ASSESSMENT OF WATER QUALITY OF OPEN WELL WATER IN KABONG DISTRICT, JOS NORTH LOCAL GOVERNMENT AREA, PLATEAU STATE

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Abstract

Water is at the core of sustainable development and is critical for socio-economic development, healthy ecosystems and for human survival itself. It is vital for reducing the global burden of disease and improving the health, welfare and productivity of populations. It is central to the production and preservation of a host of benefits and services for people. Water is also at the heart of adaptation to climate change, serving as the crucial link between the climate system, human society and the environment. The study was carried out to assess water quality of open wells water on the residents in some communities in Kabong District of Jos North, Jos Plateau State. Six samples were collected and analyzed in the laboratory of Plateau State Water Board using standard methods for the examination of water and waste water. The parameters tested includes temperature, colour, pH, conductivity, turbidity, total hardness, calcium, and magnesium, total dissolved solid, iron, nitrate, chloride, lead and total coliforms. The results obtained indicated that the open well water in Kabong Districts have high content of lead, nickel and coliforms beyond the stipulated limit of WHO. The presence of these substances in the water is capable of causing health hazard to human being. The study recommends the need for improvement and in some cases reconstruction of the wells and well waters treatment.

Key words: Water, Water Quality, Open Well, Sustainablility Development.

Introduction

Water is a terminable resource that is very essential for Sustainable development and human existence. Water quality is globally significant and a key to all sustainability initiatives. Water satisfies the needs of society for clean water (drinking water, cooking water, hygienic uses, and industrial uses); it makes a vital contribution to ecosystem services such as subsistence, commercial and recreational fishing; and ensures the safe use of surface waters for recreational purposes, hygiene, and household activities. UNDP (2018) reports that a total of 748 million people do not have access to quality drinking water. Groundwater according to Chilton (1992) is a valued fresh water resource and constitutes about two-third of the fresh water reserves of the world. The quality of water delivered and used for households is an important aspect of domestic water supplies, which influences hygiene and therefore public health. Kadiri (2000) opined that the Quality of drinking water is of highest importance and this depends on source and level of contamination or pollution. In another development Sangodoyin (1993) and McGuiness, Toole, and Barker (2021) believe that about 80% of diseases in the tropics e.g. cholera, typhoid, diarrhea and dysentery are as a result of water source contamination. Safe potable drinking water and sanitation are essential for human health and survival. Adequate and reliable water supplies and sanitation services are critical for coping with every day rural life.

Jones (1997) alluded that water is the single most important substance known in the world, it is elixir of life without it life is not possible, it represents a fundamental requirement for all life activities, it is essential to man, animals and plants. The supply of it is endless in the world map since it covers over 80% of the earth's surface, however only a small fraction of the water in the world is available to manage for human use. Buchanan (1983) puts the groundwater reservoir of the world at about 5.0 x 1024 litres. This volume is more than 2,000 times the volume of waters in all the world's rivers and more than 30 times the volume contained in all the world's fresh water lakes. Ojo (2002) explained that Groundwater is abstracted through hand-dug wells; hand-pump operated

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shallow-wells and submersible pump operated deep well or boreholes. In another development Oluwande (1983) identified water hole as the oldest means of obtaining sub-surface water. Wells are holes in the ground that intersect the water table as water bearing rocks flowing as aquifers. Shallow wells are generally less than 15 m deep while deep wells are greater than 50m in depth. Water need and use is almost unlimited in all functions of life. Hofkes (1981) explains that the usage water can be classified into three main categories: for domestic which is the focus of this study, Irrigation and for Industrial purposes. For domestic water reasons, water is used for drinking and any other daily activities such as cooking, bathing, washing clothes, house cleaning. Portable water is needed in maintaining the essential fluids of the body and to perform its physiological functions properly. Generally, polluted water serves as sanctuary for fatal diseases. According to Cairncross (1990), diseases associated with poor water quality are enormous. These include typhoid fever, cholera, diarrhea (basically dysentery) cancer, infectious hepatitis, amoebasis, filariasis, schistosomiasis, and host of others. These may be caused by different disease organisms such as parasites, bacteria, virus and other pathogens. Bradley (2017) explained that classified sources of open wells pollutants ariss due to microbes from human birds, excreta, waste disposal and poor sanitation. Drinking water also becomes poisonous if it contains minerals element in quantities excessive for normal metabolism by the human body. WHO (2020) and Musa (2019) all agreed that poor quality water is a threat to Sustainability and human life. In Nigeria, despite the myriad of problems associated with open well water for drinking, it is estimated by WHO (2004) that 85% of the rural and sub-urban population depend on the open well as source of their water for drinking. Todd (1980) explains that Hand dug wells are constructed manually and are little more than irregular hole in the ground, intersecting the water table They are prone to pollution from air borne materials, run-off from the surface, though their sanitary status may be improved by including certain features such as lining with cement ring or metal ring (Drum), cover (wooden or metal), apron and drain. Todd (1980) further gave an approximate yield of a properly constructed well to be between 2,500 to 7,500m3 per day, but most domestic hand dug wells yield less than 500m3 / day.

