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DETERMINATION OF SOME HEAVY METAL CONCENTRATION IN DIFFERENT SAMPLES OF THE DRINKING WATER IN SOME GROUNDWATER WELLS IN SHAHAT CITY, LIBYA

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ABSTRACT

Groundwater is an critical source for multipurpose, drinking, mechanical, Farming etc. the groundwater quality in a few zones slowly diminishes since of unsustainable of water assets. Water has gotten to be a major risk in today's world. Collection of overwhelming metals, a number of of them, is possibly harmful and these get disseminated to distinctive areas through distinctive pathways. With an increment within the earth's populace, improvement and industrialization are taking put quickly and these get the major source of water defilement. Groundwater wells samples were collected in January 2022 from three groundwater wells Hofra Well, El Shalalah Well and Apollo Well analyzed in order to determine the content of a number of heavy metals namely: Lead, Copper, Iron and Manganese using an Atomic Absorption Spectrophotometer (AAS) and their levels were compared to the maximum contamination limits specified by the World Health Organization (WHO). The results in the current study indicate there is variation among wells. The Lead (Pb) concentrations ranged in Hofra Well (0.4500 ± 0.061mg/l), El Shalalah Well (0.600 ± 0.46mg/l) and Apollo Well (0.4133 ± 0.080mg/l) whereas the Copper (Cu) value ranged in Hofra Well (0.00450 ± 0.0035mg/l), El Shalalah Well (0.1833 ± 0.021mg/l) and Apollo Well (0.03200, 0.006mg/l), the Iron (Fe) value ranged in Hofra Well (0.630± 0.46 mg/l), El Shalalah Well (0.8167 ± 0.085mg/l) and Apollo Well (1.1267± 0.80mg/l) and the Nickel (Ni) value ranged in Hofra Well (0.5633 ± 0.12mg/l), El Shalalah Well (0.2400 ± 0.10mg/l) and Apollo Well (0.7400 ± 0.60 mg/l). Most of the heavy metal analyzed in this study were exceed permissible limits for international standards of drinking water by WHO while Copper (Cu) did not exceed permissible limits for international standards of drinking water.

KEYWORDS

Heavy metal, Groundwater, WHO and Libya.

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INTRODUCTION

Water is the most fundamentals that requirement of human, plant and animal life[1] and it is commonly found from two major sources natural; Fresh surface water, lakes, rivers, and groundwater. Ground water are found in well water and bore well[2]. Chemical

