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Research Article

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An Assessment of Water Quality for Ain Al-Fawara in Tolmeitha, Libya Using Physiochemical and Microbial Parameters

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Abstract

Ain Alfawarra is located in Tolmeitha in the northeastern coast of Libya and its water is utilized locally for livestock consumption. This study aimed to assess water contamination in this natural, surface water source. Chemical and biological analysis has been performed to determine the level of pollution at a private, certified laboratory. Chemical analysis include qualitative analysis of cations and spectrophotometric techniques. Microbial analysis, however, was performed using traditional cultivation techniques. Even though, this Ain has not been used for human consumption, its contamination still affects public health indirectly through probable leaking into ground water or spreading water-borne diseases among animals and through insects. Chemical analysis has shown high lead levels 0.028mg/L, exceeding the WHO permissible limit of 0.01mg/L. Biological analysis has shown high bacteria counts (total bacteria:>2419.6 CFU/mL; total coliform: 1100 CFU/100ml; E.coli:1100 CFU/100ml; Fungi:>300 CFU/ml; S.faecalis: 29.1 CFU/100 mL, all exceeding international safety limits. The findings of this study suggested restricting this area for both animal and human consumption, and then manage a hygienic plan. This area needs to be monitored biologically and chemically and then treated.

Keywords: Water quality, environmental evaluation, natural water pollution, physiochemical and biological parameters.

INTRODUCTION

Drinking water comes mainly from sources including rivers, lakes, and natural springs. These surface water sources are exposed to chemical, biological, or radioactive contamination (Fakron, 2022; Khan et al., 2021; & Abera et al., 2011). Production, utilization, and disposal of inorganic and organic substances can lead to water supplies pollution. Daily activities may lead to water sources contamination; these activities include: coal combustion, using detergents, pesticides, disinfectants, fertilizers or gasoline additives. Additionally, improperly disposed chemicals and animal waste, and naturally occurring substances are potential contaminants (Das, 2025). Surface water pollution is increasing because of natural and anthropogenic reasons and there is a demand in recent years for treatment and restoration of surface water (Yang et al., 2025; & Ali et al., 2025). Water-borne microbial pathogens pose significant health threats to humans and challenges for treatment (Ali et al., 2025; & Fakron, 2022). The current study

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aimed to add to the existing literature on water quality in Libya. There are insufficient research studies explored water pollution in the east of Libya (Cyrenaica) (Nair et al., 2006). In specific, no studies have reported physiochemical or biological pollution in Ain Alfawara, Tolmeitha. One of the goals is to raise a red flag and report the status of Ain Alfawara pollution so individuals can limit exposure to this Ain. Scientific reports not only help informing people but also can draw authorities' attention to this area to prohibit the use of this Ain for both animal consumption and agricultural purposes. Evaluating water quality should be followed by treatment plans since surface water pollution has a great impact on the status of ground water because of the interaction between the two (Sophocleous, 2002).

MATERIALS AND METHODS

Description of the Area of the Study

The water sample was collected from a Ain in Tolmeitha, Libya, located approximately three kilometers from the city center and about eighty meters from the coast see Figure 1 below. The exact geographic coordinates of the sampling site are 32°43'19.9"N, 20°58'07.7"E (Google Maps, 2025). One representative water sample was obtained in June, 2025 by taking triplicate samples collected from Ain Alfawara, Tolmeitha, Libya. Water samples were collected from about 25 cm depth and then stored in a clean plastic container. Physiochemical and microbiological examination was done in a private, certified laboratory at The Man-Maid River authority. The pH was measured the same day of collection using PHS-3C Precise pH meter. However, the pH was not measured on the site of collection because the pH meter used was a bench top type. Handling the samples and storage was done according to the guidelines of American Public Health Association, American Water Works Association, and Water Environment Federation (2023). After measuring the pH, the sample then was sent to the laboratory for water quality assurance. Some tests were done inside of our laboratory at the College of Arts and Sciences, Al-Marge including pH, and qualitative analysis of cations to investigate what heavy metals are present in the sample before performing the full analysis.

Figure: (1). Ain Alfawara, Tolmeitha, Libya.

