

Assessment of drinking water quality in some schools in Nalut city

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ABSTRACT

This study aimed to evaluate the drinking water quality in some schools in Nalut to determine their suitability and their compliance with the Libyan standard for drinking water. Cross-sectional study was conducted from December 2020 to April 2021 and measurement were performed for the water of 14 schools in Nalut city to determine the quality of drinking water. From each school, the tap water samples have been taken in a clean bottles and analyzed within 24 hours. These samples were analyzed for some physical, chemical and microbiological tests. Through the study, the results showed that the source of drinking water in all the schools in the study area were transported water and stored in a tank water. Parameters for physical and chemical properties such as PH (7.3- 8), Potassium (0.1-0.8), Sodium (2.2-6.6), Chloride (2.2-4.1), Nitrate (0.2-0.62), were within Libyan standard except the total dissolved salts (591-1030) are higher than the permissible value in the Libyan standard for drinking water. However, results of the school drinking water of microbial detection showed that most of the samples were contaminated by E.coli and total coliform. Some solutions and recommendation were proposed to raise the quality of drinking water in these schools.

Key words:- school, water microbiology, physicochemical parameters.

الملخص

هدفت هذه الدراسة إلى تقييم جودة مياه الشرب في بعض مدارس مدينة نالوت لتحديد مدى صلاحيتها ومطابقتها للمواصفات الليبية 2016 الخاصة بمياه الشرب. حيث أجريت هذه الدراسة المقطعية والتي استمرت من شهر ديسمبر 2020 إلى شهر أبريل 2021م ، تم إجراء الاختبارات والقياسات لمياه عدد 14 مدرسة في مدينة نالوت للكشف عن مدى جودة مياه الشرب في هذه المدارس. لكل مدرسة تم وضع عينات المياه في أنبوبة نظيفة ومعقمة وتم إجراء التحاليل عليها خلال 24 ساعة. وتضمنت هذه التحاليل بعض الاختبارات الفيزيائية والكيميائية والميكرو بيولوجية في منطقة الدراسة. من خلال الدراسة أوضحت النتائج أن مصدر مياه الشرب في معظم المدارس هي مياه منقولة بالخرانات ومن ثم تخزينها في خزانات المدارس. وقد شملت الاختبارات الفيزيائية والكيميائية الأس الهيدروجيني (7.3-8) ، الصوديوم (2.2-6.6)، البوتاسيوم (0.1-0.8)، الكلورايد (2.2-4.1) ، النترات (0.2-0.62) كانت وفق المواصفات القياسية الليبية لمياه الشرب فيما عدا تركيز الأملاح الذائبة الكلية والتي تراوحت ما بين 591-1030 كانت أعلى من الحد المسموح به وفق المواصفات القياسية الليبية لمياه الشرب. وكذلك أوضحت النتائج وجود تلوث بكتيري في معظم العينات. وتم اقتراح بعض الحلول والتوصيات للرفع من جودة مياه الشرب في المدارس.

الكلمات المفتاحية:- المدارس، الأحياء الدقيقة المائية، الاختبارات الفيزيائية والكيميائية.

INTRODUCTION

A major concern for human health and environment is drinking water quality especially in school for both students and staff. Hygiene practices includes firstly, providing clean water in school, and assessing to sanitation which are all important contributors to children's health [1,2,9]. water contaminants can affect the water quality which ultimately affect human health and causes diseases from poisoning or infection [1,9,10].

Children, the elderly, pregnant woman, and those with chronic diseases are the highest-risk group and in many cases can become ill by pollutant in drinking water [2,9]. There are many waterborne

infectious agents such as cholera and typhoid fever that affect society may lead to many epidemics [2,6]. Diarrhea is the most common cause of illnesses in school children which is associated with contamination of water by pathogen by Feacal oral route [8].

Foundation of nitrites in well water and other water supplies can lead to methemoglobinemia via conversion to nitrite resulting of bacterial and metabolic influences [2,3]. Children may spend up to many hours in the school facilities that why it is important sitting to study and consume much of their daily of water from school water sources [1,2,7]. Complex nature of the student drinking water system and vulnerability of the users can cause schools to be a high risk environments [2].