unique properties of water due to its polarization and hydrogen bonds which resources it is able to different combinations to suspended, dissolve, absorb in natural water, is unclear as it obtains pollutants from its nearby and individuals rising from people and animals as health as other biochemical actions[2]. Water has ended up a major risk in today's world. Collection of overwhelming metals, a couple of them, is possibly harmful and these get dispersed to distinctive areas through distinctive pathways. With an increment within the earth's populace, improvement and industrialization are taking put quickly and these get the major source of water defilement. With overwhelming metals in lakes, waterways, groundwater, and different water sources, water gets contaminated by the expanded concentration of overwhelming metals and metalloids through discharge from the abruptly mine tailings, transfer of tall metal squanders, developing mechanical regions, leaded gasoline and paints, utilization of fertilizers inland, creature excrements, E-waste, sewage slime, pesticides, wastewater water system, coal, etc. Introduction to heavy metals has been connected to inveterate and intense harmfulness, which creates hindrance; neurotoxicity can harm the kidneys, lead to the improvement of distinctive cancers, harm the liver and lungs; bones can ended up delicate; and there are indeed chances of passing in case of tremendous sum of introduction[3]. The levels of heavy metals contaminations in water like, Pb, As, Cd, Hg, Cr, Ni etc. in various water sources as ground, surface, tap water etc. Variety of heavy metals, some of them are potentially toxic and are transferred to the surrounding environment through different pathways. The concentrations determined were more than the maximum admissible and desirable limit when compared with the National and International organizations like WHO (2008), USEPA, EUC, EPA[4]. In nature intemperate levels of follow metals may happen by topographical wonders like volcanic ejections, weathering of rocks, filtering into streams, lakes and seas due to activity of water[5]. Copper is one of the metals that have been found since old times. Copper was utilized early as a result of its common event in its unique shape[6]. Copper is found in oxidation states (0,+1,+2) and there numerous copper compounds, of the foremost imperative of these compounds, are Copper carbonate ($CuCO_3$), which is one of the foremost solvent sorts, and they are shaped in oxygen consuming antacid frameworks, as well as Copper sulfide (CuS), which is shaped in anaerobic situations. Copper metal is utilized in numerous businesses such as metal handling, coins, combinations, electric wires, pots and channels electroplating, electrical businesses, machine fabricating, natural union, tanning industry[7]. Copper is considered a supplement fundamental for the development of both plant and creature. But when entering tall measurements to the body of the living being causes numerous wellbeing issues such as anorexia, weakness, gastrointestinal aggravation, kidney harm, migraines, hypersensitivities, expanded hyperactivity within the early stages of childhood, learning disarranges[8]. Manganese is one of the overwhelming metals found within the earth's outside at a concentration of almost 1000ppm, hence making this element positioned 12th within the most inexhaustible components[9]. Manganese compounds are considered solid oxidizing operators and have diverse oxidation states such as the fourth oxidation state (+4) and the seventh oxidation state (+7)[9]. Among the foremost steady oxidation states of manganese particle is the double state (Mn++) which is utilized within the fundamental capacities of the metabolic forms of living life forms be that as it may other of the states of oxidation are harmful to the human[10]. Manganese particle has a few distinctive colours depending on oxidation state. Manganese is utilized in a few businesses such as shades fabricate and whereas Manganese Oxide (MnO_2) is utilized within the make of batteries by utilizing cathode materials in dry batteries. The free manganese element is additionally used within the fabricate of metal amalgams, particularly within the make of stainless steel as well as the utilize of Manganese phosphating for the treatment of rust and erosion avoidance on steel[11]. Lead may be a perilous component; it is damaging even in minor amounts. Lead component comes within the Human body majorly found in water and nourishment. It can be panted in powder

shape of lead in paints, or abundance gasses from leaded petroleum items. It is started in minor amounts in a few water bodies and nourishment, especially angle, which stay truly center to industrialized harmful squander. Around ancient family units might water channels devour lead, which can at that point contaminate admissions water. Contact to lead is growing above period. Extreme level of lead absorptions in the human body can cause death or perpetual harm to the brain, central nervous system and kidneys[12].

MATERIAL AND METHODS

The study was conducted in the Libyan city of Shahat. Shahhat (Arabic: **شحات**) is a town in the District of Jabal al Akhdar in north-eastern Libya[13]. Cyrene was located in the same area in ancient times. It is located 24 kilometres (15mi) east of Bayda. The study area is considered one of the most valuable regions in Libya because of its location relative to the Green Mountain, as well as its agricultural activities, including irrigated and non-irrigated cultivation and animal wealth as well as economic activities. The precise locations of the sampling points of the groundwater wells were determined in the field. The study area is influenced by the Mediterranean climate, which is characterized by hot, dry summers and mild, rainy winters. The study area has a dry climate, such as that of a semi desert, showing minimal rainfall and high evaporation rates and a clear appearance of aridity, which prevails over the entire area[11]. Table No.1 shows the description and the coordinates of groundwater wells under study.

An assessment of three groundwater wells in the study area was conducted to determine the degree of water quality. The samples were taken (Triplicate) by bottles (Plastic bottles of polyethylene 100ml volume) where took the sample after pumping an amount of water equivalent to three times the volume of the casing pipes (about half an hour). After that, the samples were stored with crushed ice in a bag at 4°C and then the samples were transferred to the laboratory for preservation until preparation and analysis[14]. A total of 24 (3 x 8) samples were collected during the month of February 2022. All water samples from the sites were filtered by a 0.45-µm filter and then 100ml of water required for analysis were taken and then transferred into acid cleaned 100mL polypropylene bottles. About 6 ml of concentrated nitric acid (Merck, 65%) was added to each sample, then preservation at 4°C until analysis[14]. The prepared samples were analyzed by Atomic Absorption Spectrophotometer (AAS) (Thermo model). The processed specimens were examined in triplicate with the average concentration of the metal present being shown in mg/L by the instrument after extrapolation from the standard curve. 1000mg/L stock solutions of studied heavy metals were prepared. Calibration curve solutions of the focus metal ions were prepared from the standard stock solutions by serial dilution. Statistical Analysis. Where applicable, statistical analysis was carried out in Minitab software (version17)/ Graph Pad prism8; statistical significance was assessed using ANOVA analysis with Tukey multiple comparison test after detection normal distribution to the data and appropriate $P < 0.05$ consider significant.

