



Assessment of Helminth Contamination and Associated Public Health Risk in Water Sources in Imiringi, Bayelsa State, Nigeria

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ABSTRACT

Helminths are highly infective, causing serious diseases among man and animals via water and soil routes. This study assessed helminths contamination in three water sources in Imiringi, Bayelsa State, Nigeria: Kolo Creek, a handmade pit water reservoir, and a borehole. Using sodium chloride sedimentation, 150 water samples were analysed. A 41.3% infestation rate was observed, with the handmade pit water reservoir and Kolo Creek being the most affected. The helminths observed in this study were *Ascaris* 31 (29.0), *Strongyloides* 27 (25.2) and *Triuris* 49 (45.8). Water sources in the study area was infested with helminths pathogens, indicating health risk of residents. Helminth portray a serious public health problem and require deliberate effort to curtail its spread to save residents from helminthiasis. The study established that Adherence to public health standards in the siting of bore hole and other manmade water sources can aid prevention of helminth spread and free residents from helminthiasis risk. Prioritizing personal cleanliness and ensuring strict compliance to sanitation policies can obstruction helminths contamination of water sources and promote human wellness and reduce burden on the health system. Residents depending on these sources for water should adopt the habiting of boiling water before use so as to get rid of parasitic worm residential in the water.

Keywords: Flooding, Helminths, Kolo creek, Parasitic, Pathogens, Water,

1.0 INTRODUCTION

Helminths which are generally recognised as pathogenic worms portrayed important cause of water bore diseases in many parts of the world, including Nigeria. This group of parasitic organisms encompasses soil transmitted worms and water transmissible worms. The primary route through which these worms contaminate water sources occurs by means of improper disposal of faecal materials which allows developmental stages of the worms to gain entry into the aquatic ecosystem. In Nigeria, helminth contamination of water can be exacerbated by frequent heavy down pour of rain, as worms can further be washed into water sources by runoff after rainfall.

Water emanating parasitic diseases pose serious health risk in rural communities with no adequate clean water source. Parasites in water sources can perpetrate outbreak of water borne diseases and can result to serious mortality in the society. The use of unsafe water source is life threatening to society, particularly in the rural setting. However, despite existing research on helminth contamination in diverse media of the environment, there is still finite empirical data on the comparative helminth infestation rates across different rural water sources. Specifically, little is known about the actual assemblage of helminth pathogens in creeks, handmade pits and borehole water sources and their direct implications on public health in Imiringi and Ogbia kingdom at large. Rural inhabitants are the most vulnerable to infections of pathogenic worms worldwide, due to limited access to quality water for domestic activities and drinking and deficient of

sanitation infrastructure. Awosolu *et al.* (2018) and Al-Tameem *et al.* (2019) identified inadequacy of safe drinking water, defective sanitation system and error in faecal disposal system as significant factors promoting helminths prevalence in rural and semi-urban communities in Nigeria.

The presence of helminths developmental stages in the environment can result to serious health problems including gastrointestinal infections (Ikpeze & Chima, 2020; Ito and Egwunyega, 2017). Parasitic worms form the most encountered disease-causing agent in animals and human beings with a global disease burden linked to poverty and deficiency in personal cleanliness habits (Ani & Itiba, 2015; Ejike *et al.*, 2021). Umeh & Omudu, (2023) and Chukwudike *et al.* (2024) reports that infectious worms constitute one of the most persistent public health challenges where one third of the world population is estimated to be engulfed. Chukwudike *et al.* (2024) established that infections of parasitic worms are of public health importance with high morbidities occurring among school age children in endemic regions of the world.

