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Research Article

Determination of the Nutritional and Anti-nutritional Compositions of Bitter Kola (*Garcinia kola*)

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Abstract

The nutritional and anti-nutritional compositions of Garcinia kola were determined using standard methods of the Association of Official Analytical Chemist (AOAC). The results revealed moisture (57.42±0.04), dry matter (40.53±0.02), crude fat (4.19±0.35), crude protein (2.47±0.09), ash (0.92±0.004), and total carbohydrates, (26.49±0.04) respectively. Fe was the most abundant element in Garcinia kola seed (18.14 mg100 g^{-1}), followed by K (2.51 mg100 g^{-1}). Also Co (2.01 mg100 g^{-1}) and Zn (2.31 mg100 g^{-1}) were detected. Mn and Co were available at low values. However, Cr was not detected (ND). The results of the preliminary photochemical screening of the extracts of bitter kola reveal the presence of bioactive substances. Results obtained were comparable to results obtained by other authors. From the parameters determined, it shows the sample can act as antioxidants, anticancer, anti viral, anti inflammatory, and anti allergic due to the results obtained.

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Keywords: Nutritional, Mineral, Antibiotics, Herbal, Stimulants, Medicinal, Toxicity, Constituents.

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Introduction

Garcinia kola (bitter kola) is a dicotyledonous plant having a place with the group of plant called Gutiferae. It is an enduring yield developing in the timberland, disseminated west and focal Africa (Iwu 1993). Bitter kola is a mainstream rural

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produce accessible in enormous amount in West Africa especially in Nigeria and it is a plant that develops in the rainforest. It is utilized widely in the readiness of natural medications either as energizer, supplement or as home grown cures also. Harsh kola has been recognized as a powerful anti-infection which could be compelling in the treatment of numerous maladies. It is assessed that over 70% of present day pharmaceutical items depend on herb. The natural product, seed, nuts, and bark of the plant have been utilized for quite a long time in medication to treat infirmity from hacks, fever, the runs, tuberculosis and other bacterial diseases. It assists with detoxifying the framework *Garcinia kola* plant is a plant inferred medication which has numerous advantages, for example, low harmfulness status/relative wellbeing, openness and reasonableness. Plant parts have been a wellspring of home grown medication which has been demonstrated to be powerful to about 80% of populace as essential medicinal services use (Igboko, 1983, Sodipo and Akiniyi, 2000).

Reports have been made by a few creators on severe kola, Dah-Nouvlessounon *et al*. (2015) announced healthful and hostile to supplement organization of three Kola nuts acquired in Benin, Akpakpan *et al*. (2020) wrote about phytochemical screening and explanatory evaluation of corrosive base pointer properties of red and white kola nuts concentrates, Adeniyi *et al*. (2017) looked into on the relative investigation of the proximate and unsaturated fat profiles of *Cola nitida*, *Cola acuminata* and *Garcinia kola*, Odebunmi *et al.* (2009) chipped away at the proximate and healthful structure of kola nut (*Cola nitida*), bitter cola (Garcinia cola) and crocodile pepper (Afromomum melegueta), while Onyekwelu *et al.* (2015) focused on cancer prevention agent, dietary and hostile to wholesome arrangement of *Garcinia kola* and *Chrysophyllum albidum* from rainforest biological system of Ondo State, Nigeria, however very little was done on the nourishing and antinutritional estimations of *Garcinia kola*. This work was set out upon to create more data on severe kola. In the light of this, the proximate, minerals, and phytochemical constituents of seeds of *Garcinia kola* got in Warri, Delta State, Nigeria were resolved.

Materials and Methods

The *Garcinia kola* (Bitter kola) were newly gathered and bought from neighborhood ranchers at the Warri showcase in Delta State, Nigeria. The *Garcinia kola* was enveloped by dry banana leaves (conventional technique) for 3 weeks. The dried (sun dried) seeds tests were ground utilizing research center mortar and pestle kept in a polythene sack and put away in hermetically sealed containers till investigations.

Proximate Content Determination

Standard methods of the Association of Official Analytical Chemist (AOAC, 1990) were used to determine the moisture, crude protein, crude fat, total ash and crude fiber

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contents of the sample. Moisture content was determined by heating 2.0g of each sample to a constant weight in a crucible placed in an oven maintained at 105^{o} C. The dry matter was used in the determination of the other parameters. Crude protein (% total nitrogen x 6.25) was also determined by the Kjeldahl method, using 2.0g samples, crude fat were obtained by exhaustively extracting 5.0g of the sample in a soxhlet apparatus using petroleum boiling point range 40-60^{0} C as the extract. Ash content was determined by the incineration of 10.0g samples placed in a muffle furnace maintained at 550^{o} C for 5 h. Crude fiber was obtained by digesting 2.0g of samples with H_2SO_4 and NaOH and incinerating the residue in obtained a muffle furnace maintained at 550^{o} C for 5 h, total carbohydrate was obtained by different method; each analysis was carried out in two places.

