The Fluoride Concentration of Bottled Drinking Water in Al-Basra City, Iraq

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ABSTRACT

Background: This study aimed to determine 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. Five samples of 10 ml. were taking from each one of brands and the fluoride was determined by using fluoride ion selective electrode.

Results: The highest fluoride concentration was present in BADIOT brand (1.174 mg/L) while the lowest was in Barakat brand (0.038 mg/L). One way ANOVA test showed a highley significant difference among different commercially branded types.

Coclusions: 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.

Key words: Bottled water, fluoride, Al-Basra, Iraq. (J Bagh Coll Dentistry 2016; 28(1):143-146).

INTRODUCTION

In recent year, most Iraqies 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 (hydroxyapetite crystal)[(2)].

Fluoride exerts its anticaries effect by two different mechanism; first the presence of fluoride ion enhances the precipitation of fluoroapetite 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 of fluoride ion inhibits the enzymatic production of glucosyl transferase which promotes glucose to form extracellular polysaccharide and increases bacteria adhesion [(2)] so when fluoride is available during cycles of tooth demineralization, it plays a major role in reduction caries activity [(3)].

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 who 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 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)].

MATERIALS AND METHODS

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

Seven types from the samples made in factories inside the city while four types from other countries. Only three samples mentioned the 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, five 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,

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USA). Fluoride was determined by 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 by using SPSS version 19. 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 discriptive analyses of different brand types are show in table 1.

The highest fluoride concentration was present in **BADIOT** brand (1.174 mg/L) while the lowest was in **Barakat** brand (0.038 mg/L).

One-way ANOVA test showed statsitically highley significant difference among groups.

Table 2 represented the difference between each two brands using LSD test. Generally, the difference was variables between the groups.

Three brands only mentioned the fluoride concentration on the lable. One sample t-test was used to compare the measured concentration with the labeled one and the results indicated a non-significant difference for **Evian** and **BADIOT** brands and significant difference for **OXAB** brand.

DISCUSSION

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 is 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].

The present 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 Shat- Al-Arab river.

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 researches that tested different types of bottled water with labeling reported information about fluoride concentration [10,15].

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

Bottled water	Source	Labeled content	Descriptive statsitics		Group's difference	
			Mean	S.D.	F-test	p-value
Al-Waha	Iraq	Not mentioned	0.079	0.008	535.245	0.000 (HS)
Evian	France	0.6	0.653	0.042		
Al-Khalij	Iraq	Not mentioned	0.043	0.013		
Al-Janaa´en	Iraq	Not mentioned	0.075	0.017		
Aquafina	Kuwait	Not mentioned	0.333	0.050		
Salsal	Iraq	Not mentioned	0.058	0.001		
BADIOT	France	1.2	1.174	0.013		
Barakat	Iraq	Not mentioned	0.044	0.008		
OXAB	Iran	0.1	0.124	0.001		
Pure healthy water	Iraq	Not mentioned	0.126	0.013		
Aquazalzal	Iraq	Not mentioned	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	0.000 (HS)
	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)

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.

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 so effective as a preventive dental caries program. All types of products prepared in factories of our city not mention fluoride concentration in the label display.

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