

## Seasonality Differential of Physicochemical and Bacteriological Assessment of Hand –dug Well Water in Tarasa Area Birnin Kebbi

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### ABSTRACT

Contaminated water is a global public health threat placing people at high risk of a host of diarrhoeal and other illnesses. The study determines the physicochemical Parameters and bacteriological analysis of hand dung-well water across seasons. A total of twenty (20) samples were taken in the study area. Temperature, pH, Biological oxygen demand (BOD), Dissolved Oxygen (DO), Sulphate (SO<sub>4</sub>) and Chloride (CL<sup>-</sup>) ion concentrations are the physicochemical parameters determined. The result revealed the maximum pH value of 8.20 to 8.00, DO ranges from 88.3mg/l to 7.5mg/l and BOD revealed 14.57mg/l and 14.87mg/l in dried and raining season respectively. SO<sub>4</sub><sup>2-</sup>mg/l concentration in the water sample revealed 52.00 to 8.10 during the raining and dry season while Cl<sup>-</sup>ion concentration revealed 19.72mg/l to 11.30mg/l during the raining and dried season. The Total viable count (TVC) of 4.33x10<sup>6</sup>cfu/ml and 5.7x10<sup>6</sup>cfu/ml, Total coliform count (TCC) of 3.14X10<sup>6</sup>cfu/ml and 2.67x10<sup>6</sup>cfu/ml fecal coliform count (FCC) of 6.0x10<sup>6</sup>cfu/ml and 2.0x10<sup>6</sup>cfu/ml were analysed at dried and raining seasons respectively. The bacteria isolated were *Streptococci spp* 2(15.38%), *Enterobacter spp* 3(23.10%), *Salmonella spp* 2 (15.38%) and *E. coli*, *Staphylococcus spp*, *Proteus spp*, *Klebseilla spp*, *Bacillus spp* and *Shigella spp*. *Enterobacter spp* 3(23.10%) and *Salmonella spp* 3(27.27%) are the most frequently bacterial isolated across seasons throughout the sampling period. The water used for public consumption is unsafe for drinking.

**Keywords:** Bacterial, Hand dug well water, physicochemical and seasonal

### INTRODUCTION

Contaminated water is a global public health threat placing people at high a risk of a host of diarrhea and other illnesses. Hand dug well water contain undesirable chemicals (from natural sources), the major risk to human health is faecal contamination of water supplies which causes serious health problems, water bodies are contaminated with animal/human faeces being passed or washed into rivers, streams, pools or being allowed to seep into wells or boreholes. Study determine the physicochemical parameter and bacteriological analysis of main source of drinking water (hand dung-well) and characterize (morphologically and biochemically) the bacterial across seasons.

Wide range of microorganisms such as parasites, bacteria, viruses and fungi are involved in contaminated water bodies, most common bacteria are members of the family enterobacteriaceae and life threatening chemicals get to pollute the groundwater system through leaching, fertilizer application, insecticides, herbicides and indiscriminate deposition of human and animal faeces, these are of serious public health concern. Poor sanitation practice, such as locating latrine close to these wells, is a sure contributing factor in the pollution of the ground water system (Argoss, 2001). Jason and Christiana, (2012) in their study reported that sanitation systems are sited less than 50m away from wells and bore holes, water from such wells will definitely be polluted. Therefore, it is of paramount importance to assess the microbiological standard and physicochemical status of hand dung well water of the in order to improve sanitation and reduce the risk of diseases transmission in the study area. This study determine the physicochemical parameters and bacteriological analysis of main source of drinking water

(hand dung-well) and characterize (morphologically and biochemically) the bacterial across seasons in study area.

