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Original Research Article

Monitoring the hygienic quality of underground water in different localities in Egypt and Libya

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ABSTRACT

The present study was carried out in six provinces in both Egypt and Libya throughout the period from January to October 2014. These areas were (Beni-Suef, Ismailia, and Matrouh district) in Egypt and (Tripoli, Zliten, and Zawia district) in Libya. To assess the hygienic quality of underground water sources intended for animal and human drinking and detect the source of pollution. The physicochemical parameters as pH, alkalinity (mg/l), electrical conductivity (µS/cm), total hardness (mg/l), hardness Ca^{+2} (mg/l), hardness Mg^{+2} (mg/l), ammonia (mg/l), nitrite (NO2-) (mg/l), nitrate (NO3-) (mg/l) and some heavy metals (Pb, Fe, Cu, Cd, Cr, Zn and Mn) in the underground water were determined. A total of 60 water samples of the underground water were collected from dug wells. Samples were investigated for assessment the physicochemical quality of water destined for human and/or livestock consumption using appropriate instruments for the estimation of metals in the underground water using atomic absorption spectrometer. It has been revealed that a significant increase in mean values of alkalinity (P<0.001) in Ismailia district, Egypt and Zawia district, Libya. Meanwhile, the total hardness showed a significant increase in Tripoli, Zliten and Zawia districts of Libya (367.8±23.73, 345±17.20 and 330±20.19 mg/l, respectively). Mean values of lead (Pb) were higher in Tripoli and Zliten districts, Libya and Matrouh and Ismailia districts, Egypt (0.03±0.1, 0.02±0.3, 0.02±0.07 and 0.02±0.04, respectively). Meanwhile, mean values of cadmium (Cd) were the highest in the three Libyan districts (0.24± 0.003, 0.22±0.07 and 0.012±0.006 mg/l, respectively). In conclusion, the absence of unified system to monitor physicochemical parameters in ground water sources in the studied areas represented an important task in the evaluation of such water sources and subsequently causing an environmental risk for both animals and humans health.

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1. Introduction

Water plays a crucial role in the livelihood and wellbeing of rural communities. In rural areas, in addition to basic human needs, water is also used for other livelihood productive activities such as livestock drinking (Makoni et al., 2004). Ground water is generally considered as a safe source of fresh drinking water (Haloi and Sarma, 2011). Rapid population growth, increasing living standards in urban areas and industrialization resulted in greater demand for quality water; while pollution of water sources is increasing steadily. Therefore, the ground water is getting polluted and among which wells are generally considered as the worst type of ground water sources in terms of physicochemical contamination due to the lack of concrete plinth and surrounding drainage system (Reza and Singh, 2009). Noteworthy to mention is that poor quality water can affect the productive performance of livestock, for example, in terms of reduced milk production (Solomon et al., 1995) or poor weight gain in growing animals (Lardner et al., 2005). Some of the common quality parameters affecting the health and productivity of livestock are related to the physical properties of water (e.g. taste, smell, turbidity) and chemical constituents (e.g. pH, total dissolved solids, fluoride, sulphate, nitrate, chromium, lead, phosphates, copper, iron, magnesium, calcium, manganese) of water, and the presence of microbial agents in water (Beede, 2012). The presence of toxic metals such as lead (Pb) and cadmium (Cd) in the environment has been a source of fret to environmentalist, because of their hazardous and toxic impacts to man (Hacioglu and Dulger, 2009). The presence of such metals in the aquatic ecosystem has far-reaching consequences on the biota and man; their toxic effects on man are related to dermal, lung and nasal sinus cancers (Fatoki et al., 2002).

The present study aimed to assess the quality and health aspects of water intended for livestock and human consumption as follows: 1) Estimation of physicochemical parameters of the underground water such as pH, alkalinity (mg/l), electrical conductivity (μS/cm), total hardness (mg/l), hardness Ca^{+2} (mg/l), hardness Mg^{+2} (mg/l), ammonia (mg/l), nitrite (NO_2^-) (mg/l) and nitrate (NO_3^-) (mg/l). 2) Assessment of some heavy metals (Pb, Fe, Cu, Cd, Cr, Zn, and Mn) in the underground water. 3) Detection the suitability of the underground water for human and livestock animals drinking and uses in different veterinary practices.

