

Comparative Incidences of Gastrointestinal Parasite in *Clarias Gariepinus* and *Oreochromis niloticus*, from Biu Dam, Borno State, Nigeria

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Abstract

Prevalence of gastrointestinal parasite of *Clarias gariepinus* and *Oreochromis niloticus* were carried at Biu Dam. Samples were collected for the period of four months (August – November, 2023) and the experiment was carried out using standard scientific methods. Seven parasites belonging to four taxa namely; Cestodes (*Diphyllobothrium latum*, *Taenia saginata*), Nematodes (*Ancylostoma piscium*, *Dactylogyrus vastator*, *Capillaria hepatica*), Trematodes (*Heterophyes heterophyes*) and Protozoan (*Trypanosome chagasi*) were identified. Nematodes were more prevalent than other taxa during the period of this study. The overall prevalence of the parasites was higher in *O. niloticus* (60.00%) than *C. gariepinus* with a prevalence infection rate of 46.67%. Among the organs examined, intestine has the highest prevalence of infection rate than other organs examined in *C. gariepinus* (46.67%) and *O. niloticus* (73.33%). Sex showed variation with male *C. gariepinus* recorded higher prevalence (26.67 %) than the female (20.00%), while *O. niloticus* was observed to have higher prevalence in female (33.33%) than males (26.67%). It is therefore, recommended that fish from Biu Dam should be properly roasted or cooked before consumptions to serve as precautionary measures to possible zoonotic parasite infestations.

Keywords: *Clarias gariepinus*, Gastrointestinal, *Oreochromis niloticus*, parasite, Reservoir

Introduction

Fish is a rich source of protein and is an essential food item in the diet of millions of people. Among the popular fish species that are being farmed widely are *Clarias gariepinus* and *Oreochromis niloticus*. However, these fish species are vulnerable to various diseases and parasites that can affect their growth and health (Feis and Longshaw 2008). Among the important factors that affect their growth and survival are the prevalence of gastrointestinal parasites. They are affected by different parasites, they are not only act as intermediate hosts for many digeneans and cestodes, but also act as definitive hosts for many helminthes. The infection of wild fish with parasites are common, where the requirement of parasites for intermediate and definitive hosts are chanced (Feis and Longshaw 2008). The most common parasites are gastrointestinal parasites which compete with the fish host for nutrients, hence reducing the essential nutrients absorbed by

fish. Subsequently, these parasites hamper the growth of fish leading to morbidity and mortality and making the fish more susceptible to surrounding predators (Azadikhah *et al.*, 2014 and Omeji *et al.*, 2015). This is possibly because helminthes principally infect the internal organs, chiefly the gastrointestinal tract (Ibrahim *et al.*, 2008). Parasites constitute a major problem that confronts aquaculture with pathological conditions that arise from their infection, causing potential serious consequences (Vandenbrock, 1979). Parasite across different aquatic habitant which infect fish species and inflict injuries can become a substrate to other opportunistic microorganisms, thereby reducing fish production as a result of the menace they cause. Aquaculturists may have done their best to combat this menace based on their knowledge which seems not adequate. Aliyu and Solomon (2012) also reported the presence of trematodes, cestodes and nematodes in fish. However, *C. gariepinus* and *O. niloticus* are two

major economically important fish species commonly cultured in aquaculture systems, both fish species are known to be susceptible to a wide range of gastrointestinal parasites. Therefore, understanding the prevalence and distribution of these parasite is essential for effective management and control of fish disease in aquatic habitats.

Materials and Methods

Study Area

Biu Dam is situated in Biu Local Government in Borno State. It is located on latitude 10°38'14" N and longitude 12°05'21"E. The Dam was constructed purposely to supply drinking water to Biu community being the second largest town in Borno State. However, the Dam is also used for irrigating the fertile agricultural lands around as well as for fishing activities and source of water for large cattle farmers.

Sample Collection

Fish Samples were collected from the Dam from August to November, 2023. The fish samples were kept in a plastic cooler with ices and then were transported to the Nigerian Army University, Department of Biology Laboratory where they were examined.

Examination of the Fish Parasites

Each fish was picked, examined carefully for any abnormalities on its body and then was opened with a sharp scissors by cutting from the anal region up to the throat. The connective tissue loops of the liver were carefully cut and then each organ was separated. The gut was placed in a petri dish, stretched and the esophagus, stomach and intestine were cut. The intestine was opened by pair of scissors scrapped on a slide and examined using X10 and X40 objective lenses of the light microscope.

