World Journal of Fish and Marine Sciences 10 (1): 05-11, 2018
ISSN 2078-4589

DOI: 10.5829/idosi.wjfms.2018.05.11

Comparative Study on Helminth Parasites of *Oreochromis niloticus* and *Clarias gariepinus* in Ajiwa Earth Dam Katsina State, Nigeria

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Abstract: A comparative parasitological investigation was carried out during the period of August 2016 to January 2017. A total of 269 fish samples comprising of 136 *Oreochromis niloticus* and 133 *Clariasgariepinus* of different weights and length groups were collected from Ajiwa earth dam, Katisina state, Nigeria and examined for ecto and intestinal helminth parasites. Helminth parasites encountered were mainly the trematodes: *Dactylogyrus* sp and *Neascus* sp, nematodes: *Procamallanuslaevionchus* and *Contracaecumsp,* cestodes: *Polyonchobothriumclariae* and *Bothriocephalusaegyptiacus* and acanthocephalan: *Neoechinorhynchusrutili*. Helminthic infections recorded were restricted to the intestine, skin/fin and gill, though majority of infection was found in the intestine. The overall percentage of infection recorded in the two fish species was 27.88% and the highest percentage of infection (34.59%) was observed in *Clarias gariepinus*. Infection of these parasites was more prevalent in the dry season than the rainy season, whereas male fish samples were more infected than females. Chi-square test confirmed a significant difference ($P<0.05$) in the prevalence rate between the two species, although no significant difference were observed in the prevalence rate between the seasons and sexes of the two fish species. In relation to host size (weight/length), the result showed that there was no significant difference in the parasitic infection among the groups, although infection increased with increasing host size. Since most of the parasites were recovered from the intestine, with a few from skin/fin and gill, therefore, removal of these fish parts and thorough cooking of fish before consumption will ensure human safety.

Key words: Ajiwa · Katsina · Helminth Parasites · *Oreochromis niloticus* · *Clarias gariepinus*

INTRODUCTION

Fish has continued to be important component of ecosystem from ecological, nutritional medicinal and economical point of view [1]. Fish interacts with various levels of food web and influences the structures of lakes, streams and estuaries [2]. Fish is a high quality food, apart from its protein contents; it is also reach in vitamins and contains variable quantities of fat and minerals for human health [3]. Fish provides a source of income to many communities, particularly hinterland areas where fishing is given much attention. Fish is of medical importance and serve as an intermediate and reservoir host to most stages of parasites including protozoan and helminthes that are harmful to man and animals [2].

Due to fish nutritional benefits, affordability and the increase in human population, demand for fish has increased [4]. In Nigeria, over 1.5 million metric tons of fish are consumed annually and this ranks Nigeria to be the largest consumer of fish and fishery product in Africa [5, 6]. Despite the great development in fish farming and culture, fish produced in Nigeria cannot satisfy the requirement needed. It is estimated that about 450, 000 metric tons of fish are produced in Nigeria and over 900, 000 metric tons deficit are imported. In fish farming, parasites may be highly pathogenic, contributing significantly to high mortalities and economic losses, while in natural systems; parasites may threaten the abundance and diversity of indigenous fish species [7].

Fishes are hosts to taxonomically diverse parasites and infections can significantly affect fish production through direct fish mortality, nutrient devaluation, alteration of biology and behavior, lowering of immune capability, growth and fecundity reduction and sometimes mechanical injuries which depends on the specie of parasites, intensity of infestation and depth of parasite

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penetration with the host tissue [8, 9, 11]. Parasitic community, diversity and burden may also be determine to large extent by seasonal fluctuation, geographic location, feeding habit, host age, size and sex [10, 11].

A wide range of parasitic infections of Nigerian freshwater fishes and the importance of such parasitic infections particularly with respect to huge economic loss in fishes has been well studied. However, documented information on fish parasites is lacking in this area hence the need to study the parasitic infections, including their identification, prevalence and host specificity with regard to *Orechromisniloticus* and *Clariasgariepinus*.

