SAS Journal of Medicine
Abbreviated Key Title: SAS J Med
ISSN 2454-5112
Journal homepage: https://saspublishers.com

OPEN ACCESS

Laboratory Medicine

Bacteriological Examination of Bottled Drinking Water in Benghazi-Libya

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DOI: 10.36347/sasjm.2022.v08i10.015 | **Received:** 13.09.2022 | **Accepted:** 21.10.2022 | **Published:** 25.10.2022

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Abstract **Original Research Article**

During the past three years a new trend has been widely spread, represented in the sale of bottled water produced by reverse osmosis, in the city of Benghazi. A cross-sectional descriptive study has been carried out aiming to evaluate the quality of water produced as purified and sold as "bottled water", under the bacteriological aspects. Fourteen sites of these locations were inventoried by means of search and inspect as related data was not available by concerned authorities on the number of these locations and their conditions of operations. A questionnaire was prepared gathering information including all owners which were catalogues, and one hundred citizens representing all society's segments and consumers of such water, were equally poled. Study results showed: 1) 7.7% of bottled water samples were bacteriologically contaminated. 2) Lack of awareness and environmental education and the citizens being influenced by rumors and advertisement of outlets' owners, have all lead 52% of consumers, covered by the study, to decline the use of tap water doubting its purity and safety.

Keywords: Bottled water, Reverse osmosis, bacteriological contamination.

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INTRODUCTION

U.S. Food and Drug Administration (FAD) describes bottled water as "water that is intended for human consumption and that is sealed in bottles or other containers with no added ingredients except that it may contain safe and suitable antimicrobial agents" [1].

In fact, bottled water is one of the most regulated food products, FAD oversee the packaging and labeling of bottled water. The FAD regulates statements on labels and prohibits those, which could be deceptive or misleading.

Libyan standards (NO. 36 of 1997) defines the natural mineral bottled water as "water that is contain a proportional quantities of minerals and some trace elements and is originate from ground water sources and that is handled only by one of a familiar methods to disinfect the microorganisms. Carbon dioxide, of unnatural carbonation, can be added in a quantity as explained by other item of the same standards" [2].

Bottled Water at Benghazi City

There are two different kinds of locally produced bottled water at Benghazi city [3]:

i. The water that is sealed and sold for human consumption in sanitary containers and contains under variety of labels trade names. This system known as "closed system"
ii. Water that has been produced by reverse osmosis via diverse sites spread widely in the city to sell water. The containers may be fetched by the consumer, this system known as an "opened system"

This research is considered the second type of "reverse osmosis bottled drinking water".

Osmosis and Reverse Osmosis

Water diffused through a semi permeable membrane towards the region of higher concentration to equalize solution strength. Ultimate height difference between columns is called "osmotic pressure".

Applied pressure in excess of osmotic pressure reverses water flow direction. Hence the term "Reverse Osmosis" [4].

THE OBJECTIVES

1. Evaluate the bacteriological quality of the bottled water produced by reverses osmosis methods.

2. Demonstrate the awareness of sampled citizens using this type of water .
3. Evaluate the environmental education of the employees who run the places that produce and sell the water via opened system.

MATERIALS AND METHODS

A descriptive study of places and people, attending and working, in this place of bottling water was carried out during seven months from 1st November, 2006 to 30th June 2007.

Fourteen sites has been identified by the researchers, due to the fact that data not available about numbers and locations. A comprehensive sampling of all reached premises was done. Three different Laboratories tests were done to determine the *coli form* count: presumptive, confirmed, and completed.

A questionnaire was developed to get information about the participants, knowledge about the quality of safe drinking water and environmental awareness for both of employees and consumers representing all society's segments.

The collected data were statistically analyzed to obtain numeral tables and graphical modes to represent the results.

RESULTS

i. 87.5 % of the sample run the place by the proprietors themselves، 12.5% of the sample were using an employee Fig. 1.