2. Material and methods

2.1. Study area and period

The present study was conducted in some provinces in both Egypt (Beni-Suef, Ismailia, and Matrouh) and Libya (Tripoli, Zliten, and Zawia) during the period from January to October 2014 (Figs. 1, 2). Beni-Suef is one of the governorates in Egypt and is located in the center of the country (coordinates: 29°04′N 31°05′E). The capital of the governorate is Beni-Suef city, located about 120 km south of Cairo on the west bank of the River Nile. Ismailia is located in the east of the country (coordinates: 30°35′N 32°16′E). Matrouh is located in the north-west of the country (coordinates: 31°20′N 27°13′E). Zliten is one of the governorates of Libya (coordinates: 32°27′50″N 14°34′21″E) and located in the eastern area, 130 Km west to the capital, Tripoli. It is located in the west north part of Libya and famous with found wells of water (Egyptian Environmental Affairs Agency, 2008 and www.google.com).

2.2. Water sampling

A total of 60 water samples were collected from underground water sources (dug well, supply point). The assessed water sources were utilized by rural communities for human and/or livestock consumption purposes. Samples were collected from different localities in Egypt and Libya in 2L capacity sterilized plastic containers. During sampling, containers rinsed three times with water sample before fulfilling. After collection, water samples were protected from direct sunlight and transported in a cooling box containing ice packs to the laboratory for analyses. Samples were stored at 4°C and analyzed within 48 h of samples collection. (Griebler et al., 2010). Water samples were examined for physicochemical parameters (pH, alkalinity, Electrical conductivity, ammonia (NH3-N MR), nitrite (NO2—N), nitrate (NO3—N), hardness calcium , hardness magnesium and total hardness and concentration of lead (pb), iron (Fe), copper (Cu), Cadmium (Cd), Zinc (Zn), manganese (Mn) and chromium (Cr) in water was estimated by atomic absorption spectrometer (AAS).

Fig. 1. Location of the study districts and underground water bodies/3 districts in Egypt) (www.google.map).

Fig. 2. Location of the study districts and underground water bodies/(3 districts in Libya) (www.google.map)

2.3. Physicochemical parameters examination

Multiprobes can be used to measure some physical parameters, e.g., pH of the water samples was determined *in-situ*, using a portable combined instrument (HI-991300, Hanna® Instruments). Proper calibration of the instrument was done according to the instruction of the manufacturer. For the determination of chemical parameters, certain chemical reactions need to take place, which will be discussed accordingly.

2.3.1. Alkalinity ($CaCO_3$)

Alkalinity concentrations in water samples are measured using the colorimetric method, Reagent kit (HI93755-01) and HI-83200 Hanna® Instruments.

2.3.2. Ammonia (NH_3-N MR)

Ammonia MR in water samples was measured using Nessler method, Reagent kit (HI93715-01) and HI-83200 Hanna® Instruments.

2.3.3. Nitrite (NO_2-HR)

Nitrite concentrations in water samples are measured using the ferrous sulphate method, Reagent kit (HI93708-01) and HI-83200 Hanna® Instruments.

2.3.4. Nitrate (NO_3--N)

Nitrate concentrations in water samples are measured using the cadmium reduction method, Reagent kit (HI93728-01) and (HI-83200Hanna® Instruments). Cadmium reduces nitrate to nitrite. The nitrite then reacts with sulfanilic acid to form an intermediate diazonium salt in an acidic medium. The diazonium salt then reacts with gentisic acid to form an amber coloured solution. The absorbance of the sample is measured at 500 nm and results are displayed in mg/l on the instruments screen.

2.3.5. Hardness calcium (Ca hardness, $CaCO_3$)

Hardness calcium concentrations in water samples are measured using EDTA method, Reagent kit (HI93720-01) and (HI-83200Hanna® Instruments.

2.3.6. Hardness magnesium ((Mg hardness, $CaCO_3$)

Hardness magnesium concentrations in water samples are measured using EDTA method, Reagent kit (HI93719-01) and (HI-83200Hanna® Instruments).

2.4. Estimation of heavy metals concentration

Concentration of lead (pb), iron (Fe), copper (Cu), Cadmium (Cd), Zinc (Zn), manganese (Mn) and chromium (Cr) in water was estimated by atomic absorption spectrometer (AAS) (Thermo electron Ltd., Solar House Cambridge, United Kingdom, Solar, M., 6 A.A. Spectrometer). 100 ml of water samples were measured, 10 ml of aqua regia (HNO_3 (Loba Chemie PVT Ltd) and HCl- (Analar from Rank) in the ratio of 3:1) and 1 ml of perchloric acid added in a culture test tube, then incubated at 80°C in a water bath, after total digestion and subsequent cooling. The Solution was diluted to 50 ml and analyzed for heavy metals (AOAC, 1990). Lead, iron, copper, Cadmium, chromium, zinc and manganese working calibration standards were prepared by serial dilution of concentrated stock solutions of 1000 mg/l and blank solution (distilled water) were also analyzed for the digested samples.

