Impacts Of Helminth Parasites On *Clarias gariepinus* And *Synodontis clarias* From Lekki Lagoon, Lagos, Nigeria

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ABSTRACT: The prevalence and pathological effects of gastrointestinal helminth parasites on *Clarias gariepinus* and *Synodontis clarias* from Lekki Lagoon was investigated. Sampling was carried out between July and December 2006. A high overall prevalence of helminth parasites of 68.57% and 69.70% was recorded for *S. clarias* and *C. gariepinus* respectively. There was no significant difference (P> 0.05) in helminth infection rate in male and female of *S. clarias* and *C. gariepnus*. Only cestodes and nematode were found in the intestine. Helminth parasites induce a number of pathological conditions in its host such as inflammation, necrosis, hyperemia, edema and defoliation of the surface epithelial cells.However, uninfected intestine showed mild pathology.

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INTRODUCTION

Parasites and diseases reduce fish production by affecting the normal physiology of fish (Kabata, 1985) and which, if left uncurtailed, can result in mass mortalities of fish, or in some cases infection of man and other invertebrates that consume them (Fagbenro *et al*., 1993). Fish disease and histopathology, with broad range of causes, are increasingly being used as indicators of environmental stress since they provide a definite biological end-point of historical exposure (Steniford *et al*., 2003). Van dan Brock (1979) also revealed that pathological conditions arising from parasite infections, which lead to serious consequence especially the nutritive devaluation of fish.

A check list by Khalil and Polling (1997), reported that fishes from African freshwater are infected by variety of adult helminth parasite ranging from monogenaen, digenean, cestodes, nematodes, acathocephalans and aspidogastrean. Paerna (1996) reported different helminth parasite have varying degrees of been pathogenic. For example *Spirocamalllanus spirallis,* common in the stomach of catfish has been reported to non pathogenic inspite of the form of attachment by their buccal capsule to the stomach mucosa of infected fish (Papern, 1964; Khalil, 1969). While species of Philometra and Acanthocephalans cause mild to severe pathology in fish.

Clarias gariepinus BURCHELL, 1822, the African catfish is generally considered to be one of the most important tropical catfish species for aquaculture in West Africa (Clay, 1979). This African catfish is widely distributed throughout Africa, inhabiting tropical swamps, lakes and rivers, some which are subjected to seasonal drying (Olufemi *et a*l., 1991). *C. gariepinus* is considered one of the best example of an omnivore (Holden and Reed, 1972; Clay, 1979) or predator feeding mainly on aquatic insects, fish and higher plant debris (Micha, 1973). They have also been found to feed on terrestrial insects, mollusk and fruit (Bruton, 1979).

`*Synodontis clarias* LINNAEUS, 1758 belong to the family Mochokidae and the genus Synodontis to which *S.clarias* belong is the most common and of great commercial importance (Reed *et al*, 1967). *Synodontis species* only occur in Africa and apart from those species present in River Nile they are restricted to water systems within the tropics (Willoughby, 1974). *S. clarias* (squeaker or upside-down catfish) is benthopelagic potamodroous fresh water fish (Reids, 2004). This fish is generally classified as an omnivore feeding mainly on insect larva, mollusk and detritus (Willoughby, 1974). This study reports the prevalence of helminth parasite and their pathological effect on *C. gariepinus* and *S. clarias* from Lekki lagoon, Lagos, Nigeria. Lekki lagoon is an important fishing zone to inhabitant of Epe community and metropolitan Lagos at Large.

MATERIALS AND METHODS

The Study Area

The area of study is the Lekki lagoon which lies between longitude 4^0 00' and 4^0 15' E and between latitudes 6^0 25' and 6^0 37' N in Lagos state, Nigeria. The lagoon has a surface area of about 247km^2 with a maximum depth of 6.4m. A greater part of the lagoon is shallow and less than 3.0m deep.

The Lekki lagoon supports a major fishery in Nigeria and it is a part of an intricate systems of waterways made up of lagoons and creeks that are found along the coast of south-western Nigerian from the Dahomey border to the Niger Delta stretching over a distance of about 200km. It is fed by River Oni discharging into the north-eastern and the Rivers Oshun and Saga discharging into the north- western parts of the Lagoon. Lekki lagoon experiences both dry and rainy seasons typical of the southern part of Nigeria.

