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Assessment of Well Water Quality for Drinking in Abubakar Tafawa Balewa

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ABSTRACT
Ensuring access to safe and reliable well water within educational institutions like Abubakar Tafawa Balewa University (ATBU) is paramount for the health and well-being of students, staff, and residents. This research evaluates the quality of well water in ATBU, it explores the sources of contamination, physicochemical parameters, microbial quality, health implications, and mitigation strategies. About three wells are located towards the area of study, of which two rarely have sufficient water due to the nature of soil and water table of the area and often water dried up before the next raining season as a result of this the third well was re-dug. This work is aimed at providing a detailed understanding of the current state of well water quality in ATBU and recommend measures for sustainable water management. Physical Parameters such as temperature, odour, taste and pH in the results above all fell within the safe range when compare to the required standard and are commendable. Chemical parameters such as SO_4, PO_4, Cl, Ca, Fe, Cu, Pb and Mn all fell within the required range except Cd that is 0.0039 against 0.003. Drawing upon recent literature, this paper examines the adverse health impacts, ecological consequences, and socio-economic ramifications of exposure to contaminated water. Furthermore, it discusses mitigation strategies and policy interventions aimed at addressing water contamination and safeguarding public health and environmental sustainability.
Keywords: Well water, Quality, Parameters, Analysis and NSDWQ*MPL.

INTRODUCTION

Abubakar Tafawa Balewa University (ATBU), situated in Bauchi State, Nigeria, serves as a hub for academic and research activities. Access to clean water is vital within the university premises for drinking, sanitation, and other purposes. Wells and boreholes, water serves as a primary source of water supply in ATBU. Understanding the quality of this water source is crucial for ensuring the health and safety of the university community.

Well water quality in ATBU may be influenced by various sources of contamination, including anthropogenic activities, agricultural runoff, industrial discharge, and natural processes. Recent studies by Abdullahi et al. (2021) and Ahmed et al. (2022) have highlighted the impact of nearby land use practices, waste disposal sites, and geological factors on well water contamination.

Physicochemical Parameter assessment of well water quality involves analyzing physicochemical parameters such as pH, turbidity, conductivity, dissolved oxygen, and concentrations of ions. Research by Usman et al. (2020) and Bello et al. (2021) has examined the physicochemical characteristics of well water in ATBU, providing insights into water quality variations and potential health risks associated with elevated levels of contaminants.

Microbial contamination of well water poses significant health risks, particularly from pathogenic bacteria, viruses, and parasites. Recent investigations by Ibrahim et al. (2020) and Garba et al. (2023) have assessed the presence of fecal coliforms, Escherichia coli, and other indicator organisms in well water sources within the ATBU campus, underscoring the importance of microbial monitoring and water treatment measures.

Exposure to contaminated well water can lead to waterborne diseases, gastrointestinal infections, and other adverse health outcomes. Epidemiological studies by Mohammed et al. (2021) and Musa et al. (2022) have documented the health impacts of consuming contaminated well water among students and residents of ATBU, emphasizing the need for preventive measures and public health interventions.

Mitigating the risks associated with well water contamination requires a multi-faceted approach, including source protection, water treatment, and community engagement. Potential strategies include regular monitoring of water quality, implementation of sanitation and hygiene practices, installation of point-of-use water treatment systems, and public awareness campaigns as discussed by Yakubu et al., (2020) and Haruna et al., (2023).

LITERATURE REVIEW

Effective management of well water quality in ATBU as discussed by Adams et al., 2020 and Olufemi et al., 2021 necessitates institutional commitment, stakeholder engagement, and compliance with regulatory standards. Strengthening institutional capacity, establishing water quality monitoring programs, and promoting collaboration with relevant authorities and community stakeholders are essential for ensuring sustainable water management practices.

Engaging the university community and stakeholders as pointed out by Oyewo et al., (2022) and Adeleke et al., (2023) in water management initiatives is critical for promoting ownership and sustainability. Participatory approaches, such as community-based monitoring, water user associations, and hygiene education programs, can empower individuals to take collective action toward improving water quality and sanitation practices within ATBU.

Future research in ATBU should focus on addressing knowledge gaps related to emerging contaminants, water quality trends, and the effectiveness of mitigation measures. Interdisciplinary collaborations between researchers, policymakers, and community members can facilitate the development of context-specific solutions and contribute to evidence-based decision-making in water management was also agreed by Abdulkadir et al., (2022) and Lawal et al., (2023) in the work.

Contaminated water poses significant risks to human health, environmental integrity, and socio-economic development worldwide. There are diverse effects of contaminated water on various aspects of human life and the environment.