Data Analysis

Prevalence were calculated using the following formula according to Ekanem *et al.* (2014)

$$\text{Prevalence} = \frac{Fi}{Ft} \times 100$$

Where: Fi is number of infected fish and Ft is total number of fish examined

Results and Discussion

Prevalence of Parasites in *Clarias gariepinus* and *Oreochromis niloticus*

Table 1 presents the prevalence, mean intensity and abundance of parasites in examined fish. The overall prevalence infection was 16(53.33%) for both the two species fish. *O. niloticus* had the highest number of infections with the infection rate of 9(60.00%), while *C. gariepinus* has the smaller number of infection rate of 7(46.67%). The highest mean abundance of the parasites was recorded in *C. gariepinus* with the mean abundance of 7.53, while *O. niloticus* recorded 6.13 for the period of this study. The mean intensity of the parasites recorded were 16.14 and 10.22 for both *C. gariepinus* and *O. niloticus* respectively. The results of the present work showed the existence of four parasites taxa, 2 belongs to cestodes, 3 nematodes, 1 each of trematodes and protozoan. The overall prevalence rate was higher than 32.9%, 16.9% and 17.1% recorded in Warri River, Okhua River and Osse River by Onyedineke *et al.* (2010), Ekanem *et al.* (2011) and Okaka and Akhigbe (1999). This result revealed that, *O. niloticus* has the highest prevalence of infection rate than *C. gariepinus*. This conforms to the work of Uchekukwu, (2015) who reported higher prevalence in *O. niloticus*. The result was however in contrast with the work of Osimen and Anagha (2020), who reported higher prevalence in *Clarias anguillaris* due to preference to zooplankton with increasing in size. The higher prevalence of infection rate in *O. niloticus* may be due to variation between the two species examined which may include size of fish, or differences in immunity against parasites.

Table 1: Prevalence, Mean Intensity and Abundance of Parasites in Examined fish

Fish species	NE	NI	NPR	P (%)	MI	MA
<i>Clarias gariepinus</i>	15	7	113	46.67	16.14	7.53
<i>Oreochromis niloticus</i>	15	9	92	60.00	10.22	6.13
Total	30	16	205	53.33	12.81	6.83

NE: Number Examined, NI: Number Infected, NPR: Number of Parasites Recovered, MI: Mean Intensity MA: Mean Abundance

Prevalence of Cestodes Parasites in *Clarias gariepinus* and *Oreochromis niloticus*

The result of the prevalence of cestodes in the fish examined is presented on table 2. The results revealed that, only two species of cestodes namely *Diphyllobothrum latum* and *Taenia saginata* were recovered in both *C. gariepinus* and *O. niloticus*. The prevalence of infection of *Diphyllobothrum latum* were 5(33.33%) and 3(20.00%) for *O. niloticus* and *C. gariepinus*, while *Taenia saginata* has a prevalence infection of 3(20.00%) and 1(6.67%) for both *O. niloticus* and *C. gariepinus*. The mean abundance of *Diphyllobothrum latum* and *Taenia saginata* recorded were 5.80 and 1.33 for *O. niloticus* and 1.20 and 0.40 for *C. gariepinus*. The mean intensity was also higher in *O. niloticus* with 17.50 and 6.67 for both *Diphyllobothrum latum* and *Taenia saginata*, while *C. gariepinus* has 6.00 and 6.00 for the two parasites. The overall prevalence infection rates of

the parasites were 8(26.67%) and 4(13.33%) for both *O. niloticus* and *C. gariepinus* respectively. The *Diphyllobothrum latum* and *Taenia saginata* were more prevalent on the *O. niloticus* than the *C. gariepinus*. There was very low abundance of *Diphyllobothrum latum* and *Taenia saginata* in *C. gariepinus* compared to *O. niloticus*. The prevalence and abundance of the parasites on the in *C. gariepinus* and *O. niloticus* could as well be related to the nature of the fish and feeding habits as reported by Arle, (2002). Arle, (2002) also noted that, since *C. gariepinus* prefers to feed on the bottom, edges and vegetation areas of the water while the *O. niloticus* are pelagic and feed in higher water column and edges, it could affect the exposure to parasites. The relationship of diets and feeding habits and parasites had been highlighted by Marcogliese, (2002); Nunn *et al.*, (2008). This study was in contrast with Bichi and Yelwa (2010) who reported higher prevalence in *C. gariepinus*.