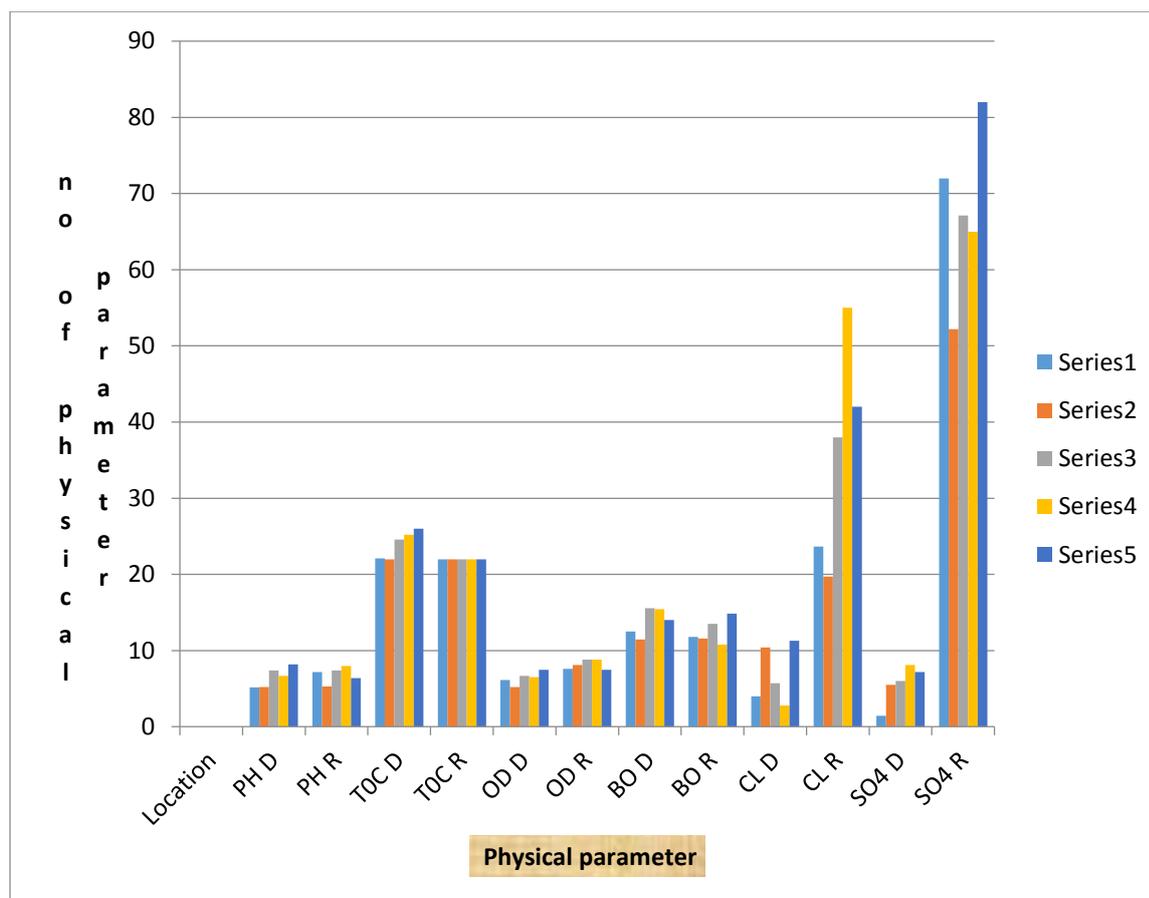
### The Study area

Birnin-Kebbi is the capital of Kebbi State in North Western Nigeria. It falls within Latitude 12.4539°N and Longitude 4.1975°E of the equator. It is the administrative headquarters of Kebbi state and is located on the Sokoto River. It is connected by road to Argungu, Jega and Bunza. Residents of the town are predominantly Hausas and Fulanis. Birnin-Kebbi is a tropical region with an average temperature of 32o C. It is characterised by seasonal rainfall which usually commence in April and last to October, though with heavy fall in July and August. The vegetation of the area is sparsely trees like the neem tree and few grasses. The town is characterised by areas which make up themetropolis, but only five (5) major areas were considered for this study

Water samples were collected monthly from all the sampling sites (A, B, C, D and E) from March to August, 2018. Triplicate water samples were collected in sterile 100ml glass bottles from each of the wells (A, B, C, D and E) from the locations using a sterile stainless steel cup. Samples were transported to Microbiology Laboratory of Waziri Umaru Federal Polytechnic Birnin Kebbi and analysis was done within two (2) hours of samples collection. The method of collection, preparation, and transportation were similar to those reported by Barati *et al.*, (2010) and Birke *et al.* (2010).

### Sampling size

A total of twenty (20) samples were taken in the study area. Ten (10) samples were used microbiological analysis, while ten (10) samples were used for physicochemical analysis sample.



**Figure 1:** Physico-chemical properties of Hand dung well Water across season in Tarasa

**Key:** Locations= A, B, C, D and E pH = power of hydrogen ion, DO = Dissolved Oxygen, **BOD** = Biochemical Oxygen Demand.