RESULTS AND DISCUSSION

This paragraph explains the results obtained in this study, as well as highlighting the efficiency of the methods used, together with the instrumentation. Groundwater wells samples were collected in January 2022 from three groundwater wells Hofra Well, El Shalalah Well and Apollo Well analyzed in order to determine the content of a number of heavy metals namely: Lead, Copper, Iron and Manganese using an Atomic Absorption Spectrophotometer (AAS) and their levels were compared to the maximum contamination limits specified by the World Health Organization (WHO). The results in the current study indicate there is variation among wells. As shown in Table No.1 and Figure No.1 to Figure No.4 the data recorded the level of Lead (Pb) concentrations ranged in Hofra Well (0.4500 ± 0.061mg/l), El Shalalah Well (0.600 ± 0.46mg/l) and Apollo Well (0.4133 ± 0.080mg/l) whereas the Copper (Cu) value ranged in Hofra Well (0.00450 ± 0.0035mg/l), El Shalalah Well (0.1833 ± 0.021mg/l) and Apollo Well (0.03200, 0.006mg/l), the Iron (Fe)

value ranged in Hofra Well (0.630± 0.46mg/l), El Shalalah Well (0.8167 ± 0.085mg/l) and Apollo Well (1.1267± 0.80mg/l) and the Nickel (Ni) value ranged in Hofra Well (0.5633 ± 0.12mg/l), El Shalalah Well (0.2400 ± 0.10mg/l) and Apollo Well (0.7400 ± 0.60mg/l). Most of the heavy metal analyzed in this study were exceed permissible limits for international standards of drinking water by WHO while Copper (Cu) did not exceed permissible limits for international standards of drinking water.

Discussion

This audit consider appears that Fe, Mn and Pb levels in all the groundwater tall but over the passable limits as suggested by WHO its causing harmfulness to human. The toxicologist has continually taken note the overwhelming metal concentration in a few groundwater, plants, herbs, soil, etc. straightforwardly influenced by human wellbeing is the drinking of contaminated ground water. Individuals ought to be careful of the unsafe impacts of drinking contaminated water. It is recommended that awareness must be spread between the individuals approximately the harmful on utilization of contaminated groundwater and sullied eatables. It is additionally imperative that agriculturalists must be taught to diminish such contamination and ought to be energized to utilize the controlled amount of pesticides, to maintain a strategic distance from the filtering of squander water. Development of areas ought to be practiced distant absent from mechanical locale as well as ranges arranged to contamination. Advances are recommended for field cultivation and commercialization within the developing nations too where development, urbanization, E-waste and industrialization are clearing out a bequest on natural debasement of heavy metals[15].

Table No.1: Description of groundwater wells

S.No	Wells Name	Coordinates		H
A	Hofra well	32°49'38"N	21°52'22"E	560
B	El Shalalah well	32°47'58"N	21°53'00"E	612
C	Apollo well	32°49'23"N	21°51'08"E	569

Table No.2: Average concentrations of heavy metals (mg/L) in water samples together with standard deviation values a (means ± SE)

S.No	Parameters	WHO Mean ± SD	Hofra Well Mean ± SD	El Shalalah Well Mean ± SD	Apollo Well Mean ± SD
1	Cu (mg/L)	2^{a}	0.00450 ± 0.0035^{b}	0.1833 ± 0.021^{b}	$0.03200\ 0.006^{b}$
2	Fe (mg/L)	0.3^{b}	0.630 ± 0.46^{ab}	0.8167 ± 0.085^{ab}	1.1267 ± 0.80^{a}
3	Pb (mg/L)	0.01^{b}	0.4500 ± 0.06^{a}	0.600 ± 0.46^{a}	0.4133 ± 0.080^{a}
4	Mn (mg/L)	0.5^{ab}	0.5633 ± 0.12^{a}	0.2400 ± 0.10^{b}	0.7400 ± 0.60^{a}

abc Within row, means with different superscript letters differ significantly ($p < 0.05$).