Table 2: Prevalence, Mean Intensity and Abundance of Infection by Cestodes

Parasites species	Fish species	NE	NI	NPR	P (%)	MI	MA
<i>Diphyllobothrum latum</i>	<i>Clarias gariepinus</i>	15	3	18	20.00	6.00	1.20
	<i>Oreochromis niloticus</i>	15	5	87	33.33	17.50	5.80
Total		30	8	105	26.67	13.13	3.50
<i>Taenia saginata</i>	<i>Clarias gariepinus</i>	15	1	6	6.67	6.00	0.40
	<i>Oreochromis niloticus</i>	15	3	20	20.00	6.67	1.33
Total		30	4	26	13.33	6.50	0.87

NE: Number Examined, NI: Number Infected, NPR: Number of Parasites Recovered, MI: Mean Intensity MA: Mean Abundance

Prevalence of Nematodes Parasites in *Clarias gariepinus* and *Oreochromis niloticus*

Table 3 shows the distribution of nematodes parasites in the examined fish. Three species of nematodes parasites were recovered from *C. gariepinus* and *O. niloticus* namely; *Ancylostoma piscium*, *Dactylogyrus vastator* and *Capilliria hepatica*. *Ancylostoma piscium* was not recovered in *O. niloticus*, while *Capilliria hepatica* was not recovered in *C. gariepinus* for the period of this study. The prevalence of infection of the parasites were 2(13.33%) and 2(13.33%) of *Ancylostoma piscium* and *Dactylogyrus vastator* in *C. gariepinus* and 1(6.67%) and 1(6.67%) of *Dactylogyrus vastator* and *Capilliria hepatica* in *O. niloticus*. The mean abundance of the parasites was 0.80 and 0.33 for *Dactylogyrus vastator* and *Ancylostoma piscium* in *C. gariepinus* and 4.93 and 0.13 for

Dactylogyrus vastator and *Capilliria hepatica* in *O. niloticus*. The mean intensity of the parasites was 74 and 2.00 in *O. niloticus* for both *Dactylogyrus vastator* and *Capilliria hepatica*, while *C. gariepinus* recorded 6.00 and 2.50 for both *Ancylostoma piscium* and *Dactylogyrus vastator*. The overall prevalence of infection were *Dactylogyrus vastator* 3(10.00%), *Ancylostoma piscium* 2(6.67%) and *Capilliria hepatica* 1(3.33%) respectively. The commonest infection of the fish was caused by a nematode. Dauda *et al.* (2016) reported that the presence of nematodes in fish lead to decline in population in their natural environment although, this study did not investigate this assertion. The abundance of nematode parasite *Ancylostoma piscium*, *Dactylogyrus vastator* and *Capilliria hepatica* in both the *C. gariepinus* and *O. niloticus* is another

indicator of cross sharing of parasites. In this research a comparative analysis of prevalence and the abundance of parasites in both *C. gariepinus* and *O. niloticus* showed that *Dactylogyrus vastator* is a major parasite. Based on the results it seems that the nematode parasites could easily attack the fishes despite their trophic levels in the water. *C. gariepinus* usually feeds at the bottom and *O.*

niloticus in the water column or edges. From current result, the nematodes have the highest species in the two fish species, this might be due to the activity of the parasites in the natural environment even as reported by Uchekukwu, (2015), that earthen ponds harboured much blood sucking parasite because it looks like a natural environment.

Table 3: Prevalence, Mean Intensity and Abundance of Infection by Nematodes

Parasites species	Fish species	NE	NI	NPR	P (%)	MI	MA
<i>Ancylostoma piscium</i>	<i>Clarias gariepinus</i>	15	2	5	13.33	2.50	0.33
	<i>Oreochromis niloticus</i>	15	0	0	0	0	0
Total		30	2	5	6.67	2.50	0.17
<i>Dactylogyrus vastator</i>	<i>Clarias gariepinus</i>	15	2	12	13.33	6.00	0.80
	<i>Oreochromis niloticus</i>	15	1	74	6.67	74.00	4.93
Total		30	3	86	10.00	28.67	2.87
<i>Capilliria hepatica</i>	<i>Clarias gariepinus</i>	15	0	0	0	0	0
	<i>Oreochromis niloticus</i>	15	1	2	6.67	2.00	0.13
Total		30	1	2	3.33	2.00	0.07

