STM JOURNALS

Research & Reviews: A Journal of
Microbiology & Virology

ISSN: 2230-9853 (Online)
ISSN: 2349-4360 (Print)
Volume 13, Issue 2, 2023
DOI (Journal): 10.37591/RRJoMV

http://medicaljournals.stmjournals.in/index.php/RRJoMV/index

Research RRJoMV

Evaluation of Parasite Contamination in Residents along Wumba River Water in Federal Capital Territory of Abuja

Andy Anyalewachi Ukah[1], M.A. Abdulkadir[2], Abdulsalam A.[2,*], Yunusa Mako Mohammed[3], Olufemi Segun Shoyemi[4]

Abstract

Access to clean drinking water is essential for maintaining a healthy lifestyle, and water quality plays a critical role in human well-being. This study evaluates the prevalence of parasite contamination among residents living along the Wumba River in the Federal Capital Territory of Abuja. Access to clean and safe drinking water is essential for maintaining a healthy lifestyle, and water quality directly impacts various aspects of human well-being. In this study, water samples were collected from 24 different points along the river Wumba, and a total of 576 samples were examined for physical, chemical, and microbiological indicators over a year and a half. The study also assessed the prevalence of Ascaris lumbricoides, a common parasitic worm, among the population dependent on Wumba River water. The results indicate a relatively low prevalence of Ascaris lumbricoides infection, with 9.18% among males and 10.0% among females. Statistical analysis revealed no significant difference in parasite contamination between males and females. However, the study identified various domestic uses of Wumba River water, with most respondents using it for bathing and washing clothes. The water quality analysis showed that some samples from the river contained parasitic organisms, including Entamoeba histolytica, Giardia lamblia, Ascaris lumbricoides, Entamoeba coli, and hookworm. The highest contamination rate was observed in stream water samples, followed by river water, while borehole and rainwater samples showed lower contamination levels. The study emphasizes the importance of treating water from this source before consumption to reduce the risk of parasitic infections. It also recommends the promotion of borehole water sources as a safer alternative to minimize the health risks associated with contaminated river water. Installing borehole water systems in the study area is suggested as a proactive measure to safeguard public health and reduce waterborne diseases.

***Author for Correspondence**
Abdulsalam A.
E-mail: just2abdul@gmail.com

[1]Senior Lecturer, Department of Environment and Occupational Health Science, School of Public Health, University of Medical Sciences, Ondo City, Ondo State, Nigeria
[2]Lecturer I, Department of Physical and Health Education, University of Maiduguri, Borno State, Nigeria
[3]Senior Lecturer, Department of Physiology, Bayero University, Kano, Kano State, Nigeria
[4]Lecturer I, Department of Human Kinetics and Health Education, National Open University of Nigeria, Abuja, Nigeria

Received Date: July 31, 2023
Accepted Date: August 30, 2023
Published Date: September 10, 2023

Citation: Andy Anyalewachi Ukah, M.A. Abdulkadir, Abdulsalam A., Yunusa Mako Mohammed, Olufemi Segun Shoyemi. Evaluation of Parasite Contamination in Residents Along Wumba River Water in Federal Capital Territory of Abuja. Research & Reviews: A Journal of Microbiology & Virology. 2023; 13(2): 10–20p.

Keywords: Parasite contamination, Wumba River water, Federal Capital Territory, Abuja, Waterborne diseases, and Water pollution

INTRODUCTION

Since ancient times, people have existed and used water [1]. A healthy lifestyle depends on access to clean drinking water [2]. Water is life, and a sufficient supply of it is essential to both life and civilization, according to Intermarch [3]. This is in line with the belief expressed by Etim et al. (2012) that the availability of water of a high enough quality to drink is essential to maintaining human health. Since there is no life without water, we must ensure that every member of every community has access to enough water [4].

The single biggest and most pressing development challenge facing Africa is projected to be the availability of water of adequate quality and quantity. This claim is supported by the observation that nearly every aspect of the human environment and standard of living is influenced by how urban and rural water management is carried out. The health of a community, the ability to generate food, economic activity, ecosystem health, and biodiversity are just a few of the components of ecosystems and human well-being that are impacted by water quality, which is a crucial metric. According to the World Health Organization (WHO), human poverty, wealth, and educational attainment are all influenced by water quality [5]. Humans rely on surface and groundwater resources for their daily needs as well as to produce electricity, grow crops, catch fish, run machines, transport garbage, and improve the environment. According to the World Health Organization (WHO), 2017: "Water from these sources is also used for washing and cleaning, industrial abstraction, recreation, cooking, gardening, as well as spiritual/religious, cultural, social, psychological, and traditional activities."