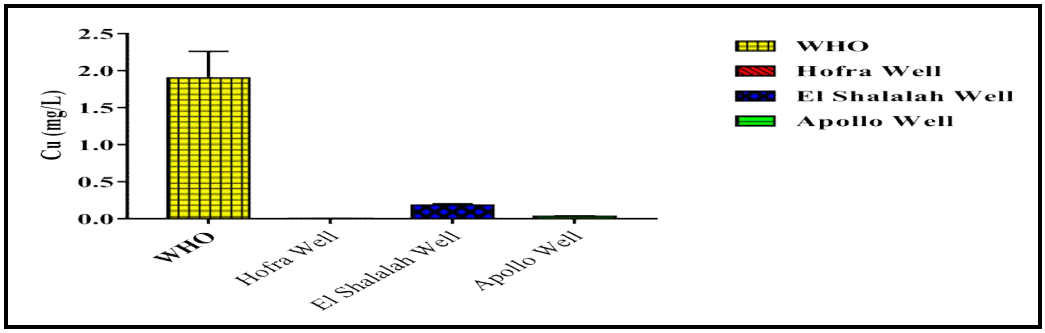

Figure No.1: The average Copper (Cu) concentration (mg/L) at different sites (samples) and WHO

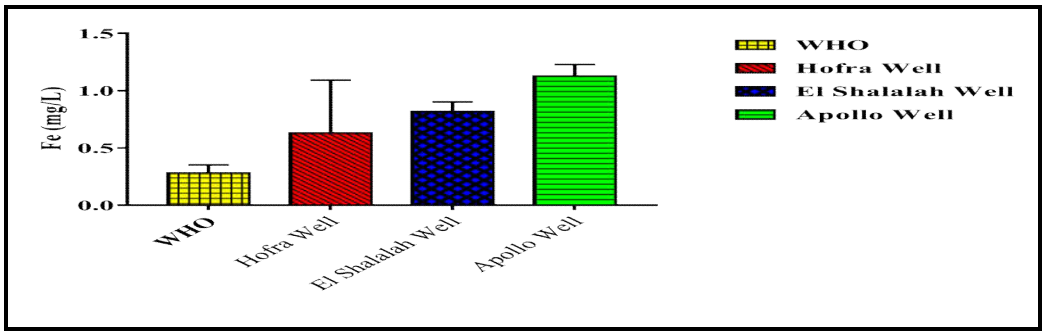

Figure No.2: The average Iron (Fe) concentration (mg/L) at different sites (samples) and WHO

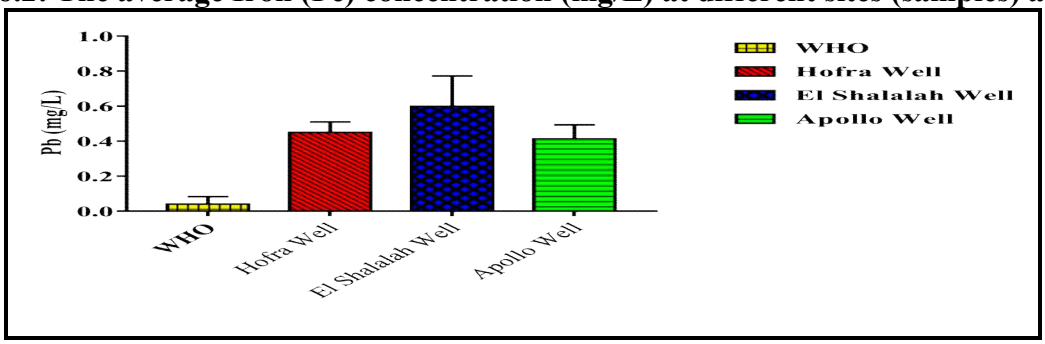

Figure No.3: The average Lead (Pb) concentration (mg/L) at different sites (samples) and WHO