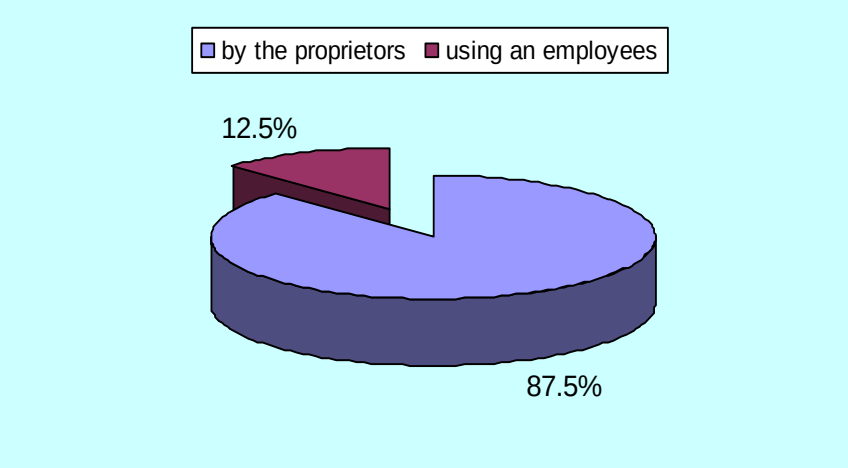

Figure 1: The water place manage

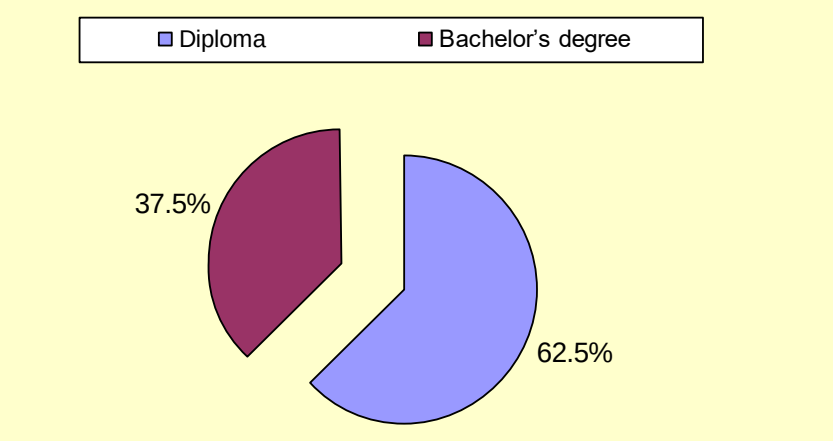

Figure 2: The educational level of the supervisors

ii. The education level for 62.5% of the supervisors were diploma, 37.5% were of bachelor's degree Fig. 2.
iii. 100 % believed that they knew the type of the water tests that must be done.
iv. 95.8 % of the sample corroborated accomplishing of periodic testing for the producing water. Only 4.2% refuted any periodic checking for the water Fig. 3.