In the Federal Capital Territory of Abuja, Nigeria, the river Wumba is a significant river with economic, agricultural, religious, cultural, social, psychological, traditional, physiological, and environmental significance. It flows through many District and Area Councils in the Territory. Along with domestic garbage and other activities, the river Wumba receives effluent from nearby companies situated along its course, which adds to its pollution [6]. Direct runoff of industrial wastewater may be the main cause of river contamination.

MATERIALS AND METHODS

Study Area

River Wumba is the major river in the Federal Capital Territory (FCT) Abuja located in the northeastern part of FCT. River Wumba originated from River (its source) River Benue in Nasarawa state to its mouth at River Niger in Niger state which the length was calculated to be 410 km (255 mi). The river cuts across three states which include (Niger, Kogi and Nassarawa state) and the Federal Capital Territory (FCT) Abuja. The river runs through Industrial and research districts which include Maitama, Central business area, Wuse, Wuye, Dayikibiu, Kukwaba, Idu Industrial Area, and Wupa district. River Wumba is a relatively clear river carrying only a little sediment because it lies in the ancient rocks that produce little silt. The river loses part of its potential flow to evaporation during the dry season and the level increases during the rainy season which makes it productive for both fishing and agriculture. Figure 1 depicts a map showing the river Wumba and the study area.

Collection of Water Samples

The temperature, turbidity, and pH of the water were monitored with Secchi discs, mercury-filled thermometers, and SETRA pH 25 pH meters, respectively. 100 ml sample bottles with caps were cleaned, rinsed, and well-corked before being neatly packed in foil paper. The autoclave was used to sterilize the bottles for an hour at 121°C. The bottles were carefully taken out of the autoclave after an hour, put in an orderly, airtight plastic bucket, and then transported to the sample locations for collection. Water samples were simultaneously collected into each of the bottles at each sampling location after the bottles were carefully taken from the bucket one at a time.

The top, middle, and lower entry, middle, and exit sites for collecting water samples were marked on a map at three (3) points in each district. 24 Water Sampling Points (WSPs) were created as a result. Global Positioning System (GPS) data were collected from the 24 WSPs every week, or four times during the wet season, to establish the WSPs. $24 \times 4 \times 6 = 576$ water samples will make up the entire sample for laboratory examination. A total of 24 samples from each week were examined at the "Wupa Wastewater Treatment Plant Laboratory Services, Abuja" for at least 30 different physical, chemical, and microbiological indices [7]. Beginning in October 2020, this study is anticipated to be finished in a year and six months. The following exercises were included in the thorough activities involved in this research: Geographic Information System location of the river Wumba's headwater (source) and mouth (emptying point).

