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Posted Date: 30 September 2024

doi: 10.20944/preprints202404.1435.v3

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Assessment of Water Supply and Water Quality in the Rural Area of Obokun Local Government, Osun State, Nigeria

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Abstract: Rural areas are not only faced with the problems of rural depopulation but also with the problem of water supply and water quality which is a basic necessity of life. In light of this, this paper assesses the rural water supply situation and the bacteriological quality of different water sources in the Obokun Local Government Area of Osun State, Nigeria. The safety of the water sources for human consumption and possible occurrence of the water borne diseases in the study area were determined. The study employed descriptive and analytical methods of data analysis to achieve the objectives of the inquiry. Findings showed that the study area suffered from inadequate water supply and poor locations of the sources of water: The study also revealed that the microbiological quality of the water sources used was unsafe, poor and not acceptable for human consumption. In addition, many man- days-hours were wasted in search of water. It is therefore recommended that the government should make the rural water supply and the maintenance of water quality a priority in its policy formulation.

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1. Introduction

Apart from air, water is the next most important natural resource for the survival of both plants and animals. Man requires water for different uses such as drinking, cooking, general sanitation, and agricultural and manufacturing processes among others. Water is essential for day-to-day human activities and has a decisive influence on the population of any region (Adedotun et al, 2024). Ibrahim et al (2018) also mentioned in their study the importance of portable water in the right quality and quantity for the survival and continued well-being of human and animal lives. Water is also considered to be vital to life sustainability and plays a critical role in the socio-economic development of human beings and the existence of ecosystems (Akinde et al, 2019). It is universally expected that an adequate water supply is required for personal hygiene, public health and the general well-being of an environment.

Water is one of the most essential needs of man. It is a natural resource that is critically needed to human survival. It is not an over statement to say that life would be impossible without water. No wonder, the global slogan of "Water is life". In spite of such importance of water to life, access to clean and safe drinking water is very rare. Water supply and quality have been a major challenge since the beginning of modern society. The primary goal of water supply is the provision of portable water on a constant basis which addresses the security of supply across seasons and between wet and dry seasons and is also imperative of health and wider poverty mitigation benefits to be met and sustained [Paschaline et al 2022, Nwankwoala, 2011; Obeta, 2017].

In spite of the importance of water to the world economy, there has been a water supply crisis. Water supply has been a major problem in the developing world. Despite the fact that about 70% of the earth's surface is water, water has become a scarce commodity in many parts of the world. Boreitti and Rosa (2019) noted that clean water scarcity is a major issue in today's world of 7.7 billion people. Akinde et al (2019) in their study of water shortage and drinking quality in rural southwest Nigeria observed inadequate water supply systems and impaired drinking water quality in the rural area of southwest, Nigeria. Obeta (2019) noted that in most rural areas of developing countries including Nigeria, water supplies are not commensurate with demand which results in a shortfall in water use which many people suffer from the scenario. In their study (Obeta et al 2015) identified the physical environment, inadequate water supply infrastructure, socioeconomic and geographical location, management and socio-cultural problems as factors responsible for water supply in their study region of Nigeria. Ishaku et al (2011) observed that over 70% of households in rural communities do not have access to improved water supply. They maintained that these people rely solely on self-water supplies such as rivers, perennial streams, water ponds and unprotected wells. Domínguez et al (2019) also noted that rural water supply systems in developing countries typically have deficiencies that threaten their sustainability. Olawale et al, 2020 reported that the provision of a sustainable water supply system in rural areas in developing countries has been a challenge for several years, which has resulted in the dependency of rural dwellers on polluted water from various sources. He (Olawale, 2020) also observed that the sustainability of rural water supply is an acute problem due to widespread water infrastructural decay and frequent system breakdowns which inadvertently lead to scarcity of safe water in the Sub-Saharan African region.

The world water supply is becoming relatively static in supply and deteriorating in quality as a result of pollution. In view of the importance of water and the acute short supply of potable water to rural areas, successive governments in Nigeria have been making tremendous efforts aimed at improving the water supply situation in the nation. Among these are

(i) The Water Resources Decree No. 101 of 1983
(ii) The National Borehole Programme of 1991.
(iii) The Osun state government mini water scheme project of 2004

It is a known fact that most Nigerians live in rural areas and these people do not have access to safe and reliable sources of water (Akinyoyenu 1990). Many developing regions suffer from either chronic shortages of freshwater or the pollution of readily accessible water resources (Lehloesa and Muyima, 2000). About 800 million people in Asia and Africa are living without access to safe drinking water. Consequently, this has caused many people to suffer from various diseases (Tanwir et al., 2003). The quality of drinking water is of vital concern to mankind since it is directly associated with human life. In spite of the problem of inadequate water supply and poor water quality in rural areas, few data exist on the bacterial quality of water supply in these settings, since most studies approach the problem by focusing on urban communities (Nevondo and Cloete, 1999). This study uses indicators of pollution (heterotrophic bacterial count, total coliform and fecal coliform) to determine the microbial quality of water sources of rural areas in the Obokun Local Government, Osun State and to compare these results with the Nigerian Standard for Drinking Water Quality (NIS 554:2007). This paper aims to address problems associated with inadequate water supply and low water quality in the study area.

