Evaluation quality of bottled drinking .water sold in Samawa city-Iraq

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Abstract

Consumption of bottled drinking water increase rabidly in Iraq and all over world, because peoples think it more safe from municipal water, this study aimed to evaluation quality of ten brands bottled drinking water that sold in local markets of Samawa city by compareresults with limited levels of Iraqi and world health organization standards for drinking water then compared its with labels on bottled. Thirty samples collected (three for each brand) during April, may and June 2012 (one sample monthly) and study quality of it by measured the following physical ,chemical and biological parameters (pH,temperature,total dissolve solids, conductivity,dissolvedoxygen,nitrite,sulfate,chloride,totalhardness,calcium electrical magnesium ,total bacterial count,Totalcoliform bacteria and fecal coliform bacteria. Results showed 70% of studied brands were within Iraqi limited levels 1998 and W.H.O. standards 2008 while 30% were above these standards for limited parameters, SO4 for brands number 1 and 2,PO4 for number 6, temperature and dissolved oxygen can conceders normal because varied according to favorite of consumers and temperature respectively. In all brands labels on bottle don't act real composition of water within it. Conclude bottled drinking water(for some brands) don't have enough safety. Statistical analysis results showed significant differences between brands for most tests in level p<0.05

.Ker words :Bottled water, Drinking water, Quality, Samawa, Iraq

الخلاصة

إن استهلاك مياه الشرب المعبأة از داد بصورة سريعة جدا في العراق والعالم اجمع وذلك لاعتقاد الناس إنهاأمنة أكثر من المداية المجهزة محليا. هدفت الدراسة الحالية إلى تقييم نو عية عشرة أصناف من مياه الشرب المعبأة التي تباع في الأسواق مقارنتها مع التراكيز المكتوبة على البطل. إذ تم جمع ثلاثون عينة (ثلاث عينات لكل صنف) خلال أشهر نيسان و أيار وحزير ان لعام 2012 (عينة في كل شهر) وتمت در اسة نو عيتها من خلال قياس الفحوصات الفيزيائية و الكيميائية والبيولوجية التالية (الأس ألهيدروجيني, درجة ألحرارة, المواد الذائبة ألكلية, التوصيلية ألكهربائية إلأوكسجين ألمذاب والبيولوجية التالية (الأس ألهيدروجيني, درجة ألحرارة, المواد الذائبة ألكلية, التوصيلية ألكهربائية إلأوكسجين ألمذاب ومزير أن لعام 2012 (عينة في كل شهر) وتمت در اسة نو عيتها من خلال قياس الفحوصات الفيزيائية و الكيميائية والبيولوجية التالية (الأس ألهيدروجيني, درجة ألحرارة, المواد الذائبة ألكلية, التوصيلية ألكهربائية إلأوكسجين ألمذاب النتريت, ألكبريتات, الكلوريدات, العسرة ألكالية ألكالسيوم العد البكتيري ألكلي بكتريا القولون الكلية, وبكتريا المنترين أل موازية). تبين من النتائج إن 70% من الأصناف المدروسة كانت ضمن المحددات العراقية لعام 1908 ومحددات منظمة الصحة العالمية لعام 2008 ما 30% من الأصناف فكانت أعلى من المحددات العراقية لعام 1998 ومحددات منظمة الصحة العالمية لعام 2008 ما 30% من الأصناف فكانت أعلى من المحددات العراقية عام 1998 ومحددات منظمة الصحة العالمية لعام 2008 ما 30% من الأصناف فكانت أعلى من المحددات العراقية لعام 1998 ومحددات منظمة الصحة العالمية لعام 2008 ما 30% من الأصناف فكانت أعلى من المحددات العراقية لما متعيرة للصنفين رقم 1 و 2 و الفوسفات للصنف رقم 6 أما الحرارة و الأوكسجين المذاب فيمكن اعتبار قياساتها طبيعية لأنها متغير حسب تفضيل المستهلك ودرجة الحرارة على التوالي. كما وجد في جميع الأصنافإن التر أكيز المكتوبة على البطل لاتمثل حسب تفضيل المستهلك ودرجة الحرارة على التوالي. كما وجد في جميع الأصنافإن التر أكيز المكتوبة على البطل لاتمثل حسب تفضيل المستهلك الإحصائي وجود فروقا معنويةبين الأصناف لمعظم الفحوصات على مستوى دلائة ألما متعيرة