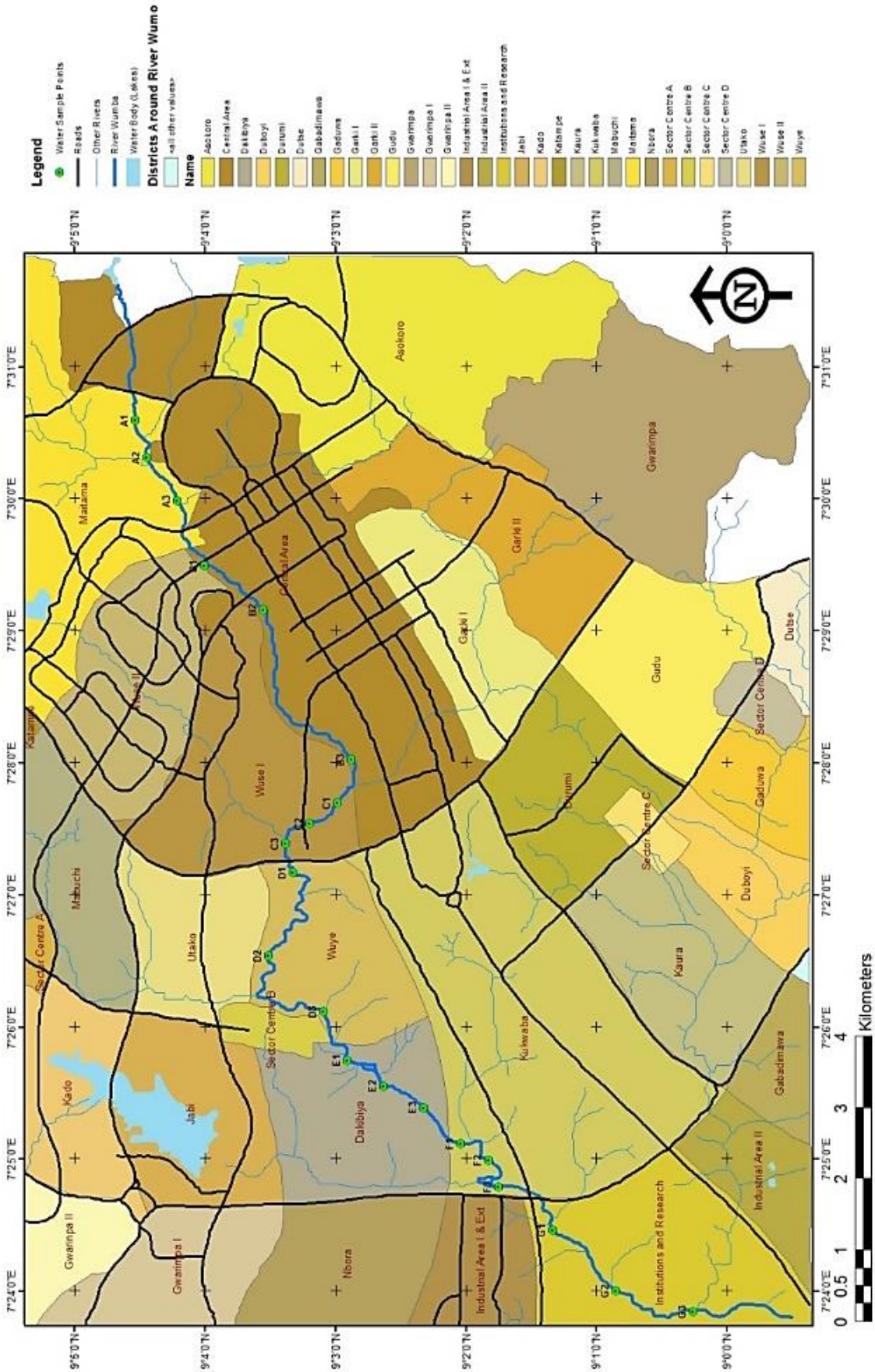

Figure 1. Map showing river Wumba and the study area.

With the use of a pipette, the filtrate was obtained and used to prepare two slides for each sample: one was stained with Lugol's iodine and viewed directly under the microscope [8], while the other was stained with acid-fast stain using Ziehl–Neelsen's carbol fuchsin stain (FERN; certified suitable for staining acid-fast organisms in smears and tissue sections) using the cold carbol fuchsin technique. On grease-free glass slides, a thin layer of the sediment was applied, and after allowing the slides to air dry for a short while, they were stained with carbol fuchsin for 15 minutes before being rinsed under running water. This preserved the parasite on the slide. The slide was treated for 15 seconds with 1% acid alcohol to remove the color before being rinsed with tap water to remove any remaining acid alcohol. The slides were cleaned under tap water, air-dried, and counterstained for 60 seconds with 0.4% methylene blue. The slides were then examined under binocular light microscopes with objectives of 10 and 40. All parasites that were observed under a microscope had their images acquired using a high-resolution digital camera, preserved appropriately, and then correctly recognized using taxonomic keys.

Statistical Analysis

Data were analyzed using simple descriptive statistics of frequency, percentage, and meanwhile inferential statistics of independent t-test using the SPSS version 22.0 software. *P* values less than 0.05 were considered to be statistically significant.

RESULTS

Age is the length of time a person has been alive, measured in years since birth, and is typically accompanied by a particular stage or level of mental or physical development as well as the capacity for legal responsibility. The distribution of respondents' ages is shown in Table 1. According to the results, the majority of respondents (84.7%) in every district are between the ages of 26 and 55, which is considered to be the economically active stage. The remaining respondents, on the other hand, are older than the economically active stage. It is recognized that people are more likely to be active and able to utilize innovation at this time of life. According to Cochran and Williams (2013) [9], respondents' older age made them more aware of their health and inclined to seek medical attention when they became ill. The number of individuals who will likely contract the disease will likely rise as their ages do as well. This can be explained by the fact that getting older is directly associated with becoming more responsible, which causes people to expose themselves more to fulfill home responsibilities. Table 2 illustrates the gender distribution among individuals involved in egg marketing. Age-related declines in immunity could lead to an uptick in illness incidence. Younger individuals may have the defenses to endure disease occurrence and may also have fewer days of disability with higher production.

