European Journal of Business & Social Sciences

ISSN: 2235-767X
Volume 10 Issue 05
Mat 2022

Study of the Physico-chemical Properties of Local and Imported Bottled Drinking Water in Benghazi and Their Compliance with the Libyan Specifications for Bottled Drinking water.

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Abstract
Libya is witnessing a great development in various areas of life. This development led to the use of different sources of water. Bottled water companies mobilize all their capabilities to convince the consumer that plastic bottled water is a rescue boat in the face of tap water. This paper aims to evaluate the chemical and physical properties of ten types of bottled water (six local brands, and four imported ones) that marketed in city of Benghazi. The study also aims to compare the results with the local Libyan specifications for bottled drinking water. The studied samples achieved a good level of quality in all measured physical and chemical properties comparing to the Libyan standard specification for bottled drinking water. Total dissolved salts and pH of the local bottled drinking water were close from the minimum standard specifications for bottled drinking water. The statistical analysis shows that the water quality of the local varieties of bottled drinking water does not differ from the quality of the imported ones. Statistical analysis showed significant differences between the quality of bottled drinking water for local and imported varieties in the parameters of total dissolved solids, pH and total hardness.

Key words: physical, chemical, bottled drinking, specifications.

Introduction

Libya is witnessing a remarkable and rapid development in the various fields of health, agriculture and industrial life. This development is paralleled by an excessive increase in water consumption. This parallel between development and water consumption also calls for continuous periodic studies of water quality, specifications and components. In the same time, using of bottled water has spread. The bottled water companies have already succeeded in attracting a large audience of consumers. (1-3) Regard to standard specifications, a specification is an approved document used for the application of requirements, characteristics and types for a particular product or a certain method. It is issued by approved bodies. There are a number of specifications in the world such as the ISO standard, European specifications and American specifications. (4-6) one of the most important physicochemical properties of bottled drinking water that must be taken into account when studying water quality is dissolved salts. Dissolved salts affect the characteristics of drinking water such as taste, hardness and tendency to form the crusts. Water with a higher content of total dissolved salts is less palatable to the consumer. Total salts should be in an average rate (from 1500 to 500) mg / litter. Also, water with a low level of dissolved salts is not healthy, and it is not palatable for drinking. The hydrogen number or pH is a measure of the acid and alkaline balance achieved by different compounds that dissolved in

ISSN: 2235-767X
Volume 10 Issue 05
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water. Acidic water contains higher hydrogen ions than hydroxyl ions, and basic water contains hydrogen ions less than hydroxyl. It can be said that the pH has an indirect effect on public health and the recommended value of the pH in drinking water ranges between (6.5 – 8.5). Water hardness does not represent a single compound , but rather it includes a group of natural salts. These salts include calcium carbonate, magnesium carbonate and magnesium sulphate. In addition to other components to a lesser extent such as carbonate and bicarbonate and sulphate of strontium, barium, silica, iron, manganese, aluminium and all dissolved heavy metal salts. It is expressed as an equivalent concentration of calcium carbonate. The hardness standards issued by the Libyan Center for Standardization and Specifications No. 10 of 2008 are 200 mg/L. (7- 10) The health concerns associated with the chemical components of drinking water are different from those associated with microbial contamination, mainly emitted from the ability of these chemical components to cause harmful health after prolonged exposure. The sulphate concentration in most fresh waters is very low, ranging from 20 to 50 parts per million. The sulphate is not removed from the water by traditional water treatment methods. The sulphate concentration in bottled water is 250 mg/litter or more. (11) Chlorides are usually in the form of sodium chloride, potassium chloride, and calcium chloride. The daily dietary intake of chlorides should be about 9 milligrams per kilogram of human weight. The limits of the palatable taste of sodium chloride, potassium chloride, and calcium chloride are 210, 310, and 222 mg/litter respectively. (12, 13) The bicarbonate is usually found in 5-500 mg / litter in the form of calcium bicarbonate. It is found in water by the dissolution action of carbon dioxide-generating bacteria from carbonate-containing minerals. Alkalinity in drinking water sources is rarely more than 300 mg /Litter. Sodium is found in water due to the rapid dissolution of its salts and the abundance of its mineral deposits. In order to ensure that the drinking water is palatable for the majority of consumers, the salt concentration in the water should be equal to the salt concentration in saliva with an average 300 mg/L. Potassium is one of the most important elements of the cellular fluid in the body. It works to regulate the acid-base balance. European Union sets 10 mg/L as level of potassium content of drinking water. Calcium salts are among the most important elements of water and have a special importance for the human body. Calcium salts are present in the form of carbonates, bicarbonates or sulphates, which lead to water hardness. The calcium concentration in fresh water reaches less than 10 mg. /L and to about 75 mg/L in very salt water. (14-16) The presence of nitrates and nitrites in water is due to the use of fertilizers, plant and animal materials, sanitation and agricultural drainage in water or soil. Water content of nitrogen (N-NO3) should not be more than 10 mg / liter, and nitrite nitrogen (N-NO2) should not be more than 0.005 mg / liter, and the sum of both of them should not exceed 10 mg / liter. Traces of fluoride are found in many waters, and high concentrations are found in groundwater. With drinking of two liters of water per day, 1.2-3.4 milligrams of fluoride per day can be obtained. The drinking water standards stipulate that the proportion of fluorides does not exceed 8.0 mg/liter.(17, 18)

