ISSN: 2504-9070

PREVALENCE AND DISTRIBUTION OF ENDOPARASITES IN JUVENILE NILE TILAPIA (OREOCHROMIS NILOTICUS) FROM SHENDAM DAM, NIGERIA: IMPLICATIONS FOR AQUATIC HEALTH AND ZOONOTIC RISK

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ABSTRACT

This study investigates the prevalence of endoparasites in Oreochromis niloticus captured from Shendam Dam, Nigeria. Ninety (90) live fish specimens were randomly procured from local fishermen and transported to the National Veterinary Research Institute, Vom, for parasitological examination. Species identification, morphometric measurements, and sex determination were conducted using standard taxonomic procedures. The prevalence of parasitic infections was 55.6%, with male fish exhibiting a higher infection rate (59.4%) than females (53.4%) ($p < 0.05$*). Infection rates varied significantly with fish length, with the highest prevalence observed in the 12–13 cm group (66.7%) and the lowest in the 8–9 cm group (36.0%). Parasitic load was highest in the intestines (35.6%) and gills (33.9%). Diphyllobothrium latum (27.27%) was the most prevalent cestode, while* Anisakis *spp. (16.66%) and Entamoeba coli (15.15%) were the dominant nematode and protozoan parasites, respectively. The results align with previous studies, suggesting that host size, sex, and environmental factors influence parasite distribution. The study underscores the potential zoonotic risks associated with fish-borne parasites, highlighting the need for effective monitoring and public health interventions.*

Keywords: *Parasitic prevalence, Oreochromis niloticus, Shendam Dam,Fish-borne parasites Zoonotic risk*

INTRODUCTION

Parasites infestation, which includes ectoparasites and endoparasites, represent a significant threat to both wild and cultured fish populations, with potential detrimental effects on fish health, growth, and overall fitness (Mustafa *et al.,*2024). Ectoparasites, which infest the external surfaces of fish such as the skin, gills, and fins, can cause direct tissue damage, induce stress, and facilitate secondary infections (Abbas *et al.,* 2023). Endoparasites, inhabit the internal organs and tissues of the host, may disrupt vital physiological functions, leading to decreased nutritional uptake, impaired organ function, and, in severe cases, host mortality (Gunn and Pitt., 2022).

Parasitic infestations in fish populations are of considerable concern in aquaculture, as they can result in reduced productivity, compromised fish quality, and substantial economic losses (Brown and Miller, 2019). In wild fish populations, parasites can influence ecosystem dynamics by affecting fish population health and biodiversity (White *et al.,* 2022). Consequently, the prevalence and distribution of parasitic infections in fish are key factors in the assessment of fish health and the implementation of effective management practices in fisheries and aquaculture (Davis *et al.,* 2023).

Nile Tilapia (Oreochromis niloticus), one of the most extensively cultured and harvested fish species globally, is highly susceptible to a wide range of parasitic infections (Shinn *et al.,* 2023). The identification and quantification of ecto- and endoparasite species within Nile Tilapia populations are essential for understanding their epidemiology and impact on both wild and cultured stocks (Giari *et al.,* 2022). Moreover, such studies provide crucial data for developing strategies to mitigate parasitic burdens, optimize fish health management, and enhance captured fisheries sustainability (Subasinghe *et al.,* 2023).

This study seeks to assess the prevalence of ecto- and endoparasites in Nile Tilapia populations, providing valuable insights into the parasitic load and its potential impact on fish health and aquaculture practices.

Ethical consideration

Ethical approval for the use of fish in this study was obtained from the (Ministry of Livestock Development, Veterinary Services and Fisheries, Plateau state)**,** it was humanely used in accordance with the Animal disease and control Law and Animal welfare Law 2022. (Approval No: MANR/sec/47/5.6.Vol 1)

Materials and Methods

Study area

Shendam, a Local Government Area in Plateau State, Nigeria, is bordered by Ibi (Taraba State) to the south, Qua'an Pan to the east, Pankshin to the north, and Mikang to the west. The area, with its headquarters in Shendam town, spans 2,477 km² and had a population of 208,017 as per the 2006 census. Shendam is the second most populous town in the state after Jos, located at 8°53′N 9°32′E. The climate includes a hot season from late January to mid-April, peaking in March with an average high of 99°F, and a cool season from late June to mid-October, with highs below 87°F. August is the coldest month, with temperatures between 72°F and 84°F (GONGS *et al.,* 2021).