2. Study Area

Obokun Local Government Area (LGA) is one of the 30 Local Government Areas in Osun State Nigeria (Figures 1 and 2). It is one of the LGAs in Osun State with a dominant rural settlement characterised by rural activities including farming, hunting, and fishing among others. It is located in South-Western Nigeria. It lies between Latitude 7°47' and 7°4' north of the Equator and between Longitude 4°46' and 4°48' east of the Greenwich Meridian, with a total land area of 527km^2. The LGA is dominantly occupied by the Ijesha land while the Headquarter is in Ibokun town, while other notable towns within the LGA include Ipetu-Ile, Otan Ile, Imesi-Ile, Ada-Owode, Esa-Oke, Ilase-Ijesha, Iponda, Ikiyinwa, Idominasi, Esa-Odo and Ora. The climate is a humid tropical type with a temperature of about 29^{o}C, while the mean annual rainfall is about 1700cm. The LGA is about 401m above sea level. The LGA is about 25km south-east of Osogbo LGA, 31km to Olorunda LGA, 23km south-west of Ifelodun LGA 21km north-east of Atakumosa West LGA and 20km north of Boluwaduro LGA.

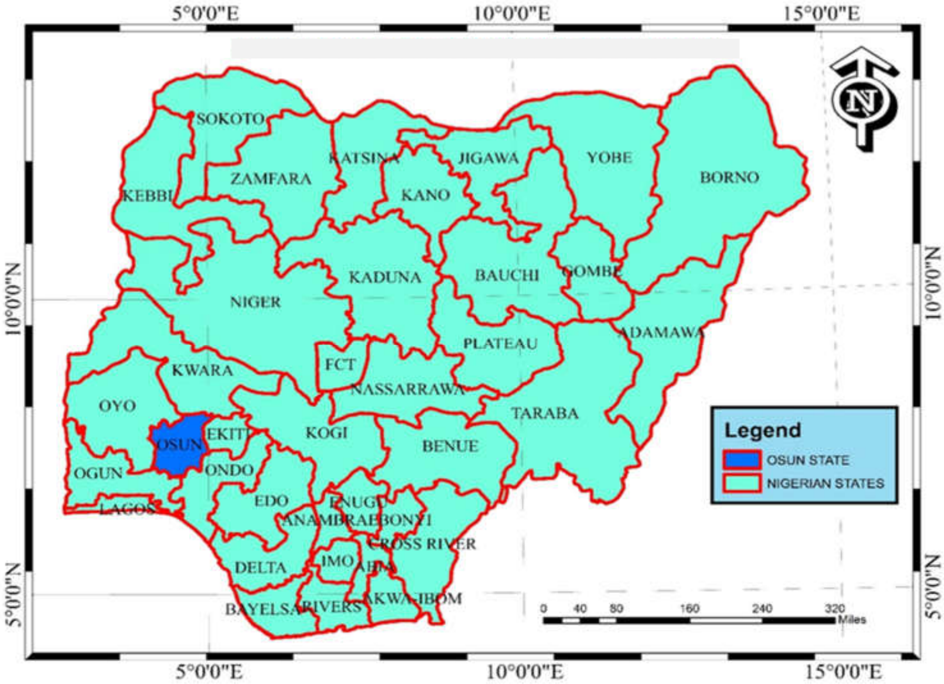

Figure 1. Osun State within the Context of Nigeria. Source: URP GIS Laboratory, UNIOSUN, 2023.