The vegetation around the lagoon is characterized by shrubs and raphia palms, *Raphia sudanica* and oil palm, *Elaeis guineesis.* Water hyacinth can be seen floating on the periphery of the lagoon while coconut palms *Cocos nucifera* are widesspread in the surrounding villages.

The rich fish fauna of the lagoon includes *Heterotis niloticus, Gymnarchus niloticus, Clarias gariepinus, Chrysicthys nigrodigitatus, Channa obscura, Mormyrus rume, Tilapia zillii, Tilapia galilaea, Hemichromis fasciatus and Saratherodon melontheron* (Kusemiju, 1981). Figure 1 shows map of Lekki lagoon, Lagos, Nigeria.

Preliminary Investigation

Fish from Lekki lagoon were procured alive from fresh fish sellers at Oluwo market Epe, Lagos. The collection was made between July and December 2006. immediately on the field, fish were identified and measured.

Examination of Intestinal Parasite

Each fish was dissected and the intestine of each fish was removed and placed in petri dishes containing 0.09% normal saline. Each intestine was carefully teased open from the anterior to the posterior end to aid the emergence of the parasitic helminths. The emergence of any worm was easily noticed by its wriggling movement in the saline solution. Some of the worms however remained permanently attached with their attachment organs to the gut walls. They were carefully removed with the aid of forcep and put into normal saline.

Preservation of Parasites

The helminth parasites from each fish were then fixed in 70% alcohol in different specimen bottles.

Staining and Slide Preparation.

The parasite were later stained and identified using identification keys of Yamaguti (1959), Ukoli (1965) and Paperna (1996).

Processing of Intestine for Histopathology

Both infected and uninfected intestine were placed in separate bottles containing bouins fluid. After 6 hours, the bouins fluid in each bottle was decanted. Then 10% phosphate buffer formalin was added to preserve the tisssue. Random selection was made from the preserved tissues based on single or multiple infection and light, heavy or no infection.The dehydration of the tissues took place in increasing concentrations of alcohol and twice in absolute alcohol at 30 minutes interval.Tissues were impregnated in molten paraffin was three times and later embedded in molten paraffin wax and allowed to solidify.the blocked tissues were sectioned at 4-5 microns floated inte a precoated slides and dried.The sections were stained using haematoxylin and eosin stains.The stained tissues were washed off in tap water and the over stained ones destained in 1% acid alcohol.The tissues were mounted using DPX mountant dried and examined under the microscope.The photomicrograph were taken in the pathology laboratory of the Department of of Veterinary Pathology, University of Ibadan,Nigeria.

RESULTS

Parasitic Helminthes Observed

Synodontis clarias

A total number of 929 parasitic helminths were recovered from 105 *Synodontis clarias* examined. All parasites belong to 4 genera of helminth parasite which include 2 species of nematode, *Procamallanus spp* BAYLIS, 1923 (Camallanidae) and *Raphidascaroides spp* YAMAGUTI, 1941 (Heterocheilidae) and 2 species of cestodes; *Wenyonia spp* WOODLAND, 1923 (Caryophyllaeidae) and a Pseudophillidean cestode. Concurrrent infections of *Raphidascroides spp* and *Wenyonia spp* were common.

Clarias gariepinus

Out of 165 *C. gariepinus* examined a total of 637 parasite helminths were recovered. All parasites belong to 3 genera which include *Wenyonia spp* WOODLAND, 1923 (Caryophyllaeidae) a Pseudophillidean cestode and pleurocercoid larva which are cestodes and *Procamallamus spp* BAYLIS, 1923 (Camallanidae) which is a nematode recovered from the infected fish host.

Neither acanthocephalans nor trematodes infections was recovered in the fish specimens examined. Multiple infections with more than 20 worms were observed in some infected specimens.

Table 1 shows the overall prevalence of intestinal helminth parasite in *S. clarias* and *C. gariepinus.*The overall prevalence of the intestinal helminth infection in *Synodontis clarias* was 68.57 %. The overall prevalence of helminth parasite of *C. gariepinus* was 69.70%.