Sample collection and identification

A total of 90 live fish specimens were randomly procured from local fishermen operating at Shendam Dam. The specimens were transported live in a 50-liter plastic container filled with water to maintain their viability and delivered to the Parasitology Laboratory at the National Veterinary Research Institute, Vom, Plateau State. The fish were sorted according to different sizes. Species identification was conducted based on morphological characteristics, following the taxonomic descriptions provided by Idodo-Umeh (2003). Lengths and weights of the fishes were measured using a ruler calibrated in centimeter (cm) and digital weighing balance (Electronic Kitchen Scale, QE-KE-4), respectively. Sex determination was performed by visual examination of the urinogenital system to distinguish males from females.

Examination of samples for endoparasites

The fish were dissected to expose the alimentary canal. The alimentary canal was removed and sectioned into various parts; esophagus and stomach, intestine and rectum. Both Gills and Intestines was removed and place into two different sample bottles and identify A and B, Normal saline was prepared at 0.85% to 1000ml distilled water and filled up the sample bottles containing the organs, with an applicator stick the organs was emulsify and the water was pured into the test tube. The sample in the test tube was placed in the centrifuge and was spined at 10mins - 3000 revolution. The sediment goes down while the supernatant comes up. The supernatant was poured out while the sediment was collected with a Pasteur pipette and place on a slide. With the aid of a stereo microscope, the slide was placed on the microscope and view through the ocular lens throughout the films to identify any available parasite (Soulsby, 2023). Identification of most parasites was made immediately following standard text as observed by (Kawe *et al*., 2016).

Statistical analysis of data

Data analysis was performed using SPSS Statistics version 26.0. Prevalence rates were calculated as percentages of infected hosts relative to the total examined. Mean intensity was defined as the total number of a specific parasite divided by the number of hosts infected with that parasite (Bush et al., 1997). The influence of host variables (length, weight, sex) on infection status was assessed using Pearson's correlation coefficient for continuous data and Chi-square (χ^2) tests for categorical comparisons. A probability value (p-value) of less than 0.05 was established as the threshold for statistical significance.

is total number of parasites species found divided by number of fish infected as describe by Gomesa *et al,* (2019).
The formulas are as follows:

$$\text{Prevalence (\%)} = \frac{\text{fish infected}}{\text{Total no of fish examined}} \times 100$$

$$\text{Mean intensity} = \frac{\text{Total No. of fish parasite found}}{\text{No. of fish host infected}}$$

The relationship between fish parasites loads and some variables such as standard length (SL cm), the fish weight (g) and the sexes of fish were analyzed using correlation coefficient and regression analysis.

Results

Table1. Show the Prevalence and Mean Intensity of Endoparasites in Correlation to Sex of *Oreochromis niloticus.* The Results of the investigation shows that out of (90) samples of *Oreochromis niloticus examined.* 50 were infected with female having a lower incidence rate of 53.4% than the male with 59.4% ($p<0.05$). Table 2. Shows the incidence of endoparasites in correlation to the total length of *Oreochromis niloticus*. Incidence rates of 55.6%, 66.7%, 64.3%, 36.0%,and 63.4 were observed in the total length groups of 14-16, 12-13, 10-11 and 8-9 cm respectively, while the total length group of 6-7 cm had an incidence of 50% ($p<0.05$).

Table 1: Incidence and intensity of infection of endoparasites based on the sex of *Oreochromis niloticus.*

Sex	**No of fish Examined**	**No (%) of fish positive**	**Parasite burden**	**Intensity of infection**
Male	32	19 (59.4)	30	1.6
Female	58	31(53.4)	38	1.2
Total	90	50 (55.6)	68	1.4

Table.2: Prevalence and Mean Intensity of Infestation of Endoparasites of *Oreochromis niloticus* in Correlation to Total length. (TL).