2.5. Statistical analysis

The primary data were analyzed for descriptive statistics using one-way ANOVA analysis and Duncan's multiple range tests. The statistical analyses were calculated, using Statistical Package for Social Sciences (SPSS version 20.0). The data values were expressed as [mean concentration (±) SE standard error]. $P<0.05$ was in the accepted significance level.

3. Results and discussion

3.1. Physicochemical parameters in underground water samples

The estimated physicochemical parameters (mean ± SE) in ground water sources intended for animal drinking in different districts (Egypt-Libya) in (Table 1 and Fig. 3). It has been revealed that a significant increase at ($P<0.001$) in the mean values of alkalinity in Ismailia district, Egypt and Zawia district, Libya followed by Matrouh, Beni-Suef, and Tripoli district, Libya were (263.0±20.89, 230.0±33.29, 223.4±24.5, 212.8±19.24 and 197.8±28.63 mg/l, respectively). Moreover, total hardness displayed a significant increase in Tripoli, Zliten and Zawia districts of Libya (367.8±23.73, 345±17.20 and 330±20.19 mg/l, respectively) as compared to total hardness in Matrouh, Beni-Suef and Ismailia districts, Egypt (270.2±29.95, 205.2±11.18 and 195.8±17.66 mg/l, respectively). The mean values of ammonia in Zawia district (0.61±0.08 mg/l) had exceeded WHO recommended standards (ammonia 0.5mg/l) while the other districts were within the recommended guidelines. Regarding the mean values of pH in the ground water in both Libyan districts (8.1±0.31, 7.96±0.27, 7.71±0.25) and Egyptian districts (7.86±0.25, 7.60±0.10 and 7.48±0.08) was within the acceptable optimum range of 6.5-8.5 according to WHO (2011) guidelines. Moreover, the estimated parameter was within the recommended guidelines (Electrical conductivity 2000 µS/cm, nitrite 3 mg/L and nitrate 0-45mg/l) in different studied districts.

Estimated physicochemical parameters (mean ± SE) in the ground water in three districts in Egypt have been detected. In Ismailia, the mean values of alkalinity revealed a significant increase compared to Matrouh and Beni-Suef districts (263.0±20.89, 223.4±24.5 and 212.8±19.24 mg/l, respectively). Moreover, mean values of the total hardness increased in Matrouh (270.2±29.95 mg/l) whereas, hardness―Ca+2‖ value was 128.26±6.13mg/l and hardness―Mg+2 value was 141.94±13.89 mg/l followed by mean values of total hardness in Beni-Suef and Ismailia (205.2±11.18 and 195.8±17.66, respectively). On the other hand, mean values of pH, ammonia, nitrite and nitrates in the three districts were in the recommended guidelines (WHO, 2011) (Table 3 and Fig.4).

Concerning estimated physicochemical parameters (mean ± SE) in ground water in three districts in Libya, it has been found that mean values of alkalinity were relatively higher in Zawia at $P<0.001$ (230.0±33.29 mg/l) than Tripoli and Zliten districts (197.8±28.63 and 176.0±24.6 mg/l). Moreover, mean values of total hardness were higher in Tripoli compared to Zliten and Zawia (367.8±23.73, 345±17.20 and 330±20.19 mg/l, respectively) whereas, hardness "Ca+2" and hardness "Mg+2" were (175.18±9.39, 192.62±32.71, 235.6±8.0 and 109.4±9.5 mg/l, respectively) in both Tripoli and Zliten districts. Meanwhile, mean values of ammonia level were the highest in Zawia district (0.61±0.08 mg/l) compared to Tripoli and Zliten (0.36±.06 and 0.04±0.03 mg/l, respectively). On the other hand, mean values of nitrites (NO_2) and nitrate (NO_3) were in the permissible limits in the three districts (0.32±0.0, 0.013±0.01, 0.01±0.0, 0.0 ±0.0, 0.0 ±0.0 and 0.0 ±0.0, respectively) as in the guideline of WHO (2011) (Table 3 and Fig. 4). Such findings revealed that the highest mean values of alkalinity in Ismailia district, Egypt and in Zawia district, Libya followed by those of Matrouh, Beni-Suef, Egypy and in Tripoli, Libya. Moreover, the total hardness showed a significant increase in Tripoli, Zliten and Zawia compared to that in Matrouh, Beni-Suef and Ismailia. Such discrepancy might be attributed to the presence of mineral salts and bicarbonates, sulphates, chloride and nitrates of calcium and magnesium. The present study was in agreement with Singh et al. (2010) who referred the total alkalinity of water to its contents of mineral salts. It is primarily caused by the carbonate and bicarbonate ions.