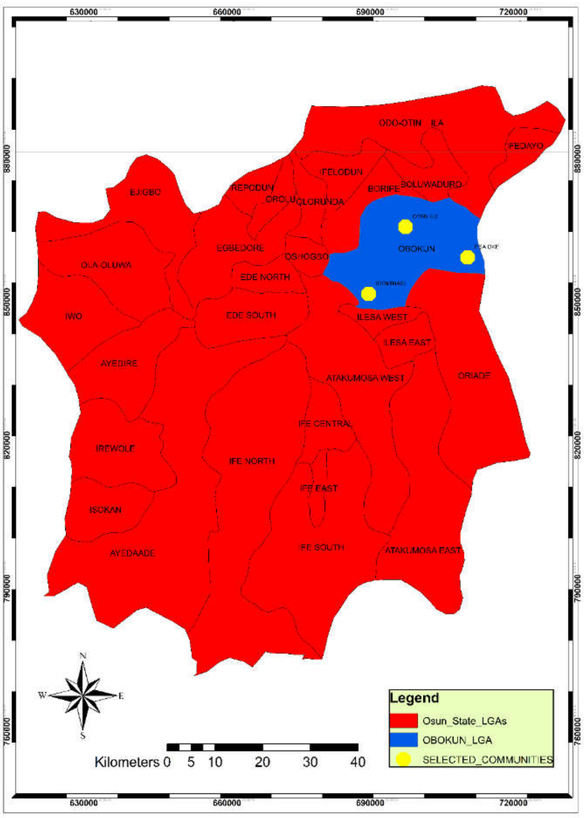

Figure 2. Esa-Oke, Otan -Ile and Idominasi in Obokun LGA within the context of Osun State. Source: URP GIS Laboratory, UNIOSUN, 2023.

3. Methods

The methodology employed in this research work is essentially descriptive and analytical in nature and, therefore, depends on fieldwork that is complemented by laboratory analysis.

3.1. Types and Sources of Data

The main source of data for this work is from the primary source. This includes information gathered from the inhabitants of the study area through the administration of questionnaires. The questionnaire sought information on the socio-economic characteristics of respondents, their source of water, the time spent in search of water, the quality and quantity of water supplied, and the water-related diseases that are commonplace in the study area.

3.2. Sampling Technique and Sample Size

Obokun Local Government Area has been taken as the study area with a population of about 116,850 (Nwaerema, 2019). Due to the widespread population as well as the wide area coverage of the Obokun Local Government Area, three communities were randomly selected for investigation. They are Esa-Oke, Otan -Ile and Idominasi. Random sampling was used in selecting streets and houses to be sampled in each of the villages. Three hundred and sixteen (316) household units were sampled in the three communities selected, while data collected were presented descriptively using tables and percentages. The water samples were collected from streams, ponds, hand-dug wells and rainwater harvester used by residents in the study area. This was done monthly over a period of three months (April to June, 2022). Water samples were collected aseptically into sterile containers and transported in ice to the laboratory for microbiological analyses within 4 to 6 hours after collection.

3.3. Distribution of Questionnaires in the Study Area

For this study, Table 1 shows the distribution of questionnaires across the villages studied. The distribution was based on the population and areal extents of the communities.

Table 1. Distribution of questionnaires in the study area.

Community	**No of respondents**	**Percentage %**
Esa Oke	156	49.33
Otan Ile	100	31.65
Idominasi	60	18.98
Total	**316**	**100**

Source: Authors' fieldwork,2022.

4. Results and Findings

This section discusses the socio-economic characteristics of the respondents in the study area, their sources of water, and the quality and quantity of water supplied.

4.1. Socio-Economic Characteristics of the Respondents

The socio-economic characteristics of the people considered here include gender, age, marital status, occupation and monthly income (Tables 2, 3 and 4). The data shows that 55% of the respondents are women, compared to 45% men. This gender disparity suggests that the responsibility for water collection largely falls on women in the community. In many rural societies, women often bear the primary responsibility for household chores, including sourcing water for domestic use.

Women's greater involvement in water collection may point to gender-based labor divisions, reflecting a traditional role where women are seen as caretakers of the family's water needs. This

 doi:10.20944/preprints202404.1435.v3

could limit women's time for other economic activities, further reinforcing cycles of poverty. Additionally, this gendered burden could increase women's vulnerability to health and social risks as they travel long distances to collect water, especially in areas with inadequate or unsafe water sources. Programs aimed at improving water access should therefore be gender-sensitive and consider the need to reduce this burden on women.

All age groups are reported to participate in water collection. This indicates that the search for water is a critical activity involving everyone, irrespective of age. Older individuals, adults, and even younger people are involved in ensuring the household has adequate water. The involvement of all age groups in water collection may reflect the severity of the water scarcity problem in the area. When older adults and younger individuals are required to collect water, it suggests that access to water is neither convenient nor sufficient. This could have further implications on health, education, and economic productivity. Younger people, for instance, may be missing out on school, while older individuals may be physically strained by the demands of water collection. These factors demonstrate the multifaceted impact of water scarcity on all aspects of daily life, from health to education and overall well-being.

The majority of respondents are married (52.5%), followed by singles (27.2%), with the rest either widowed or divorced. The high proportion of married individuals might reflect the dominant family structure in rural settings, where households often consist of multiple members with shared domestic responsibilities, including water collection. Married individuals, particularly in rural areas, are more likely to have larger households, increasing the demand for water for domestic use. Larger families may face more significant challenges in terms of water consumption and storage, as more people require a greater amount of water daily. This increases the stress on already limited water resources. Additionally, widowed or divorced individuals, especially women, may face unique challenges in water access if they do not have a reliable social or family support network, as they may need to collect water alone.