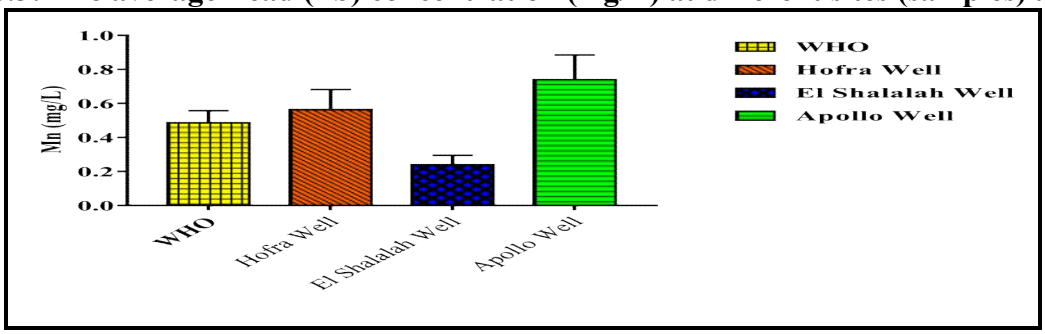

Figure No.4: The average Manganese (Mn) concentration (mg/L) at different sites (samples) and WHO

CONCLUSION

The examined water tests in several groundwater well frameworks uncovered that nearly all of the chemical parameters are not in great status, communicating not their reasonableness for drinking purposes. Major issues in nearly tests were the expanding of the concentrations in most of the overwhelming metals but copper metal. This may be due to the affect of contamination at these stations. Destitute support of the water source is the likely reason for tall concentration in these parameters or may be due to the geographical nature of the water source. To guarantee open wellbeing, competent specialists ought to closely screen the quality of drinking water provided to buyers.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

BIBLIOGRAPHY

1. Al-Paruany K B, Ali A J A, Hussain K I, Khalaf H S, Alias M F. Assessment of heavy metals in some ground water wells at Baghdad City/Iraq, *Journal of Global Pharma Technology,* 10(3), 2018, 62-70.

2. APHA-AWWA-WPCF. Standard methods for the examination of water and waste water, *APHA American Public Health Association,* 1981.
3. Claus S P, Guillou H, Ellero-Simatos S. The gut microbiota: A major player in the toxicity of environmental pollutants? *NPJ Biofilms and Microbiomes,* 2(1), 2016, 1-11.
4. Sankhla M S, Kumari M, Nandan M, Kumar R, Agrawal P. Heavy metals contamination in water and their hazardous effect on human health-A review, *Int. J. Curr. Microbiol. App. Sci,* 5(10), 2016, 759-766.
5. Bagul V R, Shinde D N, Chavan R P, Patil C L, Pawar R K. New perspective on heavy metal pollution of water, *Journal of Chemical and Pharmaceutical Research,* 7(12), 2015, 700-705.
6. Gautam R K, Sharma S K, Mahiya S, Chattopadhyaya M C. Contamination of heavy metals in aquatic media: Transport, toxicity and technologies for remediation, 2014.
7. Mudhoo A, Garg V K, Wang S. Removal of heavy metals by biosorption, *Environmental Chemistry Letters,* 10(2), 2012, 109-117.
8. Udayakumar P. Assessment of Heavy metals in the environmental compartments of the central and northern coast of Kerala, India, *Citeseer,* 2012, 1-405.
9. Emsley J. Nature's building blocks: An AZ guide to the elements, *Oxford University Press,* 2nd Edition, 2011, 710.
10. McCluggage D. Heavy Metal Poisoning, *NCS Magazine, The Bird Hospital, CO, U.S.A,* www.cockatiels.org/articles/Diseases/metals.html, 1991.
11. Zhang W, Cheng C Y. Manganese metallurgy review, Part I: Leaching of ores/secondary materials and recovery of electrolytic/chemical manganese dioxide, *Hydrometallurgy,* 89(3-4), 2007, 137-159.
12. USGAO (United states General Accounting Office), Health Effect of lead in drinking water, 2000.
13. Cecchi G, Mattioli R C. Global geospatial datasets for African trypanosomiasis management: A review, Geospatial datasets and analyses for an environmental approach to African trypanosomiasis, *Rome: Food and Agriculture Organization of the United Nations,* 9, 2009, 1-39.
14. Salem Z B, Capelli N, Laffray X, Elise G, Ayadi H, Aleya L. Seasonal variation of heavy metals in water, sediment and roach tissues in a landfill draining system pond (Etueffont, France), *Ecological Engineering,* 69, 2014, 25-37.
15. Sankhla, M S, Kumar R. Contaminant of heavy metals in groundwater and its toxic effects on human health and environment, *Int J Environ Sci Nat Res,* 18(5), 2019, 1-5.

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