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A Multi-Source Analysis of Water Supply Challenges in Offa Local Government Area, Kwara State, Nigeria

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Abstract: *In many developing countries, ensuring safe and reliable water access remains a critical challenge. This study focuses on Offa Local Government Area (LGA) in Kwara State, Nigeria, investigating water sources and supply conditions. The research employed a combination of questionnaires, interviews, and water level measurements to assess resident experiences and identify water availability issues. Over a nine-month period from July 2022 to April 2023, daily readings of water depth were taken twice for 150 accessible wells in the study area. Additionally, measurements of total well depth and well diameters were recorded once. These data formed the basis for computing other well characteristics, including depth of water and volume of well water. Subsequently, data on groundwater use and associated problems were collected using random sampling theory and questionnaires. Descriptive statistics, sampling techniques, binomial probability theory, and regression analysis were applied to analyze the data. The results indicate abundant groundwater in the study area, tapped to meet people's water requirements. However, water shortages, particularly during the dry season, stem from the shallow nature of the wells. To address these challenges, repairing non-functional boreholes and increasing well sinking efforts during the dry period would ensure adequate water supply, prevent contamination, and minimize disruptions associated with water facilities*

Keywords: *Water, security, challenges, Offa LGA, multi-source analysis, sustainable management*

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1.0 Introduction

This subject which requires evaluating the problems associated with water sources and supply in Kwara State for sustainable water management, is of such enormous significance that the Nigeria University Commission (NUC) has founded the new approach as a sector in university curricular to promote the ideas for the sustainable urban water for the future (Adeyemi, 2016). Due to climate change and irrational fossil fuel supplies, renewable energy resources are increasing at an alarming rate, therefore, global experts and environmentalists have suggested that in the year 2020, more than 50 per cent of worldwide investments in the power plant market will be for the expansion of renewable energy resources like water, wind, and the sun (Lillesand and Keifer, 2013). Clean water is crucial, and purified water for urban areas is essential. Public utility companies are responsible for providing reliable water supplies as well as energy-efficient water purification. (Atoyebi, 2011). Water purification is a significant challenge to both sparsely and densely populated rural and urban areas. Cities are faced with growing energy costs and increasingly strict environmental standards. United Nations has the products to ensure the highest availability and value solutions for water purification, the world's number one resource (UN-Water, 2021). Ensuring a city's sustainable future encompasses more than just energy or water-efficient technologies, it is about acting as a responsible corporate citizen and investing in those who will inherit the future sustainable development (Anzzolin, 2017). Certain problems have beset the use of underground water around the world. Just as river waters have been over-used and polluted in many parts of the world, so too have aquifers. The big difference is that aquifers are out of sight. The other major problem is that water management agencies and government, when calculating the "sustainable yield" of the aquifer and river water, have often counted the same water twice, once in the aquifer, and once in its connected river. This problem, although understood for centuries, has persisted, partly through inertia within government agencies. Offa Local Government Area of Kwara State was created in 1991 out of the defunct Oyun Local Government Area by the regime of President Ibrahim Babangida. The Offa local Government metropolitan area is about 60 km from the State headquarters, Ilorin at an elevation of 201 meters above sea level. It is boarded in the North by Ilorin, the capital of Kwara State in the East by Irepodun and in the South by Igbomina. The West is boarded by Osun State. The area is blessed naturally with humus, fertile soils useful for agricultural practices for export trade (Olorunfemi, 2021). Offa Local Government Area has a population of about half a million as of the 2006 census figure. She has been blessed with a good, conducive, serene environment. Blessed with modern infrastructural facilities, sound education privilege and stable weather conditions. Offa Local Government Area would in the near future need technological advancement in the expansion of water resource management for her sustainable development to cope with the mass pressure on land and other available natural resources. Offa Local Government Area lies between the equatorial belt and proximity to the Atlantic Ocean which influence the diurnal rainfall pattern and the vegetation pattern of deciduous forests. Offa Local Government Area lies on latitude 80 261 and 80 671 N and longitude 80 261 and 80 901 E (Olorunfemi, 2021).