Statement of Problem

The residents of kabong district suffer from lack of pipe-borne water and have to rely on polluted shallow hand dug open wells and many of these open wells dry up during the dry season. The few wells that survive the dry seasons are subjected to over-exploitation giving way for the high contents of hazardous minerals. Most of these wells are opened to human, birds, animals, excreta and waste disposal. This depreciates the quality of open well water of Kabong District.

Purpose of the Study

The aim of the study is Assess Water Quality of open well water in Kabong District of Jos North Local Government Area, of Plateau State. The specific objective is to determine the water quality of the open well water in the area of study.

Scope of the Study

The study look at the health implications of the open well water of Kabong District by determining physical, chemical, and microbiological parameters of the well water following the standard organization of Nigeria (SON) recommended guideline. The physical parameters for this particular study include: temperature. Color, odour, turbidity, the chemicals such as electrical as conductivity. Chloride, total dissolved hardness. Calcium, magnesium. Nitrate iron, pH, Sulphate, sodium potassium lead zinc nickel copper and the microbiological such as total coliforms count.

The Study Area

Kabong District is one the most dynamic suburb within Jos-North Local Government Area of Plateau State, North Central Nigeria. Amba (2019) established that Kabong is located towards the periphery of the eastern part of the Jos metropolis. It is located between latitude 9° 54' 20" N and 9° 58' 10" N and longitude 8° 49' 20" E and 8° 52' 40" E. The District comprises of the following wards/communities; Kabong (Gada Biyu) which is the administrative headquarters of the traditional District Head (Da. Gwom Kabong), Gura Lo Gbwagi (Janta Adamu), Gura Lo Majai (Angwan Suya), Landere (West-Side), Landura (Alheri), Rwogo Rarwat (Utan), Kagara (Rock Haven) and Vorok (faringada).