NE: Number Examined, NI: Number Infected, NPR: Number of Parasites Recovered, MI: Mean Intensity MA: Mean Abundance

Prevalence of Trematodes Parasites in *Clarias gariepinus* and *Oreochromis niloticus*

The results of the distribution of trematodes in the examined fish species is presented on table 4. The result revealed that, only one species of parasites (*Heterophyes heterophyes*) was recovered only in *C. gariepinus*. The prevalence infection was 1(3.33%), while the mean abundance of the parasites was also 0.20 from this study. The mean intensity of the parasites recorded stand at 3 and the overall infection rates of the parasite in *C. gariepinus* was 1(3.33%). Trematodes parasites have been reported in *C. gariepinus* and *O. niloticus*, causing damage to the eyes, gills, and

fins (Ayanda *et al.*, 2014). From the current study, it was observed that the parasites were only recovered in *C. gariepinus* at a very low prevalence infection rate of 1(3.33%), which was lower than the value reported by Dauda *et al.* (2016) in Gombe State who recorded 13.7% prevalence rate in *Tilapia zilli*. This was also in contrast with Amaechi (2014) who reported highest prevalence (35.9%) infection rate in *O. niloticus*. This revealed that the presence of the trematodes in Biu reservoir was minimal since both the species investigated did not show any significant availability of the parasites.

Table 4: Prevalence, Mean Intensity and Abundance of Infection by Trematodes

Parasites species	Fish species	NE	NI	NPR	P (%)	MI	MA
<i>Heterophyes heterophyes</i>	<i>Clarias gariepinus</i>	15	1	3	3.33	3	0.20
	<i>Oreochromis niloticus</i>	15	0	0	0	0	0
Total		30	1	3	3.33	3	0.20

NE: Number Examined, NI: Number Infected, NPR: Number of Parasites Recovered, MI: Mean Intensity MA: Mean Abundance

Prevalence of Protozoan Parasites in *Clarias gariepinus* and *Oreochromis niloticus*

The results of the distribution of protozoan in the examined fish species is presented on table 5. The result revealed that, only *Trypanosome chagasi* was recovered in *C. gariepinus* and *O. niloticus*. The

prevalence infection was 6(40.00) and 2(26.67%), while the mean abundance of the parasites was also 0.30 and 0.13 for both *C. gariepinus* and *O. niloticus*. The mean intensity of the parasites recorded stand at 2.00 and 1.50 for *O. niloticus* and *C. gariepinus*. The overall infection rates of the

parasite in the examined fish species was 8(26.67%). The overall prevalence infection rate was higher than the overall prevalence infection reported by Urukwu and Adikwu (2017) in Benue River with the highest prevalence of 5.37% in protozoans than any other parasites which was also in contrast with Adeogun *et al.*, (2014). Some species of protozoan were also being reported in

both *C. gariepinus* and *O. niloticus* (Ugwu *et al.*, 2019) in the present study, the prevalence of the parasites was more in *C. gariepinus* than *O. niloticus*. This may be as a result of feeding habits and feeding location which varies between the two species. Since *C. gariepinus* is a bottom dweller and feed at the bottom, it may susceptible to parasites.

Table 5: Prevalence, Mean Intensity and Abundance of Infection by Protozoan

Parasites species	Fish species	NE	NI	NPR	P (%)	MI	MA
<i>Trypanosome chagasi</i>	<i>Clarias gariepinus</i>	15	6	9	40.00	1.50	0.30
	<i>Oreochromis niloticus</i>	15	2	4	26.67	2.00	0.13
Total		30	8	13	26.67	1.63	0.43

NE: Number Examined, NI: Number Infected, NPR: Number of Parasites Recovered, MI: Mean Intensity MA: Mean Abundance

Prevalence of Parasites according to Sex in *Clarias gariepinus* and *Oreochromis niloticus*