Tl (cm) of	**No of fish Examined**	**No(%) of fish positive**	**Parasite burden**	**Intensity Infection**
6-7	4	2(50)	2	1
8-9	41	26(63.4)	31	1.2
10-11	25	9(36.0)	15	1.7
12-13	14	9(64.3)	15	1.7
14-16	6	4(66.7)	5	1.3
Total	90	50(55.6)	68	1.4

Table 3. Shows Incidence of endoparasites in Correlation to body weight of *Oreochromis niloticus*. The highest Incidence was observed in 47-60% followed by 5-18% and the lowest was recorded in 19-32% respectively while 61-72 was having 0%. ($p<0.05$).

Table3: Prevalence of Endo parasite in correlation to body weight of Oreochromis niloticus.

Weight (g) of	**No of fish Examined**	**No of fish positive (%)**	**Parasite Burden**	**Intensity parasite**
5-18	59	33(55.9)	41	1.2
19-32	13	6(46.2)	7	1.5
33-46	10	5(50.0)	9	1.8
47-60	6	6(100.0)	11	1.8
61-72	2	0(0.00)	-	0.00
Total	90	50(55.6)	68	1.4

Table4. Shows the incidence of endoparasites in *Oreochromis niloticus*, in relation to their taxonomic group, percentage of fish infected, number of parasites, and their locations.

Nematodes: *Strongyloid larva* (10.60%) and *Anisakis spp* (16.66%) were the most prevalent, affecting the gills and intestines while *Nematodirus* (4.54%) and *Ascaris* (1.52%) were less common, mainly found in the intestines.

Protozoa: *Entamoeba coli* (15.15%) and *Trichodina spp* (6.06%) were detected in both gills and intestines. *Balantidium spp*, *Coccidia*, and *Giardia* had lower prevalence (1.52–4.54%) with isolated occurrences in the intestines.

Cestodes (Tapeworms): *Diphyllobothrium latum* was the most prevalent parasite overall (27.27%), affecting both the gills and intestines.

Table 4: Frequency distribution of endoparasites of *Oreochromis niloticus*

Parasites	Parasites taxa group	No. of fish Examined (%)	Total No. of Parasites	Location in the fish
	Nematode			
Hook worm *Strongyloid larva*		(10.60)	7	Gills and Intestines
Nematodirus		(4.54)	3	Gill and Intestines
Ascaris		(1.52)	1	Intestine
Anisakis spp		(16.66)	11	Gills and Intestines
		(1.52)	1	Intestine
	Protozoa			
Cyst of *Entamoeba coli*		(15.15)	10	Gills and Intestines
Balatidious spp		(1.52)	1	Intestine
Coccidia Oocyst		(4.54)	3	Gills and Intestines
Giordiatrophozoite		(1.52)	1	Intestine
Trichodina spp		(6.06)	4	Gills and Intestines
	Cestodes			
Diphyllobothrium latum		(27.27)	18	Gills and Intestines
Tape worm		(7.57)	5	Gills and Intestines

Table 5.Shows incidence of endo parasite in relation to location, it shows that the percentage of prevalence is high in the intestine with (35.6%) compare to the gills with (33.9%) and p=0.637.

Table 5: Prevalence of Endo parasite in relation to Location.

Location	Number of fish Examined Number	Number of fish positive	Prevalence	P-value
Gill	90	29	32.2	0.637
Intestine	90	32	35.6	
Total	180	61	33.9	

Discussion

The prevalence of 55.6% observed in this study demonstrates a significant parasitic burden in Oreochromis niloticus from Shendam Dam. Male tilapia were more affected than females, consistent with Ekpo *et al.* (2020), though not statistically significant. Medium-sized fish had higher infection levels, corroborating Musa *et al.* (2019), who linked growth stage and feeding activity to vulnerability. Interestingly, heavier fish (>60 g) showed no infections, possibly due to developed immunity or dietary shifts. The predominance of intestinal parasites aligns with findings of Okeke *et al.* (2022), suggesting that the gut offers favorable conditions for helminths. The zoonotic parasites identified, particularly Diphyllobothrium latum and Anisakis spp., highlight the potential health risks to fish consumers. These results emphasize the need for public awareness and strict food safety practices in artisanal fisheries.

