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Gastrointestinal Helminth Parasites Of Hemichromis Fasciatus (Peters, 1857) From Ooka Lake, Toru-Orua, Sagbama, Bayelsa State, Nigeria

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Abstract – The prevalence of gastrointestinal helminth parasite on *Hemichomis fasciatus* from Ooka Lake, Toru-Orua, Sagbama, Bayelsa State, and the infection rate was investigated between June and December 2022 during wet and dry season. A total of hundred (100) samples of *Hemicromis fasciatus* were examined for the prevalent of parasites. The results showed the presence of *Clinostomum tilapae* parasites in fifty two sampled fish, i.e. 52% of the sampled fish. The male fish recorded a higher rate of infection (59.3%) than the female (43.5%). In terms of Body Weight and Total Length in relation to infection rate, smaller fishes depict higher infection rates of 80% and 70%, respectively. The overall parasite burden was independent of sex, size and length of the fish species at (P>0.05).

Keywords – Condition Factor; Infection Intensity; Parasite Infection; and Prevalence Rate.

I. Introduction

Fish parasite surveillance in aquatic environment is of immense importance, parasite prevalence bring about great economic losses [9]. Parasites in fish is transmittable to humans causing zoonotic diseases. The incident of disease in fish may be due to aquatic environmental stress [24]. Increase in the dynamics of the aquatic ecology determines where the hosts and parasites/pathogens inhabit in the environment [35]. Parasites are integral part of the ecosystems, hence, are common issues in capture fisheries and aquaculture. This then affect fish health, production and appearance of fish resulting to negative financial consequences [26]. Globally, it was estimated monetarily that the losses caused by parasite diseases is worth 9.6 billion US dollars/year [28]. Considering the environmental conditions in the wild fishes are challenged with, they become more susceptible to co-infections due to the diversity of parasites inhabiting the aquatic environments especially the lake environment. These parasites are dependent on the fish for nutrition, support and protection. [24] reported that, the number of parasites needed to affect the health of a fish depend on the size and health which in turn greatly depend on its fish species.

Fish being the most numerous vertebrates on earth [8], yet each has a unique clade of pathogens and parasites. Most pathogens (bacterial, viral and fungal) are species-specific unlike parasites which are not constrained to a host, these make them of great importance to study due to their biodiversity [4], [13]. [19] reported that there are about 330,000 parasites tied to one fish host, while [6] stated that the extinction of a fish species results to the complete extinction of ten [10] unique metazoan parasites species. [22] stated that fish serve as an intermediate hosts for parasites, from the larval stage with man sometimes being the definite host. Helminth parasite is usually found in freshwater fishes, their prevalence and intensity are determined by the feeding habit of fish, condition of the aquatic environment, presence of an intermediate host, parasite species, and the host [11]. According to [15], helminth infections on fisheries have a major impact on public health and sustainable fish production, hence, the need for a comprehensive study of them.

In Nigeria, lots of studies exist on helminth parasites of fish, such as; [21], [7], [18], [33], [16], etc. In Bayelsa State, not much have been done, especially in Sagbama LGA of the State, on the numerous water bodies as lakes and borrow pits that contribute immensely to the fisheries industry. In fact, there are yearly fishing festival ceremonies organized by communities. One little known water body is the Lake Ooka, in Toru-Orua community, Sagbema LGA. This lake has provided socio-economic and ecological benefits to the community, and is endowed with diverse species of aquatic resources like fishes. One of such species is *Hemichromis fasciatus*, also known as the banded jewel fish, an important freshwater species in Africa, having dual importance as an ornamental fish and for consumption [16]. Yet, studies on its biology and pathology in Sagbama LGA, Bayelsa State, are very sparse, hence, this study.

II. Materials And Methods

2.1 Study Area

The study area, Lake Ookadunu also known as Ooka Lake, is a natural tropical freshwater body of about three kilometers (3km) long and 150 metres wide. The lake is 24km from Sagbama Town by road, and lies between Latitude 5º 09′ 15″ North and Longitude 6º 07′ 89″ East, located in the Toru-Orua Community, Sagbama, Bayelsa State. It is owned by two communities, Toru-Orua and Bolu-Orua which are 13km apart on the Sagbama-Ekeremor road. The lake is surrounded by swampy vegetation with moderate to high temperature of 26 – 30ºC and humidity ranging from 75-85% (Google Weather forecast in September, 2021) The vegetation around the lake makes it home for wildlife such as monkeys, birds, and abundant aquatic fauna. Aquatic flora comprise of variety of floating, emergent, and submerged microphytes and macrophytes.