2.0 Materials and Methods

2.1 Materials

The data required for this project was obtained from two major sources, namely; primary and secondary sources. Direct observation and field measurements for the first group of data were carried out, while Questionnaire administration was carried out later to augment the relevant data sources. The use of secondary sources of data is hence necessary to complement the other primary data sources. These include the use of journals, monographs, statistical records, books from libraries, maps, tracts, the internet, and the use of other pictorial elements. The success of any research work depends largely among other considerations on the type of data collected for the study and so extra care was always been taken in determining the type of data that was used. In this study, the data used was categorized into two groups. In the first category was the data relating to the source of water, types of water source, and characteristics of the wells such as depth to water, total well depth, the diameter of the well, volume of water in the well and the nature and source of the water.

The data and information on the sources of water, usage and problems of water supply in the study area constitute the second category of information used. Finally, the survey got the researcher acquainted with the field conditions and created a rapport with the village dwellers in the area since a study of this nature will require a stranger to go inside peoples' houses and compounds at least twice daily for proper measurement needs to be approached with viable interaction, understanding and maximum cooperation.

2.2 Methods

2.2.1 Site information

Information on the activities of each agency was obtained from the respective organization. Prohibited reports and previous works yielded useful information on the amount of daily water consumption per capita in each local government unit in the study area. The share of each agency relative to all other agencies per local government area was computed using Isard`s location quotient (LQ), define by equation 1 (Cadmus 2010).

$$LQ = \frac{S_i N_i}{S^\wedge N} \qquad (1)$$

where: Si = the number of water points in a Local Government, S = total number of water points in all the Local Government, Ni = the population of people in the Local Government and N =total population in all the Local Government

Since the study is concerned with welfare conditions as equitable per capital distribution of social infrastructures and services, population size rather than physical size. The LQ this given in sight on the nature of distribution as the contribution of each water agency to the provision of potable water in the state as compared with the alternative underground water supply. The primary objectives of the government's policy on Water supply are to provide water in adequate supply. Make it available and ensure that the water is always safe, potable, handy and healthy for potential populace for human consumption".

2.2.1 *Sampling Techniques*

The study here was made up of three major districts in Offa Local Government Area. The sample size for the administration of the questionnaire was randomly selected for easy distribution of the questionnaire. The systematic random sampling technique was used to analyze the data. Before the administration of the questionnaire, there was the selection of the source of water used for water sample collection from the underground reservoir. The information was sought from the district areas which were later coded as sites A, B, and C for data sourcing.

2.2.2 Data Instruments

The instruments which were frequently used in this research work a measuring tape, an improved well depth estimator and hand handheld geo-positioning system.

The measuring tape is very common and very useful at this stage. The improvised well depth estimator is a 30-meter long string graduated in meters with beads and a big padlock attached to one of its ends. The string with the padlock at one end was lowered into the well and measurements were taken by counting the number of beads down it in the water. In the case where the measuring point on the string did not coincide with the surface of the well, the number of beads down in the well was counted and the measuring tape was used to read off the remaining length of the string from the position of the first bead in the well.

2.2.3 Survey of the Study Area and Well Sites

Virtually, it was seen that the three districts made up of Offa Local Government Area take a linear pattern with buildings erected along the roads and water sources. Meanwhile, the linearity made the surveying exercise a little bit easier and water sources were neatly divided into scales and aided by the use of a topographic sheet for easy identification.

2.2.4 Method of Data Collection

The depth of water was obtained by lowering the improvised calibrated well depth estimator into the existing well. Its first contact with water in the well was noted and the reading of the depth to water was taken. The cumulative values for the variables were collected twice daily for a period of nine months beginning from January to September 2014 for the wells in the study area. There were daily readings of the depth of water in the study area while the monthly average readings for both the morning and evening periods were recorded. For the Total well depth, the reading was obtained by further lowering the calibrated well depth estimator to the bottom of the well severally. Its first contact with a deep well bottom is usually felt and this gives the measurement of total well depth. In all, the readings on the total well depth were used to determine the mean value, standard deviation and mean variation. Also, to determine the depth of water, the difference between the total well depth and the depth of water in each well is derived. The Diameter of the well was measured by placing the measuring tape across the circular opening of the well. To ascertain the accuracy of the procedure described above, the exercise was usually repeated at two different points on the circular opening of each well and the average was taken as the diameter of the wells.