Several studies have assessed the quality of bottled drinking water in Libya and some Arab countries. In a study on the quality of bottled drinking water in the city

ISSN: 2235-767X
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of Misrata in Libya during 2018, that included 12 factories. The study has concluded that the pH values of eight samples were less than the minimum allowed level in the Libyan specifications, and the total hardness were higher the maximum allowed limits of the Libyan specifications. Furthermore, it was found that one sample has exceeded the maximum allowed limits in the Libyan specifications in term of iron and chlorides. Sodium, calcium, magnesium, potassium, bicarbonate, copper, lead, and zinc have high results. However, they did not exceed the maximum limit of the Libyan specifications. (19) Another Libyan study was carried out during 2018 included determination of pH, electrical conductivity, total hardness, nitrate, nitrite, chloride and bicarbonate. The results were within the permissible of the Libyan specifications. The dissolved solids were less than the minimum allowed in the water of three samples. (20) In Kuwait, 25 types of bottled water were examined. All varieties were conforms to the local specifications of Kuwait. (21) In Kingdom of Saudi Arabia, a study assessed the physical and chemical properties of bottled drinking water. The measurements showed that all contents expect fluoride conformed to the Saudi specifications. Fluoride among two local samples and all imported varieties recorded levels below the specifications limits. Another study was carried in Kingdom of Saudi Arabia. The study concluded that all physical, and chemical measured parameters except pH, and fluoride were confirmed to the Saudi Arabian Standards. (22, 23) In Iraq, a study of chemical and physical properties of mineral drinking water was conducted in city of Tikrit during 2016. The results of the study showed that the levels of quality standards in the water of the studied samples were in conformity with the local and international standards for drinking water, except for the pH in one samples. In Iraq another study was also conducted on some physical, and chemical properties of the locally and imported bottled water in the city of Baghdad. The results showed high values and concentrations of turbidity, pH, electrical conductivity, total dissolved solids, total hardness, calcium, and magnesium in locally bottled water samples compared to imported samples. Also in Iraq during 2009, a study of ten types of bottled water was carried out. The results showed that both local and imported water conformed to local and international specifications, except for total dissolved solids in all local samples and one imported sample. (24 -26) In Sudan, a study conducted during 2017 on the physical and chemical properties. The results showed that all properties were conformed to the Sudanese Standards.(27) The current research paper aims to evaluate the chemical and physical properties of ten types of bottled water (six local brands, four imported ones) that marketed in city of Benghazi. The study also aims to compare the results with the local Libyan specifications for bottled drinking water.

Materials and Research Methods

The study was conducted in the city of Benghazi; the second largest Libyan city during 2020-2021. Samples of bottled drinking water were collected and analysed. The analysis includes the physical, chemical and microbiological properties. The scope of this paper includes the physical and chemical properties. The study was conducted on six types of locally bottled drinking water Al-aen Al Aseel - Al Nafoura - Pure - Shahd - Al Reem. Another four imported bottled drinking water brands were included in the study as shown in Table 1. The samples taken are sufficient to complete the required analysis; the samples were

ISSN: 2235-767X
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numbered, well diagnosed, and examined immediately after taking them. The tests were conducted in the laboratory of the Food and Drug Control Center, Benghazi as well as the Laboratories of Faculty of Public Health, University of Benghazi.