Mineral Content Determination

The mineral contents of sample were determined by atomic absorption spectrophotometry (Shimadzu AA-670) after dry ashing of the samples. The ash sample was transferred quantitatively into a conical flask and dissolved in l0 cm^3 of 3% Ferric chloride and the mixture was heated on a hot plate, then filtered into a 100 cm^3 volumetric flask and made up to the mark with distilled water. The mineral contents (Potassium, Calcium, Magnesium, Iron, Zinc, Manganese and Phosphorus) of the solution were determined using atomic absorption spectrometer.

Data obtained were generated in triplicates and analyzed, using Minitab 16 Statistical Software.

Anti-nutrients

This aspect of analysis was performed qualitatively (Cannell, 1998)

Test for Tannins

About 0.5g of the ground sample of *Garcinia kola* was boiled in 20ml of water in a separate test tube and then filtered. A few drop of 0.1% $FeCl_3$ was added and observed for brownish green or blue black.

Test for Phlobatannin

An aqueous extract of the plant sample of Garcinia kola (bitter cola) was boiled with 1% aqueous HCl and deposition of a red precipitate was taken as evidence for the presence of phlobatannin.

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Test for Saponins
The powdered sample *Garcinia kola* (2g) was boiled in 20ml of distilled water in a water bath and filtered. 10 cm^3 of the filtrate was mixed with 5 cm^3 of distilled water and shaken vigorously for a stable resistant froth. The frothing was mixed with 3 drops of olive oil, shaken vigorously and then observed for the formation of emulsion.

Test for Flavonoids
A 5 cm^3 of 10% dilute ammonia solution was added to a portion of the aqueous filtrate of the extract, followed by addition of concentrated H_2SO_4. A yellow coloration observed indicated the presence of flavonoid.

Test for Cardiac Glycosides
A 5 cm^3 of the extract was treated with 2 cm^3 of glacial acetic acid containing 1 drop of $FeCl_3$ solution (0.1%). This was underlayed with 1ml of concentrated H_2SO_4. A brown ring of the interface indicates deoxysugar characteristics of cardenolides. A violet ring may appear below the brown ring, while in the acetic layer, a greenish ring may form just gradually throughout thin layer.

Preparation of Fat Free Samples
A 2 g of the sample were defatted with 100 cm^3 of diethyl either using a soxhlet apparatus for 2 h.

Determination of Total Phenols by Spectrometer Method
For the extraction of the phenolic component, the fat free samples of the plant were boiled with 25 cm^3 of ether for 15 min. A 2.5 cm^3 of the extract was pipetted into a 25 cm^3 flask, and then 5 cm^3 of distilled water was added to 1 cm^3 of ammonium hydroxide solution and 2.5 cm^3 of concentrated alcohol were also added. The sample was left to react for 30 min for colour development. The absorbance of the solution was read using a UV/Vis spectrophotometer (Mettler Toledo, Model UV 5) at 505 mm wave lengths as described by Obadoni and Ochuko (2001).

The results of the preliminary photochemical screening of the extracts of bitter kola reveal the presence of bioactive substances. Results obtained were comparable to results obtained by Faruq *et al*. (2004); Ogukwe *et al.* (2004); Akpan and Udoh (2004), and Abulude (2007) for extract of *Senna italica, Sansevieria trifasciata*, *Raphia hookeri*, and some woody plants leaves respectively.

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Results and Discussion

Table 1: Nutritional Composition (%) of *Garcinia kola*

Parameters	*Garcinia kola*
Moisture	57.42±0.04
Dry	40.53±0.02
Crude fat	4.19±0.35
Crude protein	2.47±0.09
Ash	0.92±0.004
Crude fibre	5.03±0.13
Total carbohydrate	26.49±0.64

Table 1 shows the moisture content to be 57.42 (%) and its dry matter was 40.53 % The crude fat, crude protein, crude fiber, crude and total carbohydrate were 26.49, 4.19, 2.47, 5.03, 0.92, and 0.92 % respectively. These qualities are comparative from what had recently been accounted for *Garcinia kola* (Odebunmi *et al*., 2009), they examined the proximate and wholesome organization of kolanut (*Cola nitida*), severe cola (*Garcinia kola*) and gator pepper (*Aframomu melegueta*) and announced a protein substance of 2.48%, fluid 4.51%, debris of 0.79% and rough strands substance of 5.23% in the seed and the report of Alaje *et al*. (2014). The shifting creation revealed by different examinations can be credited with season, condition and condition or time assessment.