Introduction

Safe drinking water(D.W.) is the birthright of all humankind as much a birthright as clean air. Only1% of the existing water resources on the entire planet can be used for human consumption, The remaining 99% of the existing water resources consist of 97% saltwater and 2% ice caps.⁽¹⁾

Seventy five percent of all diseases in developing countries arise from polluted drinking water.⁽²⁾Today contaminated water kills more people than cancer, AIDS, wars or accidents, andmany health effects joined with contaminated drinking water⁽³⁾: acute health effects are nausea, lung irritation, skin rash, vomiting, dizziness and even death and chronic health effects include: cancer, birth defects, organ damage, disorders of the nervous system, and damage to the immune system.⁽⁴⁾ Water that physically looks colorless, odorless and even tasteless is not sufficient to determine that the water is safe for consumption, Infactthe drinking water should be examined on microbiological and physicochemical quality, contaminants can be in the form of microorganism that barely visible in unaided eyes. ⁽⁵⁾The quality of water is defined in terms of its physical, chemical and biological parameters, and ascertaining its quality is important before use for various intended purposes such as potable, agricultural, recreational and industrial water usages, etc.⁽⁶⁾Bottled water is water that is sealed in food-grade bottles and intended for human consumption, bottled water can come from a various of sources, including groundwater from wells and springs and from tap water.

D.W. including bottled water may reasonably be expected to contain at least small amounts of some contaminants,⁽⁸⁾include trace and ultra trace metals,⁽⁹⁾or other chemicals such as Bisphenol A⁽¹⁰⁾, all of them are carcinogenic, birth defects and caused other risks .^(9,10)Some bottled D.W failed to match theminimum contaminant level.⁽¹¹⁾

Drinking water should contain minimum levels of certain essential minerals.⁽¹²⁾ In Iraq during 2004 and 2005 the quality of drinking water was deteriorated ⁽¹³⁾, the failure of chemical and biological tests reached to 40% from total samples. ⁽⁸⁾ and still bad until now. ⁽¹⁴⁾. Therefore many Iragis turning to bottled water with a strong believe that bottled water is healthier than tap water and free of impurities, this idea over world wide.⁽¹⁵⁾ As a result, the consumption of bottled drinking water has increased dramatically over from these time until now, not in Iraq only but in many developed countries such as Canada and U.S.A and it is considered a worldwide phenomenon with repercussions in social, economic, medical and environmental areas.^(15,16)Although they are not necessarily better than water available from municipal systems⁽¹⁷⁾. Because drinking commercially manufactured bottled water or water in refillable plastic bottles may becontaminate from the plastic itself,⁽¹⁸⁾and for examplefluoride content of the bottled waters waslower than the accepted limits for fluoride content of drinking water that it important for teeth^(13,19) and both Calcium and Magnesium are essential for human health⁽²⁰⁾. The purpose of this study is determined physical, chemical and biological contains of bottled drinking water sold in Samawa markets and compare there with Iraqi and (W.H.O) limited Standards of drinking water.

Materials and Methods 1-Sample collection.

Thirty samples were collected from local markets in Samawa city (300 kilometer southern west Baghdad) represent ten bottled drinking water production companies three duplicates (one monthly) for each company with consideration the followings:

a- Samples collected for different companies (Iraqi and Arabian).

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- b- Samples collected from different markets .
- c- Samples volume were different too.
- d- I sure the covering by company.

2- Physical and Chemical tests.

a- pH.