MATERIALS AND METHODS

Study Areas: Ajiwa Dam was built in 1976 in Ajiwa District (lies between latitude 12° 98^{l} N and 12° 58^{l} E and longitude 7° 75^{l} N and 7° 45^{l}) of Batagarawa Local Government in Katsina State of Nigeria, to provide water for general household use and irrigation. The dam cover an area of approximately 40 meter and width of dam is approximately 22km long Figure 1.

Samples Collection: From August 2016 to January 2017, a total of 269 randomly selected fishes comprising of 136 *Oreochromis niloticus* and 133 *Clarias gariepinus* of different weights and length groups were collected from three different sampling points with the assistant of local fishermen and examined. Sample collections were done in the morning between 06:00 to 08:00am. Water from the dam was added to the samples before being transported to the Biological science laboratory of Umaru Musa Yar'adua University Katsina in aerated plastic containers.

Morphometric Study: At the laboratory, the fishes were given serial number and then fish morphometric (measuring of weight and length) prior to observation of external fish parasites and dissection was done. Using transparent ruler, the total length of each fish was taken from the tip of the snout (with the mouth closed) to the extended tip of the caudal fin while the standard length was obtained by subtracting the length of the caudal fin from the total length and recorded to the nearest 0.5 centimetre (cm). After draining excess water, the weight (w) of the same fish was obtained to the nearest 0.1g using a weighing balance (Scout Pro SPU202). Sex determination of the fish species was done by visual examination of the anal opening for the presence of papilla just before the anal fin is indicative for a male species while the absence of the papilla indicates a female species. This was consequently confirmed by the presence or absence of testis or ovaries during dissection [12].

Examination of Fish for Parasites: As examination progresses, dead fishes were removed and examined immediately while the live ones were kept in a plastic aquaria containing water from the dam and examined subsequently. Lived fishes were killed by cervical dislocation to ease examination [13].

Ectoparasites: The entire external body surfaces of a freshly caught fish was thoroughly examined for ecto-parasites using hand lens. Mucous scrapings from dorsal part of the body of fish, lateral and tail ends were placed on clean glass slide, with a drop of saline added and were examined under x10 and x40 objective lenses of compound microscope. A small section of the affected body surfaces were cut and placed in aqueous formalin for 30 minutes. The mixture was shaken vigorously to dislodge relaxed helminthes. The operculum of fish was cut open with scissors and gills were exposed. Gill arches and gill filaments were placed in different Petri dishes containing normal saline and were observed with hand lens, dissecting and compound microscope for parasites [2, 4].

Endpoarasites: Fish samples were placed dorso-ventrally on dissecting board and fixed to prevent movement. The body cavity was opened with the aid of scissors and the mesentery and connective tissues, connecting loops of the gut and the liver were cut and the organs separated. The gut was then stretched out, placed in a large Petri dish and cut into four regions (oesophagus, stomach, intestine and duodenum). Each section was then placed in a separate labeled dish. The separated gut sections were opened by longitudinal incision to expose the inner surface which was washed with very little quantity of distilled water into labelled test tubes. A drop of the residue was placed on the slide and observed under x10 and x40 objectives of dissecting microscope for the various parasites. This was repeated until the entire residue was examined [13, 14].

Isolation and Identification of Helminth Parasites: Most of the parasites were recognized by their wriggling movement on emergence from their host. Parasites were picked with Pasteur pipette and forceps. Parasites obtained were counted, labeled with the serial number of the fish and placed in physiological saline overnight to