Table 1: The estimated physicochemical parameters (mean± SE) in the ground water in both Egypt and Libya.

Water parameter \ Tested area	Egypt			Libya			P.L.* (WHO, 2011)
	Matrouh	Ismailia	Beni-Suef	Tripoli	Zawia	Zliten	
pH	7.86±0.25	7.60±.10	7.48±0.08	7.96±.27	7.71±0.25	8.1±.31	6.5-8.5
Alkalinity (mg/l)	223.4±24.5^{b}	263.0±20.89^{a}	212.8±19.24^{ab}	197.8±28.63^{c}	230.0±33.29^{b}	176.0±24.6^{c}	180mg/l
Electrical conductivity (µS/cm)	975.76±44.59^{ab}	792.76±17.42^{abc}	671.12±21.64^{c}	1002.28±13.93^{a}	1056.60±11.77^{a}	997.02±10.51^{b}	2000 µS/cm
Total hardness (mg/l)	270.2±29.95^{c}	195.8±17.66^{ab}	205.2±11.18^{ab}	367.8±23.73^{a}	330±20.19^{b}	345±17.20^{b}	above 200 mg/l
Hardness "Ca+2" (mg/l)	128.26±6.13^{ab}	96.22±4.09^{c}	98.72±3.98^{c}	175.18±9.39^{ab}	198.40±7.60^{b}	235.6±8.0^{a}	above 200 mg/l
Hardness "Mg+2"(mg/l)	141.94±13.89^{b}	99.58±4.49^{ab}	106.48±8.17^{ab}	192.62±32.71^{a}	141.0±23.41^{b}	109.4±9.5^{ab}	above 200 mg/l.
Ammonia (mg/l)	0.12±.01^{c}	0.13±.01^{c}	0.31±.04^{b}	0.36±.06^{b}	0.61±0.08^{a}	0.04±0.03^{ab}	0.5 mg/l
Nitrite (NO_2) (mg/l)	0.014±0.01	0.012±0.01	0.16± 0.01	0.013±0.01	0.32±0.0	0.01±0.0	3 mg/l
Nitrate (NO_3)(mg/l)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0-45mg/l

Within the same row, proportions with different superscript letters $^{a,b\&c}$ differ significantly at P <0.00

*P.L.: permissible limit

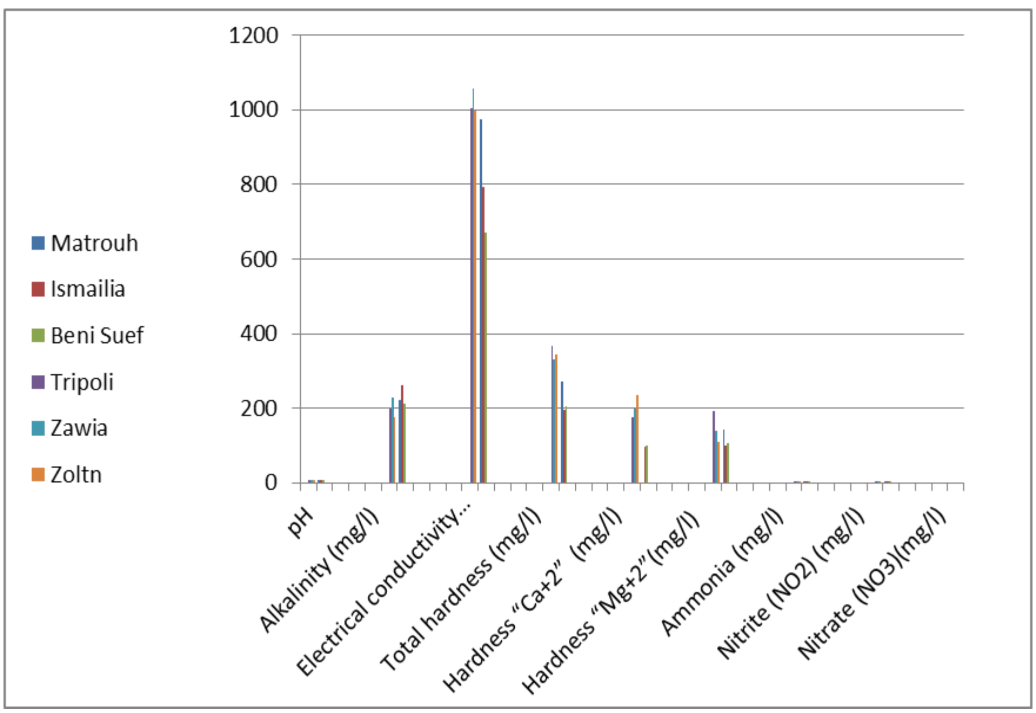

Figure 3: The mean values of physico-chemical parameters in ground water in both Egypt and Libya