Table (1) Distribution of samples by type and size Origin and method of sterilization

Symbol	Product Names	Size	Origin	Sterilization
A	Al-aen	500 ml	Libya	Ozone and UV rays
B	Al Aseel	500 ml	Libya	Ozone and UV rays
C	- Al Nafoura	500 ml	Libya	Ozone and UV rays
D	Pure	500 ml	Libya	Ozone and UV rays
E	Shahd	500 ml	Libya	Ozone and UV rays
F	Al- Reem	500 ml	Libya	Ozone and UV rays
1	Flow	500ml	Egypt	Ozone and UV rays
2	Nova	660 ml	Saudi Arabia King Dom	Ozone and UV rays
3	Pinal ELM	330ml	Turkey	Ozone and UV rays
4	Spring	500 ml	United King Dom	Ozone

Physical and Chemical Tests:

The total dissolved salts were measured by using a device (EZADO TDS 5032). pH was measured by using a device (pH Meter PHS-3C) Estimation of total hardness was conducted by using AOAC 973.52B 15th ED 1990. Determination of the percentage of chlorides was carried out using Mohr-method. (2, 3) Bicarbonates determination was carried out using the AOAC 920.194.1 method. Determination of sulphate is done by gravimetric method. Determination of ammoniawas conducted through distillation method and volumetric titration.(11, 15) Estimation of chlorine was carried out with a palin test spectrometer instrument. The test for the determination of total alkalinity was carried out using the following method: AOAC 973.43 15th ED. It is also called Titration method-first Action. Nitrate determination was carried out with a palin test Spectrometer instrument. Fluorides determination test was carried out with a Palin Test Spectrometer instrument. (20, 21,24)

Statistical Analysis:

Descriptive and analytical statistics were generated by SPSS. Correlation coefficient, analysis of variance and *t* test were calculated to detect if there are significant differences between local bottled water and imported bottled water .

Results

The results of the physical tests conducted on locally manufactured bottled drinking water samples are shown in table 2. The results of the total dissolved salts showed that the largest value was in sample A, and the lowest value was in sample C, while the average pH for all samples was 6.54 parts per million. Table 2 shows the results of the physical tests conducted on imported bottled drinking water samples. The results of total dissolved salts showed that the largest value was in sample (4) and the lowest value was in sample (3), while the average pH of all samples was 7.27. The results of the chemical tests of on the locally manufactured bottled drinking

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water are shown in table 3. It is clear that all samples do not contain chlorine, with a clear discrepancy in the results of the rest of the tests among all samples. The results of the chemical tests of on the imported bottled drinking water are shown in table 3. It is clear that all samples do not contain chlorine, with a clear discrepancy in the results of the rest of the tests among all samples. Table 4 shows analysis of variance of physical tests for locally and imported water with significant differences in all tests. Table 5 and 6 shows analysis of variance of chemical tests for locally and imported manufactured water with significant differences in all tests.

Table (2) Physical Tests of Locally and Imported Manufactured Drinking Water Samples

Symbol	Size	TDS	pH
A	500 ml	80	6.5
B	500 ml	50	6.5
C	500 ml	40	6.5
D	500 ml	65	6.6
E	500 ml	55	6.65
F	500 ml	45	6.5
Mean ± SD		55.83±14.6	6.54±0.66
1	500ml	150	6.9
2	660 ml	120	7.4
3	330ml	850	6.8
4	500 ml	180	8
Mean ± SD		133.75±40.697	7.27±0.550

Table (3) Chemical Tests of Locally and Imported Bottled Drinking Water Samples

Sample	Hardness ($CaCo_3$) PPM	Chloride PPM	Bicarbonate PPM	Sulphates PPM	Ammonia PPM	Chlorine PPM	Alkalinity PPM	Nitrates PPM	Fluorides PPM
A	22	21	12	17	0.02	0	17	0.91	0.2
B	30	70	15	30	0	0	30	0.8	0.15
C	32	17	5.5	32	0	0	32	0.9	0.19
D	35	32	29	76	0	0	76	0.91	0.2
E	25	31	48	48	0	0	48	0.8	0.15
F	22	18.5	25	11	0	0	74	0.5	0.18
M ± SD	27.66±5.465	31.58±19.68	22.41±15.19	35.66±23.58	0.022±0.04	0	46.1±24.41	0.8±0.157	1.178±0.023
1	65	50	24	0.8	0.04	0	61	0.5	0.12
2	70	19	26	26	0.03	0	70	3	0.22
3	75	17.7	30	0.7	0.08	0	40	0.5	1
4	70	11	110	1	0.01	0	90	5	1
M ± SD	70±4.08	24.42±17.41	47.5±2.58	7.12±5.465	0.04±0.029	0	65.25±20.7	2.25±2.179	0.585±0.48