A significant proportion of the population (58.2%) earns less than ₦30,000 per month as shown in Table 2, which is below Nigeria's minimum wage. This finding indicates that most respondents fall within the low-income bracket, and this may have a direct impact on their ability to access safe and reliable water sources. Low-income earners may lack the financial resources to invest in improved water infrastructure or purchase water from safer but more expensive sources. The relationship between income and water access is often critical in rural areas, where public water infrastructure may be lacking or inadequate. Lower-income households may resort to using unsafe water sources, such as streams, rivers, or unprotected wells, increasing the risk of waterborne diseases. This highlights the socio-economic constraints that limit people's ability to secure clean water, which is essential for maintaining health and preventing disease. Policymakers should focus on subsidizing water access for low-income earners and improving affordable access to clean water in rural communities.

The data shows that 56% of the respondents are farmers as presented in Table 3, while others may be engaged in small-scale or informal economic activities. Agriculture is typically a low-income occupation in rural areas, especially in subsistence farming, where the market for surplus produce is limited. Farming communities often face economic challenges due to unpredictable weather conditions, limited access to modern farming equipment, and market constraints. The reliance on agriculture as the primary source of income for most of the population means that water access is not just a household issue but also an agricultural one. Farmers may require water for their crops and livestock, in addition to household consumption. However, limited income means they may not be able to invest in irrigation systems or other water-saving technologies, compounding the difficulties of water scarcity in the region. Improving the water infrastructure in such communities could have a dual benefit—enhancing both household consumption and agricultural productivity.

A large portion of respondents (41%) have no formal education as indicated in Table 4, while only 18% have attained post-secondary education. This indicates a generally low level of formal education in the area, which could affect the community's awareness of safe water practices and the health implications of using contaminated water. Education plays a crucial role in water management

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and sanitation practices. Households with lower levels of education may be less informed about the importance of boiling or treating water to make it safe for consumption, thereby increasing the risk of waterborne diseases. Moreover, education often correlates with income levels; lower education can limit employment opportunities, perpetuating poverty and reducing access to quality water sources. On the other hand, the minority of respondents with post-secondary education may be better equipped to understand and advocate for improved water policies or technologies, although their small proportion limits the impact they can have on the broader community. This points to the need for targeted education programs and awareness campaigns on safe water use and sanitation, particularly in areas where educational attainment is low.

These socio-economic characteristics collectively indicate that water access and quality in the study area are deeply influenced by gender roles, income levels, educational attainment, and occupation. Low incomes, limited education, and the predominance of farming create a setting where water scarcity is more than just a logistical issue—it is a socio-economic challenge intertwined with other aspects of life, such as health, education, and economic productivity. The study highlights the multi-dimensional nature of water scarcity and suggests that any solution must consider these socio-economic variables. Improving water access in the study area requires a holistic approach, including investments in education, income-generating activities, and gender equality programs, alongside infrastructure development. Addressing these socio-economic disparities could alleviate the burden of water collection, improve water quality, and enhance overall well-being.

Summarily, each of these variables significantly impacts water access and quality in the area, suggesting that the socio-economic conditions of rural communities play a critical role in determining their water security. Policy interventions should aim at addressing these interconnected factors to ensure sustainable water access.

Furthermore, the study shows that most of the respondents (56%) are farmers who may equally account for their low incomes per month. About forty one percent (41%) of the respondents have no formal education. Only eighteen percent (18%) claimed to have a post-secondary school education. All these affect the quality of water supplied in the study area and also show the attributes of a typical rural area.

Table 2. Age and gender structure of the respondents.

	Age groups				
Gender	<30yrs	30-39	40-49	50 above	Total
Male	42	30	45	25	142
Female	48	20	45	61	174
Total	90	50	90	86	316

Source: - Author's fieldwork, 2022.

Table 3. Marital status and monthly income of respondents.

Marital Status	**INCOME**				**Total**
	< N30,000	**N30,000 - 60,000**	**N60,001 - 90,000**	**> N90,000**	
Single	42	21	15	08	86
Married	29	59	37	41	166
Divorced	01	06	04	05	16
Widowed	14	12	08	14	48

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Total	86	98	64	68	316

Source: - Author's fieldwork, 2022.

Table 4. Education and occupation of the respondents.

Occupation	Education				Total
	No formal Education	Primary Education	Secondary Education	Post sec. Education	
Farming	98	48	30	02	178
Trading	21	10	09	30	70
Civil Servant	0	02	18	26	46
Artisan	11	08	03	0	22
Total	130	68	- 60	58	316

Source: - Author's fieldwork, 2022.