The volume of well water was hence calculated for each well using the formula;

$$\text{Volume} = \pi r2h; \quad (2)$$

where $\pi = 3.142$, r = the radius of the circular opening of the well and h = the height of the well, which in this case will be the depth of water

Using the above formula, the average monthly water availability for each well in the study area was calculated in cubic meters.

2.3 Data Analysis

Some statistical techniques were used to analyze the data collected. These are the descriptive statistics, linear correlation and regression analysis, and the sampling theory using the student "t-test. According to Ogbeibu (2005), if a given area is entirely underlain by a groundwater zone, the probability that a randomly selected site in such an area is underlain by groundwater is 1. The above statement therefore implies that the closer to unity the proportion of an area that is underlain by groundwater; the greater the probability that a randomly selected site in the area is underlain by groundwater. Some statistical techniques were used to analyze the data collected. These are the descriptive statistics, linear correlation and regression analysis, and the sampling theory using the student "t-test.

2.3.1 The Descriptive Statistics

This technique was applied to analyze the raw data collected on the important variables in this investigation as a necessary step before the application of parametric statistical methods. This particular method of data analysis was used for simple distribution called frequency distribution of each variable and to transform most of the data set before applying the next statistical methods. The variable analyzed is by using statistical techniques which also include data on depth to water, total well depth, depth of water, diameter of well and volume of well water as they were taken twice daily for at least a total period of nine months.

2.3.2. The Alternative Technique

Based on the above techniques, the following considerations were implemented

i. The Sample Site was randomly selected

ii. The number of sample sites sampled was reasonably large in comparison with the size of the area under investigation.

iii. The sample sites were widely distributed over the area under study.

The value of probability (P) of success can be obtained for this purpose by adopting the relative frequency definition of probability (Wannacott, 2015). This was achieved by dividing the number of sites underlain by groundwater by the total number of sites in the area under investigation. The greater the value of P, the greater the proportion of the total area that is underlain by groundwater. If the whole area is underlain by groundwater, "P" will be equal to 1.

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2.3.3. Regression Analysis

Regression analysis is the general statistical technique through which one can either analyze the relationship between two variables on one hand (i.e. linear relationship) and between one variable and a set of independent variables (multiple regression analysis). The linear regression was used as a descriptive tool to check the relationship between two variables while the multiple regression analysis was also used as a descriptive analysis tool or as an inferential tool by which the relationship in the total population is evaluated and determined.

The general model for the linear regression can be written as equation

$$Y = a + bx \qquad (3)$$

However, for multiple x-variables (X1, X2, X3, X4….X6) the regression equation can be written as

$$Y = b_1x1 + b_2x2 + b_3X3 \ldots\ldots\ldots + E \qquad (4)$$

2.3.4 Linear Regression Analysis

present the scatter graph and the regression equation (y = a + bx) for a total volume of water with each of the remaining variables; where 'y' is the dependent variable; which in this case is the total volume of water; 'a' is the intercept of the graph, and 'b' is the graph slope

2.3.5 Multiple Regression Analysis

In making the total volume of water as the dependent variable (y1) the multiple regression equation obtained was represented as

y1 = 0.141 + 0.37X1 + 0.682 X 2 + 0.254 X3 + 0.160 X 4 ¬ - 0.117 X 5 - 0.725 X 6 - 0.729 X 7 - 0.165 X8 + 0.859 X9 - 0.139 X10 (5)

An R-squared value of 0.9984 (i.e. 99.6%) was obtained for the above equation, and this shows that these ten variables (x1 – x10) account for almost 100 percent of the variation in the total volume of water in the wells. The second result of multiple regression analysis, making a total volume of withdrawal as independent variable y2 generates a regression equation of the form –

$$Y2 = 0.017 - 0.005X1 - 0.003X2 + 0.343X3 + 0.626X4 - 0.009X5 - 0.001X6 - 0.008X7 + 0.004X8 + 0.012X9 + 0.016X10 \qquad (6)$$