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Table (4) Analysis of Variance of Physical Tests for Locally and Imported Bottled Drinking Water Samples

Origin	Test	Difference	Sum Sq	Freedom Degree	Mean Sq	F value	P value	Differences
Local	TDS	Between groups Within groups Total	11952.28 582.7 12534.98	5 54 59	2390.457 10.791	221.529	0	Yes
	pH	Between groups Within groups Total	0.062 0.065 0.127	5 54 59	0.012 0.001	10.241	0	Yes
Imported	TDS	Between groups Within groups Total	49802.48 456.5 50258.98	3 36 39	16600.83 12.681	1309.156	0	Yes
	pH	Between groups Within groups Total	0.047 15.993 16.04	3 36 39	0.016 0.444	0.035	0.991	No

Tables (5): Analysis of Variance of Chemical Tests for Locally Manufactured Bottled Drinking Water Samples

Test	Difference	Sum Sq	Freedom Degree	Mean Sq	F value	P value	Differences
Total hardness	Between groups Within groups Total	1495.48 637.5 2132.98	5 54 59	299.09 11.806	25.336	0	Yes
chlorides	Between groups Within groups Total	1495.48 436.6 19861.73	5 54 59	3885.03 8.09	480.52	0	Yes
Bicarbonates	Between groups Within groups Total	11592.33 491.5 12083.83	5 54 59	2318.467 9.102	254.72	0	Yes
Sulphate	Between groups Within groups Total	27576.75 626.9 28203.65	5 54 59	5515.35 11.908	475.08	0	Yes
Ammonia	Between groups Within groups Total	0.019 0.009 0.029	5 54 59	0.004 0	22.261	0	Yes
Alkalinity	Between groups Within groups Total	30318.93 533.4 30852.33	5 54 59	6063.787 9.878	613.88	0	Yes
Nitrates	Between groups Within groups Total	5.07 0.208 6.274	5 54 59	1.013 0.004	282.45	0	Yes

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Table (6): Analysis of Variance of Chemical Tests for Imported Bottled Drinking Water Samples

Test	Difference	Sum Sq	Freedom Degree	Mean Sq	F value	P value	Differences
Total hardness	Between groups Within groups Total	520.3 434.6 955.9	3 36 39	173.433 12.1	14.333	 0 0	Yes
Chlorides	Between groups Within groups Total	9208.8 435.6 9644.4	3 36 39	3069.6 12.1	253.68	 0	Yes
Bicarbonates	Between groups Within groups Total	52270 435.6 52705.6	3 36 39	17423.33 12.1	1439.9	0	Yes
Sulphate	Between groups Within groups Total	4601.963 120.7 4722.7	3 36 39	1533.988 3.353	347.44	0	Yes
Ammonia	Between groups Within groups Total	0.001 0.021 0.023	3 36 39	9 0.001	0.76	0.524	No
Total alkalinity	Between groups Within groups Total	12981 461.4 13442.4	3 36 39	4327 12.8	337.7	0	Yes
Nitrates	Between groups Within groups Total	181.316 121.222 302.538	3 36 39	60.439 3.367	17.949	0	Yes

Table (7): T test for physical and Chemical Tests

Test	Sample type	Sample size	Mean	SD	p value of equal variance test	T	p value	Decision
TDS	Local	6	55.83	14.63	0.046	-3.674	0.002	There are differences
	Imported	4	133.75	40.69				
pH	Local	6	6.54	0.066	0.006	-3.333	0.01	There are differences
	Imported	4	7.27	0.55				
Total hardness	Local	6	27.66	5.46	0.189	-13.14	0	There are differences
	Imported	4	70	4.08				
chlorides	Local	6	31.58	19.86	0.985	0.585	0.575	There are not differences
	Imported	4	24.425	17.406				
Bicarbonates	Local	6	22.415	15.19	0.068	-1.376	0.206	There are not differences
	Imported	4	47.5	41.74				
Sulphate	Local	6	35.66	23.58	0.304	2.192	0.06	There are not differences
	Imported	4	7.125	12.58				
Ammonia	Local	6	0.044	0.022	0.804	0.226	0.827	There are not differences
	Imported	4	0.04	0.029				
Total alkalinity	Local	6	46.166	24.416	0.51	-1.279	0.237	There are not differences
	Imported	4	65.25	20.742				
Nitrates	Local	6	0.88033	0.1575	0.001	-1.325	0.276	There are not differences
	Imported	4	2.25	2.179				