Table 6 shows that 44% of the respondents traveled less than one kilometer to fetch water, while 49% traveled between one and two kilometers. This indicates that the majority of the population has to walk some distance to access water, with only a minority potentially having access within their immediate vicinity. While some respondents are relatively close to water sources, the fact that nearly half have to walk between one and two kilometers suggests that water is not readily available. The distance people travel for water collection can have significant social and economic consequences. Time spent walking to fetch water could be used more productively in economic activities, education, or domestic chores. The longer distances also put physical strain on individuals, particularly women and children, who often bear the burden of water collection. In areas where people walk farther for water, there may be an increased risk of gender-based violence, exhaustion, or health issues related to carrying heavy water containers over long distances.

According to Table 7, 66.4% of respondents reported that they do not have an adequate water supply. This aligns with the finding that many water sources, such as wells and streams, dry up during the dry season. Furthermore, 71% of respondents believe that the water quality is not fit for human consumption. The inadequacy of water supply, especially during the dry season, underscores the vulnerability of the community's water infrastructure. Seasonal changes dramatically impact the availability of water, and the reliance on natural sources like streams and wells makes the community highly susceptible to water shortages. Inadequate water supply has numerous consequences, from limiting household hygiene practices to hindering agricultural productivity. The fact that most people believe their water is not safe for consumption suggests high levels of contamination, which can lead to waterborne diseases. Addressing this issue requires improvements in water infrastructure, such as drilling boreholes, rainwater harvesting, or developing community-managed water systems. Safe and adequate water supply is a fundamental need, and its absence poses severe risks to public health and socio-economic development.

The study reveals that 28% of respondents have suffered from cholera, a severe waterborne disease typically caused by drinking contaminated water as indicated in Table 8. Additionally, 29% reported suffering from malaria, which can be linked to the presence of stagnant water that serves as a breeding ground for mosquitoes. Another 20% suffered from other unspecified water-related diseases. Waterborne diseases, especially cholera, indicate the prevalence of contaminated water sources in the community. The fact that a significant proportion of the population has been affected by such diseases highlights the urgent need for intervention to improve water quality. This could involve providing better sanitation facilities, regular water treatment, and public health education to reduce the risk of contamination. The high incidence of malaria also points to environmental factors

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related to water, such as stagnant water bodies around homes, which are ideal breeding sites for mosquitoes. Comprehensive water management programs that also tackle vector control (e.g., mosquito reduction) are needed to mitigate these health risks. The impact of waterborne diseases on the community is severe, not only in terms of health but also in terms of lost productivity and increased healthcare costs.

The data shows (Table 9) that 57% of respondents spend between one and two hours per day searching for water, while 19% spend less than thirty minutes. The remaining respondents spend varying amounts of time in between. This indicates that a significant portion of the population dedicates substantial time each day solely to water collection. The time spent searching for water has direct implications for productivity. Spending one to two hours daily in search of water reduces the time available for income-generating activities, education, childcare, or rest. The opportunity cost of time spent collecting water is particularly high for women, who are often the primary water collectors in rural settings. Reduced productivity not only affects household income but also stifles economic development at the community level. Long search times for water reflect inefficiencies in water distribution and access, suggesting the need for localized, sustainable water solutions. These could include constructing new wells, rehabilitating existing ones, or introducing community-managed water kiosks that reduce the travel time for water collection. Addressing this issue would significantly improve the quality of life for community members by freeing up time for more productive activities.

The prevalence of waterborne diseases like cholera and malaria highlights the immediate health risks associated with unsafe water. Poor water quality and inadequate supply are direct threats to public health, leading to increased medical costs, reduced life expectancy, and higher infant mortality rates. Disease outbreaks, such as cholera, can overwhelm healthcare systems, particularly in rural areas with limited access to medical facilities. Ensuring that water sources are protected from contamination and treated appropriately is essential to improving the health outcomes of the population.

The significant time spent searching for water underscores the inefficiency of the current water access system in the community. This inefficiency directly affects economic productivity, education, and overall well-being. If access to water could be improved, it would allow community members to redirect their time toward more economically beneficial or personally enriching activities. For example, children would have more time to attend school, and adults could spend more time on income-generating work or agriculture.

The drying up of wells and streams during the dry season highlights the vulnerability of the community's water supply to seasonal changes. A sustainable water management system needs to be put in place to ensure a year-round supply of water. This could involve developing more reliable water infrastructure, such as boreholes that tap into deeper aquifers, or introducing water conservation measures like rainwater harvesting systems. Additionally, community-based water governance systems that involve local stakeholders in the maintenance and management of water resources could enhance the sustainability of these solutions.