Table 2 shows prevalence of helminth infection in relation to host sex of *S. clarias* and *C. gariepinus.* Although for *S. clarias,* the prevalence in males (62.5%) was lower than in Females (72.31%), it was not statically significant (χ^2=1.11; p> 0.05). There was no significant difference in infection rate in males and females of *C. gariepinus* (χ^2= 0.10; p>0.05).

Table 1: Overall prevalence of intestinal helminth in *S. clarias* and *C. gariepinus*

	S. clarias			*C. gariepinus*		
	No examined	No infected	Prevalence (%)	No examined	No infected	Prevalence (%)
Male	40	25	23.81	102	72	43.64
Female	65	47	44.76	63	43	26.06
Total	105	72	68.57	165	115	69.70

Table 2: Helminth infection in relation to host sex in *S. clarias* and *C. gariepinus*

	S. clarias		*C. gariepinus*	
	Male	Female	Male	Female
No examined	40	65	102	63
No infected	25	47	72	43
Percentage of infection (%)	62.5	72.31	70.58	68.25
	(χ^2=1.11; p> 0.05)		(χ^2=0.10; p>0.05)	

Table 3 shows intestinal helminth infections in relation to size of *S. clarias* . The length of group 11-13.9cm had the highest prevalence of 83.33%, followed by the length group 14-16.9cm with a prevalence of 62.96%, the length group 17-19.9cm had a prevalence of 48.85%, 20-21.9cm had a prevalence of 0%. The prevalence observed between size in relation to intestinal helminth was significant.

Table 4 shows intestinal helminth infection in relation to size of *C. gariepinus*. A high prevalence of 75.7%, 75.0% and 62.79% was observed in length group of 19-21.9cm, 22-24.9%16-18.9 respectively. The length group of below 15.0cm and 25-27.9 had a prevalence of 0% and 45.45% respectively. The prevalence observed between size in relation to intestinal helminth was not significant.

Table 3: Helminth infection in relation to size in *S. clarias*

	11-13.9	14-16.9	17-19.9	20-21.9
No examined	42	54	7	2
No infected	35	34	3	0

Percentage of infection (%)	83.3	62.96	48.85	0

(χ^2 =11.53; d.f= 3; p<0.05)

Table 4: Helminth infection in relation to size of *C. gariepinus*

	< 15	16-18.9	19-21.9	22-24.9	25-27.9
No examined	1	43	70	40	11
No infected	0	27	53	30	5
Percentage infection (%)	0	62.79	75.71	75.0	45.45

(χ^2 =6.09; d.f=4; p> 0.05)

Pathological Effects of Helminth Parasite

Infection by helminth parasite induced a number of pathological lesions that varied with the intensity and types of helminth parasite. The most common lesions observed were intestinal inflammation around the worm attachment surface and necrosis (cell death).

Pathology on *Synodontis clarias*

In *S. clarias*, intestine with no helminth infection showed no morphological tissue change (Plate 1A) while another intestine with no helminth infection showed mild diffuse mucosal necrosis and shortening intestinal villi (Plate 1B). Infection with single species of parasite *Wenyonia spp* with up to 15 in number in an infected host showed defoliation of surface epithelia lining cells and intestinal lumen filled with necrotic and inflammatory cellular debris (Plate 1C). Single infection by *Raphisdascroides spp* with more than 20 worms and 30 worms in different infected fish showed diffuse infiltration of lamina propria by inflammatory cells and edematous intestinal mucosa (Plate 1D). Single infection by Pseudphyllidean cestode, three in number showed defoliation of cells and necrosis of surface epithelia cells (Plate 1E).

Mixed infection in *S. clarias* by *Wenyonia spp* and *Raphascroides spp* with a total of 16-30 worms in different infected specimen showed common pathological lesion such as marked distention and congestion of mucosal capillaries, diffuse and severe infiltration of the lamina propria by inflammatory cells, thickened mucosa and necrosis and defoliation of surface epithelia cells (Plate 1F). Mixed infection of *Procamallanus spp*, 2 in number and *Raphisdascroides spp*, 10 in number showed marked edema of intestinal mucosa with exudation of fibrin and a few inflammatory cells and red blood cells are trapped in fibrin within the intestinal lumen (Plate 1G).

