

FLUORIDE CONCENTRATION IN BOTTLED DRINKING WATER

IN AL-BASRA CITY, IRAQ

BAHAA ABDULRAZZAQ JERRI

College of Dentistry, University of Al-Basar, Iraq

ABSTRACT

Background: This study aimed to measure the amount of fluoride in commercially available bottled drinking water in Al-Basra city, Iraq

Materials and Methods: Eleven brands of bottled drinking water were obtained from supermarkets in Al-Basra city, Iraq. Two sample of 10 ml. were taking from each one of brands and the fluoride was determined using fluoride Ion Selective Electrode. The mean was taken for two sample and compare with label content for each products if available.

Results: the discriptive analysis for different types are show in table 1 with ($p=0.00$) . the mean (\pm SD) difference was 0.251 (± 0.01) ANOVA test for comparison between different types show highly significant different between Evian,BADIOT,Aquafina,OXAB and pure healthy water with others commercially branded types

Conclusions: Bottled water available in Al-Basra city contains less concentration of fluoride ion than normal values because there is no adding of fluoride to the water. It's not safe for program of preventive dental caries.

KEYWORDS: Bottled Water, Fluoride, Al-Basra, Iraq

INTRODUCTION

In recent year, most Iraqi people drink bottled water which replace tap water. Sales of bottled water have increased and different types and brands of bottled water are available in Al-Basra city supermarkets.

Water fluoridation is considered as one of the most efficient methods in reduction of dental caries on public health level and its greatest influence on socially care of children with higher prevalence of tooth decay ⁽¹⁾.

Dental caries is a multifactorial disease depending on presence of bacteria (mostly Streptococcus Mutans), diet (mostly sugar) and host which mean tooth. Inorganic ion in tooth composition are calcium, phosphate and fluoride form chemical formula (hydroxyapatite crystal) ⁽²⁾.

Fluoride exerts its anticaries effect by two different mechanism; first the presence of fluoride ion enhances the precipitation of fluoroapatite into tooth structure, this insoluble precipitate replace the soluble salts containing manganese and carbonate that were lost because of bacteria-mediated demineralization. This exchange process results in the enamel become more acid resistant which secreted from bacteria. The second mechanism; fluoride has antimicrobial activity. Low concentration fluoride ion inhibits the enzymatic production of glucosyl transferase which promotes glucose to form extracellular polysaccharide and increases bacteria adhesion ⁽²⁾ so fluoride when it is available during cycles of tooth demineralization, it plays a major role in reduction caries activity ⁽³⁾.

(1)Assistant Lecturer. Department of Conservative Dentistry, College of Dentistry, Basra University

The availability of fluoride to reduce caries risk is thought to be primarily achieved by water fluoridated community, fluoride ions also intake from other source like diet, tooth pastes, mouth rinse, professional topical fluoridation application ⁽⁴⁾. Fluoride supplements should be considered for all children that drink water with fluoride at least 0.6 ppm ⁽⁵⁾. EPA recommended maximum amount of fluoride allowed in drinking water about 4.0 mg/L more than that lead to risk of crippling skeletal fluorosis ⁽⁶⁾. While HHS gives optimal level of fluoride in drinking water 0.7 mg/L ⁽⁷⁾. WHO determined the majority of bottled water fluoridation to be 1.5 mg/L ⁽⁸⁾. FDA set limits for fluoride in bottled water based on several factors, including the source of water, it gave range from 0.8-2.4 mg/L ⁽¹⁶⁾. The laboratory finding of fluoride concentration ranged between 0.32 - 1.1 ppm ⁽¹⁷⁾.

In Al-Basra city, there is no reported published fluoride content in drinking water (tap or bottled). Knowledge of fluoride content of drinking water is essential to all health care professionals especially dentists. Planning of preventive dental program and prescription of fluoride supplement would depend on accurate assessment of the current fluoride intake habits by population .

This study aimed to determine the fluoride concentration of commercially available bottled water and to compare if there is significant difference found between different products, also this study aimed to report that the important of labeling which most types of local product not mention fluoride ion concentration on patches .

MATERIALS AND METHODS

Eleven brands of bottled drinking water were obtained from supermarkets in Al-Basra city, Iraq with different patch numbers and expire dates of bottling water .

Seven types from the samples made in factories inside the city while four type from other countries. Only three samples remember fluoride concentration on the label while other products have not that.

All bottles were stored in dark place and in their original closed plastic containers at room temperature until fluoride concentration tested and pH of water tested also. After shaking the bottle of water, two samples were taking from each one of brands about 10 ml. Samples were kept in container then coded so the type and brands were unknown by the technician labraratory test .

Samples were diluted with equal quantities of TISAB (total ionic strength adjustment buffer, USA). Fluoride was determined using Fluoride Ion Selective Electrode (model 96-09 ATI Orion) in conjunction with ISE meter (model 720 A, ATI Orion) ⁽⁹⁾. pH of water sample was also measured using a pH meter (model 240, corning)

Statistical Analyses

All measurements were analyzed using SPSS version 15. One-way ANOVA test was used for comparison of fluoride contents among different brands of bottled water. One sample t-test was used to compare the label and laboratory values of bottled water.