Table 2: Mineral Composition of Seed sample (mg100 g^{-1})

Mineral	*Concentrations*
Magnesium	0.42 ± 0.30
Calcium	1.86±0.42
Potassium	2.51±0.12
Phosphorous	0.33±0.10
Sodium	0.72±0.10
Iron	18.14±0.20
Zinc	2.31±0.01
Manganese	0.78±0.20
Copper	2.01±0.50
Chromium	N D
Cobalt	0.55±0.20
Cadmium	0.29±0.10

ND - Not Detectable

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Table 2 shows the consequences of the mineral piece. Fe was the most copious component accessible in *Garcinia kola* seed (18.14 mg100 g^{-1}), trailed by K (2.51 mg100 g^{-1}). Additionally Co (2.01 mg100 g^{-1}) and Zn (2.31 mg100 g^{-1}) were distinguished. Mn and Co were accessible at low qualities. Be that as it may, Cr was not identified in *Garcinia kola*. The aftereffects of the mineral organizations may demonstrate that severe kola are plentiful as far as mineral components. This becomes significant when minerals like P, Ca, Mg, K, Fe, and Zn are required in the body. The Zn substance could imply that the seeds can assume a significant job in the administration of diabetes, which results from insulin failing. Zn is fundamental for the creation of insulin, a hormone and carbonic anhydrase, a catalyst in the body (Okwu, 2004). Fe is a segment of hemoglobin. It enables oxygen to move, together with hemoglobin and ferrodizin, it assumes significant job in man's digestion (Okwu, 2004).

Clearly seed aggregates fundamental, significant, vital, valuable and accommodating components for plant, man and creatures. The nearness of Ca^{2+}, Mg^{2+}, Na+, K+, Co^{3+}, Cr^{3+}, Cu^{2+}, Fe^{2+}, Mn^{2+}, Ni^{2+} and Zn^{2+} reflects their capacity as fundamental supplement components, frequently as co-calculate activators metal-ligand compound edifices (Valkovic, 1975). $Ca^{2+}$and $Mg^{2+}$are present in replaceable sums and go about as restricting operators to meld the cell dividers together (Dser, 1979). The high grouping of specific metals, Mg^{2+}, K+, $Ca^{2+}$and Fe^{2+} in the plants are basic for legitimate development and ordinary working of the plant (Underwood, 1971). Co^{3+}, Cr^{2+}, $Cu^{2+}$and Zn^{2+} (Valkovic, 1975) are fundamental for hair development and for expanding the pace of milk creation by pregnant females.

In any case, the lower Na substance of *Garcinia kola* may be a favorable position because of the immediate relationship of sodium admission with hypertension in human (Dahl, 1972). *Garcinia kola* seeds are rich in phytonutrient, for example, flavonoids, phenolic compound, tannins, saponin, terpernoids, cardiovascular glycosides and alkaloids.

The organic elements of flavonoids incorporates insurance against platelet ulcers, infections, and tumors (Okwu, 2004). This might be the explanation for the utilization of concentrates of this plant in the treatment of intestinal difficulties in natural medication (Okwu and Omodamiro, 2005), the nearness of phenolic mixes in the seed of *Garcinia kola* shows that this plant may be an antimicrobial operator. This is on the grounds that phenols and phenolic mixes have been widely utilized in sanitization and remain the standard with which different bactericides are looked at. Phenolic mixes as electron benefactors are promptly oxidized from phenolate particle or quinine, an electron acceptor. This offers ascend to down to earth employments. Protonated phenol is utilized as cleaning specialist. Concentrates from *Garcinia kola* subsequently have strong

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bactericidal properties (Okwu and Omodamiro, 2005). These discoveries upheld the utilization of concentrate from *Garcinia kola* in forestalling the arrangement of wound diseases and furthermore in treating wounds that not just recuperates quick (Okwu, 2004).