Developmental stages of parasitic worm can stay alive in every life supporting system including the aquatic ecosystem depending on the hydrological properties of the aquatic habitat. Man gets plagued on direct contact by means of recreation, domestic activities like washing or drinking the helminths contaminated water. Parasitic worms are most implicated in a variety of illness not limited to cognitive impairment in growing children and gastrointestinal diseases (Chukwudike *et*

al., 2024; Umeh & Omudu, 2023; Ikpeze & Chima, 2020). The contamination of water sources by these worms can be devastating. Disease incidence due to infections of pathogenic helminths can hamper work efficiency, places economic burden on disease management and increases burden on the health system. Therefore, a good knowledge on public health implications of helminths infestation of water sources is essential as it can awaken consciousness on the rural inhabitants on the necessity to prioritize sanitation and personal cleanliness as a means to obstruct water contamination and stay safe from water bore helminth infections. For this purpose, this study is aim to assessing the public health implications of helminths infestation of waters sources in Imiringi.

2.0 MATERIALS AND METHODS

2.1 Study Area

This study was conducted in Imiringi community in Ogbia kingdom, Bayelsa State. Imiringi is about 23 kilometres to Yenagoa, the capital city of the oil rich Bayelsa State. It is located between latitude 6° 14' and 6° 4' N and Longitude 4° 44' and 6° 5' E. Imiringi community is predominantly occupied by farmers and fisher men. Fishing is major occupation Imiringi, engaged in by both men and women. The community is situated 6 km away from Otuoke, the host community of the Federal University Otuke. As a tropical region, Imiringi experienced increase rain fall annually with an average temperature of about 31- 33°C.

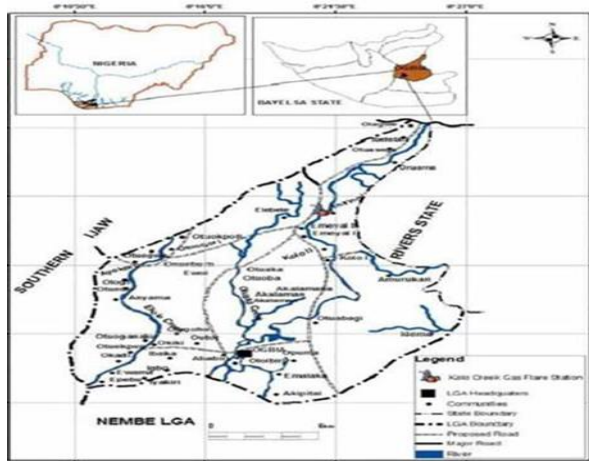


Figure 1: Map of Ogbia

2.1 Collection Of Water Samples

Water samples for this study was collected from three commonly used water sources in Imiringi. The water sources were borehole, pit water reservoirs (well), and the Kolo creek. Water from these water sources were sampled twice a month between January and May, 2025. The waters were collected into plastic containers, adequately labelled and conveyed to the laboratory for helminths developmental stages analysis.

2.3 Laboratory Procedure

The sodium chloride sedimentation method as documented in Ada *et al.* (2018) was used in the bio-assay of water for helminths detection. The water from each plastic container (15 cl) was filtered with a clean white handkerchief to discard solid particles. Sodium chloride was added to the water filtrate and allowed to settle for 120 minutes at room temperature after which the solution was filtered again and centrifuge at 250 rmp for 5 minutes. The centrifuged solution was filtered again and the sediment was subjected to microscopic viewing for helminths detection. The detected helminths were identified based on their observable features as seen in Ejike *et al.* (2021).

2.4 Data Analysis

Data in this study was presented using tables and charts and the result calculated using simple percentage ($n/N \times 100$). The test for significance was done on SPSS version 20 using one way analysis of variance.

3.0 RESULTS

3.1 Helminth Infectivity Of Water In Imiringi

A total of one hundred water samples, fifty each from the commonly domestically used water sources (kolo creek, bore hold and pit hole water reservoir (well) in the study area were screened for helminths contamination and reports that 62 (41.3 %) were infested, indicating health risk on users. Although, 88 (58.7 %) were free from helminths infestation.