Sex Distribution of the Respondents by Districts

Sex refers to the two main categories (males or females) into which humans and other living things are divided. The result shows that 88% of the respondents are male while 12% are female. The low participation of women could be attributed to core cultural values which place more household

Table 1. Age distribution of the respondents by district.

Variable	District (percentage distribution)								All districts (%)
Age group (Year)	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IDAD*	*WUPD*	
15 and below	-	-	-	-	2.5	=	=	=	0.3
16–25	26.8	20.0	9.2	4.2	6.7	10.8	-	10.0	11.0
26–35	30.8	45.0	47.5	63.2	36.7	62.5	50.0	30.0	45.7
36–45	10.8	25.0	28.3	19.2	34.2	26.7	40.0	40.0	28.0
46–55	10.8	5.0	9.2	9.2	13.2	-	10.0	20.0	11.0
56–65	10.8	5.0	5.8	4.2	4.1	-	-	-	3.7
66 and above	-	-	-	-	2.5	-	-	-	0.3
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

Table 2. Sex of egg marketers.

Variable	District (percentage distribution)								All districts (%)
Sex	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IDAD*	*WUPD*	
Male	85.0	100	90.0	90.0	100	68.3	75.0	95.0	88
Female	15.0	-	10.0	10.0	-	31.7	25.0	50.0	12
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

Table 3. Marital status of cassava farmers.

Variable	District (percentage distribution)								All districts (%)
Marital status	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IDAD*	*WUPD*	
Married	75.0	80.0	75.0	85.0	90.0	84.2	80.0	90.0	82.4
Single	25.0	20.0	25.0	15.0	10.0	15.8	15.0	10.0	17.0
Divorced	-	-	-	-	-	-	5.0	-	0.6
Widow/widower	-	-	-	-	-	-	-	-	-
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

responsibilities on women than the men. In a traditional African society, the male usually has access to productive resources. Also, the findings support the belief that in the study area, households are mainly headed by men. Table 3 displays the marital status of cassava farmers. Examples of such responsibilities include housekeeping and child-rearing. There was an indication that women were somewhat involved in other household chores to support their family needs.

Marital Status of the Respondents by Districts

Marriage, also known as matrimony or marriage, is a socially or ritualistically acknowledged union or legal contract between spouses that outlines the rights and responsibilities of the parties, as well as those of the parties' children and in-laws. As a result, someone who has the status of married has been married in a way that their jurisdiction has recognized as legitimate. According to the table's distribution of respondents by marital status, 82.4% of them are married, 17% are single, and 0.6% are divorced. This suggests that more married people in the research area participate in activities near riverine areas [10]. The higher proportion of married people in the study area could be attributed to the social status that is attainable by married persons. Married households are likely to be heavy water consumers because the amount of water used is typically correlated with household size. Therefore, it is not surprising that this group is interested. It should be highlighted that fetching water for the household puts a lot of strain on big rural households where nearly every adult member is expected to participate in the production process. Married household members put in more effort to secure the family's long-term food security as a result of the increased number of mouths to feed, which increased the risk of illness. Mtama (1997) discovered that marriage has an impact on the production process because it increases the amount of available labor in the home due to the more man hours provided by the larger number of household members, which lowers the cost of labor for the household [11]. This result is comparable to those of Yande (2005) and Kaine and Okoje (2014) who found that married people had a wider range of occupations than single, divorced, separated, and widowed household heads. Table 4 provides information about the educational qualifications of cassava farmers [12].

Educational Status of the Respondents by Districts

Education is liberation from ignorance, poverty, and diseases. It is also viewed as the process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs, and habits. Level of education therefore refers to the stage of formal education in which an individual was able to achieve. The level of education of the household head has a serious implication for the types and quality of water consumed by the household. Table 5 showcases the educational achievements of the respondents in

Table 4. Level of education of the cassava farmers.

Variable	District (percentage distribution)								All districts (%)
Educational status	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IDAD*	*WUPD*	
Educated	55.0	40.0	70.0	80.0	75.0	68.3	45.0	55.0	61.0
Not Educated	45.0	60.0	30.0	20.0	25.0	31.7	55.0	45.0	39.0
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

Table 5. Categories of educational status acquired by the respondents.