Pathology on *C. gariepinus*

No morphological tissue change was observed in the intestine of *C. gariepinus* with no helmnth parasite (Plate 2A). However, another intestine with no helminth infection showed moderate diffuse necrosis of surface epithelium with matting and shortening of villi (Plate B)

Infection with a *Procamallanus spp* and a pleurocercoid larva in the intestine of different fish specimen showed no morphological tissue change in both cases (Plate C) . Single infection by *Procamallanus spp* with more than 10 worms showed edema in the submucosa with diffuse lymphocyte infiltrations (Plate D). Extensive necrosis and disorganization of epithelia mucosa and presence of thick inflammatory and necrotic exudates in lumen was observed in the intestine of *C. gariepinus* infected with Pleurocercoid larvae alone of more than 20 in number (Plate E). Single infection by Pseudophyllidean cestode, 6 number showed mild defoliation of cells in the lumen (Plate F)

Multiple infection by *Procamallanus spp* and pleurocercoid larvae two in number each in the infected intestine showed marked localized distention of intestinal lacteals (lymphatics),

presence of localized solitary calcified parasitic granuloma embended within tunica muscularis (both longitudinal and circular fibres), and extensive necrosis of mucosa in adjacent segment (Plate G).

Also thickening of mucosa, infiltration of lamina propria by imflammatory exudates and defoliation of epithelia cells in the lumen was observed in the intestine infected with *Procamallanus spp* and Pseudophyllidean cestode (Plate H).

DISCUSSION

The high overall prevalence of helminth parasite observed in *S. clarias* (68.57%) and *C. gariepinus* (69.70%) may be attributed to some factors such as pollution by human waste, physico-chemical properties in the lagoon and availability of the right fish host for the parasite. Sosanya (2002) reported high positive correlation between pollution and prevalence rate of helminth parasite. Sosanya reported that some physico-chemical properties such as biological oxygen demand (BOD) and total dissolved solids (TDS) influenced parasitic helminth positively. (Lile, 1998) on the other hand suggested that the diversity of parasites may be linked to the availability of their hosts. Poulin (1995) reported that parasite richness is correlated with the diversity of the free-living fauna in a certain area. Also the high prevalence of intestinal parasite may be attributed to the presence of their intermediate host such as copepods which would have been eaten by *S. clarias and C. gariepinus* due to their omnivorous feeding habit (Willouhbhy, 1974; Bruton, 1979).

In both *S. clarias and C. gariepinus*, the infection in male and female specimen was insignificant. This difference in the prevalence rate in male and female of both species of fish may probably be attributed to random selection of the specimen from Lekki lagoon and the small sample size examined.

A significant prevalence observed in *S. clarias* between size in relation to intestinal helminth parasite burden indicates that infection with intestinal helminth parasite seems to correlate with fish length which in turn correspond to fish age (Lagler et al., 1979). A high prevalence of 83.33% and 62.96was observed in length ranges 11-13.9cm and 14-16.9cm respectively. This could be logically attributed to their feeding habitat. However, helminth infection diminished with fish size of 20-21.9 having 0% prevalence. This may be attributed an increased resistance with age. A similar phenomenon has been observed in *C. lazera* infected by *Polyochonbothirum clarias* by (Faisal *et al*., 1989).

According to Hoffman (1967) the first intermediate host of segmented tapeworms Pseudophyllideans and Protocephalids are copepods and the second larval stage, pleurocercoids, develops in fish species non-compatible as definite host. Predatory fishes may therefore accumulate large numbers of such larval cestodes since the larvae are able to re-encyst until they are ingested by a suitable final host such as Piscivorous birds, mammals and reptiles (Paperna, 1996). Hence this accounts for the large number of pleurocercoid larva observed in the intestine of *Clarias gariepinus.* A similar observation was made by Fagbenro *et al.* (1993) in *Hetrobrachus bidorsalis*, a predatory fish which was found to accumulate large numbers of larval cestode. This is suggesting a reservoir of infection or second intermediate host.