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Discussion

The results from the total dissolved salts indicated that all samples were low in the concentration of dissolved salts and they did not exceed on average 55.83±14.6. It is also worth noting that they did not exceed the minimum allowed limits in the Libyan standard specification number (10) for the year 2008. The maximum permissible level does not exceed 500 mg/litter. The results also showed that the concentration of total dissolved salts was the largest value in sample (A) with a value of 80 parts per million, while the lowest value was in sample (C) with a value of 40 parts per million. When looking at the results of the pH of locally manufactured bottled drinking water samples, most of its values were at the minimum level in the Libyan Standard Specification number (10) for the year 2008. The mean pH of the samples was 5.6 ±0.66. The statistical analysis showed that there are significant differences for total dissolved salts and pH at the level of probability 0.05 between the locally manufactured bottled drinking water samples. While the results obtained from the analysis of imported bottled drinking water samples for total dissolved salts and pH showed that the largest value for both tests achieved by the sample number (4) with values of 180 ppm, and 8, respectively. The results also showed that the lowest value of the total dissolved salts was 85 parts per million, and the pH were 6.8 in the sample number (3). The results also indicated that the average total mean of the total dissolved salts of the samples was 133.75± 40.69 parts per million. Also, both test results were in conformity with the Libyan Standard Specification for Bottled Drinking Water No. 10 of 2008, which states that 500 ppm is the maximum amount of the total dissolved salts, and 6.5-8.5 for pH. Through the statistical analysis of the results of the physical tests of imported bottled drinking water samples, it showed that there are significant differences at the probability level (0.05) in the test of total dissolved salts among the imported samples, while the results of the pH test showed no significant differences at the probability level (0.05) between the imported bottled drinking water samples. The results of the current study showed agreement with the bacteriological, chemical and physical study of bottled drinking water circulating in the local markets of Tikrit in Iraq. (24) It also agrees with the study of some physical and chemical properties of some types of local bottled drinking water circulating in the Libyan market. (20) However, the results of this study do not agree with the study of some evidence on the quality of bottled drinking water in the city of Misurata, Libya, where the results showed that most of the pH values are not within the permissible limits and do not match the Libyan standard specifications. (19) The reason for these differences in results may be due to technical factors related to the quality of the water processing, water sources, environmental influences and geological nature. The groundwater sources remain naturally containing higher concentrations of salt compared to other sources. (34)

Regarding the chemical tests results of local samples; all local samples do not contain chlorine. While the results of the total hardness as calcium carbonates ($Ca\ Co_3$) showed that the value for local samples was between 22-35 ppm, with an average of 27.66 ± 5.46 for samples, and the highest value was for sample D, which obtained 35 ppm, and the lowest value for samples A, F, which obtained 22 ppm. The

ISSN: 2235-767X
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results also showed that the highest value of the chlorides test was for sample B, which obtained 70 parts per million, and the lowest value for sample C, which obtained 17 parts per million, and the average of chlorides for the samples was 31.58 ± 19.68. The results for sulphate showed that the highest value of sulphate was for sample D with a value of 76 ppm and the lowest value for sample F with a value of 11 ppm. While the sulphate mean of the samples was 35.66 ± 23.58. The results of ammonia were all less than 0.7 ppm with an average of 0022 ± 0.0.04 samples, where the highest value for sample D was 0.074 ppm and the lowest value for sample F was 0.018 ppm. The results also showed that the total alkalinity had the highest value of 76 parts per million in sample D and the lowest value in sample A with a value of 17 ppm, with an average of samples equal to 46.1 ± 24.41. As for the results of nitrate, it was found that it ranged between 0.5 - 0.91 ppm with an average of 0.8 ± 0.15 for samples, where both samples (A and D) showed a value of 0.91 ppm, while the sample F had a value of 0.5 ppm. Through the results of chemical analysis conducted for locally manufactured bottled drinking water samples, it was found that all of them are within the permissible limits and therefore conform to the Libyan Standard Specification No. 10 of 2008 for bottled drinking water. The results show the average of the bicarbonate test equal to 22.41±15.19 ppm, and sample E recorded the highest value of 48 ppm, and the lowest value recorded in sample C with a value of 5.5 ppm. The results of the statistical analysis find out differences between the locally manufactured bottled drinking water samples for chemical tests. The results indicate that there are significant differences at the probability level of 0.05.