Measured by PH meter calibrated by standard solutions from (Martini company).

b- Temperature.

used the mercury thermometer and laser thermometer to measured this parameter.

c- Total dissolve solids. d- Electrical conductivity.

These parameters measured bymultimetercalibrated by standard solutions from (Martini company)

- e- **Dissolved oxygen.**Measured by D.O metercalibrated by standard solutions from (Hanna company).
- f- Nitrite.

Used method mentioned in ⁽²¹⁾ by spectrophotometer wave length (543nm).

g- Sulfate.

Used method mentioned in ⁽²²⁾ by spectrophotometer wave length (420nm).

h- Phosphate.

Used method mentioned in⁽²²⁾ by spectrophotometer wave length (885nm).

- i- Chloride.
- j- Total Hardness.
- k- Magnesium.
- I- Calcium.

These parameters measured according to methods mention in⁽²²⁾

3- Bacteriological tests .

Media prepared according to instructions of manufacture company on the containers.

- a- Total Bacterial Count.
- b- Total Coliform Bacteria.
- c- Fecal Coliform Bacteria.

These tests done according $to^{(23,24)}$.

4- Statistical analysis.

Data were statically analyzed using the one –way ANOVA, results were considered to be statically significant when P values are less than 0.05 (p<0.05). Statistical analysis done by SPSS version 11.

Results and Discussion.

1- physical and chemical tests.

pH.As present in table(1) Values were between (7.2-8.0),results were similar with other researches in Iraq⁽²⁵⁾ and other countries such as Tanzania and Egypt ^(26,27)while dissimilar with locally study in Baghdad⁽²⁸⁾, studies in new York and Malaysia ^(17,5). Statistical analysis showed significant differences between results of brand 2 with brands 9,10(p<0.05),although all brands had pH values within described limited levels by Iraqi and W.H.O. standards.Fig.1.



b-Temperature. Most researches on bottled D.W. don't measured temperature may be thinks not important and variable according to consumers favorites, but one study in Kurdistan of Iraq concluded temperature were very important parameter by influence on chemical and physical parameters of water⁽²⁹⁾ therefore must measured and mention this parameters in researches. My results showed the temperature values from 28.9 to $30.4C^{\circ}$ (table 1)these results were normal in Samawa

weather during April, May and June, especially I measured temperature directly. No limited levels of temperature by W.H.O. but all brands had values high from Iraqi standards may be because storage method or sun light exposure, significant differences shown in result of brand 5 with results of all brands (P<0.05) Fig.2



C-Total dissolve solids.

Measurement of T.D.S. used to indicate increase of one or more contaminants naturally or by human causes, high T.D.S. in water caused inoffensive odors ,tastes, colors and health problems depended on type of contaminants. Values of T.D.S. had ranged from 50 mg/l to 150mg/l(table.1) ,all results within levels limited by Iraqi and W.H.O. and agree with study in Iraq for imported brands but disagree with same study for local brands⁽²⁵⁾, and disagree to with studies in Kurdistan of Iraq ,Iran and New York^(29,30,17). No significant differences appeared between results (P>0.05) Fig.3.



nd No. versus T.D.S

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In recent study results showed the range of E.C. 40to 240 m.s/cm in samples (10,6) respectively, relationship with T.D.S values 50 to 150 in same brands(table 1).All brands within limited standards of Iraqi and W.H.O. nearly similar with other studies in Babylon and Tanzania^(13,26), dissimilar with many studies in Baghdad, Kurdistan of Iraq and Nigeria^(28,29,31), significant differences shown in results of all brands with some exceptions(1-9, 2-5, 4-5-7) (P<0.05) Fig. 4.Variation may be fallow to variation in T.D.S.or may be depended on source of water and purification methods.



e-Dissolved oxygen

As present in table (1) D.O.values between (3.7 to5mg/l),that mean fifty percent of brands unended by W.H.O. and Iraq, think this lowering

) significant differences shown by statistical



f- Nitrite

Nitrite and nitrateare important for living body contribute in formation of nitrogen base in DNA in low concentration ,while in high concentration cause health problems ,NO3 may be converted to NO2 by bacteria in infants intestine, NO2 formation methaglobuline cannot transport blood caused blue baby⁽²⁷⁾. Results showed NO2 values from 0.223 mg/l in sample 8 to 0.486 mg/l in sample 4, All results within levels recommended by Iraqi and W.H.O.standards. significant differences shown between results for all brands with some exception(1-3-7, 2-6-10, 5-8-9)(P<0.05) Fig.6



g-Sulfate.

