Tea Bag-Golestan	2.73	13
Tea Bag-Mahmoud	1.27	13
Tea Bag-Zarin	0.7	13

Table 2. Fluoride Concentrations (mg/L) Various Types of Common Tea (Black & Green) in Iran

Type and Brand of Tea	Fluoride mg/L	References
Tea-Sabalan	1.37	11
Tea-Do Ghazal	1.58	11
Tea-Golestan	1.67	11
Tea-Ahmad	1.44	11
Tea-Oghab	2.6	12
Green Tea -1	2.2	9
Green Tea -2	1.91	9
Green Tea -3	1.86	9

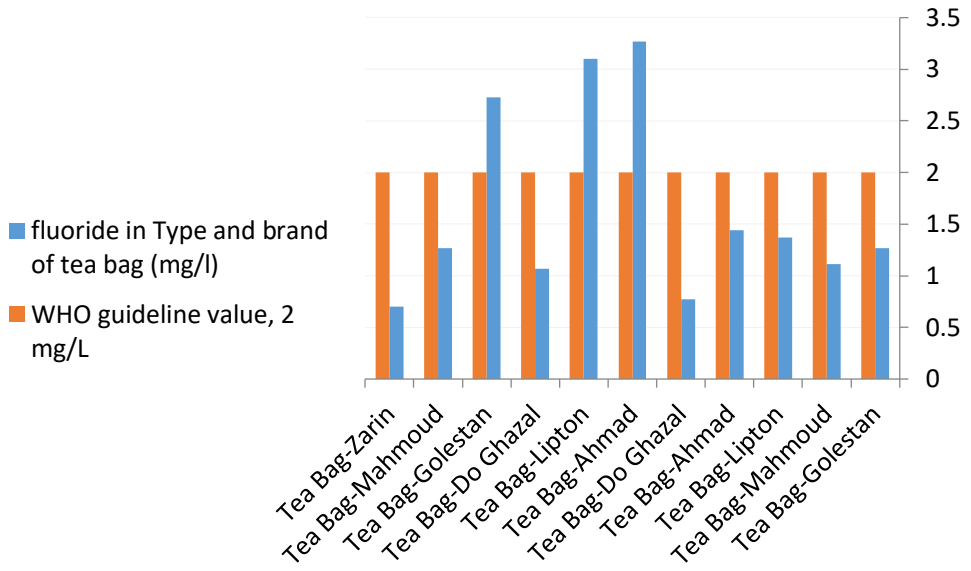

Figure 2. A Comparison of Searched Fluoride Concentration in Different Brand of Tea Bag and Values Reported in the Literature With the WHO Guideline.

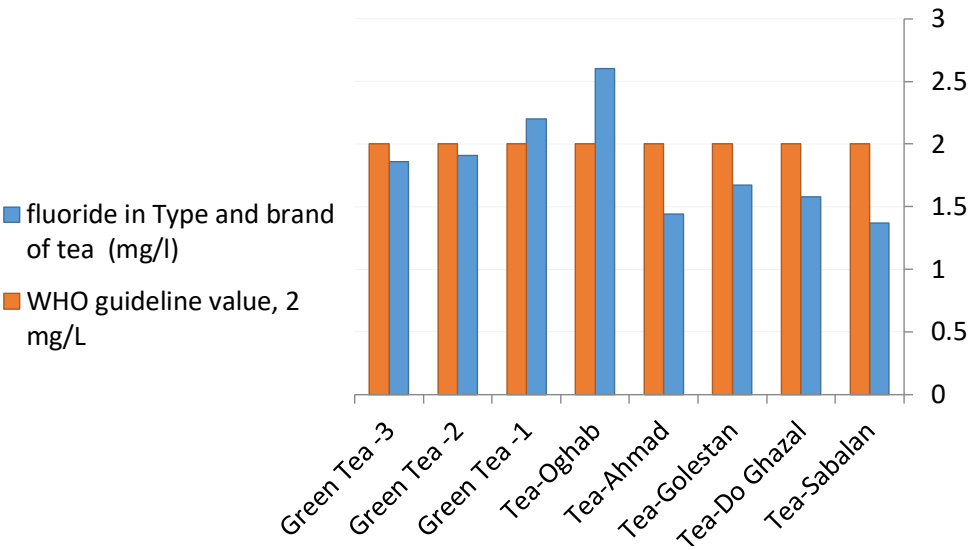

Figure 3. A Comparison of Searched Fluoride Concentration in Different Brand of Tea and Values Reported in the Literature With the WHO Guideline.

Moreover, the WHO recommends a maximum daily fluoride intake of 2 mg/d for children and 4 mg/d for adults,[14] plus the result of this study regarding the daily consumption of drinking water and the mean tea fluoride calculated, it can be conclude that daily fluoride intake should be controlled

It seems that measure should be taken into consideration for controlling of fluoride concentration in tea, since the excess amount can lead to diseases such as dental fluorosis and bone injury in both children and adults, however, the lack of fluoride also has a harmful effect on public health.[10]

So nowadays, more of tea brands fluoride concentration are less than 2 mg/L in their own tea supply source. It is recommended that 1 mg/L of fluoride is suitable in 15°C of ambient temperature.[15]

Authors' Contributions

All authors contributed equally to this study.

Conflict of Interest Disclosures

The authors declare they have no conflicts of interest.

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