The total hardness is the parameter of water quality used to describe the effect of dissolved minerals (mostly Ca and Mg), determining the suitability of water for domestic, industrial and drinking purposes and attributed to the presence of bicarbonates, sulphates, chloride and nitrates of calcium and magnesium (Taylor, 1949). High values of the total hardness recorded could be due to the discharge of sewage from a nearby marketplace, use of soaps and detergents in washing and bathing by humans and from domestic effluents (Adewoye et al., 2013). However, The mean electrical conductivity and total dissolved solid (TDS) and total hardness values of the underground water in Beni-Suef were significantly higher (965.3±6.4 µS/cm, 620.7±3.5and 587.7±28.4 mg/l, respectively) than other water sources examined (775.0 ±1.4 µS/cm, 584.0 ±2.3 and 476.3±33.9 mg/l, respectively) at $P<0.05$ occurring within the acceptable limit standard (2000 µS/cm and < 500 mg/l, respectively). Mean total hardness values can be considered very hard especially in the ground and raw surface water, whereas total hardness values were above 200 mg/L CaCO3 as recommended by WHO standard limit (Mohammed, 2014). In the current investigation, mean values of water alkalinity were higher than those obtained by Adewoye et al. (2013) who collected water samples from twenty hand dug wells in Gambari, Ogbomoso, Oyo State, Nigeria were analyzed to evaluate drinking water quality and determine mean values of alkalinity (0.43-4.73 mg/L mean; 1.27 mg/L), and nitrates (0.00-5.0 mg/L, mean; 0.41 mg/L). Mean values of water pH ranged between 5.57 (from GA02) and 7.1 (from GASP). Eight (40%) samples had pH values below 6.5-8.5 (permissible limit) and were slightly acidic, while the remaining 60% are within the admissible limits and could be regarded as neutral and unpolluted. The mean value for the potential hydrogen concentration in all samples analyzed was 6.454; slightly below the WHO standard. On the other hand, electrical conductivity is a measure of water's ability to conduct an electric current and is related to a number of dissolved minerals in the water, but it does not give an indication of which element is present. The higher value of the conductivity is a good marker of the presence of contaminants such as sodium, potassium, chloride or sulphate (Orebiyi et al., 2010). This indicates a high level of dissolved solids and subsequently impurities in the water rendering the water unfit for drinking. However, Murhekar (2011) investigated the physicochemical status of water samples from ten major localities in Akot city, India. Physicochemical properties such as pH, electrical conductivity (EC), alkalinity (A), total hardness (TH), calcium (Ca^{++}) magnesium (Mg^{++}), and nitrate (NO_3) were determined for wells and bores. He found that the ground water was contaminated at few sampling sites compared to WHO guidelines.

3.2. Determination of heavy metals in underground water samples

Heavy metals are stable and persistent environmental contaminants since they cannot be degraded nor destroyed. They possess adverse effects on the human health and other creatures in the terrestrial and aquatic environment as well as on the food chain (Das et al., 2012).