For these reasons, in this study we investigated the quality of drinking water in Nalut schools to ensure a safe water supply and providing water from reliable source such as establishing a monitoring and surveillance system, and also local municipality to ensure that the water is safe for students and stuff in all the schools.

In this study, the physical, chemical, and microbiological parameters of the water supplies for 14 public primary schools were examined to determine the quality of the drinking water provided to the students and school staff.

MATERIAL AND METHODS

This cross sectional study was conducted in the primary schools in Nalut between December 2020 and April 2021. A total of (14) schools were selected using a random sampling methods. Sample collections were started at the schools in the morning on workdays. Tap water samples were collected in clean bottles 500 ml. Samples were transported to the laboratory on ice and analyzed with 24 hours. In this research, the test items for school drinking water include

physical, chemical property which cover hydrogen ion concentration (pH), total dissolved salt (TDS), sodium (Na), potassium (k), chloride(Cl), nitrates (No₃) as shown in table no 1, for total hardness (TH) a soap solution was used to analyze the hardness of the water sample, and microbiological detection involves E.coli and total coliform. For the analysis of the total coliform bacteria, the samples were initially filtered using a membrane filtration device and subsequently inoculated into Tryptone Glucose Extract Broth and mackoncy agar. The cultures were incubated for 24-48 h at 36-37 C° in an incubator. The analysis were in Central Nalut Hospital according to the standard method for examination of water.

Table no 1. The school drinking water quality analysis item and methods.

Property	Item	Method
Physical and chemical	PH	Electrode method
	Total dissolved salts (TDS)	Electrode method
	Sodium (Na)	Flame photometric method
	Potassium (K)	Flame photometric method
	Chloride (Cl)	Flame photometric method
	Nitrates (No ₃)	Spectrophotometer method

RESULTS AND DISCUSSION

This research conducted on water quality in selected 14 governmental schools in Nalut city. All schools used transported water and stored in stored tanks. The analysis result is explained as follows:-

Table no 2. Physic – chemical parameters of selected sampling sites .

Test	PH	TDS	Sodium Na ⁺	Potassium k ⁺	Nitrates No ₃ ⁻	Chloride cl ⁻	T.H
Unit	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Libyan standard	6.5-8.5	100-500	200	12	45	250	
School 1	7.6	1000	3.4	0.3	0.53	3.5	high
School 2	8	748	6.6	0.5	0.41	4.1	mild
School 3	7.8	868	2.7	0.1	0.48	3.2	high
School 4	8	791	2.3	0.3	0.62	2.2	high
School 5	7.8	851	4.5	0.8	0.50	3.5	mild

School 6	7.7	591	4.1	0.5	0.48	3.2	high
School 7	7.9	715	2.4	0.2	0.57	4.0	low
School 8	7.3	781	4.2	0.1	0.51	3.3	low
School 9	7.9	765	4.4	0.5	0.53	2.4	low
School 10	7.5	911	3.4	0.1	0.44	3.2	mild
School 11	7.9	755	4.5	0.7	0.46	4.1	high
School 12	7.8	607	3.4	0.3	0.52	2.0	mild
School 13	7.8	599	2.2	0.6	0.59	3.1	mild
School 14	7.3	1030	3.4	0.4	0.2	2.2	high

1mg= 1ppm.

The result of physic- chemical parameters of drinking water samples collected from different schools are shown in table no 2.

1-Hydrogen ion concentration (pH).

A parameter that indicates the acidity of a water samples is pH . The permissible value of pH prescribed by the draft Libyan specifications for drinking water and World Health Organization is 6.5- 8.5. The pH values of all the school samples were observed between a range of 7.3- 8 which showed that all the samples have met the Libyan standard as shown in figure 1. There are no direct adverse effect on health by the pH .However, high value above of 8.5 which recommended by Libyan standard can show alkaline taste and lower value below 4 can produce sour taste [4].