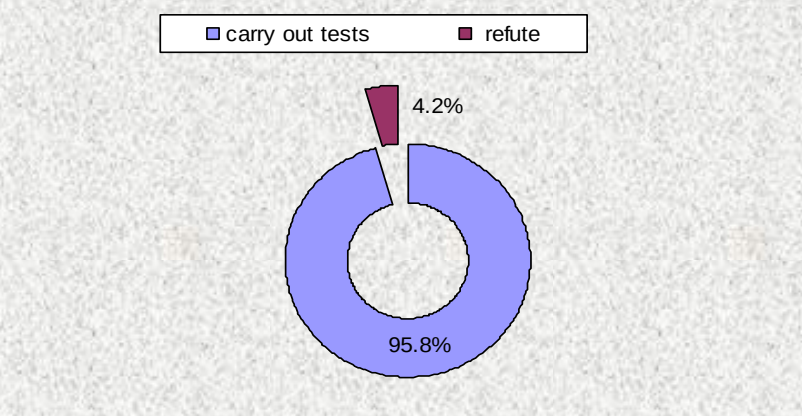

Figure 3: The periodic testing

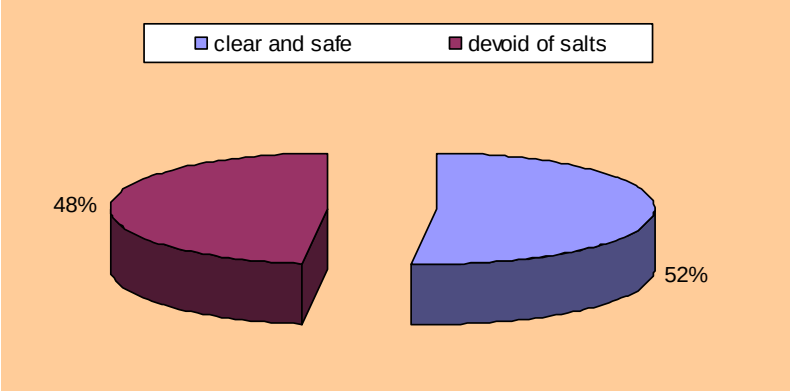

Figure 4: The cause of the citizens to buy the bottled water

v. When we asked the supervisors about the kind of testing, 100% answered that the only test that must be carried out was the chemical test. No one knows anything about physical test or bacteriological test.
vi. The cause for 52% of the citizens to buy this type of water were because they were accepted as true that this water is clear and safe, 48% were believed that the water is devoid of salts Fig. 4.
vii. Utilizing the water for infants, elders, and sick individuals was for 8%, 2%, and 11% of the sample under study respectively. 79% of the sample was using the water for the drinking by the family.
viii. When we asked about the citizen means for identifying the clearness of the water and its devoid from salts, the answer was:
    a. 65%knew the kind of water only by look at it.
    b. 1 % did the required tests by himself.
    c. 34% did nothing (he just know).

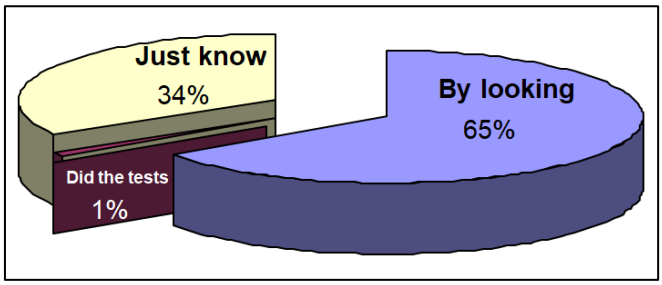

Figure 5: The Citizen Means for Identifying the Clearness of the Water and its Devoid From Salts

ix. 85% of the populace didn't know anything about the type of the test that must be carried out. 15% rejected the answer.
x. 18%of the sample under investigation read the list of required tests at the same places that produce and sell the water; whereas 82% did not noticing any list.
xi. 76% don't like to buy a brand sealed type of plastic bottled water because it is more expensive, 24% thought it is expose to the sun light (bad storing up).

Laboratory Results

i. The results from table 1 show that 11 of 14 examined test tubes represent the presumptive

test of MPN of bottled water were found positive for bacterial growth (i.e. 78.6%)of the tested sample were contaminated. The range of MPN index per 100 ml of water was from 4 to 1100 .

Table 1: The Laboratory Results

Number of Samples	MPN		MPN index range per 100 ml	Contaminated Sample (%)
	Negative	Positive		
14	3	11	4 - 1100	78.6%

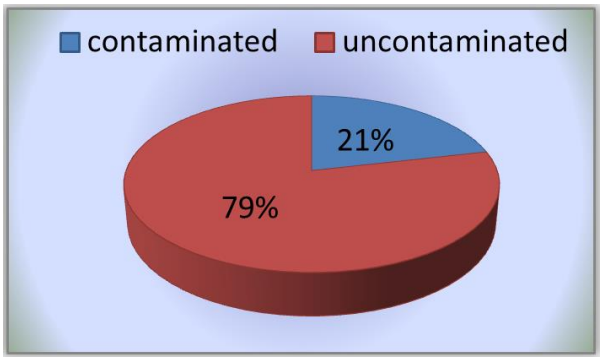

Figure 6: The results of Bacteriological Examinations

DISCUSSION

Consumers often perceive that bottled water is safer than tap water; however, the safety of bottled water must be carefully valuated since not all bottled water is the same. In some instances, the quality of bottled water is the same as tap water, or less in quality, due to the potential for re-growth of bacteria while processing for sale and consumption [1].