As present in table (1) SO4 values had between (142-389 mg/l) that mean 80% of brands had allow according to Iraqi and W.H.O. standards, while 20% were above these levels in 1 and 2 brands, significant differences appeared in most results of brands especially brands 1,2 with other brands (P<0.05) Fig.7.

Increase SO4 in drinking water may be cause bitter taste and have a laxative effect in individuals don't adapted to this water.

High of SO4 in some brands may be because Source of water come from ground water that rich with sulfate, results were disagree with many local and international researches ^(25,26,29,31).



and No.versus SO4

h- Phosphate

Table (1) show range of PO4 from 3 84 to 12.84 mg/l, all brands except number 6 were *N*.H.O. no more studies mention this parameter in ement with study in Egypt.⁽²⁷⁾High level in brand 6 from rejoin rich with phosphate rocks(geological ess of purification. Significant differences shown result of brand 6 with other brands.(P<0.05) Fig.8





i- Chloride.

Chloride values had between (8.9-29.6 mg/l) illustrated in table (1), this nearly similar with two studies in IranandSaudi Arabia^(30,32), but dissimilar with studies in Kurdistan of Iraq ,Tanzania and other study Saudi Arabia ^(29,26,33)

All results were within levels of Iraqi and W.H.O. standards . significant differences appeared between all results of brands with some exception(1-8-9, 2-5-6, 3-4-7-10) (P<0.05) Fig. 9.



j-Total hardness

No.versus Chloride

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Total hardness is term to represent the contains of water from minerals especially Ca and Mg ions and other alkaloids mineral and variable with water type .In recent study T.H. had between (4.082-61.23 mg/l) all them accepted by Iraqi and W.H.O. limited levels, similar with local study in Baghdad ⁽²⁸⁾, dissimilar with other local study ⁽²⁵⁾. Significant differences appeared in most results especially result of brand 8 with other brands.(P<0.05) Fig. 10.



and No.versus T.H

k- Calcium.

Calcium is very an important parameter must measured in drinking water because high levels concentration from it in D.W. may be contribute in formation of kidney and urinary tract stones ⁽²⁷⁾, but intake it in low levels due to Osteoporosis, hypertension coronary arteries diseases . It very necessary to embryo development stages , pregnant, lactation, formation of bones , teethes, blood clothing , and action of nerve system ⁽³⁴⁾ . My results (table 1)showed Ca values had range from (0.72 to 25.2 mg/l) in brands 1,7 respectively, all these results within levels of Iraqi and W.H.O. standards . Significant differences showed between most results of brands especially brands 6,7 with other brands (P<0.05) Fig.11.My results nearly similar to study in Baghdad ⁽²⁸⁾, similar to other studies in Tanzania and Saudi Arabia^(26,33)and dissimilar with another studies in Iran and Nigeria^(30.31).



I- Magnesium.

Magnesium it to necessary for human body. Low levels of it companion with hypertensions coronary heart disease and metabolic syndrome⁽³¹⁾, its play importance roles in enzyme reaction ,protein and nucleic acid synthesis and nerve muscles actions⁽³²⁾.

All my Mg values were within standards of Iraq and W.H.O. for drinking water ,had between (0.55-8.39 mg/l), these agree with other studies^(26,33),while disagree with another studies^(28,30). Significant differences showed between most results especially in brands number7,8 with other brands.(P<0.05) Fig.12.





2- Biological tests.

