JBR Journal of Interdisciplinary Medicine and Dental Science

Vesna et al., J Interdiscipl Med Dent Sci 2016, 4:3
http://dx.doi.org/10.4172/2376-032X.1000199

Research Article Open Access

Determining the Optimal Concentration of Fluoride in Drinking Water from the Republic of Macedonia

Ambarkova Vesna[1*], Jankulovska Mira[1], Kochubovski Mihail[2], Memeti Shaban[2] and Ljuben Guguvcevski[1]

[1]*Faculty of Dentistry, University St. Cyril and Methodius, Republic of Macedonia*

[2]*Institute of Public Health, Republic of Macedonia*

Abstract

Aim: The aim of this study was to determine the optimal concentration of fluoride in drinking water from 11 cities located on different sites throughout the Republic of Macedonia.

Method: The optimal level of fluoride in drinking water is universally calculated by applying the equation of Galagan and Vermillion, which permits the calculation of water as a function of temperature.

Results: The annual mean maximum temperatures (AMMT) recorded during the last 5 years were collected from the meteorological centres of the 11 divisional headquarter stations. The optimal fluoride concentration in drinking water from different cities in Macedonia was calculated to be 0.84 mgF/L in Gevgelija, 0.83 mgF/L in Demir Kapija, 0.88 mgF/L in Strumica, 0.89 mgF/L in Shtip, 0.9 mgF/L in Skopje (Zajcev Rid), 0.92 mgF/L in Bitola, 0.94 mgF/L in Prilep and Ohrid, 0.95 mgF/L in Kriva Palanka, 1.00 mgF/L in Berovo and 1.09 mgF/L in Lazaropole.

Conclusion: Determining the most appropriate concentration of fluoride in drinking water is crucial for communities. The optimal fluoride concentration in drinking water from different cities from the Republic of Macedonia was calculated to be between 0.84 -1.09 mg F/L.

Keywords: Drinking water fluoride levels; Optimal fluoride level; Macedonia

Background

The greatest achievement of dentistry achieved by these modern times is certainly the discovery of the protective capacity of fluoride against caries made in 1930. The researchers conducted in this area have shown that fluoridated water, natural or by means of artificial adding (fluorination) reduces the manifestation of caries for around 40-50% in the case of deciduous teeth and 50%-60% in the case of permanent teeth [1-5]. The information that different fluoride concentrations in potable water largely influence the manifestation of caries has encouraged great challenge for researchers in the area of fluoride content in the world [1,2,6,7].

As our country is going to be a member of the EU, it is obliged to determine the values of a set of microbiological parameters and of chemical compounds, among which is the fluoride, within the great program of the control of the drinking water quality, which is used by people, the water from the rivers and the lakes. Actually, European Union countries develop their own regulations about the quality of drinking water based on the European directive for water quality from 1983 [8]. This directive provides permissible concentrations for many substances, among which is fluoride.

In 2006 the European Commission adopted a regulation with the aim to harmonize divergent national views which refer to addition of vitamins, minerals and other substances in the food. Fluoride is included as a mineral which may be added in the food in form of sodium fluoride and potassium fluoride [9].

For the dentistry, the information about the concentration of fluoride in drinking water is still most important and popular information.

The various committees of specialists from the WHO repeatedly re-examined all the data, as epidemiological data of dental fluorosis, caries prevalence and climatic conditions, which resulted in the issuance of more guidance over the last 40 years [10-14] (Table 1).

Minimal deviations which appear in these guidelines are consequence of the difficulties that exist around the determination of a value acceptable for each geographical area, which could provide at the same way anti-caries effects of fluoride and minimizes the risk of dental fluorosis [15].

Climate in the Republic of Macedonia

Climate in the Republic of Macedonia depends on many climatic factors. The most significant of them are the following: geographic position, closeness of the surrounding seas and the relief. As a result of the climatic and other natural factors, three basic climatic types have been represented in the territory of the Republic of Macedonia. They are as it follows: alternated Mediterranean, temperate continental and mountainous climate.

Our country expand between 40˚50` and 42˚20` north geographic latitude and 20º27` and 23º05` east geographic length. That means our country is not very close to the equator, where reign to the end of time summer, nor very close to the North Pole where reign everlasting winter. Republic of Macedonia is situated approximately on the middle between them, in the north temperate thermal zone.