Variable	District (percentage distribution)								All districts (%)
Educational status	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IIAD*	*WUPD*	
Primary	-	-	7.5	12.5	30.5	35.0	36.7	40.0	20.4
Junior Secondary	25.0	24.0	14.2	18.3	18.5	5.8	8.3	10.0	15.0
Senior Secondary	63.6	38.0	37.7	18.3	21.5	41.7	46.7	40.0	38.4
Tertiary	11.4	15.0	18.3	12.5	15.4	5.8	8.3	-	10.8
Others (e.g., Arabic)	-	23.0	22.3	38.4	14.1	11.7	-	10.0	14.9
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020

the survey. The result shows that a significant proportion of 80% in Wuye district, 75% in Daykibiu, 70% in Wusedistrit, 68% in Kukwaba, and 61% in pooled results were educated. This implies that education helped the swamp rice farmers in their approach to malaria treatment, prevention, and access to healthcare facilities [13].

Categories Educational Status Acquired by the Respondents

Education is an important factor influencing livelihood choices or choice decisions. Several studies have shown that improving education and disseminating information is an important measure for stimulating participation in various livelihood options and the development of natural resource management initiatives [14]. Higher educational attainment may enable farm households to make a broader series of choices, ranging from engaging in safe construction practices to assessing the potential risk that results in fewer deaths when an extreme event strike [15]. The educational status of respondents may help source information from various sources on the assessment of the sanitary quality of river Wumba as 84.6% of the respondents had formal education ranging from primary to tertiary level. However, the proportion of respondents with primary education (20.4%) and secondary education (38.4%) was higher than that of tertiary education (10.08%), while others (e.g., Arabic constituted (14.9%). Table 6 exhibits the professional or job statuses of the survey participants.

Occupational Status of the Respondents

The distribution of the respondents among the various occupation groups in the communities studied shows that the majority (62.1%) were engaged in farming as their major occupation while few were in business (23.4%) civil service (3.0%), students (5.9%), not employed (3.1%) and others (2.3%). Farming ranks as the first major occupation in the area and this may also in the long run have implications for the degradation of major sources of water such as rivers and streams, etc. This finding agrees with Agwu (2008) who found that the occupational status of their respondents showed that they were primarily engaged in farming [16]. From the results a greater number of the respondents were farmers. According to a 2019 report, civil servants actively engage in farming, making it their primary occupation. As a result, there has been a consistent increase in food production across all districts. Furthermore, the two major occupations in the focus communities—trading and farming—are activities that require long human hours daily. Table 7 provides an inclusive inventory of the actions and engagements undertaken by the survey participants in the proximity of the river Wumba Channel. Hence, if the same set of people that are expected to fetch water are also expected to be in the market or farm, then the implications of water fetching for human hour loss to water fetching would be glaring.

Table 6. Occupational status of the respondents.

Variable	District (percentage distribution)								All districts (%)
Occupational status	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IIAD*	*WUPD*	
Civil Service	10.8	-	5.0	-	-	4.2	4.1	-	3.0
Farming	58.0	66.7	57.5	68.3	55.0	55.8	51.7	80.0	62.1
Business	16.7	28.3	19.1	26.7	30.0	20.0	30.6	15.8	23.4
Student	10.3	5.0	9.2	5.0	5.0	4.2	4.4	4.2	5.9
Not employed	3.1	-	7.0	-	8.0	4.2	3.0	-	3.1
Others	1.1	-	2.2	-	2.0	11.6	2.0	-	2.3
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

Table 7. Activities carried out by the respondents along the river Wumba Channel.

Variable	District (percentage distribution)								All districts (%)
Activity	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IIAD*	*WUPD*	
Marketing	1.4	-	5.3	4.0	6.0	4.0	5.0	-	3.2
Block making	25.4	30.4	28.4	26.0	20.0	10.3	10.0	1.3	19
Social	5.2	3.0	6.3	4.0	4.2	4.0	4.0	1.0	4
Industrial	-	-	-	-	-	15.0	36.0	5.5	7.1
Sewage discharging	15.6	13.3	11.7	25.0	21.6	12.2	11.0	28.2	17
Farming	46.7	52.3	43.6	36.0	45.2	51.5	30.0	53.7	45
Others (sand harvesting)	5.7	1.0	4.7	5.0	3.0	3.0	4.0	10.3	4.6
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

Activities Carried Out by the Respondents along the River Wumba Channel

Water is one of the important basic amenities of life and it is essential for human survival. It covers 71% of the earth's surface and it is used for many purposes such as industrial, agricultural, and domestic uses [17]. Access to and use of safe drinking water can make an immense contribution to human health, but when polluted it becomes an undesirable substance dangerous to human health. Acute shortage of good quality water has been a challenge for most rural populace. The majority (about 45%) of the respondents carried out farming activities along river Wumba Channel, 19% were block makers, 19% were sewage discharging, 7.1% were for Industrial usage, and 4.6% for others (sand harvesting). Table 8 presents the responses gathered from the participants regarding their utilization of Wumba River water for domestic purposes.