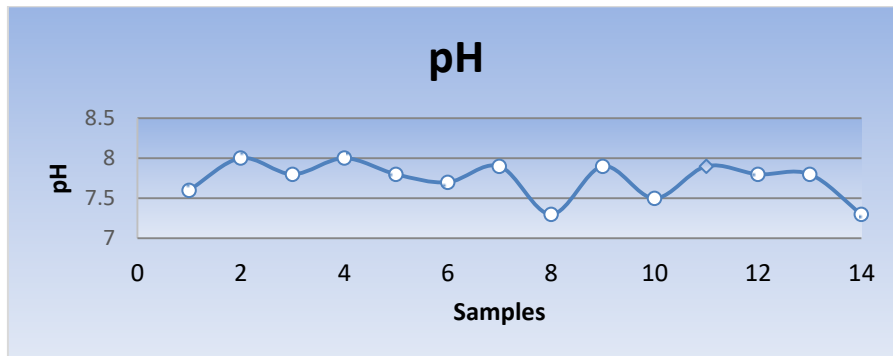


Figure no 1. shows the value of hydrogen ion concentration (pH) in the study area.

2-Total dissolved salt (TDS).

Total dissolved salts of all the school samples throughout the period of the study ranged between (592- 1030) (mg/l) as shown in figure no 2. Hydrogen carbonate ion , chloride salt, calcium sulfate ,inorganic salt as well as little soluble organic synthesis are included as TDS [9] . Libyan standard recommends that the value of TDS of drinking water is 100- 500 mg/l. In this research, the results showed that the TDS value in all school samples higher than the allowable Libyan standard. In addition, water of TDS higher affected the taste of water which is unacceptable.

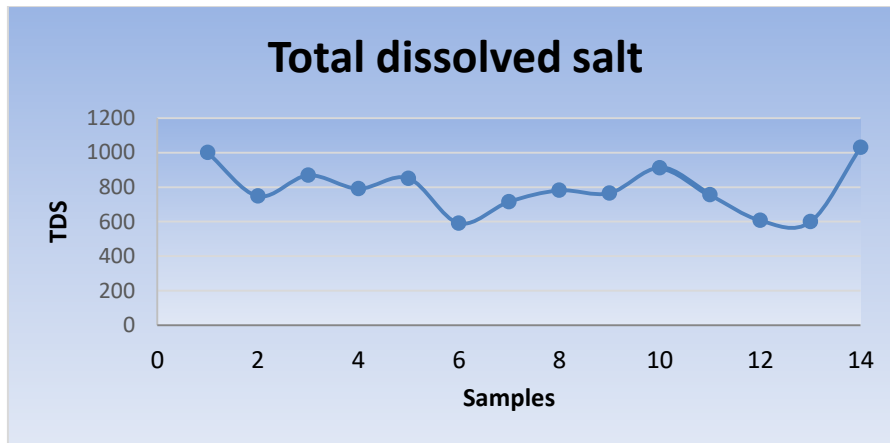
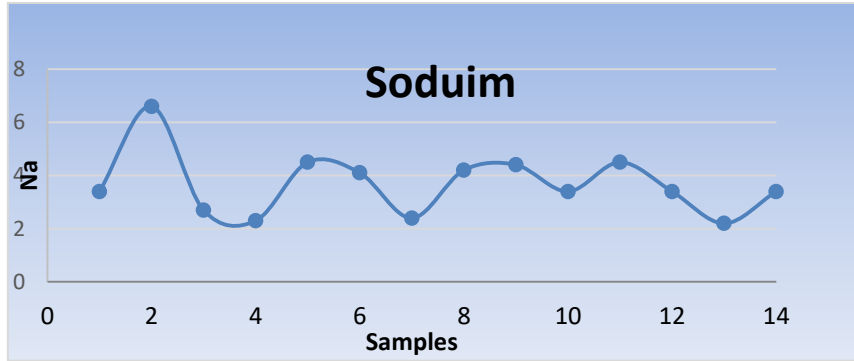


Figure no 2. shows the value of Total dissolved salts (TDS) in the study area.