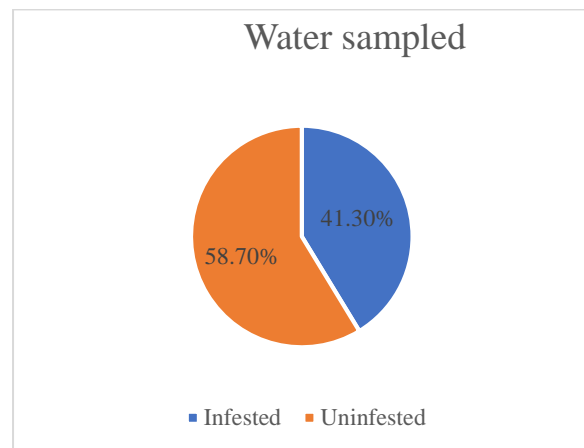


Figure 2: Helminth infectivity of water

3.2 Helminths Infestation Of Water Sources

The water sources investigated in this study were the bore hole, kolo creek, and pit hole water reservoirs. The result shows that water from the bore hold were free from helminths parasites whereas the kolo creek and pit hole water reservoirs were infested with pathogenic worms. The rate of helminths infestation was 61.3% in kolo creek and the pit hole had 38.7 % respectively. Infestation rate was statistically significant ($p < 0.05$).

Table 1: Helminths Infestation of Water sources

IJSGS FUGUSAU VOLXXX			WEBSITE: https://fugus-ijsgs.com.ng
Water source	Examined (%)	Infested (%)	occurrence in this was statically significant ($p < 0.05$). Helminths distribution pattern between investigated water sources was uneven, such that <i>Trichuris</i> 40 (65.5 %) display higher populations in pit hold water reservoir and manifested low number 9 (19.6 %) in the kolo creek. The distribution of other helminths across the sampled water sources showed 20 (43.4 %) <i>Strongyloides</i> in the kolo creek and 7 (11.5 %) in the pit hold water reservoir. <i>Ascaris</i> had 17 (37.0 %) in the kolo creek and displays 14 (23.0 %) in the pit hole water reservoir. Nevertheless, no helminths were recorded from the bore hold water source, and the total helminths infestation in kolo creek and pit hole water reservoir was 46 (43.0 %) and 61 (57.0%) respectively.
Bore hole	50 (33.3)	0	
Kolo creek	50 (33.3)	38 (61.3)	
Pit hole water reservoir	50 (33.3)	24 (38.7)	
Total	150 (100)	62 (100)	
Pv = 0.025			

3.3 Helminth Distribution And Occurrence In Water Sources

The helminths parasites reported in this study were *Strongyloides*, *Trichuris* and *Ascaris*. The population of these parasitic worms was 107. *Trichuris* 49 (45.8%) reported higher prevalence when compare to the pupations of *Ascaris* 31 (29.0%) and *Strongyloides* 27 (25.2%) respectively. The observation of helminths

Table 2: Helminth Distribution And Occurrence In Water Sources

Helminth	Bore hole	Kolo Creek (%)	Pit water reservoir (%)	Total (%)
<i>Ascaris</i>	0	17 (37.0)	14 (23.0)	31 (29.0)
<i>Strongyloides</i>	0	20 (43.4 %)	7 (11.5)	27 (25.2)
<i>Trichuris</i>	0	9 (19.6%)	40 (65.5)	49 (45.8)
Total	0	46 (43.0%)	61 (57.0)	107 (100)
	Pv	0.55	0.98	

4.0 DISCUSSION

This study assessed helminth infestations of water sources and obviously reported high public health risk rising from helminths infestation of the commonly used water sources in the rural community. The percentage infestation in this study was 41.3%, indicating a necessity for public intervention. Although, this result is less than 53.9 % parasitic infestation of water recorded in Akure north (Simon-Oke *et al.*, 2020) and higher than 21.6 % reported in Abdullahi *et al.* (2018). The variations in these studies can be attributed to the life style of the populace inhabiting the various study locations. It can also be ascribed to the immediate environmental features charactering the study area and season of study. However, this result firm the postulation of Hartmann *et al.* (2021) and Abdullahi *et al.* (2018) who sights that water born disease emanating from parasitic helminths inhabitation of water sources has escalated in recent time particularly among rural dweller and threatening the public health system. The presence of pathogenic worms as seen in this study calls for concern on the health safety of the rural inhabitants in Nigeria. Ekine and Orluoma (2024) suggested regular personal cleanliness and adherence to sanitation regulations as the most possible preventive approach to stay free from helminth contamination and their infections.