Table 5. Sources of water supply in the study area.

Sources of water	COMMUNITIES			Total
	Esa Oke	Otan-Ile	Idominasi	
Well	82	78	38	198
Rain	26	04	04	34
Stream	40	10	18	68
Borehole	08	08	-	16
Tap water	-		-	-

Total	**156**	**100**	**60**	**316**

Source: -Author's fieldwork, 2022.

Table 6. Distance of source of water from residences.

Distance(kms)	COMMUNITIES			'Total
	Esa Oke	Otan-Ile	Idominasi	
<1km	56	56	26	138
1-2km	92	38	24	154-2
2 km and above	08	06	10	24
Total	**156**	**100**	**60**	**316**

Source: Author's fieldwork, 2022.

Table 7. Respondents assessment of water quality and quantity.

Quality	QUANTITY		Total
	Inadequate	Adequate	
Very good	20	18	38
Good	30	24	54
Fair	95	46	141
Bad	65	18	83
Total	**210**	**106**	**316**

Source: Author's fieldwork. 2022.

Table 8. Water related diseases suffered in the study area.

Disease	COMMUNITIES			Total	%
	Esa Oke	Otan-Ile	Idominasi		
Cholera	50	26	12	88	28
Typhoid	08	4	-	12	4
Dysentery	20	2	8	30	9
Diarrhea	14	10	06	30	9
Malaria	36	40	16	92	29
Others	28	18	18	64	20
Total	156	100	60	316	100

Source: Author's fieldwork, 2022.

Table 9. Hours spent in search of water per day.

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Hour	COMMUNITIES			Total
	Esa Oke	Otan-Ile	Idominasi	
30 mins	20	15	25	60
30-60 mins	36	25	15	76
60-90 mins	60	35	15	110
90-12 mins	40	25	05	70
Total	**156**	**100**	**60**	**316**

Source: Author's fieldwork, 2022.

4.2. Microbiological Analyses of Water in the Study Area

The bacterial counts in various water sources provide valuable insights into the water quality and potential contamination risks associated with each source. Below is an analysis of the results for heterotrophic bacteria, total coliforms, and fecal coliforms, along with inferred implications for water safety and public health. The heterotrophic bacterial count was determined using the spread plate method on nutrient agar and the plates were incubated aerobically at 37^0C for 48 hours. The total coliforms and fecal coliforms were enumerated on MacConkey agar using the spread plate method and aerobically incubated at 37^0C and 44.5^0C respectively for 24 hours. Selected colonies were purified using the streaking method. Pure colonies were characterized and identified using morphological and biochemical methods as described by Buccanhan Gibbon, 1974.

Table 10 shows the mean population of heterotrophic bacteria, the total coliform count and the fecal coliform count. The heterotrophic bacterial count ranged between 3.4 x 10^3 to 1.8 x 10^5 for stream water, this broad range suggests a variable degree of organic matter and nutrient availability in stream water, which can support a diverse microbial community. The higher end of the count indicates potential pollution, possibly from agricultural runoff, wastewater discharge, or other anthropogenic activities.

$7.7 \times 10^4 to\ 3.5 \times 10^5$for pond water, the pond water exhibits the highest levels of heterotrophic bacteria, indicating an enriched environment likely due to stagnant water conditions that promote bacterial growth. Factors such as organic debris accumulation or nutrient runoff from surrounding land can contribute to these elevated counts.

$1.0 \times 10^2 to\ 6.7 \times 10^2$for well water, the considerably lower counts suggest that well water is relatively cleaner, likely due to the filtration processes that occur naturally through soil and rock layers. However, even these low levels indicate potential contamination, especially if the upper range is approached. While $1.9 \times 10^1 to\ 2.8 \times 10^2$for rain water, rainwater is expected to be the cleanest, and the low counts reflect minimal bacterial presence. Nonetheless, post-collection contamination from storage containers or exposure to atmospheric pollutants could contribute to detectable levels. The total coliform count ranged between $2.9 \times 10^2 to\ 3.4 \times 10^3$for stream water,3.5× $10^2 to$ 3.7x10^3 for pond water, 1.7 x 10^1 to 2.6 x 10^2 for well water and 1.2× $10^1 to 2.2x$ 10^2 for rain water. Similarly, faecal coliform count ranged from $2.0 \times 10^1 to\ 2.7 \times 10^2$for stream water, 3.2 x 10^1 to 3.5 x 10^2 for pond water, $0.9 \times 10^1 to\ 2.1 \times 10^2 for\ well$ water and $0.7 \times 10^1 to 1.9 \times 10^1$ for rain water.