***Corresponding author:** Ambarkova Vesna, Faculty of Dentistry, University St. Cyril & Methodius, Macedonia, The Former Yugoslav Republic, E-mail: vambarkova@stomfak.ukim.edu.mk

Received: February 29, 2016; **Accepted:** May 17, 2016; **Published:** May 24, 2016

Citation: Vesna A, Mira J, Mihail K, Shaban M, Guguvcevski L (2016) Determining the Optimal Concentration of Fluoride in Drinking Water from the Republic of Macedonia. J Interdiscipl Med Dent Sci 4: 199. doi:10.4172/2376-032X.1000199

Institutions		Proposed Cf (Concentration of fluoride) mgF/l	Average annual value of maximal daily temperature in degree Celsius	Remarks about proposed values
Guidebook 1962, US Pub Health service **Healthy People 2010** US Health and Human services, 2000	**Optimal concentration**	1.2	10.0-12.0	Prevention of dental caries: provide Risk of dental caries: • Mild grade • Small percent of people • Inconsiderable sensitive problem
		1.1	12.1-14.6	
		1.0	14.7-17.6	
		0.9	17.7-21.4	
		0.8	21.5-26.2	
		0.7	26.3-32.5	
1971 WHO International Standards for drinking water Guidelines		0.9-1.7	10-12	Borders are determined in compliance with the local temperature of the air
		0.6-0.8	26.3-32.6	
1980 Decree 80/778/EOC(Equal Opportunities Commission)		Max. 1.5	8-12	Borders are determined in compliance with the local temperature of the air
		Max. 0.7	25-30	
1984 & 1993 WHO International Standards for drinking water Guidelines		Max. 1.5	10-12	Borders are established by the local conditions: • Climate • Consumption of water
1994 WHO expert Committee on Oral Health& Fluoride use		Max. 1.0	Cold climate	Borders are review with respect to: • Climate • Consumption of water • Other sources of fluorine
		Max. 0.5	Tropical and subtropical climate	
2003 Council of Europe Directions 98/83/European Community Official Journal of the European Union		Max. 1.5	There isn't report about the temperature of the air	Member States of the European Union of the European Union determine their own optimal value of fluorine
2003 WHO Guidelines for drinking water quality		Max. 1,5	There isn't report about the temperature of the air	National standards are nominated in proportion to: • water consumption • fluorine intake from other sources

Table 1: Chronological representation of the proposals from the official services (subjects, institutions) with respect to determination of the optimal concentration and avoidance of harmful concentration of fluorine in water.

The vicinity of the surrounding seas is the second important factor on which the climate in our country depends. The Aegean Sea in the north is most closely to the Republic of Macedonia and in the west the Adriatic Sea. The warm influences of the Aegean Sea get in trough the valleys of the Vardar and Strumica rivers. The warm influences of the Adriatic Sea enter trough the valley of the Black Drim river. Also, the influences of the Atlantic Ocean, from where the west winds bring rainfalls in the spring and the autumn months penetrate from the west.

The orography is as well the important factor for the climate in our country. The Kozuv, Nidje and Belasica mountains, as well and Jablanica, Desat and Korab mountains with their heights and direction of stretch prevent warm influences from the south and the west. The Skopska Crna Gora and the Shar Mountains prevent the cold continental influences from the north.

The temperature of the air in the Republic of Macedonia is affected by the orography, vicinity of the seas, vegetables and other things. The correlation existing between dental fluorosis and fluoride concentration in water is based on average water consumption, a condition that depends directly from air temperature and local climate conditions. As a result of its geographic position and topography, our country is at the crossroads of continental and Mediterranean climates (Figure 1). Temperatures, rainfall, atmospheric pressure, wind and moisture vary significantly and influence the overall water regime. Dry and hot periods predominate (summer-autumn) while cold periods are short (winter). Rainfall is irregular, sporadic and in small quantity throughout the country (average annual precipitation is 733 mm).

Fluoride uptake is increasing proportionally with the increasing of the concentration of fluoride in water, as well as with air temperature in the area, since summer temperatures are higher than winter temperatures [5]. Drinking-water is typically the largest single contributor to daily fluoride intake [16]. For a given individual, fluoride exposure via drinking-water is determined by the fluoride level in the water and the daily water consumption. More recently national figures can be obtained or computed from various compendia of environmental and water supply statistics such as World Bank (1994) and World Resources Institute (1996). However, national consumption figures, especially for developing countries, may be of limited use for this purpose because there are likely to be major differences between urban and rural communities using wells and boreholes with hand pumps.