The lake is of great importance to the indigenes of Toru-Orua and Bolu-Orua communities as means of transportation with dugout and V-shape canoes to farms located across the lake. It also host annual fishing festival of the communities' holding between February to March every year. The festival brings indigenes from across the LGAs and diaspora, contributing immensely to the socio-economics development of the communities affiliated to the lake. The fishes harvested during the festival are; *Gymnachus niloticus*, *Heterobranchus* spp, *Heterotis niloticus*, *Citharinus* spp, *Clarias* spp, *Hepsetus odoe*, *Gnathonemus niger*, *Parachanna* spp, *Xenomystus nigri*, *H. fasciatus*, etc.

2.2 Sample Collection

Specimens of *H. fasciatus* were purchased from fishers from June to December, 2022. A total of one hundred specimens were obtained for the study. The fishers used gillnet set in the evening (1800 – 2000 hrs) and retrieved in the morning (0600 – 2000 hrs). Then after each sampling, dry fish were transported in ice-packed coolers to the UAT laboratory for analysis.

2.3 Laboratory Observations

At the laboratory, fish were sexed based on [10] characters, that is, specimen with long gonad that serves as anal orifice are males. Whereas fish with too short anal and genital orifice are female. Also, the female have a rough and roundish genital papillae is elongated.

2.4 Parasites Identification

Sorted fish were disserted, the stomach and intestine were cut opened and examined for gastrointestinal helminth parasites. The contents of the stomach and intestines were emptied into a petri-dish containing water and quickly stained with giemsa stain using a pasture pipette. The pasture pipette was dipped into the giemsa stain bottle and few drops of it was put in the petri-dish. Thereafter, the contents in the petri-dish was mounted in a slide, then covered with the cover-lid and viewed under an Electron microscope, at x40 magnification and later at x100 magnification. The parasites recovered from the stomach and intestines were identified using available keys of [34], [30 and 31], [23] and, [5].

2.5 Preservation

Each fish specimen was assigned a reference number from 1 to 100 for ease of identification as well to ensure the accuracy and efficiency of recording. The parasites recovered from the fish stomach and intestines were stored and preserved in vials containing 70% ethanol for further studies.

2.6 Helminths Prevalence Rate

The rate of helminths prevalence was determined based on [1];

$$Prevalence = \frac{No\ of\ Fish\ Host\ Infected}{Total\ No\ of\ Fish\ Host\ Examined}\ X\ 100\% \quad (1)$$

Where prevalence determinate was based on sex and intensity of parasites according to [3] was estimated by the models;

$$Prevalence = \frac{No\ of\ a\ Particular\ Sex\ of\ Fish\ Infected}{Total\ No\ of\ Particular\ Sex\ of\ Fish\ Examined}\ X\ 100\% \quad (2)$$

$$Intensity = \frac{Total\ No\ of\ Parasite\ Species\ in\ a\ Sample\ of\ Fish}{No\ of\ Fish\ Host\ Infected} \quad (3)$$

2.7 Morphometric Analysis

The morphometric relationship, Length-Weight Relationship (LWR) for *H. fasciatus* in Lake Ooka was determined using the mathematical expression, "$W = aL^b$" , a is the scaling coefficient for weight at length of fish, b is the shape parameter for the body form of the fish. Condition Factor (K), which determined the wellbeing of the sampled fish was based on the relationship, "$K = 100(W/L^3)$". Where K = Condition Factor/Wellbeing of fish, L = Length of fish, and W = Weight of fish [14].

2.8 Statistical Analysis

Simple descriptive statistics was used to estimate percentage prevalence and infection intensity. Data collected were subjected to Chi-Square analysis using SPSS 23 to determine the significant difference at P<0.05.

III. Results

Summary of the results of the hundred (100) samples of *H. fasciatus* examined for helminth parasites infection are as shown in Table 1.

Table 1: Prevalence of Gastrointestinal Helminth Parasites Examined in Relation to Sex of *H.fasciatus* in Lake Ooka.