RESULTS

The method was confirmed by taking first and second reading of the samples. the discriptive analysis for different

types are show in table 1 with ($p=0.00$) . the mean (\pm SD) difference was 0.251 (\pm 0.01) and the information about the labeling and the concentration of fluoride of the eleven branded bottled water was measured in mg/L. only three branded batches of bottled water has labeling information about fluoride concentration.

ANOVA test for comparison between different types show highly significant different between Evian,BADIOT,Aquafina,OXAB and pure healthy water with others commercially branded types that listed in table 2 while slightly significant difference between :

- OXAB and Aquazalzal
- pure healthy water and Aquazalzal

the quality of the three labeling types of bottled water with other types comparing using one - sample t-test with no significant difference of Evian and BADIOT while there is significant difference of OXAB TABLE 3. other types which considered widely used in AL-Basra city not mentioned any concentration of fluoride .

Table 1: Comparison the Fluoride Concentration (Mg/L) among Bottled Water

Bottled Water	Source	Labeled Content	Raw Data		Descriptive Statistics		Group's Difference	
			Reading 1	Reading 2	Mean	S.D.	F-Test	P-Value
Al-Waha	Iraq	Not mentioned	0.084	0.073	0.079	0.008	535.245	0.000 (HS)
Evian	France	0.6	0.623	0.682	0.653	0.042		
Al-Khalij	Iraq	Not mentioned	0.034	0.052	0.043	0.013		
Al-Janaa'en	Iraq	Not mentioned	0.063	0.087	0.075	0.017		
Aquafina	Kuwait	Not mentioned	0.368	0.297	0.333	0.050		
Salsal	Iraq	Not mentioned	0.058	0.057	0.058	0.001		
BADIOT	France	1.2	1.183	1.164	1.174	0.013		
Barakat	Iraq	Not mentioned	0.049	0.038	0.044	0.008		
OXAB	Iran	0.1	0.124	0.123	0.124	0.001		
Pure healthy water	Iraq	Not mentioned	0.116	0.135	0.126	0.013		
Aquazalzal	Iraq	Not mentioned	0.065	0.057	0.061	0.006		

Table 2: LSD Test after ANOVA Test

Bottled Water		Mean Difference	P-Value
Al-Waha	Evian	-0.574	0.000 (HS)
	Al-Khalij	0.036	0.132 (NS)
	Al-Janaa'en	0.004	0.875 (NS)
	Aquafina	-0.254	0.000 (HS)
	Salsal	0.021	0.356 (NS)
	BADIOT	-1.095	0.000 (HS)
	Barakat	0.035	0.137 (NS)
	OXAB	-0.045	0.063 (NS)
	Pure healthy water	-0.047	0.054 (NS)
	Aquazalzal	0.018	0.439 (NS)
Evian	Al-Khalij	0.610	0.000 (HS)
	Al-Janaa'en	0.578	0.000 (HS)
	Aquafina	0.320	0.000 (HS)
	Salsal	0.595	0.000 (HS)
	BADIOT	-0.521	0.000 (HS)
	Barakat	0.609	0.000 (HS)
	OXAB	0.529	0.000 (HS)

	Pure healthy water	0.527	0.000 (HS)
	Aquazalzal	0.592	0.000 (HS)
Al-Khalij	Al-Janaa 'en	-0.032	0.170 (NS)
	Aquafina	-0.290	0.000 (HS)
	Salsal	-0.015	0.520 (NS)
	BADIOT	-1.131	0.000 (HS)
	Barakat	-0.001	0.982 (NS)
	OXAB	-0.081	0.004 (HS)
	Pure healthy water	-0.083	0.003 (HS)
	Aquazalzal	-0.018	0.426 (NS)
	Al-Janaa 'en	Aquafina	-0.258
Salsal		0.018	0.439 (NS)
BADIOT		-1.099	0.000 (HS)
Barakat		0.032	0.176 (NS)
OXAB		-0.049	0.048 (S)
Pure healthy water		-0.051	0.041 (S)
Aquazalzal		0.014	0.534 (NS)
Aquafina	Salsal	0.275	0.000 (HS)
	BADIOT	-0.841	0.000 (HS)
	Barakat	0.289	0.000 (HS)
	OXAB	0.209	0.000 (HS)
	Pure healthy water	0.207	0.000 (HS)
	Aquazalzal	0.272	0.000 (HS)
Salsal	BADIOT	-1.116	0.000 (HS)
	Barakat	0.014	0.534 (NS)
	OXAB	-0.066	0.011 (S)
	Pure healthy water	-0.068	0.010 (HS)
	Aquazalzal	-0.004	0.875 (NS)
BADIOT	Barakat	1.130	0.000 (HS)
	OXAB	1.050	0.000 (HS)
	Pure healthy water	1.048	0.000 (HS)
	Aquazalzal	1.113	0.000 (HS)
Barakat	OXAB	-0.080	0.004 (HS)
	Pure healthy water	-0.082	0.003 (HS)
	Aquazalzal	-0.018	0.439 (NS)
OXAB	Pure healthy water	-0.002	0.929 (NS)
	Aquazalzal	0.063	0.015 (S)
Pure healthy water	Aquazalzal	0.065	0.013 (S)