For a given individual, water consumption increases with temperature, humidity, exercise and state of health, and is modified by other factors including diet. Roughly, the closer to the Equator the higher is the water consumption [16]. From the perspective of public health, drinking water should be the main source of fluoride for humans. The entire population of every region of the world drink equal quantity of water and thus brings equal quantity of fluoride in the body. In some areas of the world where the amount of fluoride in drinking water ranged between 0.5 and 1.5 mg F/L not caused the occurrence of dental fluorosis while the occurrence of dental caries was significantly reduced. Due to this fact, it is necessary to determine the "optimal" amount of fluoride for each climate area. It is necessary for the additional input of fluoride to drinking water, salt, milk or used of fluoride tablets, and dental pastes with fluoride.

Material and Method

Based on average maximum temperature of various climates in 1957 Galagan DJ and Vermillion JR proposed this formula to calculate the optimal amount of fluoride in drinking water, which is widely accepted:

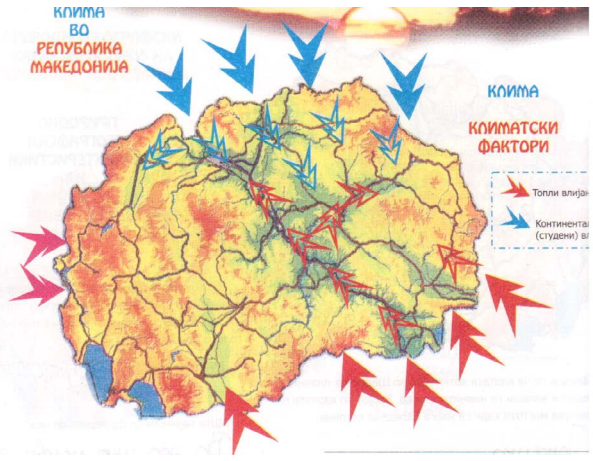

Figure 1: Climate of Macedonia.

Op (mg F/L) = 0,34/[(-0,038+0,0062 x (9/5 Tsr C°+32)]

Op= "optimal" amount of fluoride in mg F / L

Tsr C°= average maximum temperature in Celsius degrees

It is recognized that in areas with temperate climates, "optimal" amount of fluoride is 1 mg / L. Prepared tables which include the proposed highest, lowest and optimal values [15].

Optimal concentration within the water supply network depends on the naturally existing fluorides and the average maximal daily temperature for a year. The average daily temperature is important parameter, which in direct way determines the average amount of liquids that are consumed in one body.

On the base of that, the followed optimal fluoride concentrations in drinking water are recommended in Table 2.

Experimental

The air temperature in the country is affected by orography, distance from the sea, vegetable world and more. The average annual temperature in our country is 11.5°C. The warmest month of the year is July, with an average air temperature of 22.2°C, while the coldest is January with an average temperature of 0.3°C. The highest air temperature was measured at Demir Kapija from 44.5°C, and the lowest in Berovo -31,5°C. In Macedonia there are days with air temperature under 0°C, called frosty days. South part of our country have fewer frosty days in comparison with the north [16].

The air temperature is among the major elements of the weather and climate. The temperature depends directly on the substrate over which it is located, because the air is heated from the surface of the substrate, and only a small part from the solar radiation. Daily and annual changes in air temperature depends on several factors: the type of surface, the shape of the land, the seasons of year, the geographic position, the opacity of the atmosphere and more. We should determine the optimal amount of fluoride in drinking water using the average annual air temperature to provide protection against dental caries [17].

Results and Discussion

Water quality parameters such as alkalinity, p^H and hardness have high impact on water fluoride level due to the promotion of fluoride from fluoride containing minerals by carbonates and dissolved solids.

Average annual temperature (°c)	Fluorides concentration (ppm)		
	minimal	optimal	maximal
10-12	0.9	1.2	1.7
12-14.5	0.8	1.1	1.5
14.6-17.5	0.8	1.0	1.3
17.6-21.4	0.7	0.9	1.2
21.5-26.2	0.7	0.8	1.1
26.3-32.5	0.6	0.7	0.8

Table 2: Optimal fluorine concentrations in drinking water
Source: Voinovic J., Tatic E., Andelic P., Pintaric J. Preventive program in dentistry. Scientific book, Beograd, 1990.

Fluoride in drinking water considerably contributes to the daily fluoride intake, but more than 50% of the fluoride in total fluoride intake per day is derived from food and beverages such as tea and coffee.

Because water consumption, and therefore the amount of imported fluoride is proportional to the average outdoor temperature, it would be desirable to calculate the optimal amount of fluoride based on average seasonal temperature (winter, summer and average years Table 4).

