
EFFECTS OF AGE AND SEASON ON PREVALANCE OF HELMINTHS OF FAMILY Cichlidae IN SABIYEL LAKE, ALIERO, NIGERIA

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Abstract

The research was carried out from July, 2020 to June, 2021 to assess the effects of age, sex and season on the prevalence of helminths and condition factor of the family Cichlidae in Sabiyel Lake. Four Cichlids Species Sarotherodon galilaeus (Linnaeus, 1758), Hemichromis fasciatus, Oreochromis niloticus (Linnaeus, 1758), and Hemichromis bimaculatus belonging to three genera: Sarotherodon, Hemichromis and Oreochromis were sampled in Sabiyel Lake. Out of 480 randomly selected Cichlids specimens examined, 192 (40%) were infested with one or more helminths parasites. The worm's prevalence rate of infection was highest in Sarotherodon galilaeus with Capillaria sp. (112), Contracaecum sp. (54) and Clinostomum sp. (8). The Oreochromis niloticus was infested with 18 Capilaria sp only and there were no helminths infestation recorded in Hemichromis fasciatus and Hemichromis bimaculatus. However, significant difference was found between the prevalence of helminth parasitic infection and age of the Cichlids species examined ($P < 0.05$). Adult Cichlids were found to be more parasitized than juveniles and young specimens. Similarly, there is an association between the prevalence of helminth parasitic infection and the season. The young males Cichlids specimens in Sabiyel Lake should be preferred and sourced during the dry season period due to lower helminth parasitic infection.

Keywords: Helminths, Cichlids, Prevalence, Age, Season, Sabiyal lake.

Introduction

Cichlids, are a diverse Family of fish which live only in freshwater and are found in lots of different lakes and rivers across the world (Magalhaes and Ford, 2022). They are extremely fascinating to researchers and are a cherished source of nourishment. Cichlids are studied to understand how different kinds of cichlids have developed to adapt to their changing environments.

Some species of Cichlids are substrate spawners, whereby the eggs are laid either on the ground or any hard surface in water; in which case parental care then consists of guarding the eggs, fanning them to provide oxygenated water; and then caring for the hatchlings which eventually become free swimming fry (Keenleyside, 1991).

However, Cichlids could serve as hosts to different helminths, particularly the nematodes (Marcogliese, 2004). A number of researchers, (Yanong 2006; Moyo *et al.*, 2009; Onyedineke *et al.*, 2010; Abdel-Gaber *et al.*, 2015 and Sinaré, *et al.*, 2016), have observed that fish serve as definitive, and even intermediate hosts in the life cycles of several helminth parasites. The chief freshwater parasitic groups of fish include the microparasites; protozoans, microsporideans and myxozoans while the macroparasites group consists of helminths such as monogenea and the diagenes, trematodes (Flukes), cestodes (Tapeworms), nematodes (Round worms) and acanthocephalans (Thorny headed worms), while examples of arthropods parasites are include the copepods and the annelid parasites the leeches (Marcogliese, 2002).

The prevalence of helminths of freshwater fishes is also observed to be influenced by seasons. Price and Clancy (1983) in Zehmer and Aral (1998), opined that bigger fish species accommodate higher parasitic variety than small-bodied fish. Separation of infections by host age or size classes would contribute to the aggregation that is often observed in parasite populations when host age and size classes are pooled (Crofton, 1971 in Zehmer and Aral, 1998).

Fish parasites may be greatly pathogenic and assist to high mortalities and monetary losses. These parasites either cause infections in fish out rightly or make them vulnerable to other diseases, consequently leading to loss of fish (Onyedineke *et al.*, 2010). Besides mortality in fish, some parasites are also transmitted to humans through fish (Ahmad *et al.*, 2014). Parasites are important group of pathogens causing infection and diseases in both freshwater and marine environments. Parasitic infestations are therefore becoming threats to fish production and the fish health management (Chandra, 2006).

Helminth parasites are of vital consequence on fish healthiness, growth, behavior, fecundity and mortality (Marcogliese, 2004). Parasitic infections tremendously contribute to the risk of the occurrence of secondary infections like fungal, bacterial and viral diseases in fish (Sun *et al.*, 2012).

Fish production in Nigeria as found in other developing countries, is strengthened by the availability of extensive inland water systems made up of streams, rivers and lakes which support a large number of fish species, many of which are endemic and of economic importance. Sabiyel Lake fish catches which are dominantly Cichlids may sometimes constitute over 95% of fresh fish marketed in Aleiro town. In addition, also the lake provides daily source of fresh fish for most villages nearby (Field Survey, 2020). Humans can accidentally be infected with larval stages of nematodes, leading to a severe disease generally known as *anisakidosis* (Shamsi and Butcher, 2011). This research is aimed at assessing the

effects of age and season on the prevalence of helminths of the family *Cichlidae* in Sabiyel Lake.