3-Soduim (Na)

Sodium values throughout the period of the study at all the school samples ranged between (2.2-6.6) (mg/l) as shown in figure no 3. According the Libyan Standard the maximum acceptable concentration of sodium in drinking water is 200 mg/l. The result showed that the sodium value in all school samples has met the Libyan standard.

Figure no 3. shows the value of sodium (Na) in the study area.



4-Potassium (K).

Naturally, potassium is occurring elements [9]. At all the samples were found the potassium concentration between (0.1-0.8) mg/l as shown in figure no 4 ,which is in permissible Libyan standard 12 mg/l. The result showed that potassium value in all school samples has met Libyan Standard. In water samples the excess amount of potassium presented may lead to nervous and digestive disorder [9].

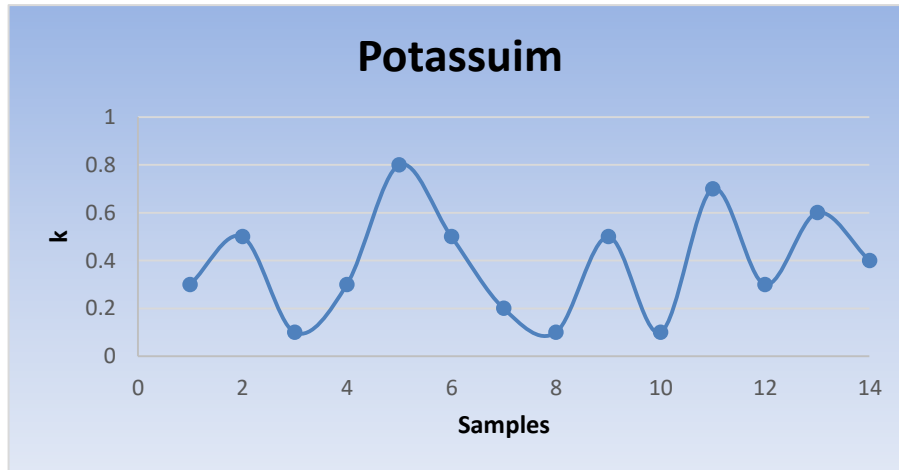


Figure no 4. shows the value of potassium (k) in the study area.

5-Nitrate (NO₃)

The maximum acceptable concentration of nitrates in drinking water according to Libyan Standard is 45 mg/l. the results showed that the values of nitrate in water samples of all schools ranged between (0.2-0.62) mg/l as shown in figure no 5. it is found that all the school samples are free from nitrate pollution.

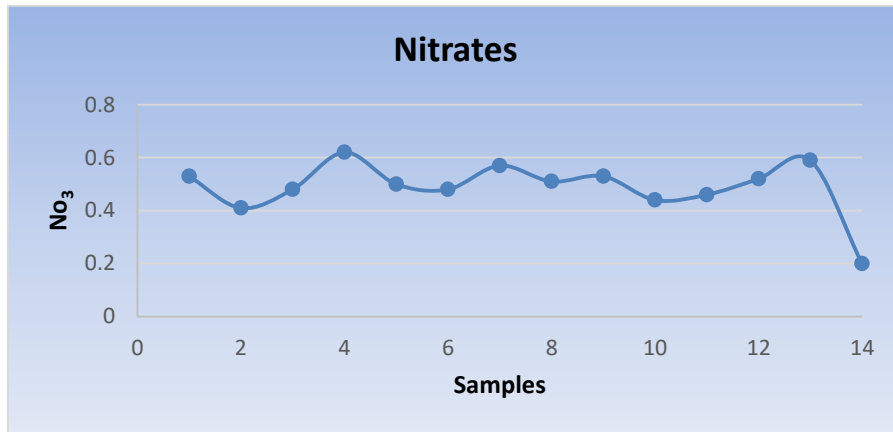


Figure no 5. shows the value of nitrates (No₃) in the study area.