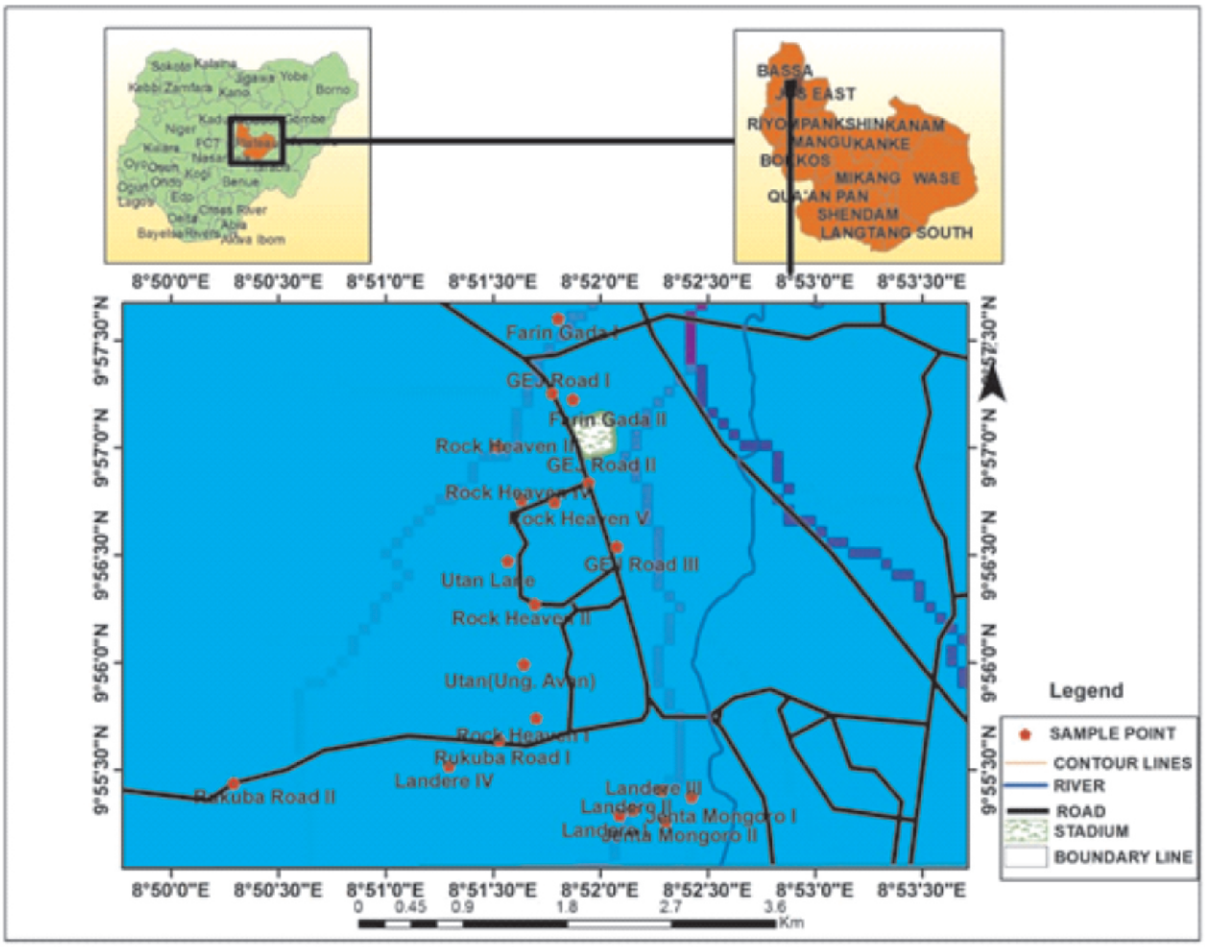

Figure 2. Map of the Study Area

Materials and Method

The methodology employed in the research was sampling and sample analysis. Water samples were collected from six wells, each from one of the six selected wards in the district (Kabong, Farin-gada, Jenta, Angwan-Suya, Alheri and Utan) randomly using grab method within Kabong. The wells selected for sampling were public ones. The samples were collected in April 2021, when the area was experiencing its peak of water scarcity. The analysis was carried out in the chemistry laboratory of the Plateau state water board (PSWB) using standard methods for the examination of water and waste water as described by World Health Organization (WHO) 2004. The time between sample collection and analysis was five hours. The samples were immediately placed in a light proof insulated box containing melting ice-packs with water to ensure rapid cooling. The bottles in which the samples are placed should contained sodium thiosulfate to neutralize any chlorine present, so that microbes would not be killed during transit. The box used to carry samples was cleaned and disinfected after each use to avoid contaminating the surfaces of the bottles and the sampler's hands.

Table 1. Number of Sampled wells from Wards in the Study Area

S/N	Village/Ward	Number of Sampled well
1.	Kabong (GadaBiyu)	1
2.	Gura Lo Gbwagi (JantaAdamu)	1
3.	Gura Lo Majai (AngwanSuya)	1
4.	RwogoRarwat (Utan)	1
5.	Vorok (Farin-Gada)	1
6.	Landura (Alheri)	1
	Total	6

Four methods were used for the analysis to determine the quality for turbidity Conductivity, total dissolved

Table 2: Shows the result of the open water samples analysis

S/N	PARAMETER	A Kabong	B Farin-gada	C Jenta	D Angwan-Suya	E Alheri	F Utan	WHO STD
1	Turbidity (NTU)	50	41.70	120	180	187	75.70	0-5.0
2	Chloride mg/1.	49.97	16.99	13.99	30.99	14.99	16.99	2.50
3	Conductivity /cm	76.00	40.60	36.30	84.50	29.80	68.90	1000
4	Total Dissolved	38.00	20.30	18.15	42.25	14.90	34.40	500
5	Hardness mg/L	100.00	34.00	58.00	84.00	62.00	98.00	150
6	Calcium mg/l	62.04	32.00	42.00	60.00	36.00	48.00	100
7	Magnesium mg/l	38.00	2.00	16.00	24.00	26.00	50.00	150
8	Nitrate Mg/L	4.20	3.60	3.10	3.40	3.01	3.20	44
9	Iron Mg/L	0.86	1.86	1.82	1.88	1.88	1.88	1.00
10	PH	5.80	60.60	6.70	6.90	6.70	6.80	6-5 8.4
11	Sulphate Mg/L	20.00	10.00	36.00	83.00	53.00	63.00	200
12	Sodium Mg/L	15.33	7.96	4.83	11.84	ND	11.75	200
13	Potassium Mg/L	3.66	0.85	0.83	2.52	0.43	0.03	
14	Lead Mg/L	0.62	0.41	0.90	0.70	0.99	1.11	0.1
15	Zin mg/L	ND	ND	ND	ND	ND	ND	0.5
16	Ni mg/L	ND	ND	ND	ND	0.09	ND	ND
17	Copper (Cu)	ND	ND	ND	ND	ND	ND	0.05
	TOTAL COLIFORMS	1,800	1,800	1,800	1,800	1,800	1,800	NIL

Source: Authors field work 2021

and pH, their corresponding meter were used. Chloride hardness, calcium and magnesium, atomic absorption spectrometer (AAS) was used. For the analysis of sodium. Potassium, lead, zinc, nickel. Copper nitrate and iron, spectrophotometer was used. Multiple tube method was adopted for the total coliforms count, and the used of visual and smelling senses were employed for colour and odour of the water respectively at the time of collection

Result and Discussion

The results obtained from the laboratory analysis of the open well water samples were compared with the World Health Organization guideline as shown in table 2.