Materials and Methods

Study Area

The research was carried out in Sabiyel Lake, Aliero Local Government Area, Kebbi State. Sabiyel lake is a natural eutropic, perennial standing fresh water body, located between latitude 12⁰ North and longitude 4⁰ East.

Sampling Procedure

The Cichlids species specimens were collected from fishermen catch purposively at three different Sampling Sites (SS) designated as SS1 for Tari, SS2 for Kashinzama and SS3 for Sabiyel. A total of 480 Cichlids were collected (the sampling size) as described by Lwanga and Lemeshow (1999). The formula below was used to determine the sampling size (n).

$$n = \frac{P(100-P)z^2}{E^2}$$

z = Point of normal distribution curve equivalent to 95% confidence interval (1.96).

P = Prevalence rate from previous study; 29.91% (Abba *et al.*, 2018).

E = 5% Margin of error.

Sample Collection

The Cichlids species specimens were collected live from the fishermen catches from July, 2020 to June, 2021 and were immediately transported in modified 25 liters Jerry Can half-filled with clean water to Fisheries Laboratory, Kebbi State University of Science and Technology Aliero for morphometric measurement and examination of helminths infection.

Cichlids Species Identification

The Cichlids species were identified as described by Adesulu and Sydenham (2007).

Cichlids Sex Determination

The sexes of the fish were determined using one or more of these;

1. The abdomen of each Cichlids species specimen was pressed for the extrusion of whitish milt (for males) or eggs (for females). This approach was used for fish in ripe or running stage.
2. The Cichlids species specimen was dissected for the presence or absence of testes or ovaries. Presence of testes signifies maleness, while the presence of ovaries indicates that the fish is a female.
3. The gonads were excised and examined under the microscope for immature eggs or milt and conclusion were made as in (1) above. However, where the sex was difficult to identify by these three methods, the Cichlids species specimen were categorized as immature or juvenile (Ash, 2012).

Pithing

A scalpel was used to kill the Cichlids by cutting their nerve cord (Lab activity)

Helminths Examination on Cichlids External Openings

The Cichlids species specimens were placed dorso-ventrally on a dissecting board. A hand-held Magnifying glass was used to examine Gills, Buccal cavity, Eyes and Skin. When any helminths were recovered, they were taken out and placed in Wet Mount Slide prepared with 0.9% physiological Saline solution. The slide was microscopically studied with the aid of a BX41 Olympus Compound Light Microscope at 40, 100 or 400 Total Magnification (TM) as described by Ajala and Fawole (2014). The diluted Methylene Blue solution was used to stain the helminths for proper morphological features identification.

Helminths Examination on Cichlids Abdominal cavity and Alimentary Canal

A central incision was made on the specimen abdominal region with a pair of dissecting Forceps. The gut was taken out, stretched and squeezed gently to release its content into a Petri Dish with 0.9% Saline Solution. A Wet Mount Slide with some drops of 0.9% physiological Saline solution were prepared and the slide was microscopically studied with the aid of a BX41 Olympus Compound Light Microscope at 40, 100 or 400 Total Magnification (TM) as described by Ajala and Fawole (2014). The diluted Methylene Blue solution was used to stain the helminths for proper morphological features identification.

Identification of Helminths

The helminths found were identified based on their distinctive body shapes and the morphological features as described in literature such as (Abba *et al.*, 2018), a key from Paperna (2004) for identification of major taxa of fish adult and larval parasites and a key to from Frimeth (1994) for identification of the major taxa of Fish helminths.

Helminths Diversity

The helminths species composition was determined according to method of (Okoye *et al.*, 2014).

Helminths Prevalence of Infection

The prevalence rate of the helminths was determined with the formula below (Okoye *et al.*, 2014);

$$\text{Prevalence} = \frac{\text{Number of fish infected}}{\text{Total Number of fish examined}} \times 100$$

Data Analysis

Descriptive Analysis

The helminths prevalence rate of infection and mean intensity of infection were analyzed using Percentage and Means respectively.

Chi Square Test

IBM SPSS 22 Pearson Chi-Square test for independence was used to evaluate whether there is a relationship or association between the prevalence of helminths infection and the Cichlids age and season in Sabiyel Lake.

Results

Composition of Helminth Parasites infesting Cichlids in Sabiyel Lake

Three helminths species were found infesting the gut only of Cichlids in Sabiyel Lake during the study period (July, 2020 to June 2021). The helminths parasites belong to two Classes Class Nematodes: *Capillaria* and *Contracaecum tilapiae* from the genus *Capillaria* and *Contracaecum* respectively. And one species of Class Trematodes: *Clinostomum tilapiae* of the genus *Clinostomum*.

Prevalence of Helminth parasites infection in relation to Age on Cichlids species in Sabiyel Lake.

The prevalence of helminths species infection in relation to Cichlids age is shown in (Table 1). The result shows that helminths infection was most prevalent in adult Cichlids followed by young Cichlids than juveniles Cichlids.

Table 1. Prevalence of Helminth parasites infection in relation to Age on Cichlids species (n = 480) in Sabiyel lake ($\alpha = 0.05$).