Regarding the results of chemical tests for imported bottled water samples, the total hardness results ranged between 65-75 ppm as (Ca Co_3) with an average of 70 ± 4.08 ppm. The highest value was obtained from sample No. 3 and the lowest value from sample No. 1. Furthermore, all imported samples do not contain chlorine. Regarding the chlorides test, the highest value was obtained from sample No. 1; it equals 50 ppm, and the lowest value was 11 ppm for sample number 4, with an average equals to 24.42 ± 17.41 ppm. The results show the average of the bicarbonate test equal to 47.5 ± 2.58 ppm, and sample No. 4 recorded the highest value of 110 ppm, and the lowest value recorded in sample No. 1 with a value of 24 ppm. The results of the sulphate showed that their values ranged between 0.08 - 1 ppm, except for sample No. 2 which had a value of 26 ppm, with an average of 7.12 ± 5.465 ppm for imported samples. Regarding the ammonia test, all imported samples had ammonia less than 0.08 ppm, and the average for imported samples was 0.04 ± 0.029 ppm. The results of the total alkalinity test showed that the highest value of 90 ppm in sample 4, and the lowest value in sample 3 was 61 ppm, while the average of samples was 65.25 ± 20.7 ppm. The results of the nitrate test also showed that the lowest value for samples 2 and 3 equals to 0.5 ppm, and the highest value was 5 ppm for sample 4, with an average of 2.25 ± 2.179 ppm for all imported samples. Through the results of chemical analysis conducted for imported bottled drinking water samples, it was found that all of them are within the permissible limits and therefore conform to the Libyan Standard Specification No. 10 of 2008 for bottled drinking water. The results of the statistical analysis of chemical tests of bottled drinking water samples indicated that there are significant differences in all tests except for the nitrate test. Nitrate test showed that there were no

ISSN: 2235-767X
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significant differences between the imported bottled drinking water samples. This is in agreement with another study of some physical and chemical properties of bottled drinking water types Local tests (total hardness - chlorides - bicarbonates - total alkalinity - nitrates) Also, the results of this study agree with a bacteriological, chemical and physical study of bottled drinking water circulating in the local markets of Tikrit. (19, 20) The study also agreed in the tests of chlorides, sulfates, and nitrates with the study conducted in the State of Saudi Arabia in the city of Riyadh on the quality of local and imported drinking water. (22, 23,,24) The results of fluoride concentration shown in a table showed that the average fluoride concentration of local and imported bottled drinking water samples, respectively, had values of 0.178 + 0.023, and 0.585 + 0.480 ppm. The third and fourth samples of imported water contained the highest value of 1.00 ppm, while the local water in the two samples (A, D) had a value of 200 parts per million, and the lowest value of the local water for the sample E was 0.15 parts per million, while the imported water had the lowest value of the first sample with a value of 0.12 parts per million. Fluoride in most imported varieties is higher from local varieties, studies have indicated that drinking water containing fluoride at a concentration of 1.00 ppm helps reduce the incidence of tooth decay by 65% for children aged 12-15 years, while an increase in fluoride concentration to 2.00 ppm leads to the emergence of gray spots. To blackening and caries in the teeth, this is known as Fluorosis. The results of the current study do not agree with the study conducted in the State of Saudi Arabia in the city of Riyadh on the quality of local and imported drinking water. The results showed that the local varieties of bottled water contained higher concentrations of fluoride than the imported ones. (22,23)

Conclusion

The studied local bottled drinking water brands in Benghazi and the imported ones from Egypt, Saudi Arabia, Turkey, and the United Kingdom achieved a good level of quality in all measured physical and chemical properties comparing to the Libyan standard specification for bottled drinking water. Total dissolved salts and pH of the local bottled drinking water were close from the minimum standard specifications for bottled drinking water. Based on the statistical analysis, the water quality of the local varieties of bottled drinking water does not differ from the quality of the imported ones. There are no significant differences between them in term of chlorides, bicarbonate, sulfate, ammonia, total alkalinity, nitrate, chlorine and fluoride. On the other hand, the statistical analysis showed significant differences between the quality of bottled drinking water for local and imported varieties in the parameters of total dissolved solids, pH and total hardness.

Consent

As per international standard or corresponding universities standards, factories consent has been collected and preserved by the researchers.

Acknowledgements

Authors are grateful to all factories who participated in the study.

Competing Interests

Authors have declared that no competing interests exist.

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Volume 10 Issue 05
Mat 2022

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