The results reveals that the physical parameters such as temperature, odour, were found to conform with the WHO guidelines except that the water samples are light brown and the turbidity value exceeded the permissible limit. In the chemical parameters, chloride. Conductivity, total dissolved solid. hardness, calcium are within the permissible limit of WHO, zinc, copper and nickel were not dictated in the water samples except at Alheri where the nickel level was found beyond the stipulated value of 0.002 mg/l, others such as iron, lead were found above the stipulated limit. The all was found to conform to the guideline of WHO concept at Kabong where the water sample is acidic. In the microbiological parameter test, the total coliforms were found to exceed the limit of the WHO guide lines. Though results show heavy level of coliforms, they are no of faecal origin, but are likely topsoil coliforms.

General Implication of Poor Water Quality

Low-income families are most at risk of low-quality water. The result of the analysis presented in table 2 shows that the physical parameters such as colour and turbidity are high in the water of the open wells of Kabong District. According to a WHO (2004) report, high turbidity in water does not have any health implication but it is not appealing for human

consumption. Chemical parameters like lead and nickel are highly concentrated. The content of lead in well water according to WHO (2020) can cause cancer, interference with vitamin D metabolism, affect mental development in infants, and is toxic to the central and peripheral nervous systems. The presence of Nickel above the required level is also carcinogenic. In the microbiological test the total coliforms content in the well water of Kabong District is high. It is an indication of faecal contamination which Balogun and Redina (2021) explained can result to health complications like urinary track in factions, bacteraemia, meningitis, diarrhea, acute renal failure and haemolytic anemia though the authors did not collect data on the existing water related health challenges that confronts the populace in the study area. Microbial pollution has a major effect on human health. Typhoid disease and cholera are common diseases caused by low-quality water. Cholera and other diseases related to poor sanitation and hygiene are most prominent in developing countries where water quality is often overlooked and overcrowded populations lead to waste and bacteria draining into the drinking water. Viral disease due to poor water quality is also possible in the study area. These diseases include hepatitis, gastroenteritis, poliomyelitis, and even some forms of cancer. Viruses in water occur when human and animal waste enter the rivers, lakes, and oceans. Some water-borne viruses have vaccines to prevent infection, but others don't have preventative medication yet. Parasitic diseases are found in waste contaminated water. Many parasitic diseases cause problems with the digestive system and lead to excessive vomiting and diarrhea. These diseases spread through both consumption and recreational activities like swimming, boating, and other water-based activities. Certain water contaminates impact the reproductive system in particular. Both men and woman experience the negative repercussions of low quality water on their reproductive systems. However, in each circumstance infants have lower birth weights and are often premature. Additionally, infertility may result from chronic exposure to poor quality water. Poor water quality unquestionably affects the environment in a negative way because it impacts plant and animal life. Plants rely on clean groundwater to sustain life, but pollutants lower the quality and kill plants. Additionally, animals drink freshwater from ponds, lakes, rivers, and the like. Those animals contract any disease in the water. This leads to the spread of illness in animals and death. In the most extreme circumstances, death is possible due to poor water quality. These deaths are directly linked to diseases contracted via contaminated water. WHO (2020) reports that there are up to 1.8 million death. In another development, a WHO (2020) report explains that there were 143000 cases of Cholera death in 2015. These deaths could be prevented with higher water quality standards around the globe.

Conclusion

The availability of a reliable and clean supply of water is one of the most important objectives needed to achieve the Sustainable development goals. WHO (2021) report explains that diseases related to drinking-water contamination represent a major burden on human health and the interventions to improve the quality of drinking-water provide significant benefits to health. Bradley (2017) corroborates that about 80 percent of all the diseases in the developing countries are related to unsafe water supply and inadequate sanitation. Lack of access to quality water is a global crisis and the effects of inadequate quality water supply is more visible and prevalent in many communities of Jos North. This paper establishes that residents of Kabong District in Jos North local Government Area of Plateau State rely on groundwater in the form of wells, which are grossly polluted by unsanitary practices such a unsanitary maintenance of wells and their features, proximity to potential pollution sources such as pit-latrines, indiscriminate dumping of refuse and poor sanitation. This is clearly evident in the water well usage lifestyle and maintenance attitude resulting in heavy pollution observed. This is capable of causing some sanitation and water related diseases like cholera, diarrhea, among others. This study opined that communities of Kabong District are therefore prone to poor water quality risks, because of their dependence on these sources; thus there is need for improvement and in some cases reconstruction of the wells and well waters treatment.

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