Cichlids	Variables	Prevalence (%)	95% CI	X ²	P value
	Age				
<i>S. galilaeus</i>	Juveniles	22			
	Young	72			
	Adult	6			
			2.1420-2.2691	29.460	0.003
	Age				
<i>H. fasciatus</i>	Juveniles	0	-	-	-
	Young	0	-	-	-
	Adult	0	-	-	-
	Age				
<i>H. bimaculatus</i>	Juveniles	0	-	-	-
	Young	0	-	-	-
	Adult	0	-	-	-
	Age				
<i>O. niloticus</i>	Juveniles	0	-	-	-
	Young	67			
	Adult	33			
			2.1577-2.2805	16.404	0.002

Prevalence of Helminth parasites infection in relation to Season on Cichlids species in Sabiyel Lake.

The prevalence rate of helminths parasites infestation was found to vary with seasons (Table 2). Prevalence was higher during the rainy season compared to dry season.

Table 2. Prevalence of Helminth parasites infection in relation to Season on Cichlids species (n = 480) in Sabiyel Lake ($\alpha = 0.05$).

Cichlids	Variables	Prevalence (%)	95% CI	X ²	P value
<i>S. galilaeus</i>	Season				
	Rainy	63			
	Dry	37	1.1307-1.2393	45.399	0.450
<i>H. fasciatus</i>	Season				
	Rainy	0	-	-	-
	Dry	0	-	-	-
<i>H. bimaculatus</i>	Season				
	Rainy	0	-	-	-
	Dry	0	-	-	-
<i>O. niloticus</i>	Season				
	Rainy	100			
	Dry	0	1.1307-1.2393	14.724	0.022

Discussion

The overall helminths prevalence rate of 40% was close to 41.9% reported by Amaechi *et al.*, (2015). The results of this study showed that the species of genus *Capillaria* of class Nematodes maintained the highest prevalence rate throughout the sampling period, followed by species of *Contracaecum tilapia* of same class. The *Capillaria sp.* prevalence was 112 (86%) and 18 (14%) in *S. galilaeus* and in *O. niloticus*, respectively. This may be due to *Capillaria sp.* are most likely being consumed as food as necropsy shown that all the *Capillaria sp.* are dead and found only at the posterior part of the Cichlids gut.

In this study, there is statistically significant relation between prevalence rate of helminths infection and Cichlids species age ($p < 0.05$). The prevalence of Nematodes and Trematodes parasites was also evaluated based on different age group. This study result revealed a higher nematode and Trematoda parasite infestation in the young and adult Cichlid species. This finding agreed with Bichi and Ibrahim, (2010) and Amaechi *et al.*, (2015) who stated that larger fishes were heavily parasitized than the smaller ones. Perhaps, the reason for the higher infection rate in adult and young maybe because of the longer duration of time the older fish were exposed to the agents in the environment.

Similar observation of higher infection in adult was reported by Amare *et al.*, (2014.) who noted that longer fish provide greater surface for infection than smaller fish. In addition, a higher prevalence in adult and young may be due to the accumulation of the worms over a longer period and their larger size which tend to be too big for the piscivorous bird, which will feed on small and medium sized fish.

Prevalence rate was higher during the rainy season (July to November, 2020) and highest in the month of November, 2020 (78%) compared to dry season (December to June, 2021). The lowest prevalence was recorded in the month of June, 2020 (8%). The p-value ($p < 0.05$) is less the significant value of 5% or the alpha ($\alpha = 0.05$). Thus, there is significant difference between the prevalence rate of helminths infection and Season.

The prevalence rate was rising and falling in a manner that depicts clear seasonal trends and (Chandra, 2006) and Hussen *et al.*, 2012), findings have shown that helminths are mostly found in fresh water fishes where factors such as parasite species and its biology, host and its feeding habitats, physical factors, hygiene of the water body and presence of intermediate hosts contribute to their prevalence. Thus, the high prevalence recorded in this study during the raining season may be due to the environmental conditions, the host feeding habits and the availability of intermediate host (copepods, insects, molluscs etc.) which harbors the infective larval stage of some of these helminth parasites making them available to fishes in the water.

Conclusion and Recommendations

It is concluded that there is occurrence of helminth parasites infection of class Nematodes and Trematoda in the family *Cichlidae* (Cichlids) in Sabiyel Lake Aliero Local Government Area Kebbi State, Nigeria. The prevalence rate of parasitic helminths infection recorded in this study was considered high (40%) and very important to the Sabiyel Lake fishery which serves as a good source of fresh fish for local communities and Aliero town.

Although low incidence of helminths infection was recorded during the dry season period, the infection rate was significantly enough to elicit some pathological effects on the Cichlids species and may be affecting their condition factor (K) therefore, it is suggested that sourcing of *Sarotherodon* and *Oreochromis* for aquaculture in Sabiyel Lake should be done during dry season where these species are less infected with helminth parasites.

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