The estimated heavy metals values (mean ± SE) in the ground water source intended for animal drinking in different districts (Egypt-Libya) were recorded in Table 2 and Fig. 4. It has been found that mean values of lead (Pb) was higher in Tripoli and Zliten districts, Libya and in Matrouh and Ismailia districts, Egypt (0.03±0.1, 0.02±0.3, 0.02±0.07 and 0.02±0.04, respectively) compared to Zawia district, Libya and Beni-Suef, Egypt (0.01±0.06 and 0.01±0.02, respectively). Moreover, mean values of Fe was higher in Zawia and Tripoli, Libya and in Beni-Suef and Matrouh, Egypt compared to other areas (0.91±0.37, 0.55 ± 0.24, 0.37± 0.08 and 0.22 ±0.38 mg/l, respectively). On the other hand, mean values of cadmium (Cd) were the highest in Libyan districts (0.24±0.003, 0.22±0.07 and 0.012±0.006 mg/l, respectively) compared to Egyptian ones (0.032±0.18, 0.01±0.005 and 0.006±0.011mg/l, respectively). Moreover, mean values of chromium (Cr) were higher than the recommended guidelines of WHO (0.05 mg/l) in Libyan districts (2.1±3.5, 1.6±3.1 and1.3±4.4 mg/l, respectively) followed by Matrouh and Ismailia, Egypt (1.4±2.1 and 0.4±5.5 mg/l, respectively). Meanwhile, mean values of zinc (Zn) and manganese (Mn) were in WHO recommended standard in all districts. Estimated heavy metal values (mean ± SE) in the ground water source intended for animal drinking in Egypt revealed that mean values of lead (Pb) were higher in Matrouh and Ismailia district at $P<0.05$ (0.02±0.07 and 0.02±0.04 mg/l, respectively) compared to Beni-Suef (0.01±0.02 mg/l). Furthermore, mean values of Fe was higher in Beni-Suef and Matrouh districts (0.37± 0.08 and 0.22 ±0.38 mg/l). On the other hand, mean values of cadmium (Cd) and chromium (Cr) were the highest in Matrouh (0.032±0.18 and 1.4 ±2.1 mg/l) followed by Ismailia (0.01±0.005 and 0.4±5.5 mg/l mg/l, respectively). The mean value of zinc (Zn) and manganese (Mn) were in WHO recommended standard in the three districts (Table 2).

Regarding estimated heavy metals values (mean ± SE) in the ground water source intended for animal drinking in Libyan districts (Table 2 and Fig. 2). It has been showed that mean values of Pb were higher in Tripoli and Zliten (0.03±0.1, 0.02±0.3 mg/l, respectively) at P<0.05 compared to Zawia district (0.01±0.06 mg/l). Moreover, mean values of Fe were higher in Zawia and Tripoli (0.91±0.37 and 0.55 ±0.24mg/l, respectively) than Zliten district. On the other hand, mean values of Cd were higher in Zliten and Tripoli followed by those in Zawia district (0.24± 0.003, 0.22±0.07 and 0.012±0.006 mg/l, respectively). Moreover, those of Cr were higher in Tripoli, Zawia and Zliten (2.1±3.5, 1.6±3.1 and1.3±4.4 mg/l, respectively) than the recommended guideline of WHO (0.05 mg/l). Meanwhile, mean values of Zn and Mn were within WHO recommended standards in the three districts. Such findings might be attributed to high concentrations of trace metals resulting from agricultural sources, and other anthropogenic activities that produce industrial, transport and domestic waste, as well as accidental pollution incidents. Meanwhile, Adewoye et al. (2013) found that Pb concentration levels in water samples obtained from twenty hand dug wells in Gambari, Ogbomoso, Oyo state, Nigeria were maximum (0.03mg/l) in water samples collected from GASP, while they were minimum, below the detection level (0mg/l), from water sampled obtained from GA04. The concentration of lead obtained from 95% of samples was low, while concentrations obtained from GASP was found to be slightly higher compared to the rest indicating the highest level of lead contamination.

Table 2: The estimated heavy metals values (mean±SE) in ground water in both Egypt and Libya.

Tested area / Heavy metal	Egypt			Libya			P.L.* (WHO, 2011)
	Matrouh	Ismailia	Beni-Suef	Tripoli	Zawia	Zliten	
Pb	0.02±0.07	0.02±0.04	0.01±0.02	0.03±0.1	0.01±0.06	0.0±0.3 2	0.01 mg/l
Fe	.22± 0.38^{ab}	0.19±0.27^{b}	0.37±.08^{b}	0.55±0.24^{a}	0.91±0 .37^{a}	±0.37^{ab} 0.26	0.03mg/l
Cu	0.03±.003^{ab}	0.01±.005^{b}	0.02±.011^{ab}	0.013±0.005^{b}	.034±.015^{a}	0.05±0. 012^{a}	0.6 mg/l
Cd	.032±.018	.01±0.005	0.006±0.01 1	0.22±.007	.012±.006	.±0.003 024	0.05 mg/l
Zn	.54±.19	.51±0.21	0.12±.12	0.48±0.22	0.33±.15	0.±0.13 60	0.003 mg/l
Mn	.08±.037	0.86±.031	0.00±0.002 2	0.056±.023	.08±.039	0.72±	5.0 mg/l
Cr	1.4±2.1^{b}	0.4±5.5^{ab}	0.0±0.0	2.1±3.5^{a}	1.6±3.1^{b}	1.3±4.4^{b}	0.05 mg/l