Species	No Examined	No Infested	% Infected	Intensity of Parasites	Mean Parasite Intensity
H. fasciatus	100	52	52.0		
Male	54	32	59.3	1.06	
Female	46	20	43.5	1.2	1.13

$x^2 = 4.651$, df = 2, p = 0.098

The major gastrointestinal helminth parasites identified in the study was *Clinostomum tilapae* with an overall parasitic prevalence of 52%. The result revealed that male sampled fish rate of infection was 59.3%, while the females was 43.5%, Table 1. Intensity of parasite for the female fish was 1.2 and the male, 1.06, while the mean parasite intensity was 1.13. The Chi Square statistical analysis revealed that there is no significant association between sex and Helminth infection of *H. fasciatus*, p > 0.05 (p=0.098), in Table 1.

Result on *H. fasciatus* relationship between body weight and parasite infection is shown in Table 2.

Table 2: Prevalence of Gastrointestinal Helminth Parasites of H. fasciatus in Relation to Body Weight in Lake Ooka,

SN	Body Weight (g)	No (%) Examined	No (%) Infected	% Infected	Intensity of Parasites	Mean Parasite Intensity
1	15.0 – 24.9	10	8	80.0	1.25	
2	25.0 – 34.9	22	12	54.5	1.17	
3	35.0 – 44.9	26	18	69.2	1.29	
4	45.0 – 54.9	26	8	30.8	1.0	
5	55.0 – 64.9	14	6	42.9	1.0	
6	65.0 – 74.9	2	0	0	0	
7	Total	100	52	52. 0		1.142

$x^2 = 17.398$, df = 10, p = 0.66

Result on helminth infection of *H. fasciatus* in relation to body weight revealed that sampled fish with largest body weight (65.0 – 74.9g) were not infected with parasites but fish with body weight of 15.0 – 24.9g had the highest rate of infestation 80 percent, while the lowest infestation rate of 30.8 percent was recorded for body weight of 45.0– 54.9g. Body weight of 35.0 – 44.9g parasite severity were more than the other groups, the last three groups revealed low parasite intensity (Table 2). Statistically, there was an insignificant association between body weight of sampled *H. fasciatus* and the parasite Helminth infection as indicated by value of p>0.05 (p = 0.66).

The result on total length in relation to parasite infection shown in Table 3 revealed that the group with the smallest total length range of 11.1 – 12.5cm had the highest rate of infection (70 %) while 15.6 -17.0 had the lowest (30.8). The middle and smallest total length groups had the highest parasite intensity compared to the other three.

Table 3: Prevalence of Gastrointestinal Helminth Parasites of H. fasciatus in Relation to Total Lenght in Lake Ooka

SN	Total Length (cm)	No (%) Examined	No (%) Infected	% Infection	Intensity of Parasites	Mean Parasite Intensity
1	11.1 – 12.5	20	14	70.0	1.14	
2	12.6 – 14.0	6	4	66.7	1.0	
3	14.1 – 15.5	42	22	52.4	1.18	
4	15.6 – 17.0	26	8	30.8	1.0	
5	17.1 – 18.5	6	4	66.7	1.0	
6	Total	100	52	52.0		1.064

$x^2 = 11.381$, df = 8, p = 0.181

The statistical analysis was similar to the outcome of body weight association with Helminth parasites (P = 0.66) and sex association to the parasite infection (P = 0.098), the association between TL and Helminth infection on *H. fasciatus* was also insignificant, p>0.05 (p = 0.181), Table 3.

Graphical presentation of the linear relationship of length and body weight is shown in Fig. 1. The morphometric relationship (LWR) for *H. fasciatus* was determined and given as "$W = 3.9335L^{0.3546}$", from the power relationship equation on the graph, *a* and *b* were also estimated from the relationship as 3.9335 and 0.3546, respectively. Condition Factor (K) of the environment which was determined from TL and W of the fishes revealed a positive value of 1.3179.