In the USA, the authorities established the rule there is no need of changing the water for areas with less than 200 inhabitants and with water which contains to 4 mg F/l. The decision is supported by the fact that the above mentioned concentration of fluoride does not cause any problems for the general health and is related only to the dental fluorosis. For the USA, the prevention of dental fluorosis is not a cause for neglecting the cost-benefit analysis.

Instead of changing the water which requires many expenses, it is suggested to inform the families who have babies and small children, in order to avoid drinking and using this water for preparing meals, until the children are sex years old.

The content of fluoride in the drinking water has an effect upon the dental health of the population of the Republic of Macedonia.

So far in our country there were some information about existence of areas with abundance of fluoride in the drinking water that attracted the interest of dentists due to teeth aesthetic damage (dental fluorosis) [18-21].

In the Progress Report 2008 for the Republic of Macedonia, prepared by the Commission of the EU it is stated that little progress has been made in the field of water quality. The new Law on water was enacted. The monitoring system has improved but still lacks sufficient coverage and data collection. The first annual report on water quality and quantity was submitted to the European Environment Agency. The new Law on water has not yet been adopted by parliament. The new Law for water came in to force. The monitoring system was improved (upgraded), but there is still insufficient scope of work and collecting of data. Some investments were made for project preparation and implementation of small infrastructure projects. The substantial investments required for compliance with the acquis have not yet been planned. Preparations in the area of water quality are moderately advanced.

Within their work the dentists are obliged to prescribe individual a mass preventive programs. It is necessary for the dentist to know the F-concentration of drinking water of the area where the patients live, before any mass or individual fluoride program (local or systemic F-supplements) is applied.

On the Table 5 are presented the calculated optimal concentrations of fluoride in water according to average annual temperatures of 11 meteorological stations.

	period 2008-2012 year												
Month/ Year	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**Average**
GEVGELIJA	9.2	11.0	16.3	21.0	26.4	31.5	34.9	35.5	29.4	21.9	17.2	10.8	22.1
DEMIR KAPIJA	6.4	9.7	15.4	20.5	25.8	31.1	34.7	35.1	28.7	20.6	15.3	9.0	21.1
STRUMICA	6.6	9.7	15.5	20.1	24.9	29.9	33.1	33.5	27.8	20.4	15.1	8.5	20.4
ŠTIP	5.7	8.8	14.4	19.5	24.2	29.6	32.9	33.6	27.8	20.1	15.0	8.4	20.0
BITOLA	3.9	7.2	13.2	17.8	23.0	27.9	31.4	31.8	25.9	18.8	14.0	7.7	18.6
PRILEP	4.1	7.0	12.4	17.1	22.2	26.9	30.2	30.8	25.0	18.1	13.6	7.2	17.9
KRIVA PALANKA	4.9	6.9	11.8	16.8	21.5	26.2	29.2	30.0	24.8	18.0	13.7	6.9	17.6
OHRID	6.4	7.8	12.2	16.4	21.3	25.7	29.1	30.1	24.7	17.9	13.5	8.3	17,8
BEROVO	4.6	6.2	10.8	15.8	20.3	24.6	27.6	28.7	23.2	17.2	13.6	7.1	16.7
LAZAROPOLE	2.5	3.2	7.0	11.9	16.7	21.1	24.5	26.2	20.3	14.2	10.8	4.0	13.5
SKOPJE ZAJČEV RID	4.9	7.7	14.3	19.3	24.1	29.0	32.3	33.6	27.5	19.3	13.6	6.7	19,3

Table 3: Average monthly and annual maximum air temperature in ^{0}C
Source: Hydrometeorological Service, in May 2013

	Period 2008-2012 year			
Season	**WINTER**	**SPRING**	**SUMMER**	**AUTUMN**
GEVGELIJA	12.16	26.3	33.27	16.63
DEMIR KAPIJA	10.5	25.8	32.83	14.97
STRUMICA	10.6	24.97	31.47	14.56
ŠTIP	9.63	24.43	31.43	14.5
BITOLA	8.1	22.9	29.7	13.5
PRILEP	7.83	22.07	28.67	12.97
KRIVA PALANKA	7.87	21.5	28	12.87
OHRID	8.8	21.13	27.97	13.23
BEROVO	7.2	20.23	26.5	12.63
LAZAROPOLE	4.23	16.57	23.67	9.67
SKOPJE ZAJČEV RID	8.97	24.13	31.13	13.2

Table 4: Average seasonal temperatures.