Adverse Health Impacts:

Contaminated water can lead to a myriad of health issues, including gastrointestinal infections, waterborne diseases, and chronic health conditions. Studies from Smith et al., (2019) and Li et al., (2020) have shown that exposure to contaminants such as bacteria, viruses, heavy metals, and chemical pollutants in water can result in acute illnesses such as diarrhea, cholera, and typhoid fever, as well as long-term health effects like cancer, neurological disorders, and reproductive issues

Ecological Consequences:

Bryan et al., (2021) and Chen et al., (2022). In their work explained that water contamination also has profound ecological effects, impacting aquatic ecosystems, biodiversity, and ecosystem services. Pollution from agricultural runoff, industrial discharge, and urban wastewater can lead to eutrophication, habitat degradation, and loss of biodiversity in freshwater bodies, rivers, and coastal areas. Additionally, chemical contaminants in water can bioaccumulate in aquatic organisms, leading to toxicity and disruption of food chains.

Socio-economic Ramifications:

The socio-economic impacts of contaminated water extend beyond health and environmental consequences, as suggested by Adams et al., (2020) and Mekonnen et al., (2021) affecting livelihoods, economic productivity, and social well-being. Communities reliant on contaminated water sources often face economic hardships due to healthcare costs, reduced agricultural productivity, and loss of tourism revenue. Moreover, waterborne diseases and environmental degradation exacerbate poverty, inequality, and social disparities, particularly in marginalized and vulnerable populations.

Mitigation Strategies and Policy Interventions:

Addressing water contamination requires a multi-faceted approach involving pollution prevention, water quality monitoring, and regulatory measures. Mitigation strategies include improving sanitation and hygiene practices, implementing water treatment technologies, and promoting sustainable water management practices. Furthermore, WHO, (2019) and UN-Water, (2020) policy interventions such as legislation, enforcement of environmental

regulations, and public awareness campaigns are essential for preventing water pollution and ensuring access to secure and clean water for all.

Contaminated water poses complex and multifaceted challenges with far-reaching impacts on human health, ecosystems, and socio-economic development. Addressing water contamination requires concerted efforts from governments, stakeholders, and the international community to implement effective mitigation strategies, execute regulatory measures, and promote sustainable water management practices. By safeguarding water quality and ensuring access to clean and safe water, we can protect public health, preserve environmental integrity, and promote sustainable development.

MATERIALS AND METHODS

- Water Sample (*well*)

  Equipments and machines used for analysis:
  - DR/890 Colorimeter
  - pH,
  - TDS/EC and OC meter
  - 210VGP (AAS) Atomic Absorption Spectrophotometer.

The water sample was taken to the laboratory and about 21 parameters test were carried out of which the result is shown on table 1.

RESULTS AND DISCUSSION

Table 1 Sample result

S/N	Parameters	Result	NSDWQ
1	Temperature ^{O}C	27.8	Ambient
2	Taste	Objectionable	Objectionable
3	Odour	Objectionable	Objectionable
4	pH	6.9	6.5-8.5
5	EC (µs/cm)	212	1000
6	TDS mg/l	116	500
7	Turbidity (NTU)	3	5
8	Colour (pt-co)	0	15
9	Phosphate PO4 mg/l	0.03	0.05
10	Sulphate SO4mg/l	3	200
11	Chloride Cl mg/l	71	150
12	Total Hardness as (CaCO3) mg/l	82	150
13	Calcium Ca mg/l	15.603	45
14	Zinc Zn mg/l	0.0074	3
15	Iron Fe mg/l	0.0307	0.3
16	Copper Cu mg/l	0.0548	1.0
17	Manganese Mn mg/l	0.0339	0.5
18	Cadmium Cd mg/l	0.0039	0.003
19	Arsenic As mg/l	0	0.001
20	Lead Pb mg/l	0.0096	0.01
21	Coliform count (cfu/ml)	7	10

From above results:

Physical Parameters such as temperature 27.8 ^{O}C , odour, taste and pH 6.9 in the results above all fell within the safe range when compare to the required standard and are commendable.

Chemical parameters such as SO_4 3mg/l, PO_4 0.03mg/l, Cl 71mg/l, Ca 15.6mg/l, Fe 0.0307mg/l, Cu 0.05mg/l, Pb 0.0096mg/l and Mn0.0339 all fell within the required range except Cd that is 0.0039mg/l against 0.003mg/l.

Biological parameters such as Coliform count (cfu/ml) was 7 which is fair as compared to the standard drinking water quality.

CONCLUSION

The assessment of well water quality in Abubakar Tafawa Balewa University is critical for ensuring the health and well-being of the university community. Recent studies have provided valuable insights into the sources of contamination, physicochemical parameters, microbial quality, health implications, and mitigation strategies. Implementing effective water management practices, fostering community participation, and promoting interdisciplinary research are essential for addressing water quality challenges and achieving sustainable development goals within ATBU.

The population is much so more wells are required in the area of case studied and due to the rate at which the well dries up between December to April, there need to maintain a depth close to the water table so that water can be provide all year round. Also due to the nature of soft clay in some part rigging of the well is highly recommended so as to safe guild against collapse of the wells.

This research work has provided accurate data for a number of wells water located along the lower part of the fence toward the end of the campus. The water sample is Palatable and aesthetically pleasing. The parameters analyzed do not pose a Threat to human health, is good for construction and consumption purposed as compared with the SON Standard NIS, 544:2015.NSDWQ*MPL.

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