Respondents' Responses on the Domestic Uses of Wumba River Water

Many rural residents who lack access to clean water rely on unimproved water sources such as dams, reservoirs, rivers, and groundwater to meet their needs. Groundwater is the most readily accessible supply, and most people rely on it to meet their daily domestic water demands [18]. Groundwater quality is closely tied to regional environmental and geological factors, including the quality of the soil and the types of rocks present. The most frequent source of water in rural areas in Nigeria is groundwater, which has also proven to be the most reliable option for supplying water to rural areas. Table 9 outlines the various domestic purposes for which river Wumba water is utilized. The results show that 93.2% of the respondents confirmed the usage of Wumba River water for domestic uses while 5.7% did not use it within the entire district.

Areas of Domestic Uses of River Wumba Water

A key step in water resource valuation is to identify the functions it performs by establishing the connections between the structures and processes of water resources and the goods and services it provides that are of value to society [19]. The results also revealed that river Wumba water is majorly

Table 8. Respondents' responses on the domestic use of Wumba River water.

Variable	District (percentage distribution)								All districts (%)
	MTD	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IIAD*	*WUPD*	
Yes	100	100	90.0	76.7	95.0	93.0	100	91.0	93.2
No	-	-	8.0	20.2	4.0	5.0	-	8.0	5.7
No response	-	-	2.0	3.1	1.0	2.0	-	1.0	1.1
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

Table 9. Areas of domestic uses of River Wumba Water.

Variable	District (percentage distribution)								All districts (%)
Domestic uses	*MTD*	*CBD*	*WUSD*	*WUYD*	*DBD*	*KUD*	*IIAD*	*WUPD*	
Drinking	5.3	2.5	8.5	18.3	19.7	10.0	5.0	10.0	9.9
Cooking	12.5	5.8	15.8	20.2	18.7	16.0	17.0	20.0	16
Bathing	35.7	41.7	30.8	25.0	28.2	36.7	39.0	45.0	35.2
Washing of clothes	46.5	50.0	40.8	34.2	30.3	32.5	36.0	20.0	36.2
Others (ablution)	-	-	4.1	2.3	3.1	4.8	3.0	5.0	2.7
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Researcher's Field Work, 2020.

Table 10. Prevalence of parasites among population depending on Wumba River water (n = 148).

Participants	Number	No. of participants with *Ascaris lumbricoides*	Prevalence (percent)
Male and female children drinking Wumba River water	148	14	9.46
Male	98	9	9.18
Female	50	5	10.0

used for household chores where 71.4% of the respondents were using the water for both bathing and washing clothes, 16% for cooking, and 9.9% for drinking. Figuring out how individuals use water is important in establishing the total economic value of water. They place a higher value on the consumptive use of water as expected. Surprisingly, they also place a high importance on the non-use values of the river. For them to attach such economic value to the water resource shows that the resource is important to their livelihoods [20]. Table 10 presents data on the incidence of parasites within the population, with a dependency on the water from the Wumba River.

What is the prevalence of Ascaris lumbricoides among the population depending on Wumba River water?

Infections with helminths (e.g., *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm) are global public health threats that are closely associated with poverty, unsafe water, and inadequate sanitation and hygiene. More than one billion people worldwide are infected with one or more species of soil-transmitted helminths (STH), of which over 267 million pre-school children and over 568 million school children are considered at risk of morbidity, especially in less developed countries. Infections can cause diarrhea, abdominal pain, malnutrition, and physical and intellectual growth retardations. The result showed that the prevalence of *Ascaris lumbricoides* among population depending on Wumba River water is considerably low, as 9 (9.18%) of the males had *Ascaris lumbricoides*, while 5 (10.0%) of the female respondents had had *Ascaris lumbricoides*. This is similar to the study conducted in Uganda where the writers observed that the overall prevalence of *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm was 6.3%, 5.0%, and 43.5%, respectively. Table 11 summarizes the results of a t-test conducted to assess the disparity in parasite contamination between males and females.

Table 11. t-test summary on the difference between males and females in parasite contamination.

Sex	N	Mean	SD	SE	df	t	Prob.
Male	9	5.43	0.90	0.634	12	0.732	0.464
Female	5	4.02	0.61	0.621			

t=0.732, df =12; p = 0. 464

Test of Hypotheses

The following null hypotheses were tested:

1. *There is no significant difference between males and females in parasite contamination among the population depending on Wumba River water.*

A t-test indicated that the mean differences between male and female is due to standard error. Therefore, the null hypothesis was retained, meaning that there is no significant difference between males and females in parasite contamination among populations depending on Wumba River water.