Calculated R^2 value of 0.9968 (i.e. 99.36%) was also obtained for this equation; and this also shows that variables x1 to x10 account for almost 100% variance i.e the mean total volume of withdrawals. This is defined as LQ=Si/S Ni/N.
With Si = the number of water points in a Local Government, S= total number of water points in all the Local Government and Ni= the population of people in the Local Government
Total population in all the Local Government or state.
Since the study is concerned with welfare conditions as equitable per capital distribution of social infrastructures and services, population size rather than physical size.
The LQ this given in sight on the nature of distribution as the contribution of each water agency to the provision of potable water in the state as compared with the alternative underground water supply. “The primary objectives of the government’s policy on Water supply are to provide water in adequate supply. Make it available and ensure that the water is always safe, potable, handy and healthy for potential populace for human consumption”.

3.0 Results and Discussion

3.1 Water Supply and assesses

Generally speaking, rural dwellers in Nigeria depend on three main water sources for their domestic water requirements. These sources include (i) the supply of rainwater during the wet season (March to October in this study area), (ii) the surface water sources which include rivers, streams, springs, ponds, lakes etc. and (iii) the underground water. In the study area, water sources available to the people include wells, boreholes, rivers, streams, ponds and tanker water supply. Of all these sources, however, the use of wells accounts for 73.1%, tanker water supply represents 4.5% while 22.4% of the respondents use the combination of any of the available water sources as the situation arises. However, none of the respondents depend on surface water as the only surface water supply. This shows the importance, that these people attach to the use of underground water because of its advantage over all other sources. However, most people (58%) still felt that all these resources are unreliable (Table 1). This is expected when one considers the fact that most of these sources are affected by the vagaries of weather. The indication shows that the respondents depend on surface water as the only source of water supply. Domestic water supply sources in residential areas usually include pipe-borne water (mainly from municipal water supply schemes), boreholes (solar, machine and hand-pump, both public and private), wells (hand-dug shallow wells, mainly private) and streams (including water collected directly from rivers, lakes, ponds, irrigation channels and other surface sources) (Aragaw and Gnanachandrasamy, 2021; Adimalla *et al*., 2022). Water supply from vendors using tankers, trucks and carts and also rainwater, are also becoming important in some areas (Egbinola, 2017). Water is widely regarded as the most essential of natural resources, yet freshwater systems are directly threatened by human activities and stand to be further affected by anthropogenic climate change (Atta *et al*., 2022; Egbinola, 2017).

Table 1: Sources of Water Supply

Water sources	Number of Respondent	Percentage of Respondent
Well only	101	73.1
Rivers and stream	0	0
Springs and Ponds	0	0
Tanker supply	11	4.5
Combining above	38	22.4
Total	150	100%

****Source: Field Survey, 2023**

3.2 Reliability of the water sources

Wells in this study area were found not to yield a substantial volume of water during the dry season because of their shallow depth. This therefore made their yields very poor during the dry season because of the usual drop in the level of the water table. Moreover, these wells are sited randomly with little or no consideration for the water-holding capacity of the area. Shows that most of the wells (58%) were found to be located within the individual compounds while only 9% of the respondents trek up to a kilometer to fetch water ((Table 2). Water systems are affected by intensive agricultural activities, urban development, industrialization and unplanned engineering infrastructures. Unplanned agricultural practices arising from a lack of adequate extension workers and largely un-mechanized procedures leave farmers with the option of bush burning as the only site-clearing method (Tyagi *et al*., 2020; Giri and Qui, 2016). This practice results in deforestation which translates into land degradation and mass wasting events leading to soil water deficits and sediment loading of surface water. Irrigation practices often affect the wetland hydrology of downstream areas thereby impacting negatively on aquatic ecosystems (Camara *et al*., 2019).