As present in table(1) recent study don't detection any species of bacteria in all brands for three testes ,that's mean all brands were safe according to biological standards for human consumption and all these within recommended levels of Iraqi and W.H.O.

My results were similar with two studies don't detected coliform bacteria in bottled D.W. ^(31,33), nearly similar with other study in Nigeria detected coliforn in one brands from sixteen⁽³⁵⁾ and disagree with local study in Baghdad detected bacteria for three testes in most brands⁽²⁸⁾ and another two studies first in India detected 10 species of bacteria and all resistance to antibiotics⁽³⁶⁾, second in Ohio detected bacteria in most brands⁽³⁷⁾.

3- Compare measured results with labeling on bottles.

During my research I observed the production companies for bottled drinking water mentioned few parameters on your bottles such as pH.T.D.S.,Mg,Ca ,its don't mentioned other parameters include these within standards limited levels.

Generally all brands have labels on your bottles don't represent real composition of its inside water.

In my study all brands had water different from labels on its bottles with very little exceptions don't reach 1% from all samples for all parameters. My results agree with other studies^(25,33), while disagree with study found most labels identified with composition of water in most brands⁽³⁸⁾. Causes of these variation either production company or period of transport and storage until arrive to consumptions.

Conclusions.

My conclusions from recent study are some bottled drinking waterbrands don't evaluated for human consumption and labels on bottles don't act real composition of water, therefore production companies in Iraq must be under control by periodical examination, and control on imported brands before inter my country.

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					C	antan	<u>nhar</u>	2012	<u> </u>						
F.C.	T.C.	Т.В.	Mg	Ca	T.H	CI	PO	SO4	NO	D.	E.C	Т.	Те	р	Bra
B	В	C	mg	mg	mg/	mg/	4	mg/	2	0	M.S/	D.	.mp	н	nd
Cell/	Cell	Cell	/L	/L	L	L	mg	L	mg	m	cm	S	°C		.NO
ml	/ml	/ml					/L		/L	g/L		m			
												g/L			
0.0	0.0	0.0	0.5	00.	04.	21.	4.0	357	0.3	5.	90.	70	28.	7	1
			56	72	082	758	8	.65	08	0	0	.0	9		
														5	
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			96	44	492	703	6	.27	27	7		0	2		
							-		5	-		-		2	
0.0	0.0	0.0	23	04	20	00	42	242	0	Δ	70	60	28	7	3
0.0	0.0	0.0	10	22	410	000	6	54	22		/0.		20.	'	
			40	55	410	090	U	.54	52	U	U	.0	9	:	
									1	_				/	
0.0	0.0	0.0	3.3	10.	40.	08.	3.9	152	0.	3.	160	11	29.	7	4
			00	80	820	900	6	.37	48	9		0	4	•	
									6					7	
0.0	0.0	0.0	3.5	11.	12.	29.	3.8	203	0.	4.	170	11	30.	7	5
			99	80	246	670	4	.98	23	5		0	4		
							-		6	-		-	_	6	
0.0	0.0	0.0	12	21	48	29	12	164	0	4	240	15	29	7	6
0.0	0.0	0.0	22	60	0.00/	600	9/	60	26		240	10		'	Ŭ
			25	00	904	000	04	.00	20	U		U	U		
0.0			0.0	25	20			1.00	9		1.00	10	20	0	
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			99	20	574	980	2	.18	31	2		0	0	•	
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0.0	0.0	0.0	8.3	10.	61.	19.	4.6	181	0.	3.	210	13	29.	7	8
			52	80	230	780	2	.29	22	7		0	1		
									3					7	
0.0	0.0	0.0	1.5	05.	08.	19.	3.9	160	0.	3.	100	80	29.	7	9
			21	76	164	800	6	72	23	6		0	2	,	Ĩ
					104			., 2	6				-		
	0.0	0.0	0.7	00	04	10	47	152		-	40	50	20		40
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			60	88	082	000	4	.43	89	7	0	0.	9		
														0	

.Note : Each value is mean for three duplicates

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