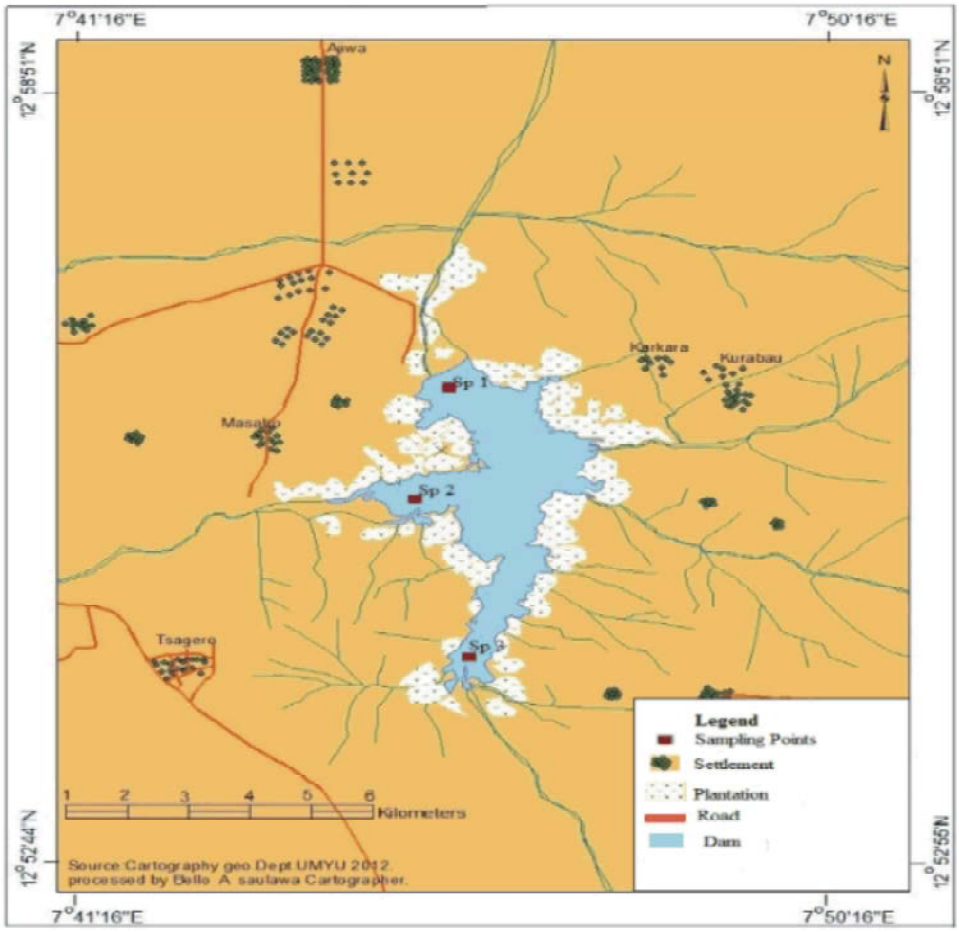

Fig. 1: Map of Ajiwa Dam showing the sampling Points

allow them stretch and relax; they were then fixed and stained using acetocarmine and lactophenol. Identification of the isolated parasites to species level was done by comparing observed parasites using keys provided by Yamaguti [15], Yamaguti [16], Gibson [17] and Barson and Avenant-Oldewage [18].

Statistical Analysis: The relationships between factors such as length, weight, sex, species and season were obtained using Analysis of Variance (ANOVA). All statistical analysis were done using Graph Pad Instat Software, 2016. Values equal to or less than 0.05 ($p=0.05$) were regarded as significant.

RESULT

Out of 269 samples of both *O. niloticus* and *C. gariepinus* examined in the study area, 75(27.88%) were found to harbor different helminth parasites. *C. gariepinus* recorded the highest percentage of infection (34.59%) compared to *O. niloticus* (21.32%) and infection was found to be statistically significant ($p<0.05$). Worm burden was high in *C.gariepinus* with one hundred and sixteen (116) helminth parasites isolated than *O. niloticus*with seventy seven (77) isolated parasites in both single and mixed infections (Table 1). Helminth parasites encountered were *Neascus*sp, *P. clarias*, *B. aegypticus*, *P. glanduliger*, *P. laevionchus*, *Contracaecum* sp and *N .rutili*. The distribution of these parasites in the organs of studied fishes showed infection was restricted to the stomach, intestine and skin/fin. Intestine recorded the highest percentage of infection of 33.33% and 50.3 in *Oreochromis niloticus*and *Clarias gariepinus* respectively (Table 2). Results of the relationship between sex and percentage of infection are shown in Table 3. It was observed that males were more infected (22.08% and 44.08%) in *O. niloticus* and *C. gariepinus* respectively than the females, although the

Table 1: Overall Percentage of Infection in the study area

Host	NE	NI	Prev. (%)	Total No. of Parasites recovered	Intensity
O. niloticus	136	29	21.32	77	2.7
C. gariepinus	133	46	34.59	116	2.5
Total	269	75	27.88	193	2.6