DISCUSSION

By establishing the physical and chemical characteristics and performing a microbiological examination of the river quality indicators, the study aims to determine the parasite contamination among residents along the Wumba River in the Federal Capital Territory, Abuja segment. In accordance with the World Health Organization 2006 guidelines on the quality of drinking water, quality water should be free from chemical and biological contaminants and acceptable in terms of color, taste, and aroma [5]. The necessity for extensive protection against pollution and contamination by possible parasites, microorganisms, and hazardous chemical substances applies to wells, boreholes, ponds, and streams. Unfortunately, many disease-causing organisms are now bred and harbored in these water sources [21]. This study discovered no statistically significant difference between males and females in parasite contamination among Wumba River-dependent populations ($p>0.05$). This slightly contradicts a recent study by Ejike, Ohaeri, and Amaechi (2021) [22] in the Nigerian metropolis of Abia State. According to the authors, there were statistically significant differences in the levels of contamination among the examined water sources (p 0.05). The highest rate of parasite contamination was observed in stream water samples, which had a contamination rate of 27 (44.3%), followed by river water samples, which had a contamination rate of 14, and borehole samples, which had a contamination rate of 7, or 11.5%. Rainwater, on the other hand, was found to be parasite-free. *Entamoeba histolytica*, *Giardia lamblia, Ascaris lumbricoides* of *Entamoeba coli*, and hookworm were the five parasites that were seen. Except for rainwater, all the sample sources contained at least one of these parasites, with hookworm 8 (13.1%) having the lowest incidence of occurrence (15.4%), followed by *Entamoeba histolytica* (14.9%) and *Giardia lamblia* (15.4%). The fact that this investigation was done in a rural location, where access to drinkable water is always a problem, as opposed to an urban environment, may be the cause of the disagreement in the tested hypotheses.

Additionally, the findings of this study are connected to those of a prior study conducted in 2013 in Barkin-Ladi Local Government Area of Plateau State, Nigeria, by Chollom, Iduh, Gyang, and Idoko [23]. According to the authors, there was no difference between the participants' water contamination levels for parasites ($p>0.05$). They discovered that 59 out of the 100 water sources examined were infested with parasites. The highest level of parasite contamination was found in ponds, followed by streams with 50% and wells and boreholes with 35% and 0%, respectively. The majority of the parasites were from the helminth family, with 33.9% of them coming from Ascaris species. With a prevalence of 20.3%, hookworm was the second-most prevalent helminth.

CONCLUSION AND RECOMMENDATION

According to the findings of this study, the water sources that were sampled were contaminated with parasites, which means that people living in the study areas are at a high risk of contracting parasitic

diseases that are spread through contaminated water [24]. Water sources in this area must be treated before consumption to reduce the risk of infection. Therefore, it is important to promote the use of boreholes as a source of water. The government should install borehole water systems throughout the study regions to significantly lower the risk of developing water-borne illnesses.