Hydro-meteorological stations	**Average annual air temperature**	**Op (mg F/L)**
GEVGELIJA	22.1	0.84
DEMIR KAPIJA	21.1	0.83
STRUMICA	20.4	0.88
ŠTIP	20.0	0.89
BITOLA	18.6	0.92
PRILEP	17.9	0.94
KRIVA PALANKA	17.6	0.95
OHRID	17.8	0.94
BEROVO	16.7	1
LAZAROPOLE	13.5	1.09
SKOPJE ZAJČEV RID	19.3	0.9

Table 5: Optimal amounts of fluoride according to average annual air temperatures expressed in mg F / l.

There are 90 pedodontists in the Republic of Macedonia and another 60 general dentists employed at Public health institutions which geographically belong to eight regions. The work of every dentist will be helped to a great deal when they will know the optimal concentration of fluoride in the drinking water, no matter if they work in private practice or in the State Health System.

The benefits of using water fluoridation as a public health measure for the prevention of dental caries have been clearly demonstrated over the past 50 years. However, whilst it is recognized as being one of the most successful health promotion measures it is currently only available in a few high-income communities. The opportunities to introduce water fluoridation in middle and low-income communities would, in the foreseeable future, seem to be limited as the costs involved will often prove to be prohibitive. According to the recommendations of the WHO, FDA, and many other medical and dental organizations, the systematic introduction of fluorides is safe, effective and efficient method for the reduction of dental caries.

During the last two decades in many parts of the world salt has also been used effectively as a vehicle for fluoride. However, there are many communities where the need for fluoride intervention is clear but neither water nor salt fluoridation can be implemented. This encouraged the World Health Organization (WHO) to establish the International Milk Fluoridation Programme (IMFP) which has been in operation since 1990. The main objective of the IMFP is to promote and support programmes aimed at demonstrating the feasibility of using milk fluoridation at a community level as an alternative to water or salt fluoridation.

The optimal fluoride level in oral environment that would minimize the manifestation of caries and fluorosis should be determined on an individual level, thus, having in mind the systematic (endogenous) uptake of fluorides, as well as the influence of potential usage of local fluorides in the form of supplements [10,12,13,22-26]. The first formal WHO Guidelines on fluorides in drinking water were established in 1984 and were issued in the first edition of Guidelines for drinking water quality. The World Health Organization has determined the recommended value as a "concentration that does not cause any significant risk related to health during life-long consumption". At that point, the recommended value of 1.5 mg/l was determined for fluorides [10].

WHO guidelines for drinking water quality contain the following

"Upon determination of national standards related to fluorides or upon evaluation of possible consequences on human health coming from exposition to fluorides, it is very important to take in consideration the uptake of water by the population in question, as well as the uptake of fluorides from other sources (for example, from food, air and dental preparations). In the cases where the uptake from other sources shall approximate or shall be higher than 6 mg/day, it would be more appropriate to consider the possibility for determining standards with lower concentration than the recommended value [12]. "Besides the above-mentioned, it has been suggested that:

"In regions with high natural concentrations of fluorides in potable water, it might be difficult to reach the recommended value in certain circumstances only by means of available water treatment technology".

When setting up the national standards/legislation for the content of the fluoride in the drinking water one should always have in mind how much content of fluoride is going to be consumed through the drinking water, as well as through the other sources (food, toothpastes, etc.), as well as to take into consideration climatic factors. According to the recommendations of the WHO [12], as well as according to the existing regulation (Regulation for the safety of water, Official Gazette No 46/08), the content of fluoride in the drinking water has to be up to 1.5 mg/l.

The protective role of the fluoride in the drinking water against the appearance of dental caries is most evident when the fluoride concentration is from 0.8 to1.2 mg/l. The appearance of the fluoride in the drinking water varies from the type/structure of the soil.

In general, the drinking water in the Republic of Macedonia are poor with fluoride that is in correlation with the frequent appearance of caries among our population.

Conclusions

This type of approach for assessing the optimal fluoride level in drinking water is helpful for governmental and non governmental organization in supplying drinking water with appropriate fluoride content. The optimal fluoride concentration in drinking water from different cities from the Republic of Macedonia was calculated to be between 0.84 -1.09 mg F/L.