Wenyonia spp was isolated from the intestine of both *S. clarias and C. gariepinus.* A similar observation was made by Akinsanya *et al*. (2006) also from Lekki lagoon. Ukoli (1965) isolated a species of the genus Wenyonia from the intestine of *Synodontis spp.* from the River Niger at Shagamu near Kainji. In West Africa, species of Wenyonia have been reported in *Synodontis spp.* (Khalil and Polling 1997). Also, Bahavwy *et al* (1975) isolated *Wenyonia virilis* from the ileum of the silurid fish, *Synodontis schall*. Although Ukoli 1965 reported some degree of host specificity in some *Wenyonia spp.* even within their diferent *Synodontis spp.* host. The occurrence of *Wenyonia spp* in *C. gariepinus* may be indicative of similar diets and feed habits patterns amongst the fresh water fishes.

Khalil (1971) listed over 50 species of trematodes, from 15 families, occurring in a variety of freshwater fish in Afrrica. Paperna (1964) and Khalil (1969) have reported the infection of *C. gariepinus and S. clarias* by trematode. Infection by ascanthocephalans have also been reported by Khaliil (1969). Oniye *et al* (2004) in Zaria, Nigeria, isolated five species of helminth parasites comprising of three cestode species, one nematode species, and one acnthocephalan species. The absence of acanthocephalans and trematodes in this study may indicate the absence of the respective intermediate host in Lekki lagoon. This is in agreement with Akinsanya *et al* (2006) who also did not record any trematode or

acanthocephalans in *C. gariepinus* in Lekki lagoon. Akinsanya *et al* (2006) however, noted that the parasite fauna of *C. gariepinus* varied from southern and northern part of the country. This is significant from the aquaculture viewpoint.

Helminth infection induced a series of pathological effects that were present separately or together in the same individual fish. The lesion also showed variation with the number of parasite present in the intestine. However, that there was no morphological tissue change observed with specimen of *C. gareipinus* infected with one individual *Procamallanus spp* and pleurocercoid in different fish host could probably be due to a fresh introductuion or infestation of the parasite into the intestine.

The mild diffuse mucosal necrosis and shortening of intestinal villi observed in the intestine of a specimen of *C. gariepinus and S. clarias* each with no intestinal helminth parasite could be attributed to infection by bacteria pathogen. Olufemi *et al* (1991) isolated certain number of bacteria pathogen from tissues and organs of the African catfish, *C gariepinus*. Also a considerable number of bacteria disease of freshwater fish have been recognized in Nigeria (Olufemi *et al*., 1991)

The pathological effect observed with infection by *Procamallanus spp* is not in agreement with Paperna (1964), Khalil (1969) and Bookmer (1982) who reported no pathological effect of *Procamallanus spp* in spite the large intensity and the firm attachment by the buccal capsule to the stomach mucosa. However, lesions such as inflammation of the intestinal mucosa, extensive defoliation of the epithelial mucosa and necrosis which is caused by the Pseudophhyllidean cestode is in accordance with the observation of Wabuke-bunoti (1980) who reported some tissue response (inflammation) around bothria of Polyochonbothrium clarias (a Pseudophyllidean cestode) attached to gut mucosa of infected *C. gariepinus* in LakeVictoria. It is also in agreement with observation of Faisal *et al* (1989) who reported infection with *P. clarias* in *C. gariepinus* to cause intestinal inflammation, hyperemic condition of the intestinal wall and the mucosa covered with viscous exudate that was tinged with blood.

Mictchell and Hoffman (1980) reported severe damage to the intestine (obstruction and enteritis) caused by Caryophyllidean cestode infecting cultured European and Chinese carp. This is in accordance with this present study in which *Wenyonia spp* (Caryophillideans) where observed to cause surface defoliation of surface epithelia lining and necrosis of the mucosa cells.

Helminth parasites induced series of pathological effect in *C. gariepinus* and *S. clarias*, which gives an easy evasion by microbial pathogens. This point should be considered when planning prophylactic measure in aquaculture**.** Knowledge of this kind will help in planning an ideal prophylactic measure in aquaculture.

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