The total length of *Oreochromis niloticus* also significantly influenced the incidence of endoparasites. The highest infection rate was recorded in 12-13 cm length group (66.7%), while the lowest was found in the 8-9 cm group (36.0%) ($p<0.05$). This result is in agreement with the findings of Musa *et al.* (2019), he reported a similar result, with fish in the 12-14 cm length group having a 65.4% prevalence of parasitic infections. In contrast, smaller fish (6-7 cm) showed lower infection rates (50%), likely because of shorter exposure to parasite transmission cycles. This is consistent with the results of Adewale *et al*. (2020), who found that fish below 8 cm had lower parasitic loads (40.5%) due to their limited exposure to infection vectors and less complex body systems, which might make parasitic establishment more difficult.

Body weight also showed a strong correlation with parasitic infection. These findings are in agreement with Njiru *et al.* (2020), who found that fish within 45-60 g weight range had a 49% infection rate. Larger fish, with body weights between 61-72 g, showed no parasitic infections in this study, which supports the findings of Bello *et al.* (2022), who noted that larger fish often exhibit more robust immune responses, thereby limiting the establishment of parasites in their systems.

The prevalence of parasitic infections in different organs revealed that the intestines harbored the highest infection rate (35.6%), followed closely by the gills (33.9%) ($p=0.637$). This observation is in line with the study of Abubakar and Udo (2021), who recorded a 34.8% infection rate in the intestines of *Oreochromis niloticus*, while gills showed a lower but significant prevalence of 32.5%. The intestinal tract is often the primary site for parasitic colonization, particularly for trematodes and nematodes, due to its rich nutrient environment, which supports parasite development.

Gill parasites, though frequently observed, typically occur in lower intensities, likely because of the continuous flow of water over the gills, which may dislodge or prevent the successful establishment of large parasitic

loads. This trend is similar to the findings of Okeke *et al.* (2022), who also documented higher parasitic loads in the intestines compared to the gills in freshwater fish. Nematodes were the second most common parasite group, with *Anisakis spp.* (16.66%) and *Strongyloid larva* (10.60%) being the most prevalent, affecting the gills and intestines. This result is comparable to the findings of LePage *et al*. (2012), he reported *Anisakis spp.* as the dominant nematode in *Oreochromis niloticus*, particularly affecting the same tissues due to the parasites' preference for well-vascularized organs. Lower incidences of *Nematodirus* (4.54%) and *Ascaris* (1.52%) were observed, with both primarily colonizing the intestines, consistent with the work of Ngueku and Eyo (2021), who reported similar distributions of these nematodes.

Protozoans, particularly *Entamoeba coli* (15.15%), were also prevalent, followed by *Trichodina spp.* These results align with the findings of Adeyemo, F. E. (2020), who observed *Entamoeba coli* as a common protozoan parasite in freshwater fish, with infections occurring in polluted environments. The lower prevalence of *Balantidium spp.*, *Coccidia oocysts*, and *Giardia* (1.52–4.54%) in this study reflects a pattern similar to that reported by Ngueguim *et al.* (2020), where these protozoans were found sporadically, potentially due to the host's immune response or the presence of specific environmental conditions that limit protozoan survival and transmission. Among the cestodes, *Diphyllobothrium latum* was the most prevalent parasite overall, with a 27.27% infection rate. This finding corroborates the work of Mustafa *et al.* (2024), who documented high levels of *Diphyllobothrium* species in freshwater fish, underscoring the parasite's adaptability to a range of hosts and environments. Its high prevalence raises concerns about the zoonotic risk posed to humans through the consumption of infected fish, as also noted by Zin Eldin *et al.* (2023).

Conclusion

This study revealed a high prevalence of ecto- and endoparasites in *Oreochromis niloticus* from Shendam Dam, with infection rates significantly influenced by fish sex, size, and organ preference. The predominance of *Diphyllobothrium latum* and *Anisakis* spp. Shows a potential zoonotic risks, emphasizing the need for stringent monitoring and preventive measures. These findings contribute to the understanding of fish-parasite interactions and their implications for fisheries management and public health.

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