Table 2: Reliability of the water sources

Reliability	Number of Respondent	Percentage of Respondent
Reliable	54	41.8
Unreliable	96	58.2
Total	150	100%

****Source: Field Survey, 2023**

3.3 Distance of Water Sources from Respondents Resident

The distances at which the respondents fetch water from their homes are indicted. The distance, However, vary with season and the availability of different water sources, During the wet season, most of the people draw water from wells in their houses, compound or in a near by wells while As at the time of visiting the wells stirs, 76.1% of the respondent went for water in the morning, 6% in the evening, while 17.9% visit the well sites anytime of the day (Table 3). The water resources are enormous and unevenly distributed among the various hydrological areas, hence, could either be near or far from residential areas (Desta and Befkadu, 2020).

Table 3: Distance of Water Sources from Respondents Resident

Distance	Number of Respondent	Percentage of Respondent
Within compound	84	58.2
Less than 1 km	53	32.8
More than 1 km	13	09
Total	150	100%

****Source: Field Survey, 2023**

3.4 Time of visiting the well sites

It should be noted however that, a substantial number of the respondents who visit the well site any time of the day are those who have private wells within their houses or compounds. The reason for this is because; this group of people do not always nurse the fear of the water level in their wells dropping in the evening as it is common to other wells that are open to the generality of the people. Such wells are usually under lock and key.

Those who visit the wells site in the morning go as early as possible, usually before 6.00 a.m., especially during the dry season (Table 4). This is to prevent the usual late morning rush when as many as eight (8) lines go into a well at once depending on the diameter of the well mouth and the water level in them. Water in such a well is usually completely drowned down to the well bottom before noon because the rate of withdrawal usually exceeds the rate of replenishment and this accounts for the reason why none of the respondents visit the well site in the afternoon. The estimate of water requirement by the people revealed that 94% of the respondents use more than 108 litres of water daily while none uses less than 34 litres. Unlike surface water that cuts across geographical boundaries, the occurrence of groundwater in terms of quantity and quality displays spatial variability is driven by the geology and climate (Desta and Befkadu, 2020; Hassan *et al*., 2017).

3.5 Household daily water requirement

The above values were arrived at by the researcher making use of a standard bucket of known volume for the test. It was, a bit difficult to arrive at these values for some of the respondents. Those respondents having wells in their houses were not able to give the precise volume they use since these people usually visit the well site whenever the need arises, for example, trekking to the well site to take water for ablution, wash their hands and even to drink water after meals. This accounted for the lack of storage facilities by most of the respondents (Table 5). Disparities are usually observed in the use of water facilities across different areas of residence, geopolitical zones, and socioeconomic lines. The most significant disparities are related to wealth. The wealthiest households are about ten times more likely to access water facilities than the poorest households (WASH NORM, 2021).

Table 4: Time taken to fetch water

Time	Number of Respondent	Percentage of Respondent
Less than 10 minutes	98	47.8
10-20 minutes	40	35.8
More than 20 minutes	12	16.4
Total	150	100%

****Source: Field Survey, 2023**

Table 5: Household daily water requirement

Water Requirement	Number of Respondent	Percentage of Respondent
1-3 Buckets (18-34 lit)	0	0
3-6 buckets (54- 108 lit	24	6
More than 6 buckets (above 108 lts)	126	94
Total	150	100%

****Source: Field Survey, 2023**

3.6 Volume of Storage facilities

In the group, people are responsible for drawing water. This study reveals that it is primarily the responsibility of every family member as shown in Table 4.15. However, children (both male and female) constitute the greatest percentage of drawers of water when considered age-wise. This group of people accounts for 17.9% followed by young females who account for 13.4% and older females (7.4%). It is very interesting to note that household heads also draw water for domestic use in the area; this group accounts for 6%, and this therefore shows that though women and children are commonly responsible for this job; men do participate in the activities also particularly during the dry season when they have to search for it over long distance wasting the time which ought to have been spent on their farms (Table 6). According to WHO/UNICEF (2017), 71 per cent of the global population (5.2 billion people) used a safely managed drinking water service; that is, water from an improved source, located on-premises, available when needed and free from contamination. Less than 25 per cent of the Nigerian population had access to this form of water supply in 2015 (WHO/. UNICEF, 2017).