NE = Number Examine, NI = Number Infected, Prev. = Prevalence

Table 2: Parasites Distribution in organs of *O. niloticus* and *C. gariepinus* in the study area

		O. niloticus (N=136)		*O. niloticus* (N=133)	
Parasites	Gills	Skin/fin	Intestine	Skin/fin	Intestine
Trematode					
*Dactylogyrus*sp	01(0.74%)	-	-	-	-
*Neascus*sp	-	05(3.68%)	-	11(8.27%)	
Cestode					
B. aegyptiacus	-	-	04(2.94%)	-	04(3.01%)
P. clarias	-	-	-	-	09(6.77%)
Nematode					
P. laevionchus	-	-	09(6.62%)	-	19(14.29%)
*Contracaecum*sp	-	-	18(13.24%)	-	17(12.78%)
Acanthocephalan					
N. rutuli	-	-	02(1.47%)	-	-
Total	01(0.74%)	05(3.68%)	33(24.26%)	11(8.27%)	49(36.84%)

Table 3: Sex and infection of Helminth parasites in the study area

	Host					
	O. niloticus			*C. gariepinus*		
Sex	NE	NI	Prev. (%)	NE	NI	Prev. (%)
Male	77	17	22.08	59	26	44.08
Female	59	12	20.34	74	20	27.03
	X^2= 0.001; d.f=1; p>0.05			X^2= 3.494; d.f=1; p>0.05		

NE = Number Examine, NI = Number Infected, Prev. = Prevalence

Table 4: Seasonal occurrence of Helminth parasites in the study area

	Host					
	O. niloticus			*C. gariepinus*		
Season	NE	NI	Prev.(%)	NE	NI	Prev.(%)
Rainy	64	12	18.75	55	19	34.55
Dry	72	17	23.61	78	27	34.62
	X^2= 0.232; d.f=1; p>0.05			X^2= 6.972; d.f=1; p>0.05		

NE=Number Examine, NI= Number Infected, Prev. = Prevalence

Table 5: Relationship between total length and percentage of infectionin *O. niloticus* and *C. gariepinus* in the study area

	Host					
	O. niloticus			*C. gariepinus*		
Length (cm)	NE	NI	Prev.(%)	NE	NI	Prev.(%)
10-13	04	-	-	-	-	-
14-17	78	15	19.23	-	-	-
18-21	45	11	24.44	29	11	37.93
22-25	09	03	33.33	56	19	33.93
26-29	-	-	-	38	12	31.58
30-33	-	-	-	10	04	40.0
	X^2=1.609; d.f=3; p>0.05			X^2=0.209; d.f=3; p>0.05		

NE=Number Examine, NI= Number Infected, Prev. = Prevalence

Table 6: Relationship between weight and percentage of infectionin *O. niloticus* and *C. gariepinus* in the study area

	Host					
	O. niloticus			*C. gariepinus*		
Weight (g)	NE	NI	Prev.(%)	NE	NI	Prev.(%)
41-60	13	01	7.79	19	03	15.79
61-80	38	06	15.79	28	05	17.86
81-100	57	11	19.30	26	09	34.62
101-120	24	08	33.33	23	11	47.83
121-140	03	02	66.67	17	09	52.94
141-160	-	-	-	12	07	58.33
161-180	01	01	100	04	02	50.0
181-200	-	-	-	04	-	-
	X^2=6.020; d.f=5; p>0.05			X^2=8.272; d.f=7; p>0.05		

NE = Number Examine, NI = Number Infected, Prev. = Prevalence

differences are not statistically significant (p>0.05). Infection was high in dry season than the rainy season, but no seasonal variation in prevalence was observed in the two hosts (p>0.05) (Table 4).