#### Physicochemical Analyses and media used

The water samples were analyzed for various physicochemical parameters using standards method recommended by APHA (2005, 2008, 2005). Temperature, pH, biological oxygen demand (BOD), dissolved oxygen (DO), sulphate ( $\text{SO}_4$ ) and chloride ( $\text{Cl}^-$ ) ion concentration were determined. Preparation of nutrient agar (N.A), McConkey agar, Eosin methylene blue and Salmonella-Shigella agar used for this research work were prepared in accordance to the manufacturer specification as described by Oyeleke and Manga (2008).

#### Enumeration of bacterial across season and identification of bacteria isolates.

Method described by Koster *et al.* (2003) was adopted with modification. The viable plate count was determined using a pour plate technique (VPC). The bacterial isolated were identified using microscopy and biochemical Test i.e Urease test Citrate utilization, catalase and sugar fermentation reaction.

#### RESULTS AND DISCUSSION

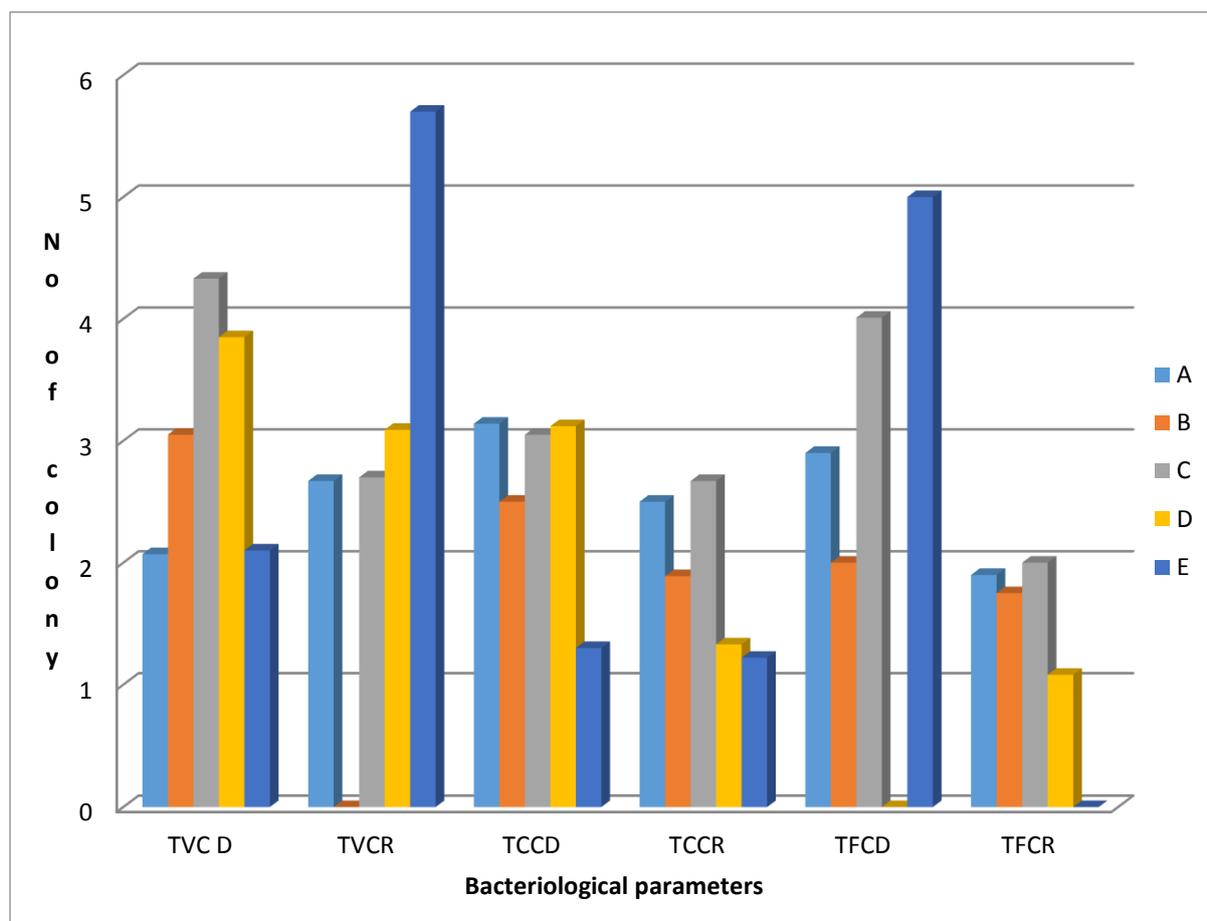
The physicochemical properties (pH, temperature, dissolve oxygen, sulphate, chloride ion and biochemical oxygen demand) of water samples from wells in study area