Table 6 present the result of sex of examined fish. The overall prevalence of the parasites was higher in the female *O. niloticus* 5(33.33%) than the male species of both *O. niloticus* and *C. gariepinus* which recorded 4(26.67) and 4(26.67%) respectively. The female *O. niloticus* also recorded the highest number of infected fish (5). Generally, *O. niloticus* recorded the highest prevalence of parasites 9(60.00%) than *C. gariepinus* which was 7(46.67). It was observed that 26.67 % of *C. gariepinus* males were infected, this percentage was higher than the infection of female's *C. gariepinus* which was 20.00 %. The sex ratio found in this study indicated that more females than males occurred in the samples fish population but a higher number of parasites were found in males than the females for *C. gariepinus*. A similar trend of results was reported by Hassan *et al.* (2010), who recorded higher percentage of infection in males (70.58 %) than that in females (68.25 %). Akinsanya and Otubanjo (2007) recorded same trend with lower infection rates in males and

females of *C. gariepinus*. Ayanda (2009) reported same prevalence of intestinal helminthes infection (26.25 %) in both *C. gariepinus* males and females. The disparity in the prevalence of infection between males and females in many studies may be attributed to the locality, seasonal variation, and water temperature, size of fish, or differences in immunity against parasites between males and females. This also agreed with the work of Aliyu and Solomon (2012) who reported in their separate studies that male *C. gariepinus* harbour more parasites than the female. In *O. niloticus* on the other hand, higher infection rates in females than males could be suggested to a marked of difference in fish feeding behaviour by sex. Kawe *et al.* (2016) and Uchechukwu, (2015) reported a similar result in their separate studies. But was in contrast with the work of Olugbotemi and Olajumoke (2018) who reported higher prevalence in male *O. niloticus* than the female. The disparity in the prevalence of infection between males and females may be attributed to the numbers of fishes examined against parasites or more females were available for infestation.

Table 6: Prevalence of Parasites Infection in Examined Male and Female fish

Fish species	Sex	NE	NI	P (%)
<i>Clarias gariepinus</i>	M	6	4	26.67
	F	9	3	20.00
Total		15	7	46.67
<i>Oreochromis niloticus</i>	M	5	4	26.67
	F	10	5	33.33
Total		15	9	60.00

NE: Number Examined, NI: Number Infected

Prevalence of Parasites in organs of *Clarias gariepinus* and *Oreochromis niloticus*

The prevalence of the parasites in various organs of examined fish species is shown on table 7. Three organs (gills, liver and intestine) were examined. Parasites were only recovered in the intestine 7(46.67%) and no parasite was recovered from both gills and liver of *C. gariepinus*. Parasites were recovered in all the organs of *O. niloticus*, with the intestine having the highest prevalence 11(73.33%), followed by gills 3(20.00%) and liver 3(20.00%). The distribution of parasites in the organs of *C. gariepinus* and *O. niloticus* showed that the majority of the parasites occurred in the intestine. Similar finding was reported by Aliyu, and Solomon (2012), Auta *et al.* (2000) and Emere

(2000). This could be due to the conducive nutritional advantage presented by the host's intestine to the parasites. Onwuliri *et al.* (1989) observed that helminthes sometimes differ in their nutritional and respiratory requirements. Also, the distribution of helminthes parasites in the fishes showed a clear preference for the intestine as sites of attachment attributable to the availability of food in these regions. The highest prevalence of parasites in the intestine implies that it is a more preferred predilection site; this could be due to the favourable conditions that enhance their survival. Similar findings were reported by Auta *et al.* (1999), Emere (2000) and Aliyu and Solomon (2012).

Table 7: Prevalence and Mean Intensity of Parasites in Organs of Fish Species Examined

Fish species	Organs	NE	NI	P (%)
<i>Clarias gariepinus</i>	Intestine	15	7	46.67
<i>Oreochromis niloticus</i>	Gills	15	3	20.00
	Intestine	15	11	73.33
	Liver	15	3	20.00

NE: Number Examined, NI: Number Infected

Conclusion

In conclusion, seven parasites belonging to four taxas namely; cestodes (*Diphyllobothrum latum*, *Taenia saginata*), nematodes (*Ancylostoma piscium*, *Dactylogyrus vastator*, *Capilliria hepatica*), trematodes (*Heterophyes heterophyes*) and protozoan (*Trypanosome chagasi*) were identified. The overall prevalence of the parasites was recorded higher in *O. niloticus*. *C. gariepinus* recorded the highest prevalence of protozoan, trematodes and a species of nematodes *Ancylostoma piscium* throughout the period of this study, while *O. niloticus* was observed to have higher nematodes such as *Dactylogyrus vastator*, *Capilliria hepatica*, and cestodes. Among the organs examined, intestine has the highest prevalence of infection rate than all other organs. The sex showed variation among the two species with male *C. gariepinus* recorded higher prevalence than the female, while *O. niloticus* was observed to have higher prevalence in female than male fish.

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