The consumers depending on their senses to evaluate the quality of water and decide if they will purchase it or not. They don't know that the sense's judgment is not enough to decide whether the water is free from contaminants.

Most of consumers have no idea about water tests; and did not notice any hanging list of these tests or hear about it. They have no awareness or environmental education about this daily important matter .

In spite of the higher general education level of the owners, our study reflects that many of them don't have any knowledge about the examination of water especially the physical and bacteriological. They have the benefit of a major section of the beverage and the prestige of being the fastest growing segment of the entire beverage industry, not to mention the most profitable.

Leaving the quality and purity up to discretion of the citizen who have little or no background in water quality.

This study showed that three-quarter of the samples under investigation was positive for bacterial growth. It is well known that microorganisms can cause ill health related problems [5].

Destroying pathogenic agents remains the primary reason for treating drinking water. However, fecal *coli form* bacteria in the water may indicate human or animal wastes because these bacteria inhabit the intestines of human and other vertebrates. *Coli form* does not necessarily cause disease themselves. Nevertheless, may contain pathogens. If *coli form* is found in the water, then it is tested further for presence of organisms to be pathogens. we are depended only on the tests of determining the *coli form* count (presumptive, confirmed, and completed).

The purpose of most primary standards is to guard against potential health effects. Sources of pathogenic may include poorly maintained reverse osmosis systems, presence of the poor disinfecting of drinking water. These finding are in agreement with the finding of several other researchers [3, 6]. Some they usually neglect UV unit because of cost [3]. People at greatest risk are infants, elderly people, and individuals whose immune systems are compromised by other illness. On the other hand, the unavailability of the exclusive list for these places which make it very difficult to follow up by the control and inspections.

Water systems authority must issue annual reports, telling consumers what is in their water; the bottler to put it as a list in noticeable places in addition to the published Libyan's standards for water to prevent deception. To know for sure about the quality of water. The facts must be considered benefits of low cost, convenience and quality assurance in this type of water.

95.8 % of consumers confirm the importance of periodic testing for the water, 100% were not familiar with the type of the examinations to be done !

The purity of water is one of the most important factors in the prevention of degenerative disease.

CONCLUSION

i. 52% of the citizens were believed that this water is clear and safe, 48% were accepted as true that the water is devoid of salts. 99% have now logical way of knowing the actual quality of the water .
ii. Most of consumers have no idea about water tests (85%); and did not notice any list of these tests or hear about it (82%). They have no awareness or environmental education about this daily important matter. All the samples under studied use the water for drinking; (22%) were buying it especially for infant, elderly, and sick person.
iii. Bottled water supervisors do not have any knowledge about the examination of water especially the physical and bacteriological tests.
iv. 7.7 % of the samples are of bacteriological contaminated. This is due to the efforts exerted by the control and inspections departments in spite of the unavailability of the exclusive list for these places.
v. Lack the awareness and environmental education for both of citizens and bottlers .

RECOMMENDATION

1. Exclusive list for water places must be available to follow up.
2. License for such places must be ruled after the owners pass the education cycle about drinking water for at least two weeks.
3. Create “Consumer Protection Council” to prevent the deception and questionable ethics.
4. Increase the knowledge and awareness of the public by all media, especially TV to ensure success in the efforts of the health authorities in this field.
5. Bottled water consumers should be informed about water tests and potential risks associated with its products.

REFERENCES

1. Pontius, F. W. (1990). Water Quality and Treatment. American Water Work Association, fourth edition, McGraw Hill, Inc., United State, 80.
2. The Libyan National Center for Standardization and Standardization of Bottled Drinking Water for the year 1997.
3. Al-ani, F. G., Fatema El-sonosy, A., & Younis, M. (2006). Quality of Botted Drinking Water. *El-Meear J. Libyan National Centre for Standardization and Metrology,* 34-37.
4. http://www.freedrinkingwater.com/products.htm (accessed2/5/ 2008).
5. http://www.evian.com (accessed 23 /4 /2008).
6. Jawetz E., Melnick J. L., Adelberg, E. (1987). A. Review of Medical Microbioloyy. Prentic-Hall International Inc. *United State of America,* 110.