Higher counts of heterotrophic bacteria in stream and pond waters indicate potential pollution and risk to public health. Regular monitoring is essential, particularly for recreational and agricultural use of these water sources. The relatively lower counts in well and rainwater suggest they could be safer alternatives, although testing for specific pathogens should be performed. The high total coliform counts indicate significant contamination, possibly from fecal sources. The potential presence of pathogens raises concerns regarding water safety for human consumption and recreational activities. Similar to stream water, the elevated counts suggest a substantial level of

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organic pollution, likely exacerbated by stagnant water conditions that foster microbial growth. While lower than surface waters, these counts may indicate contamination from nearby sources or improper well construction, underscoring the need for regular testing. The low presence of total coliforms indicates relatively clean conditions, but post-collection contamination remains a concern.

Thus, The presence of total coliforms, particularly in stream and pond waters, signals significant water quality issues. It underscores the importance of treating surface water before use, as these bacteria can indicate the potential presence of harmful pathogens.

Fecal coliforms are a specific subset of total coliforms and are used to indicate fecal contamination The elevated fecal coliform counts reinforce the conclusion that stream water is likely contaminated by fecal matter, presenting a risk for waterborne diseases. Similar concerns apply here as with stream water, indicating a significant risk of contamination from wildlife or human sources. The presence of fecal coliforms in well water, albeit at lower counts, raises concern about potential sources of contamination from surface runoff or septic systems. The very low levels indicate rainwater is relatively safe but still suggests monitoring, particularly concerning contamination from collection practices. The high levels of fecal coliforms in stream and pond waters are indicative of serious contamination issues, which could pose health risks, particularly to vulnerable populations. Well and rainwater, while comparatively lower, still require regular testing to ensure safety, especially for drinking and agricultural use.

Summarily, the results from the bacterial counts across different water sources indicate varying degrees of contamination, with stream and pond waters showing the highest risks. This data underscores the importance of continuous monitoring and management of water quality to protect public health. Water treatment, better waste management practices, and educating the public about safe water usage are essential to mitigate contamination risks.

Table 10. The mean population of heterotrophic bacteria, total coliform and faecal coliform counts.

Samples		Population of Bacteria		
		Heterotrophic Bacterial Count	Total Coliform Count	Faecal Coliform Count
Stream	S1	$1.5x10^4$	$2.3x10^3$	$1.5x10^2$
	S2	$3.4x10^3$	$3.4x10^3$	$2.0x10^1$
	S3	$1.8x10^5$	$2.9x10^2$	$2.7x10^2$
Pond	P1	$7.7x10^4$	$3.5x10^2$	$3.2x10^1$
	P2	$1.4x10^5$	$3.7x10^3$	$1.7x10^2$
	P3	$3.5x10^5$	$2.8x10^3$	$3.5x10^2$
Well	W1	$1.3x10^2$	$2.6x10^2$	$2.1x10^2$
	W2	$1.0x10^2$	$1.7x10^1$	$0.9x10^1$
	W3	$6.7x10^2$	$2.3x10^1$	$1.7x10^1$
Rain	R1	$2.8x10^2$	$2.2x10^2$	$1.9x10^1$
	R2	$1.9x10^1$	$1.2x10^1$	$0.7x10^1$
	R3	$1.1x10^2$	$1.9x10^1$	$1.2x10^1$

Key. S1: Stream water from Esa-Oke; S2: Stream water from Otan-lle; S3: Stream water from Idominasi; P1: Pond water from Esa-Oke; P2: Pond water from Otan-Ile; P3: Pond water from Idominasi; W1: Well water from Esa-Oke; W2: Well water from Otan-lle; W3: Well water from Idominasi; R1: Rainwater from Esa-Oke; R2: Rainwater from Otan-Ile; R3: Rainwater from Idominasi.

A total of six bacterial species: Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa, Salmonella sp, Enterobacter aerogenes and Shigella sp were isolated. Their distribution among the various sources is shown in Table 11. Escherichia coli was found in all the stream water samples, some pond water samples and only one well water sample, Shigella species was found in all the pond water samples and in some stream water samples while Salmonella sp, Enterobactia aerogenes and Shigella sp were not isolated from the well water and rainwater samples.

Table 11. Pathogenic bacteria isolated from water sources in the Obokun Local Government Arca of Osun State, Nigeria.