Phytochemicals have been found to restrain microbes, parasites, infections and bugs. The nearness of phytochemicals in the foundation of *Garcinia kola* might be liable for the antibacterial movement of the plant (Margorie, 1999), for example, the nearness of tannins in plants removes which is known to have antibacterial and antifungal properties may give the opportunity for customary specialists to utilize it as solutions for fever and cerebral pain, seizures and stomach issue.

This somewhat clarified the utilization of these seed materials in natural medication, as rich wellsprings of phytochemicals combined with the nearness of the fundamental nutrients and minerals. *Garcinia kola* seeds can be viewed as a potential wellspring of helpful nourishments and medications detailing. The employments of these plants for the treatment of the infection as guaranteed by customary healer are likewise being examined.

Conclusion

Garcinia kola is plentiful in supplement and mineral pieces. It very well may be of huge use in phytomedicine and can be remembered for medicinal services conveyance framework especially in the creating economy. It tends to be finished up from thiThis implies that residents of Burutu town are constantly faced with health risks associated with the consumption and utilization of contaminated water obtained from these sources.

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Short Communication

Microbiological Assessment of Well Water Obtained in Burutu Town, Delta State, Nigeria

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Abstract

This study was carried out to assess the microbial quality of ground water sources (well water) in Burutu town. Five randomly selected wells from five(5) areas of the town were selected and water samples obtained. The samples were subjected to standard methods of analysis. The results showed that the total coliform present in the water samples ranged from 2204 cfu/100ml to 2477 cf/100ml. These values are far above the World Health Organization (WHO) standard of 0cfu/100ml (absence of coliform) for safe potable water. These values may be as a result of poor groundwater source (well) construction, poor handling and lack of maintenance. Individuals who utilize water from these wells for consumption and domestics purposes are at risk of contacting water borne diseases if not properly treated before use.

Keywords: Ground water, Glaziers, ice caps, Water borne disease, Analysis and Microbes.

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Introduction

Water is viewed as the dissolvable of life (Reece *et al*., 2013), as it is fundamental for the endurance of each type of life, and the requirement for water is continually expanding because of high paces of populace development and urbanization. In any case, the expanded requests for water for drinking, residential, agrarian and modern procedures are not equivalent with water accessible, accordingly presenting critical dangers in keeping up worthy water quality (DESA, 2008). It is believed that by the year 2025, the greater part of the total populace would be confronted with water-based weakness (Kulshreshthan, 1998). Water is an all inclusive and significant dissolvable required

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throughout everyday life. It has numerous utilization relying upon needs of people. Water covers over 70% of the world's surface. It makes what we call groundwater and surface water, for example, well, waterway, downpour, stream, and so on (Fashae *et al*., 2017; Herman, 2009, 2010; Khongwir *et al*., 2014; Slimani and Kalla, 2017; Yasin *et al*., 2015). According to the Water Project (2016), WHO (2016), UNDP (2014) and Living Water Africa (2016), about one billion people do not have access to clean and save water. In many places of the world, access to water has been potentially a critical factor in alleviating poverty and enhancement of economic growth.

Groundwater represents an important source of water and constitutes the largest source of dug well water, as well as borehole water. Water from these shallow and profound wells is frequently of preferable quality over surface vast water source; if the dirt is fine-grained and its bedrocks don't have breaks, hole and bedding plants which license the free section of contamination water. The accessibility and virtue of groundwater are influenced by area, development and activity of wells. It is regularly expected that common uncontaminated water from profound wells is spotless and solid, and this is normally evident with respect to bacteriological synthesis.

There are numerous wellsprings of water defilement, notwithstanding, the vast majority of them are arranged or ordered into two gatherings, specifically: immediate and roundabout sources. The immediate sources incorporate profluent outfalls and squanders from industrial facilities, processing plants squander treatment plants, sewage treatment plants, and horticultural practices (manures and pesticides), and so on, that produces liquids of different characteristics legitimately into urban water supplies. Backhanded sources incorporate sources incorporate contaminants that enter the water gracefully from soils or underground frameworks and from the air by means of downpour water and human practices, (for example, vaporous oversights from autos, industrial facilities and even pastry kitchens).

Different wellsprings of water defilement emerge from the poor development, absence of support and poor treatment of water gracefully frameworks, particularly ground water, (for example, wells and boreholes).

The nature of water from ground or surface can be affected anytime by the lithology of the bowl, environmental, climatic, and anthropogenic information sources (Shrestha *et al*., 2008; Al Aizari *et al*., 2017). Tainting of water are from anthropogenic sources of info which are man-produced using urban, modern and agrarian exercises, traffic, and expanding utilization of water assets) and furthermore from common procedures which

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remember changes for precipitation inputs, disintegration, enduring of crustal materials.