RESULTS AND DISCUSSION

Chemical and biological parameters were used to determine water quality in Ain Alfawara. The results of the qualitative analysis for cations indicated the presence of the metal lead and the absence of cadmium. Chemical analysis indicated that Ain Alfawara was found to be very polluted

since lead was detected as Ain as the other chemical parameters including alkalinity, hardness and conductivity.

Chemical Analysis

Table 1 shows the chemical parameters used in examining the water quality. All of the quality assurance tests were done in a certified laboratory. The pH was 7.29, and seems to be acceptable for natural water according to the World Health Organization (WHO). The lead levels were high (0.028 mg/L), and it is above 0.01 mg/L, the local and international limits; these high concentrations of lead need to be monitored overtime because it can accumulate in soil and then transfer into the crops (Brown, 2016). Total hardness is four times above the limit. It can cause sediments and calcification in pipes or on ancient walls since this open Ain is located in an ancient area. Calcium hardness specifically can cause a white calcium carbonate layer that can obscure artificial details of archaeological sculptures. Total alkalinity is high and it can cause. High conductivity indicates high salinity that cause metals corrosion and salts crystallization on walls and monuments. Table 1 below shows the maximum permissible limit for potable water (World Health Organization (WHO), 2025).

Table:(1). Pysiochemical parameters of Alfawara water sample.

Physiochemical Parameters	Alfawara sample	WHO Limits
pH	7.29	6.5-8.5
Conductivity (E.C) (µs/cm)	5700	<1500
Total Dissolved Salts (TDS)	3705	1000
Total Hardness (mg/L as CaCO3)	1040	>180 very hard water may cause scale deposition.
Calcium Hardness (mg/L as CaCO3)	612	The taste threshold for the calcium ion is in the range of 100–300 mg/l.
Magnesium Hardness (mg/L as CaCO3)	428	The taste threshold is lower than that for calcium. Not of health concern at levels found in drinking-water but may affect water acceptability.
Total Alkalinity (mg/L as CaCO3)	228	<200
Iron (Fe) in mg/L	ND	0.3
Cadmium (Cd) in mg/L	ND	0.003
Nickel (Ni) in mg/L	0.004	0.07
Copper (Cu) in mg/L	0.39	2
Lead (Pb) in mg/L	0.028	0.01

Biological Analysis

Traditional cultivation of bacteria was performed. The direct count methods for bacteria were used to report the total counts; total bacteria count was >2419.6 see Table 2 below. Microbiological contamination has a serious impact on public health, soil pollution, and animals including wild animals. Since water production in this Ain is not significant, there is a low probability that individual directly consume water from this natural source. However, there is indirect impact on public health including insects that spread diseases, livestock animal consumption, and sick hunted birds and wild animals since this water source is open for animal consumption. Bacteriological analysis indicated that the sample exhibit unsafe levels of bacteria: total coliform was 1100 CFU per 100ml; E-coli counts was 1100 CFU per 100ml which is 220 times the local and international limit; Fungi exceeded 300 CFU per 1 ml, and Streptococcus Faecalis was 29.1 CFU per 100 mL. These high numbers indicates that this water source is highly contaminated with either sewer water or human or animal wastes. These bacteria could navigate to the ground water and contaminate neighboring water sources (Sophocleous, 2002). Investigating the sources of this pollution is crucial before the treat-

ment to stop the accumulation of these chemical and biological contaminants.

Table:(2). Biological Parameters.

Biological Parameters	Alfawara sample
Total Bacteria Count (per 1 mL)	>2419.6
Total Coliform (per 100 mL)	1100
Escherichia Coli (E. Coli) (per 100 mL)	1100
Fungi Test (per 1 mL)	>300
Streptococcus Faecalis (per 100 mL)	29.1

CONCLUSION

In conclusion, the water source we examined had unacceptable bacteria count. Chemical pollution is determined by high lead concentration in the sample as well as other physiochemical parameters including alkalinity, hardness and conductivity. Ain Alfawara was positive for presumptive coliform count had E. coli showing fecal contamination of water sources. Thus, prohibiting the use of this water is necessary; this study suggests regular disinfecting of this water sources and periodic bacteriological appraisal.

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ETHICS

Authors should address any ethical issues that may arise after the publication of this manuscript.

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