The absence of pathogenic worms in the bore hole water sources suggests that borehole possessors adhered to the World Health Organisation standard of siting bore hole on a required distance of 30 kilometre away from sock away pits. This result agrees with Simon-Oke *et al.* (2020) and Solomon *et al.* (2013) who

report zero parasite contamination of bore hole water in rural communities in Nigeria. This result implies that the health safety of the general public can be grante and people free from infectious helminths on compliance with required standards in setting up water sources particularly well and bore holes for human use. The result further demonstrates the essentiality of protected water facilities as to free them from infectious organisms not excluding helminths. Borehole water often drawn from deeper aquifers and less exposed to surface contamination, meets basic sanitary standards, which conform existing literatures that associated improved water sources with minimal disease chances (Abdullahi *et al.*, 2018; WHO, 2021; Solomon *et al.*, 2013). This observation implies that provision and efficient maintenance of bore holes can be a concrete measure to obstruct helminth transmission and reduce human susceptibility helminthiasis.

The high infestation rate noticed from the pit hole water reservoir source can be ascribed to the frequent flooding experienced in the study area. This result implies that handmade pit hole water reservoir should be built above flood level to serve as preventive measure and avert helminth contaminations of the water source. Flooding significantly aid the spread of helminths developmental stages into domestically use water sources as it overflows. In some scenario, pit latrine is broken down by flood, and the content been washed into other water sources and increases human vulnerability and water bore diseases perpetrated by pathogenic helminths washed alongside.

The result observed from the kolo creek can be attributed to the unhealth attitude of the rural residents



toward the aquatic ecosystem, which includes using the creek as refuse dump and faecal disposal site. The kolo creek, an exposed natural water ecosystem is particularly vulnerable to faecal contamination by means of runoff and refuse dump which improve conditions for helminths proliferation and spread. Ito *et al.* (2023) echoed that inadequate method of disposing domestic waste including faecal materials propel high chances of helminths contamination of environment, to which the aquatic ecosystem is no exception. The trend in this study agrees with Ngowi (2020) and Al-Tameem *et al.* (2019) which link the occurrence of helminths pathogens in rural communities to poor sanitation, ignorance on the importance of hygiene and direct use of contaminated water.

The helminth pathogens recorded in this were *Ascaris*, *Strongyloides* and *Trichuris* have obviously been implicated in significant disease morbidity. The presence these parasites in water sources can result to serious health issues not limited to malnutrition and anaemia among other problems. The rich occurrence of *Trichuris* implies high faecal contamination of the water sources, considering its life pattern dependency on environmental exposure to human waste. However, the uneven distribution helminths among the investigated water sources underscore the interplay of environmental factors like flooding, hydrological properties peculiar to each water source and surrounding sanitation practice, impacting on parasite population. Nevertheless, the atmosphere conditions of the study area likely encourage the survival and spread of helminths as seen in the study. This observation agrees with Abdullahi *et al.* (2018), Zeleke (2019), Simon-Oke *et al.* (2020), Pukuma *et al.* (2022) who also reported the presence of parasitic worms in surveyed water and soil.

5.0 CONCLUSION

Water sources in the study area were infested with helminths pathogens, indicating high chances of possible out-break of water borne disease. Helminths portrayed a serious public health problem and require deliberate effort to curtail it. Adherence to public health standards in the siting of bore hole and other manmade water sources can aid prevention of helminth spread and free residents from helminthiasis risk. Prioritizing personal cleanliness and ensuring strict compliance to sanitation policies can obstruction helminths contamination of water sources and promote human wellness and reduce burden on the health system. Residents depending on these sources for water should adopt boiling of the water before use.

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