Tainting of water debilitates its utilization for drinking, modern, rural, diversion or different purposes (Muangthon, 2015).

Defilement of water is related gastrointestinal disease in people, with sickness, retching, and additionally looseness of the bowels, pneumonia (Yu, 2000; Ahmed *et al*., 2010), dreariness among small kids (Heyworth *et al*., 2006), typhoid fever, cholera, hepatitis A, flu, dengue, and leptospirosis (Rappler, 2015).

All through the world, a few research works have been done. Ahmed *et al*. (2010) decided the microbial dangers of water acquired in Australia, Al Aizari *et al*. (2017) evaluated the nature of groundwater in Dhamar City, Yemen, Budiwati *et al.* (2016) chipped away at the synthetic qualities of water in Sumatera, Indonesia, same was recorded for Nigeria (Bada *et al*., 2012; Abulude *et al*., 2017). No records of such evaluations were found for ground water in Buruku town in Nigeria. It won't be strange if the water found in this area is assessed for its quality.

Some portion of the 2030 Agenda is Good Health and Well-being (Goal 3) and Clean Water and Sanitation (Goal 6) (UN, 2018). These imply that there must be water accessible for utilize each season and should be spotless and solid for use. This motivation can't be accomplished if groundwater isn't kept sterile. Not all waters can be put away particularly whenever debased (truly, artificially, and microbiologically) and steady checking must be guaranteed. Before water can be tanked or saved for sometime later, the quality should initially be determined. It is on this reason our exploration depended on the evaluation of the nature of well water in Burutu town dependent on the microbiological properties.

The reason of this paper was to determine the microbiological constituents of well water got in Burutu Town, Delta State, Nigeria.

Materials and Methods

The well water was obtained in five extraordinary (Amba, Okorodudu, Low Beach, Quarters, and Court street) zones in Burutu town, Delta State with plastic pails pre-washed with dilute HCl, flushed with refined water and later with a lot of water from the areas. The water was then moved into the plastic containers and secured after all the air bubbles had been wiped out. The samples were marked and sent to the lab for

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examination after six hours of assortment. The climate around there is a tropical atmosphere which is made of downpour (April-October) and dry (November-March)

seasons. The testing locales were encircled by horticultural fields, trees, private structures, untarred streets for vehicular exercises (low traffic), and homesteads.

The nutrient agar was prepared by weighing 28g of the powdered nutrient agar and dissolving in 100ml of distilled water. The resulting solution was then heated to boiling point to dissolve the medium completely. It was then sterilized by autoclaving at 121^{O}C (15 ibs pressure) for 15 minutes. The sterilized nutrient agar was then allowed to cool (50^{O}C).

The determination of the total coliform in the water samples was carried out using the plate count method. The recently prepared warm molten nutrient agar was added to 100ul (approximately 2 drops) of the water sample in a Petri dish and allowed to cool and solidify, after which it was inversely placed in the incubation period of 24 hours at 37^{O}C. At the end of the incubation period, the colonies formed were counted and recorded and their corresponding coliform forming units were recorded.

Data obtained were generated in triplicates and analyzed, using Minitab 16 Statistical Software.

Results and Discussion

Table 1: Results obtained from the microbial analysis of water samples

s/n	Location of Groundwater source (Well)	Total coliform (cfu/100ml)	WHO standard (cfu/100ml)
1	Amba	2380±0.06	0
2	Okorodudu	2462±0.05	0
3	Low Beach	2431±0.05	0
4	Quarters	2477±0.08	0
5	Court Road	2204±0.05	0