Relationship between total length and percentage of infection in *O. niloticus* and *C. gariepinus* are shown in Table 5. Highest percentage of infection (33.33% and 40.0%) were recorded in size range between 22-25cm and 30-33cm in *O. niloticus* and *C. gariepinus* respectively, while the least (19.23% and 31.58%) were recorded in the length range between 14-17cm and 26-29cm in *O. niloticus* and *C. gariepinus* respectively. Results of the relationship between the weight and percentage parasite infestation are shown in Table 6. The highest percentage of parasite infestation (100% and 58.33%) in *O. niloticus* and *C. gariepinus* respectively were recorded in the weight range between 161-180g and 141-160g in *O. niloticus* and *C. gariepinus* respectively, while the least percentage of infection (7.79% and 15.79%) in *O. niloticus* and *C. gariepinus* respectively were recorded in the weight range between 41-60g.

DISCUSSION

The overall percentage of parasites infection (27.88%) observed in this study was low particularly when compared to 59.2% recorded byOnyedineke *et al.* [19], 60.23% reported byOlofintoye [20] and 56.4% reported byAmaechi [21]. It was however high when compared with the findings of 18.70% reported byBiuand Nkechi [22] and 18.5% by Ogbeibu, Okaka and Oribhabor [23]. The varying percentages of parasites infection recorded could be due to the factors like endemicity, availability of intermediate host, susceptibility of a definitive host, amongst others, that determine to a large extent the rate of infection. [5] Helminth parasites recorded in the present study have been reported previously byBiu *et al.* [4], Simon-Oke and Morenikeji [6], Ajala and Fawole [13], Bichi and Yelwa [14], Yakubu*et al.* [24] and Adeyemo and Falaye [25]. Amonghelminth parasites community namely, nematode, trematode, cestode and acanthocephalan recorded from fishes in the study areas, nematode parasites dominated the helminth fauna of the fishes followed by cestode, trematode and very rarely infection caused by acanthocephalans. These variations in relative prevalence of the different parasitic classes maybe attributed to prevailing physico-chemical and ecological factors for the development of parasites, as well as the probable relative abundance of their intermediate hosts.

The relative abundance of the helminth parasites also varied from one anatomical site to another. Helminthes differ in their nutritional and respiratory requirements which may influence their choice of habitat [14]. In this study, the results of Gastro Intestinal Tract infestation showed that majority of the parasites occurred in the intestine than the stomach, similar to the findings by Bichi and Yelwa [14], Onyedineke *et al.* [19] and Mohammed *et al.* [26], who also found high prevalence of helminth parasites in the intestine than the stomach and argued that regional localization in the gut can be attributed to several factors, such as Hydrogen ion concentration, chemotactic response as well as food reserve or due to the greater surface area presented by the intestine.

The high percentage of parasitic infection in males than the females in this study agrees with the reported work of Oniye, Adebote and Ayanda [27] who reported high prevalence of infection in male fish than the female, but disagrees with the reported work ofEmere, Egbeand Ayanda [28, 29], who reported higher parasites prevalence

in females in their work and attributed it to physiological state of the females, as most gravid females could have had reduced resistance to infection by parasites.

Parasitic infection was higher in dry season than rainy season in this study. This cannot be unconnected to the report ofFawole andAkinsanya [30] who reported similar prevalence of infection in Opa reservoir in Ile-Ife, Nigeria, but disagrees with the findings ofBichi and Bizi [31]. Seasonal variation in the occurrence of parasites in this study may be attributed to ecological conditions, particularly distribution of intermediate hosts and also the age of the host and the life cycle of the parasite species.

In relation to size (weight and length) it was observed in this study that the percentage infection increased with increasing size. Similar observations were reported by Ayanda and Omeji *et al.* [29, 32] that the longer and heavier the fish is, the greater the susceptibility to parasitic infection. This could be due to the fact that bigger fish cover wider areas in search of food than the smaller ones and as a result, they take in more food than the smaller ones and this could expose them more to infestation by parasites [33]. Also change in dietary preference from phytoplankton and zooplankton to insects, larvae, snails, worms and crustaceans for food may predetermine trophic acquisition and infection levels of helminth parasites among fishes [34].

ACKNOWLEDGEMENT

The authors are thankful to the fishermen in providing the specimens used for this study. We also acknowledge the assistance rendered by Dr. Babangida Abdulkarim and Dr. Abdulhamid Ahmed of Umaru Musa Yar'adua University Katsina for helping in providing necessary laboratory facilities and the technical assistant rendered by the staff of the Department of biology in the preparation of the specimens.

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