Bacteria isolates	Water samples											
	S1	S2	S3	P1	P2	P3	W1	W2	W3	R1	R2	R3
Escherichia coli	+	+	+	-	+	+	-	-	+	-	-	-
Bacillus subtilis	+	-	-	+	-	-	-	+	-	-	+	+
Pseudomonas aeruginosa	-	-	+	-	+	-	-	-	+	+	-	-
Salmonella sp	-	+	+	-	+	+	-	-	-	-	-	-
Enterobacter aerogenes	+	-	+	-	-	-	-	-	-	-	-	-
Shigelia sp	+	+	-	+	+	+	-	-	-	-	-	-

Key. S1: Stream water from Esa-Oke; S2: Stream water from Otan-Ile; S3: Stream water from Idominasi; P1: Pond water from Esa-Oke; P2: Pond water from Otan-Ile; P3: Pond water from Idominasi; W1: Well water from Esa-Oke; W2: Well water from Otan-lle; W3: Well water from Idominasi; R1:Rain water from Esa-Oke; R2: Rain water from Otan-Ile; R3: Rain water from Idominasi + Positive - Negative.

The counts obtained for the heterotrophic bacteria, the total coliform as well as the fecal coliform exceeded the maximum permitted levels for no risk according to Nigerian Standard for Drinking Water (NIS 554: 2007). The maximum permitted level of 10cfu/ml is allowed for total coliform count while the maximum allowable limit for fecal coliform is 0 cfu/100ml. The high number of indicators detected revealed that the microbiological quality of the water sources used was unsafe, poor and not acceptable for human consumption (Obi et al, 2002). The presence of potential pathogenic enteric bacteria such as E. coli, Pseudomonas aeruginosa, Salmonella *sp.* and Shigella *sp*. portends serious health dangers as these enteric bacteria are reportedly causative agents of various diseases and their complications. the hemolytic uraemic syndrome caused by E. coli and dysentery caused mainly by water from the different water sources by rural residents in the Obokun Local Government area of Osun State in Nigeria must not be underestimated.

Human and animal feces or the introduction of microorganisms by birds and insects fetching water which are often placed on the ground (Olowe et al., 2005) and the poor study. This study as well as similar studies on the quality of potable water in rural 2001 and Obi et al., 2002) showed the challenges for health and water resources in developing countries.

5. Summary and Conclusion

Water is one of the necessities of life. It is the foundation on which other necessities of life are based. Without a regular supply of fresh water, standards of life tend to decline. Although more than 70% of the earth's surface is water, water has become a scarce commodity in many parts of the world. The threat of world water crises is becoming increasingly real in the face of the increasing demand for this necessity of life because of its deteriorating quality due to pollution. It is against this background that this study concerned itself with the assessment of the quality of water supplied in the rural area of the Obokun Local Government and the implication it has on the rural dwellers.

The major findings in this study showed that a large number of people do not have access to safe and reliable sources of water. The area is characterized by unclean and seasonal water supplies.

Hence, the inhabitants experience hardship in getting potable water, most especially during the dry season. The study also shows that water sources in the study area are mainly well water, streams and rainwater. There was no provision of public tap water in the area as mentioned earlier; water shortage is rampant during the dry season when many of the sources of water dry up. People are obliged to trek long distances in search of water. The study further shows that many respondents in the area suffered from various water-related diseases such as malaria, diarrhoea, dysentery and cholera.

According to these findings, most of the respondents have no formal education which constitutes one of the problems of the people because it affects their perceptions of water quality and general behaviour. The study also showed that the majority of the (N10,000.00). Hence, most of them cannot afford to sink or construct their wells or boreholes.

6. Recommendations

According to the results, it can also be concluded that the microbiological quality of the following recommendations are made: the government should make the rural water attention to the provision and maintenance of water in rural areas. The government and agencies responsible for rural water supply should ensure adequate provision of communal deep wells and boreholes which must be centrally, located for easy accessibility to the users.

Communities should be encouraged and assisted in providing potable water for themselves. People must be trained in the maintenance of boreholes and hand pump machines. Clubs and organisations in the rural area should also be encouraged to embark on the provision of potable water. The government should assist in treating sources of water with water treatment chemicals. Also, alternative sources of water like springs and streams should be protected. Rural dwellers should be educated on water treatment methods. Health educators should, however, supply chemicals to the villagers. Above all, communities should be involved in water project planning, construction, operation and maintenance. Integrated rural development should be embraced. The development of the rural area rests on a combination of the various sectors of the rural economy combined with the backward linkage from urban centers.

Author Contributions: Introduction, Conceptualisation, Methodology S. B.A, D.O.A, and S.K.E.; Software, Validation, and Analysis D.S.O. R.B.I and O.O.; writing—original draft preparation, S.B.A, O.O., D.O.A., and R.B.I.; writing—review and editing, S.K.E, O.O. D.S.O. and S.B.A. All authors have read and agreed to the published version of the manuscript.

Funding: This does not receive external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The corresponding author may provide the data from this study upon request.

Acknowledgments: Not applicable.

Conflicts of Interest: Conflicts of interest are not reported by the authors.

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