REFERENCES

1. Morshed M. Water: the elixir of life. Daily. Sun Mag. 2016.
2. Accepta. Private supplies-wells, springs, boreholes. Manchester, United Kingdom: Water Treatment Products Company; 2017.
3. Intermarc. SDG six and the big water question: National Water Conference. Vol. 2016. Lagos: Intermarc Consulting Ltd; 2016. p. 1–6.
4. Etim EE, Akpan IU, Andrew C, Edet EJ. Determination of water quality index of pipe borne water in Akwa Ibom State, Nigeria. Int J Chem Sci. 2012; 5: 179–82.
5. World Health Organization, Centre for Environment & Health (BON), Water & Climate (WAC). Drinking-water, sanitation and hygiene in the WHO European Region: highlights and progress towards achieving Sustainable Development Goal 6. Geneva: World Health Organization; 2022.
6. Stewart BD, Jenkins SR, Boig C, Sinfield C, Kennington K, Brand AR, Lart W, Kröger R. Metal pollution as a potential threat to shell strength and survival in marine bivalves. Science of the Total Environment. Feb 2021 Feb 10; 755: 143019Stewart BD, Jenkins SR, Boig C, Sinfield C, Kennington K, Brand AR, et al. Metal pollution as a potential threat to shell strength and survival in marine bivalves. Sci Total Environ. 2021 Feb 10;755(1):143019. doi: 10.1016/j.scitotenv.2020.143019.
7. Cheesbrough M. District Laboratory Practice in Tropical Countries. Part 2. Second edition. Cambridge: Cambridge University Press; 2006.
8. Bakir B, Tanyuksel M, Saylam F, Tanriverdi S, Araz RE, Hacim AK et al. Investigation of waterborne parasites in drinking water sources of Ankara, Turkey. J Microbiol. 2003 Jun; 41(2):148–51.
9. Cochran R, Williams I. Incidence of malaria among various rural socio-economic households. Eur J Med Sci. 2013;11:24–34.
10. Udechukwu CE, Chukwu PE, Amaechina EC. River use, conservation and management among riverine communities in Southeastern Nigeria. Ethiopian Journal of Environmental Studies and Management. 2017 Mar 28; 10(2): 176–1-85Udechukwu CE, Chukwu PE, Amaechina EC. River use, conservation and management among riverine communities in Southeastern Nigeria. Ethiop J Env Stud & Manag. 2017 Mar 28;10(2):176–85. doi: 10.4314/ejesm.v10i2.4.
11. Mtama LY. Factors influencing female-headed household involvement in Sasakawa Global 2000 project in Rukwa Region [dissertation] for Award of MSc degree at Sokoine University of Agriculture. Morogoro, Tanzania. p. 50–84; 1997.
12. Kaine AI, Okoje LJ. Estimation of cost and return of plantain production in Orhionwon Local Government Area, Edo State, Nigeria. Asian J Agric Rural Dev. 2014;4:(393-2016-23791):162–8.
13. Ibrahim M, David J, Shaibu U. Malaria and agriculture: examining the cost implications and effect on productivity among farm households in Kogi State, Nigeria. Int J Trop Dis Health. 2017 Jan 10;23(3):1–9. doi: 10.9734/IJTDH/2017/33730.
14. Dolisca F, Carter DR, McDaniel JM, Shannon DA, Jolly CM. Factors influencing farmers' participation in forestry management programs: A case study from Haiti. Forest Ecol Manag. 2006 Dec 1;236(2-3):324–31. doi: 10.1016/j.foreco.2006.09.017.
15. Toya H, Skidmore M. Economic development and the impacts of natural disasters. Econ Lett. 2007 Jan 1; 94(1): 20–5. doi: 10.1016/j.econlet.2006.06.020.
16. Agwu AE, Ekwueme JN, Anyanwu AC. Adoption of improved agricultural technologies disseminated via radio farmer programme by farmers in Enugu State, Nigeria. Afr J Biotechnol. 2008;7(9):1277–86.
17. Hemant P, Limaye SN. Assessment of physico-chemical quality of groundwater in rural area nearby Sagar city, MP, India. Adv Appl Sci Res. 2012; 3(1): 555–62.
18. Chollom SC, Iduh MU, Gyang BJ, Idoko MA, Ujah A, Agada GO et al. Parasitological evaluation of domestic water sources in a rural community in Nigeria. BMRJ. 2013 Jul 1; 3(3): 393–9. doi: 10.9734/BMRJ/2013/3513.

19. Young RA. Measuring economic benefits for water investments and policies (World Bank Technical Paper No. 338). Washington, D.C., United States: World Bank; 1996.
20. Achumu, James, et al. "Agricultural financing and economic growth: A Bayesian VAR Examination of the Nigerian Evidence." Journal of Applied Business & Economics. 24.1 (2022; 24(1).
21. Adams J. Managing Water Supply and Sanitation in Emergencies. Oxford, UK: Oxfam GB; 1999.
22. Ejike BU, Ohaeri CC, Amaechi EC. Parasitic contamination of local drinking water sources in Aba Metropolis, Abia State, Nigeria: Parasitic contamination of local drinking water sources. SQU Journal for Science. 2021 Jun 24; 26(1):1–7. doi: 10.53539/squjs.vol26iss1pp1-7.
23. Chollom S. Parasitological evaluation of domestic water sources in a rural community in Nigeria. Br Microbiol Res J. 2013; 3(3): 393–9. doi: 10.9734/BMRJ/2013/3513.
Mwape YP. An impact of floods on the socio-economic livelihoods of people: A case study of Sikaunzwe Community in Kazungula District of Zambia. A Mini Dissertation for the Award of Master's Degree in Disaster Risk Management, Disaster Risk Management Training and Education Centre for Africa (DIMTEC), Faculty of Natural and Agricultural Sciences, University of the Free State, Bloemfontein. 2009