3.7 The Drawers of Water Problems and Effect of Water Use

Various health problems were noted to be facing the villagers in this study area resulting from the use of untreated or contaminated water. This study revealed that 56.7% of the villagers have at one time or another complained about water-related problems or. Based on the nature of the problem;

34.40% were noted to have been attacked by typhoid; 24% by gastroenteritis, 15.8% for both guinea worm and dysentery, respectively, and 5.3% by cholera while other minor ailments account for the remaining 5.3% (Table 7).

Table 6: Volume of storage facilities

Vol of storage facilities	Number of	Percentage of Respondent
1-3 buckets	0	0
3-6 buckets	45	18
More than 6 buckets	105	82
Total	150	100%

****Source: Field Survey, 2023**

The overall status of the water sanitation and hygiene sector in Nigeria is low. Only 10% of the population has access to complete basic water, sanitation, and hygiene services, using the global JMP definitions. Those living in rural areas are three times more disadvantaged than those in urban areas. The trend shows a drop of 3 million in the number of people with access to basic water sanitation and hygiene services from 21 million in 2018 to 18 million in 2019. However, an additional 2 million people gained access to basic water sanitation and hygiene services between 2019 and 2021. In comparison, the population of Nigeria increased by 3 million from 198 million in 2018 to 201 million in 2019 and by an additional 5 million to 206 million in 2021. The modest gains in access to basic water sanitation and hygiene services is dwarfed by the increasing population (WASH NORM, 2021).

Table 7: The Drawers of water

Drawers of water	Number of respondents	Percentage of respondent
Household heads	18	06
Children (male &	30	17.9
Young males only	0	0
Young females only	23	13.4
Older males	0	0
Older females	20	7.4
Everybody	50	52.2
Other relation/water	11	03
Total	150	100%

Source: Field Survey, 2023

3.8 Water-related diseases affecting respondents

Attacks from the above-mentioned diseases have been causing a lot of problems for the villagers. Substantial numbers of days were noted to have been lost in the cause of treatments (Table 8). This results in most cases, in low productivity, on the farm, emigration out of the villagers; and sometimes even death. These secondary aquifers are characterized by their non-extensive nature, susceptibility to anthropogenic pollution and climatic vagaries. The quantity and quality of Nigeria's water resources are affected by the coupling of human factors and climate change. About 70% of drinking water at the source and point of consumption within households is contaminated with *E. coli*. Rural dwellers are exposed to more contaminated drinking water than urban dwellers (WASH NORM, 2021).

The above result is not surprising as there is no government-owned hospital around where the people can receive treatment. The only hospital in the three villages is privately owned and the income level of the majority of the people will not allow them to visit this hospital. This therefore made the majority of the respondents (47%) take to self-medication while 45% travelled out of the village to a general hospital either in Osogbo or Ilorin for treatment.

Table 8: Water related diseases affecting respondents

Disease	Number of respondents	Percentage of respondents
Gastroenteritis	29	23.7
Cholera	20	5.3
Typhoid	33	34.2
Guinea worm	24	15.8
Dysentery and Diarrhea	24	15.8
Other disease	20	5.3
Total	150	100%

****Source: Field Survey, 2023**

3.9 Number of days prevented from working due to water-related diseases among respondents

The remaining 8% receive their medication from herbalists within the town (Table 9).
Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks, a condition that may reduce the productivity of the workforce in both rural and urban areas. This is particularly the case in healthcare facilities where both patients and staff are placed at additional risk of infection and disease when water, sanitation and hygiene services are lacking (WHO and UNICEF, 2017; UN-Water, 2021).

Table 9: Number of days prevented from working due to water-related diseases among respondents

No. of days	Number of respondents	Percentage of respondents
None	56	47.3
Few days	44	21.1
Weeks	50	31.6
Months	0	0
Years	0	0
Total	150	100%

Source: Field Survey, 2023

3.10 Disease treatment centre for the respondent

It is very surprising to note that despite the four wells and three boreholes sunk by the government for the villagers, 12% of the respondents still believe that the government has yet to do anything to aid them with their various water supply problems. Out of the remaining 88% that believed the government had done something, 79.9% of them regarded whatever the government might have done a failure (Table 10). This is understood when one considers the fact that three boreholes sunk in the area, for most dry periods when the villagers need them most do not yield a significant volume of water while the wells are vastly being sealed up due to the presence of debris and other loose materials that have accumulated in them over the years. The nation's water sources are under serious threat from widespread pollution, including the indiscriminate disposal of refuse including hazardous substances, epileptic power supply as well as inadequate or unavailability of health facilities (Garba *et al.*, 2012).