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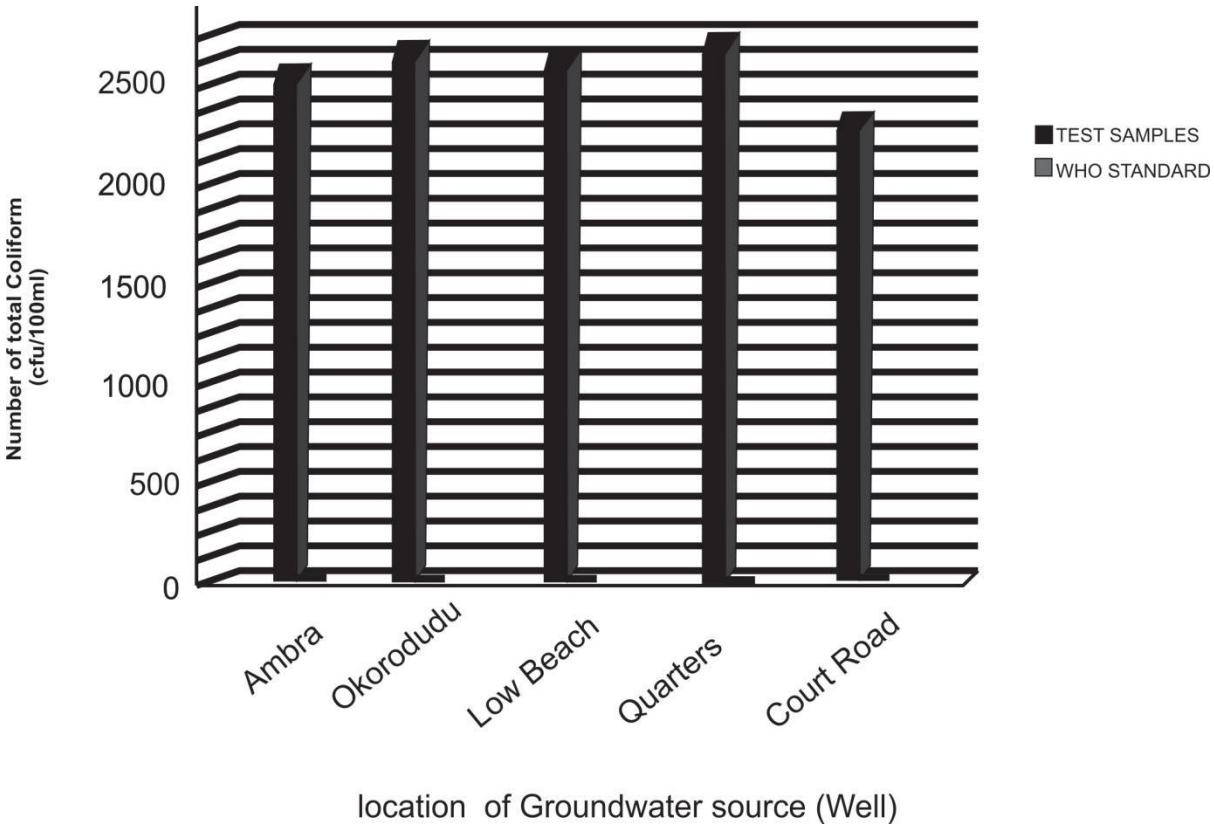

Figure 1: Comparison of test samples values with WHO standard values.

Table 1 and Figure 1 portray the qualities acquired for the microbiological examinations in the investigation. The outcomes got show that the Total coliform in Quarters (2477 cfu/100ml) and Okorodudu (2462 cfu/100ml) had the higher qualities compared to those from different destinations (Amba, Low Beach, and Court Road, 2380, 2431, and 2204 separately). In comparing with the WHO standard, the outcomes here are a lot higher. This uncovers none of water tests satisfied the WHO suggested guideline of 0cfu/100ml for safe consumable drinking water.

This demonstrates the water tests acquired from individual wells are defiled with microbial contaminants and represent a high danger of transmitting water-borne sicknesses because of the significant level of all out coliform. It subsequently shows that occupants and creatures of Burutu town who use such wells as wellspring of water for

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utilization and for residential purposes face genuine wellbeing hazard emerging from the transmission of any at least one of the diverse water-borne illnesses.

Conclusion

Water is a significant asset that is fundamental forever, populace development and urbanization has realized a regularly expanding interest for safe consumable water, particularly in numerous networks and towns in creating nations has prompted the dependence and usage of dangerous defiled water. Burutu town is one of such networks, and occupants rely essentially upon well water as significant wellspring of water. From this examination, it has been uncovered that the well water in Burutu town are anyway exceptionally tainted with all out coliform that far surpasses the World Health Organization (WHO) standard. This suggests occupants of Burutu town are continually confronted with wellbeing dangers related with the utilization and usage of sullied water got from these sources.

Recommendation

Based on the findings of this study, the following recommendations were made:

- The consumption of water obtained from this the wells in Burutu town should be strictly avoided.
- The periodic availability of relatively less contaminated sources of water (eg. Rain water) should be harnessed by way of harvesting and storage.
- There is the need for the proper sitting and construction of wells
- The handling and maintenance of wells should be greatly improved upon Water treatment processes (such as filtration, chlorination, boiling, use of disinfectant, etc) should be carried out before utilization of the water.
- There should be safe potable water for residents of Burutu town.

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