Within the same row, proportions with different superscript letters $^{a, b \& c}$ differ significantly at P <0.05.
*P.L.: permissible limit

Mean values of Pb concentrations in water samples collected from four locations (Snabis beach, Al-Nasra beach, Marine Cornish, North Al-Qatif and Al-Shatek district) in Al-Qatif, east of Saudi Arabia were 0.72-0.88, 1.02-1.15, 0.62-0.77 and 1.13-1.19 mg/l, respectively (Wafaa, 2010). Lead was the most significant among all heavy metals because of its harmful effect even in small amounts (Gregoriadou et al., 2001). Lead gains access the human body in several ways. It can be inhaled in dust from lead paints, or waste gases from leaded gasoline. It is found in trace amounts in various foods, notably in fish, which are heavily subjected to industrial pollution..

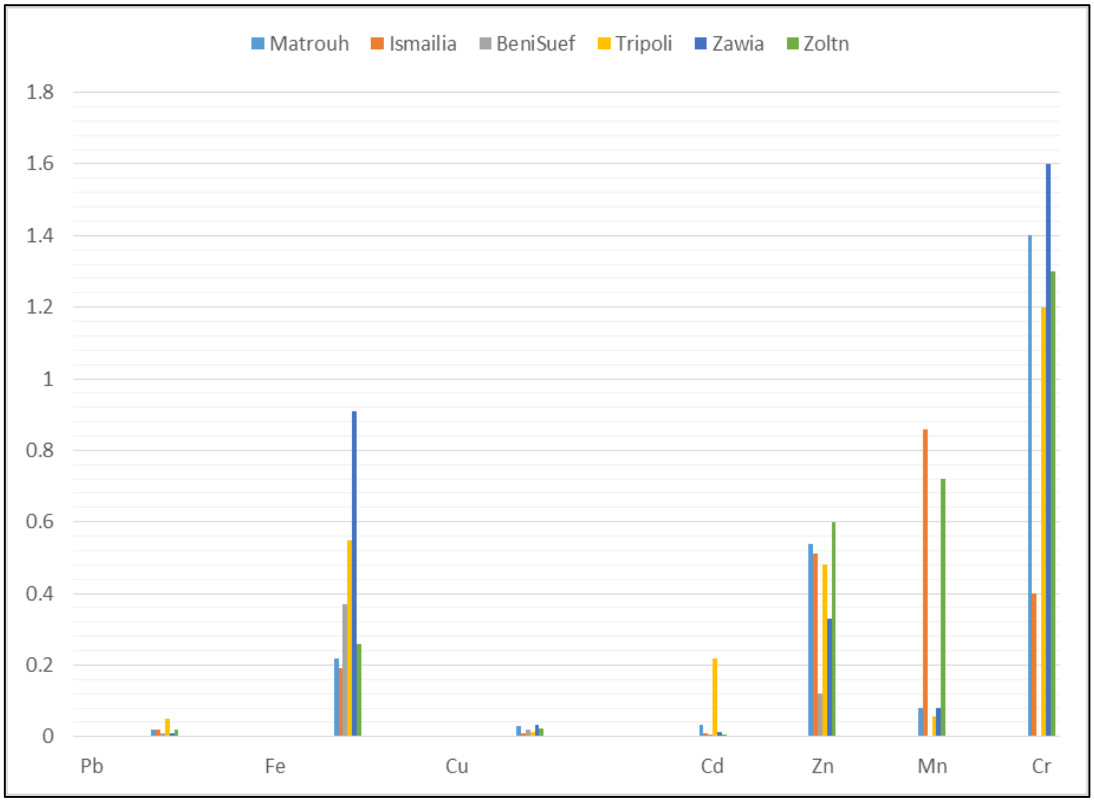

Figure 4: The mean values of heavy metals in ground Water source intended for animal drinking in different districts (Egypt- Libya)