References

1. Ambarkova V, Topitsoglou V, Iljovska S, Jankulovska M, Pavlevska M (2007) Fluoride Content of Drinking Water in Relation to the Geological-Petrographical Formations From FYROM. Balk. J. Stom11: 163-166.
2. Ambarkova V, Topitsoglou V, Iljovska S, Carcev M (2005) Natural fluoridated drinking water from the Republic of Macedonia. Macedonian Stomatological Review 29: 177-182.
3. Fejerskov O, Ekstrand J, Burt BA (1996) Fluoride in Dentistry (2nd Ed) Munksgaard, Copenhagen.
4. Kolevska L, Filjanski P, Cvetkovska T, Gjorgjev D, Mitriceska M (1985) Contents of the fluoride in the drinking water from the SR Macedonia. Macedonian Stomatological Review 3-4:103-106.
5. Topitsoglou V, Liatsa TH, Tsolaki A (1995) Naturally fluoridated drinking waters at the prefecture of Thessaloniki, Greece. STOMA 23: 15-22.
6. Griffin SO, Beltran ED, Lockwood SA, Barker LK (2002) Esthetically objectionable fluorosis attributable to water fluoridation. Community Dent Oral Epidemiol 30:199-209.
7. DenBesten PK (1999) Biological mechanisms of dental fluorosis relevant to the use of fluoride supplements. Community Dent Oral Epidemiol 27: 41-47.
8. (1998) Council Directive 98/83/EC on the quality of water intended for human consumption. CELEX-EUR Official Journal L 330: 32-54.
9. (2006) Regulation (EC) No. 1925/2006 of the European Parliament and of the Council on the addition of vitamins and minerals and of certain other substances to foods. Official Journal of the European Union L404 26-38.
10. World Health Assembly (1975) Fluoridation and dental health resolution.
11. World Health Assembly (1978) Fluoridation and dental health resolution.
12. World Health Organization (1984) International Standards for drinking water Guidelines.
13. World Health Organization (1993) International Standards for drinking water Guidelines.
14. WHO (2003) Guidelines for drinking water quality.
15. Topitsoglou V (2004) Monograph. Fluoride Map of Greece and Cyprus-natural fluorinated drinking water. Thessaloniki.
16. Murray JJ, Rugg-Gunn AJ (1982) Fluorides in caries prevention (2nd edn) Wright, Bristol, pp 57-73.
17. Voinovic J, Tatic E, Andelic P, Pintaric J (1990) Preventive program in dentistry. Scientific book, Beograd
18. Ambarkova V (2015) Comparative study between oral health and natural fluorinated drinking water in certain regions of the Republic of Macedonia. Doctoral dissertation. Faculty of dentistry. University St.Cyril & Methodius, Skopje 2015.
19. Ambarkova V, Jankulovska M, Zabokova-Bilbilova E, Kokoceva-Ivanova O, Trajkovska L (2012) Determining the optimal concentration of fluoride in drinking water. 17th Congress of the Balkan Stomatological Society, Tirana, Albania.
20. (2010) Hydrometeorological Service. Monthly and annual average air temperatures in some places in the country.
21. Carcev M, Gjorgjev D, Neceva Lj, Docevska V, Filjanski P (1992) Fluoride in drinking water and caries frequency in endemic areas of the Republic of Macedonia. Macedonian Stomatological Review 16: 51-57.
22. Gjorgjev D, Neceva Lj, Filjanski P, Kolevska L, Pashu M, et al. (1989) Some aspects of dental and nutritional status of school children in endemic fluoridated areas of the SR Macedonia. Macedonian Stomatological Review13: 83-85.
23. Tavciovski I, Rafajlovski R, Stevanovic M, Kederov P, Stojanovski J, et al. (1979) Multiple examining the correlation between dental caries and fluoride concentration in drinking water. Macedonian Stomatological Review, 3: 209-214.
24. World Health Organization (1984) Fluoride & Fluorides. Environmental Health Criteria 36, World Health Organization.
25. World Health Organization (1994) Fluorides and oral health. Report of an Expert Committee on Oral Health Status and Fluoride Use. Technical Report Series No 846.
26. Galagan DJ, Vermillion JR (1957) Determining optimum fluoride concentrations. Public Health Rep 72: 491-493.
27. Drinking water standards (1962) Washington: US Department of Health, Education and Welfare, Public Health Service.

Citation: Vesna A, Mira J, Mihail K, Shaban M, Guguvcevski L (2016) Determining the Optimal Concentration of Fluoride in Drinking Water from the Republic of Macedonia. J Interdiscipl Med Dent Sci 4: 199. doi: 10.4172/2376-032X.1000199