6-Chloride (cl)

The value of chloride of all the school samples throughout the study period of the study were found to have a range of between (2-4.1) mg/l as shown in figure no 6. The permissible limit of chloride in drinking water according to Libyan Standard is (0-250) mg/l.

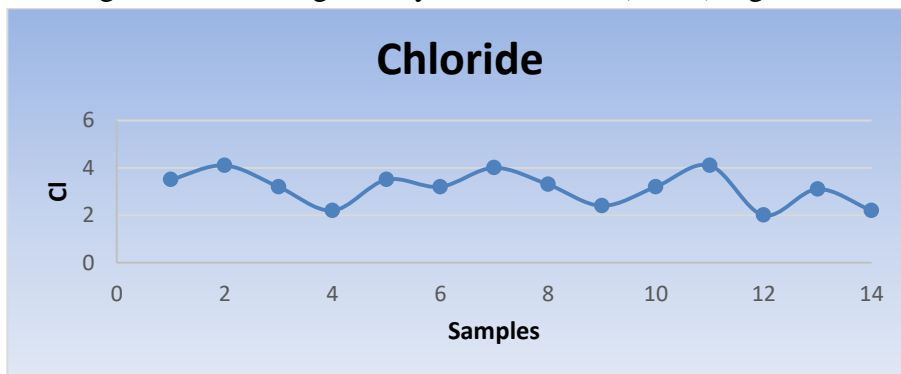


Figure 6. shows the value of Chloride (cl) in the study area.

7-Total hardness (T.H).

The results of all the school samples ranged between (high, middle, and low).The hardness in drinking water indicates the availability of some ions including calcium and magnesium which exist mainly in sandy rocks especially in limestone. Drinking water with high hardness can cause increases of urinary tract infections [5].

The results of microbial detection of drinking water samples collected from different schools are shown in table no 3.

Table no.3. Results of microbes detection of school drinking water in the study area

Samples Coliform.	E.coli.	Total
School 1. absent	absent	
School 2. Positive	Positive	
School 3. Positive	Positive	
School 4. Positive	Positive	
School 5. Positive	Positive	
School 6. absent	absent	
School 7. Positive	Positive	
School 8. Positive	Positive	
School 9. Positive	Positive	
School 10. absent	absent	
School 11.	Positive	

Positive	
School 12.	Positive
Positive	
School 13.	absent
absent	
School 14.	Positive
Positive	

1- Microbe detection.

The most important aspect of drinking water is the microbiological quality of drinking water because of its association with waterborne disease. There are numerous disease transmitted by water which include Typhoid fever, enter viral disease, bacillary and amoebic dysentery , cholera, and many varieties of gastrointestinal disease [6,9]. E.coli is one of the gram negative bacteria which should not be present in drinking water because its provides evidence of recent feecal pollution. Feecal pollution of drinking water indicated by testing microbial quality which include testing for E.coli. Total coliform bacteria can be tested too [9].

In this research microbial detection covers detection of E.coli and total coliform. As shown in table 3. The majority of the water samples at schools in Nalut city contaminated by E.coli and total coliforms.

CONCLUSION

From this study the following conclusion are obtained:

- 1- The water quality parameters of hydrogen ion concentration (PH), sodium (Na), potassium (k), chloride (cl) and nitrates (NO₃) had met the domestic Libyan standards.
- 2- The results showed that the values of Total dissolved salts (TDS) during the period of the study at all the schools higher than the allowable Libyan standard.

- 3- The highest unqualified rate in microbial detection is 71.5% for the schools in Nalut city, which were positive for E.coli test and total coliform test. While the lowest value was 28.5% which were negative in both tests done.

RECOMMENDATION

- 1- Inform and raise students and teachers awareness on issues related drinking water protection and its impact on health.
- 2- To provide safe drinking water for the student and the staff , water quality parameters (chemical and biological testing) should be done and the schools should provide additional technology to help clean and disinfection of drinking water.
- 3- The study suggesting that further studies are necessary to be done for the knowledge of the source of the contamination in the water in these schools.

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