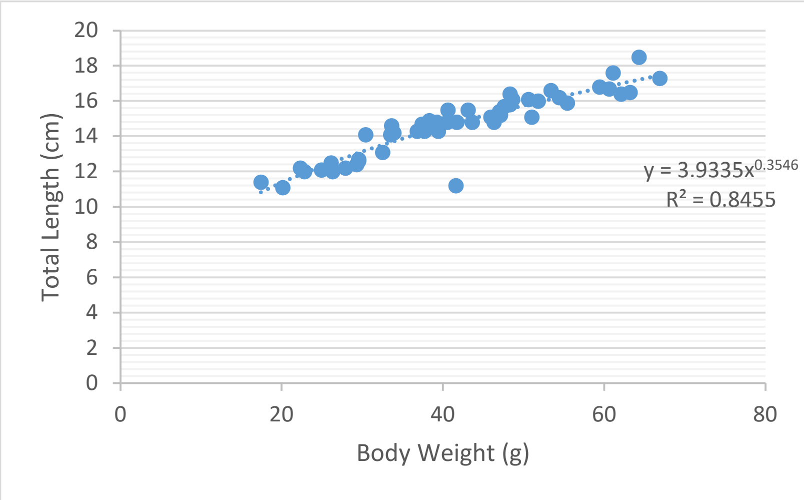

Fig. 1: Length-Weight Relationship of H. fasciatus of Lake Okao Katsina

IV. Discussion

The rate of helminth parasites prevalence studied on Cichlids species of *H. fasciatus* of Lake Ooka was found to be 52%, this is close to the prevalence rate obtained by Sadauki *et.al.* [25] who reported 60% overall prevalence rate for catfish parasitic study from Jibia reservoir, Katsina State. This value supersedes the values of Amaechi [2] and Bashar and Jega [9] of 41.9% and 40% prevalence rates on *H. fasciatus*, respectively.

The result on parasite prevalence in relation to sex of fish revealed that male fishes had the highest infection rate (59.3%) and females had 43.5% with P>0.05. Despite the lower rate of infection in the female fish, it parasite intensity was more than that of the male, 1.2 > 1.06. The female revealed more parasite intensity when compared to the mean (1.13).

The result on infection rates (59.3% for male and 43.5% for female) is contrary to the findings of Sadauki *et.al.* [25] study on *C. gariepinus*, Ratnabir *et.al.* [29] study on *Channa punctate, Notopterus notopterus,* and *Heteropneustes fossilis*, Amos *et.al.* [3] study on C. gariepinus, and Okita *et.al.* [17] study on *Alestes nurse, Clarias gariepinus, Tilapia zilli,* and *Oreochromis niloticus*. Their studies reported more parasite infections in female fishes than males.

The results on parasite infection rate in relation to body weight showed that the smaller body weights had the highest rate of infection (80%) compared to the largest with o% infection rate, all indicated P>0.05. This implies that the prevalence of parasite was more in smaller fish. This result is in consonance with the findings of Sadauki *et.al.* [25] and Shehata *et.al.* [27], who reported smaller body weight fishes are more susceptible to parasite infection than bigger body weight fishes due to the nature of their immune systems at that age which is weak possibly because of the less amount of food they fed on, the environmental condition of the study area and the feeding habit of the fish. This study is contrary to the findings of Echi *et.al.* [7], Okoye *et.al.* [2], and Uzonnah [33], whose reports indicated higher parasite infection rate in larger fish.

Parasite infestation rate in relation to length of fish (Total Length, TL) showed that the smaller fishes had the highest rate of infection (70%) with the biggest also next to it (66.7%), all at P>0.05. This depicts that smaller fishes have less immunity against parasites infection than the adult fish. This result is in consonance with the findings of Sadauki *et.al.* [25] and Sehata *et.al.* [27] study on *C. gariepinus, Cyprinus carpio,* and *O. niloticus*, but contrary to the findings of Okita *et.al.* [17], Uruku and Adikwu [32] study on Clariids catfish (*C. gariepinus* and *C. anguillaris*), and Amos *et.al.* [3], their reports stated that adult fish have less immunity against parasites than smaller fish.

The general condition factors (K) determined through the body weight and total length of the fish for this study was 1.3179, which is positive. This estimated value indicates that the environmental conditions are suitable for the growth of *H. fasciatus* despite the prevalence of parasites in the environment. Amos *et.al.* [3] reported that K does impact the general infestation rate and is influenced by age, sex, maturation, amount of fat reserve, type of food consumed, degree of muscular development and etc.

V. Conclusion

The condition factor in this study reveals the general health status of the fish and environment to be positive, the smaller fish being more susceptible to parasite infection in the lake because of the high infection rate recorded in them. This implies that the smaller fish are key determinants in the distribution and existence of parasites in the lake. The results on helminth parasitic infection on *H. fasciatus* reflects an average prevalence rate on sampled fish, hence, it is mandatory that constant surveillance and monitoring of fish parasite in an epidemiological manner be done to prevent their multiplication in the Ooka Lake. This study being a baseline study on the lake, therefore advocate the need for an awareness programme on the zoonotic potentials and the negative impact of the parasitic organism to consumers' health should be availed to stakeholders in Toru-Orua and its environs for protection and development of the potentials of the lake.

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