Some houses may have lead water pipes, which can then contaminate drinking water. Most of the lead we take is eliminated in urine; however, as exposure to lead is cumulative over time, there is still risk of buildup, particularly in children. Studies on lead are numerous because of its hazardous effects. High concentration of lead in the body may lead to death or permanent damage to the central nervous system, the brain, and kidneys (Hanaa et al., 2000). In the present study, heavy metals (mean ±SE) estimation showed that concentrations of Fe were found more than the prescribed permissible limits (0.3 mg/l of (WHO, 2011) in underground water samples in Zawia and Tripoli, Libya compared to Egyptian districts. Meanwhile, Mohammed (2014) reported that mean values of heavy metals concentrations; e.g. Pb and Fe in the underground water in Beni-Suef district have exceeded the maximum permissible limits of drinking water for cattle (0.07±0.0 and 3.02±1.4, respectively). Iron is not hazardous to health but it is considered a secondary or aesthetic contaminant as it stains laundry and plumbing fixtures at levels above 0.3mg/L. It is essential for a good health and it facilitates oxygen transport in the blood (Nartey et al., 2005). The combination of naturally occurring organic material and iron can be found in shallow wells and surface water. This type of iron is usually yellow or brown but may be colorless (DHHS, 2009). In the present work, copper concentration in ground water samples did not exceeded the permissible limits of WHO (P.L. 0.6 mg/l). Heavy metals such as lead and copper are most commonly leached into water supplies through corrosion of household plumbing fixtures, pipes, fittings and solder. However, many heavy metals enter the water supply as the ground water dissolves rocks or soil from runoff due to environmental contamination (Pedersen, 1997). Excess of copper could impart a bitter taste to water and promotes the corrosion of galvanized iron and steel fittings. The concentration of copper detected in the water samples obtained from twenty hand dug wells in Gambari, Ogbomoso, Oyo state, Nigeria was from 0.1mg/l to 0.3mg/l (Adewoye et al., 2013). Meanwhile, water samples collected from Beni-Suef Governorate displayed no the increase of cadmium levels than the international standards except in Beni-Suef district, which had an average of 0.0136 ppm with a maximum concentration of 0.023 ppm in the period of 2001/2002 (Walaa, 2003). Heavy metals such as Cr is of special concern because of chronic poisoning in aquatic animals, and it was detected in the water in the Bird Paradise Lake, which is situated near the south-eastern coasts of the Marmara Sea in Turkey (Wang et al., 2012). Analyses of the metal content of chromite mine of Sukinda and its adjacent area in water samples from mine quarry (CW-1, CW-2), and Damsala Nala (CW-3) showed a contamination with the Cr tested, while ground water samples from mine adjacent areas CW-4 and CW-5 (dug well and tube well) did not contain Cr. The total Cr (0.74−3.12) mg/L and Cr (VI) (0.347−2.15 mg/L) in mine water samples were quite high. The total chromium and Cr (VI) were absent in ground water samples. Mining of chromite provides an obvious source of contamination of different metals including chromium. Different metals usually occur along with chromium in chromite mine soil and water (Mohanty et al., 2009). Underground septic tanks are used to collect domestic wastewater. The ground water pollution is a consequence of wastewater discharging into permeable underground septic tanks. Groundwater (from a well-used for irrigation and drinking) samples were taken at the pumping level. Chromium value of wastewater (1997-2009) is 0.026 mg/L. The concentration value of Cr^{3+} is highly increased. The concentration of Cr^{3+} was zero at IY=1997, then gradually increases to 0.375 and 0.285 mg/liter respectively at IY=2009 (Alnos and Ashraf, 2010). Zinc is one of the important trace elements that play a vital role in the physiological and metabolic processes of various organisms. Nevertheless, higher concentrations of zinc can be toxic to the organism (Rajkovic et al., 2008). It plays an important role in protein synthesis and is a metal which shows fairly low concentration in the surface water due to its restricted mobility from the place of rock weathering or from natural sources (Rajappa et al., 2010). Water samples obtained from twenty hand dug wells in Gambari, Ogbomoso, Oyo state, Nigeria, showed zinc levels a with minimum values of 0.01mg/l were recorded from five samples: GA08, GA10, GA41, GA49, and GA58. Maximum concentrations of 0.05mg/l were also recorded from five samples GA04, GASP, GA12, GA45, and GA51. The concentrations recorded from the remaining 50% ranged from 0.02mg/l to 0.04mg/l (Adewoye et al., 2013).

4. Conclusion

Based on the present findings, it can be concluded that evaluating the hygienic quality of underground water collected from Matrouh, Ismailia, Beni-Suef districts in Egypt and from Tripoli, Zawia, and Zliten districts in Libya, revealed that some of the estimated parameters indicated poor quality drinking water with the least minimal satisfactory level. The absence of unified system to monitor physicochemical parameters in groundwater sources in the studied area represented an important task in the evaluation of such water sources and subsequently causing an environmental risk for animals and human health. Therefore, it is advised to do periodical monitoring of water quality before its uses for animal and humans drinking as well as in different veterinary practices. Assessment of ground water sources and detection of their suitability for animal drinking and veterinary practices needs innovative methods for the treatment of such water sources and discovering the extent of pollution in the possible sources in other non-examined districts in both Egypt and Libya.

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