were presented in Figure 1. The result revealed the maximum pH value of 8.20 and 8.00 at dried and raining season respectively. This implies that pH value is very important because it influences the other physicochemical parameters and the availability of metal ion in the water and waste water. In addition, all the biochemical reactions are sensitive to the variation in pH and it is one of the most important operational water quality parameters (Reda, 2016). The result of pH of this study is in line with the WHO (2012) acceptable pH value of 6.5 to 8.5. Temperature ( $T^\circ\text{C}$ ) revealed  $26^\circ\text{C}$  and  $22^\circ\text{C}$  in both dried and raining season respectively this implies that water sample are within the acceptable limit. Increase water temperature decreases the solubility of dissolved oxygen and water temperatures above  $27^\circ\text{C}$  are "unsuitable" for public use. Reda (2016) in his study revealed that water sample above  $32^\circ\text{C}$ , it would be considered "unfit" for public uses. The value of Dissolved oxygen (DO) ranges from 88.3mg/l at raining season to 7.5mg/l at dried season. The biological oxygen demand (BOD) revealed 14.57mg/l and 14.87mg/l in dried and raining season respectively.  $\text{SO}_4^{2-}$  concentration in the water sample revealed 52.00 during raining season and 8.10 during dried season and  $\text{Cl}^-$  concentration revealed 19.72mg/l during the raining season and recorded 11.30mg/l during the dried season. Chloride is very common in water systems as they are added to drinking water for various health and sanitary

purposes. However, the contaminants can cause dramatic increases in chloride concentrations, which should be closely monitored (Jason and Christina, 2012). According to WHO (2012), the permissible value is 250 mg/L, the current analysis result reveals that at all season of study the samples of water sample across seasons have low value of chloride ranging from which is in the permissible range for drinking.

Results in Figure 2 and Table 2 revealed the total viable plate count (TVC) of  $4.33 \times 10^6$ cfu/ml and  $5.7 \times 10^6$ cfu/ml at dried and raining season respectively, total coliform count (TCC) OF  $3.14 \times 10^6$ cfu/ml to  $2.67 \times 10^6$ cfu/ml in

dried and raining season respectively, Figure 2 further revealed faecal coliform count (FCC) of  $6.0 \times 10^6$ cfu/ml and  $2.0 \times 10^6$ cfu/ml at dried and raining seasons respectively. Thirteen and eleven bacteria were isolated and identified to genus level at dried and raining seasons respectively. The bacteria isolated were *Streptococci spp* 2(15.38%), *Enterobacter spp* 3(23.10%), *Salmonella spp* 2 (15.38%) and *E. coli*, *Staphylococcus spp*, *Proteus spp*, *Klebseilla spp*, *Bacillus spp* and *Shigella spp*. *Enterobacter spp* 3(23.10%) and *Salmonella spp* 3(27.27%) are the most frequently bacterial isolated across season of isolation.