Table 3: Comparing the Labeled Fluoride Content with the Measured One Using One-Sample T-Test

Bottled Water	T-Test	D. F.	P-Value
Evian	1.780	1	0.326 (NS)
BADIOT	-2.789	1	0.219 (NS)
OXAB	47	1	0.014 (S)

DISCUSSIONS

The detection of fluoride content in this area of Iraq is so recommended because there is no previous research in this field so that no any comparison with other researches.

Generally, the concentration of fluoride in these branded types of bottled water is less than normal values ^(7,8,16), because there no adding of any artificial fluoride ions and the source depends on natural finding in the river (Shat-Al-Arab)

Drinking Water Inspectorate (DWI) of ministry of health in Al-Basra city did not supervised these factories and inform them the important of adding fluoride like other minerals in the drinking water which is essential to all health care professionally especially dentists.

Effective and safe preventive fluoride programs require an awareness of the exact concentration of drinking water either public or bottled. When prescribing fluoride supplement, dentists should be know the content of fluoride in bottled drinking water used by children which not increase higher than 0.5 ppm⁽¹⁰⁾.

This study reported a narrow range in the fluoride concentration for the same patches and different branded product of the same local area, this disagrees with other studies^(11,12) which showed significant difference between the batches of water products because the weather changes including heavy rains while in our region one sources of water from river (Shat- Al-Arab).

American Dental Association reported that safe concentration of fluoride is 0.7 -1.2 ppm⁽¹³⁾ which is enough for protecting against tooth decay while in this research recommended concentration of fluoride with low level 0.07 ppm. But with warm city when people drink larger amount of water consumption due to hot temperature⁽¹⁴⁾.

Only three samples has labeling information of fluoride concentration which are commercial in other countries. This is not agree with other research that tested different types of bottled water with labeling reported information about fluoride concentration^(10,15).

Dentists should have information about water fluoridation reliable values which effect on decision for giving fluoride supplement from other sources like topical fluoridation in case of high caries activity specially when dealing with children. In addition, drinking water inspectorate need more closed supervision on factories that monitor fluoride and other ions minerals in drinking water with accurately reported labeling information .

CONCLUSIONS

As conclusions; bottled water available in Al-Basra contains less concentration of fluoride ion because there is no adding of fluoride to the water. It is not safe for program of preventive dental caries. All types of products prepared in factories of our city not mention fluoride concentration in the label display.

REFERENCES

1. Harrison PTC flouride in water ; UK perspective J flour chem 2005;126:1448-56
2. Sturdevant Art & Science of operative dentistry : chapter 2 : 77
3. Broun LJ ,Lazar V : The economic state of dentistry . Demand-side trends. J Am . Dent Assoc 129(12): 1685-1691,1998
4. Sturdevant Art & Science of operative dentistry : chapter 2 : 56-59
5. Adair SM. Evidence - based used of fluoride in contemporary pediatric dental practice . Pediatr Dent 2006 :28(2):133-42
6. united states environmental protection Agency (EPA)

7. HHS : Human health service 2011
8. World Health Organization : Average fluoride concentration :WHO 2004
9. christian G.D , 2004 Analytic chemistry ,john Wily and Sons,Inc,Hoboken
10. Ahiropoulos V. 2006 :Fluoride content of bottled water available in northern Greece Int J Pediatric . Dent . 16(2),111:116
11. Quok R.L Chan J.T ,2009 Fluoride contents of bottled water and its implication for the general dentis. Gen Dent 57(1),29:33
12. Bartels D. Haney ,K ., Khajotia, S,S 2000 Fluoride concentration in bottled water . J. Okla . Dent . Assoc. 91(1),18: 22
13. American Dental Association (updated on June 5. 2002) , American Dental Statement on water fluoridation efficacy and safety
14. AIDosari,A.M Akpata , E.S . Khan ,N. Wyne . A.H ,Al- Meheithif , A, 2003. Fluoride level in drinking water in the central province of saudi Arabia . Ann. Saudi Med 23(12).20:23
15. Tomba,K . J. Levy, S . Curzon, M.E..., The fluoride content of bottled water drinking water Br. Dent J . 176(7),266:268
16. Federal Drinking Association 2000
17. KHAN . N.B Chohan A.N 2010 Accuracy of bottled drinking water label content. Environ. Monit. Assess. 166(14), 169 ;176.