3.11 Suggestions to the Government for Improvement in Water Supply

When the respondents were asked about the steps being taken by the community as a whole in solving the various water problems confronting the people, 73% of the respondents regarded all efforts taken so far as private ones through well sinking within individual compounds.

Table 10: Disease treatment centre for the respondent

Centre	Number of respondents	Percentage of respondents
Hospital within town	0	0
Herbalist within town	25	7.8
Hospital outside town	67	44.4%
Herbalist outside town	58	47.4%
Total	150	100%

****Source: Field Survey, 2023**

On what the respondents think the government can do to solve the water problem in the area; 46% want provision of the pipe-borne water supply, 30% want more wells, and productive boreholes to be sunk; 6% want more wells, 11 % preferred repair works to be carried out on the unproductive boreholes while 8 and 30% want tanker water supply from Ilorin and Osogbo and water tank construction, respectively (Table 11). In Nigeria, water supply development is a three-tier responsibility between the Federal, State and Local Governments. Thus water supply is often a key campaign issue for politicians. The extent of water supply in Nigeria is appreciable even though statistics are unreliable due to the non-sustainability of previous interventions (Garba *et al*., 2012). The responsibility for sanitation is not always clear but appears to fall into the purview of state governments. The Federal Ministry of Water Resources, which had been part of the Ministry of Agriculture for a period until 2010, is responsible for large water resources development projects and water allocation between states. Responsibility for potable water supply is entrusted to State Water Agencies or state water departments in the 36 Nigerian states. The State Water Agencies are responsible to their state governments, generally through a State Ministry of Water Resources. State Water Agencies are responsible for urban water supply, and in some states also for rural water supply. As of 2000, 22 states had separate state rural water and sanitation agencies, mostly set up to implement a UNICEF program (WHO and UNICEF, 2017; Garba *et al*., 2012).

Table 11: Suggestions to the Government for Improvement in Water Supply

Suggestions	Number of	Percentage of respondents
Sinking of more wells	19	06
Sinking of more boreholes	31	26.9
Repairing of boreholes	21	10.5
Provision of pipe borne water	45	46.3
Provision of tanker water	20	7.5
Construction of water tank	17	03
Total	150	100%

**** Source: Field Survey, 2023**

4.0 Conclusion

This study investigated the challenges associated with water sources and supply in Offa Local Government Area, Kwara State, Nigeria. The findings revealed that residents face difficulties due to [summarize key problems identified, e.g., unreliable supply from boreholes, well water contamination, limited access due to distance]. These problems contribute to water insecurity and pose health risks to the community. The data analysis identified [mention key factors contributing to the problems, e.g., fluctuating water levels, inadequate infrastructure, limited treatment facilities]. Based on these findings, it is recommended that [suggest solutions based on your research, e.g., implementing rainwater harvesting systems, improving well maintenance, investing in water treatment plants]. Additionally, promoting water conservation practices and community education on hygiene can further enhance water security in Offa LGA.

This research provides valuable insights for policymakers and stakeholders to develop sustainable water management strategies for the region. By addressing the identified challenges and implementing the recommended solutions, Offa LGA can move towards ensuring a reliable and safe water supply for its residents.

Based on the above, findings and conclusions, we recommend some immediate ameliorative measures as follows

(i) Sourcing for other sources of water that is not contaminated(ii) Investment in borehole rehabilitation and maintenance

(iii) Upgrading of the distribution network for portable water

(iv) Environmental education on the consequences of water contamination

4.0 References

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Compliance with Ethical Standards

Declarations

The authors declare that they have no conflict of interest.

Data availability

All data used in this study will be readily available to the public.

Consent for publication

Not Applicable

Availability of data and materials

The publisher has the right to make the data public.

Competing interests

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Authors' Contributions

Both authors participated equally in all sections