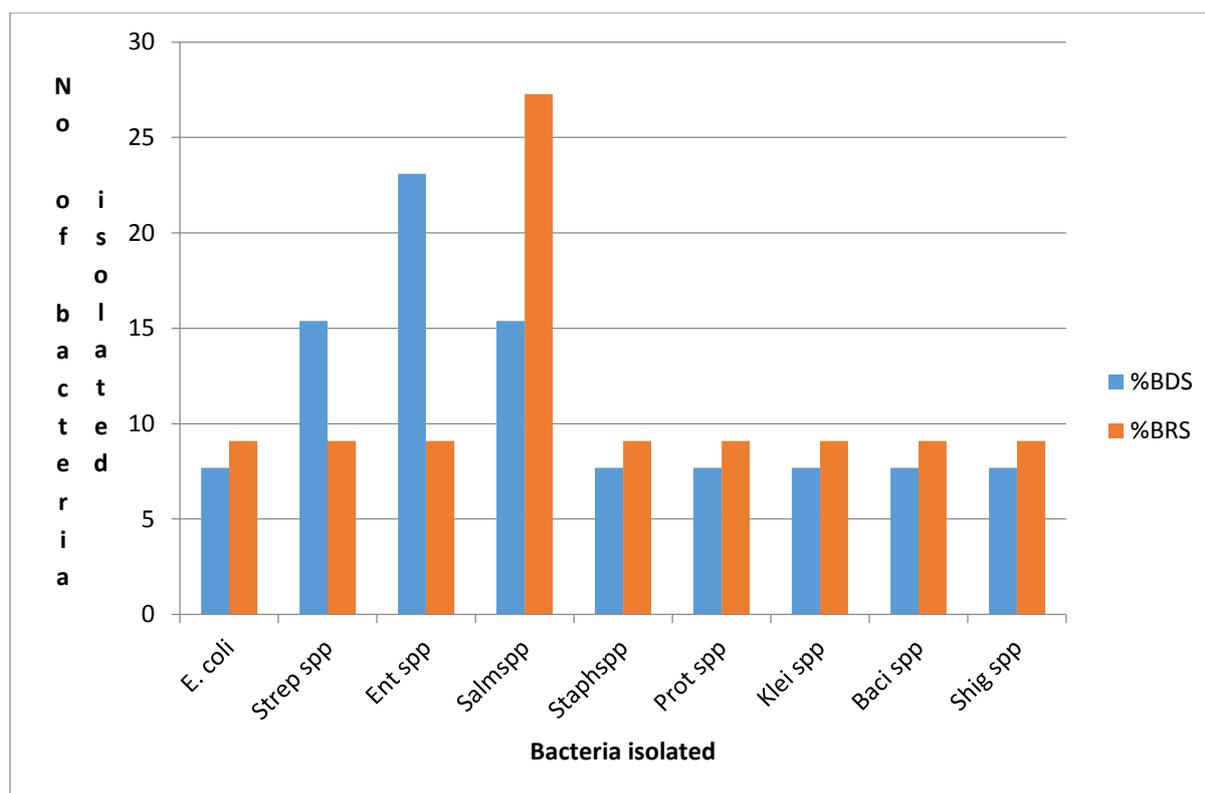


**Figure 2:** Bacteriological Analysis of Hand dung well water across season in Tarasa area

**Key;** TVC Dry = Total viable count at dried season, TVC Rainy =Total viable count at raining season; TCC Dry = Total coliform count at dried season, TCC Rainy = Total coliform count at raining season, TFC Dry =Total faecal coliform at dried season TFC Rainy =Total faecal coliform at raining season.

**Table 1: Determination of TVC, TCC and TFC**

Location	TVC across seasons		TCC across seasons		TFC across seasons	
	Dry	Rainy	Dry	Rainy	Dry	Rainy
A	2.07	2.67	3.14	2.50	2.90	1.90
B	3.05	4.00	2.50	1.89	2.00	1.75
C	4.33	2.70	3.05	2.67	4.01	2.00
D	3.85	3.09	3.12	1.33	6.00	1.08
E	2.10	5.70	1.30	1.22	5.00	1.00



**Figure 3:** Percentage bacterial isolated across seasons

KEY: %BDS = Percentage Bacterial Isolated at Dried season %BRS =Percentage Bacterial isolated at raining season

According to Krapac *et al.* (2002) and Yarima *et al.* (2008) in their study revealed that the presence of faecal coliforms or *Escherichia coli* is an indicator for the presence of water borne pathogens. Yarima *et al.* (2008) also reported that bacteriological examination of water is therefore a powerful tool in order to foreclose the presence of micro-organisms that might constitute health hazards. However, World Health Organization (WHO, 2012) recommended that no faecal coliform should be present in 100 ml of drinking water. Good quality water should be odourless, colourless, tasteless and free from faecal contamination and chemicals in excess of WHO tolerable levels. Most of the communities within the study area depend on hand-dug wells as their major source of water supply.

### CONCLUSION

The water used for public consumption is unsafe for drinking because none of the water samples analyzed met the national and international standards for drinking water. The following recommendations were drawn based on the results obtained during the research period

1. The suspected bacteria should further identify to their molecular level

2. Health education to explain the importance of clean and adequate supply of water, and its relationship to possible disease outbreaks.  
3. Full cooperation of the local community to protect well water pollution and chemical contamination.

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