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Gut Parasites Associated with Selected Freshwater Fish Species, Mormyrus Rume and Oreochromis Niloticus From River Kaduna.

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Abstract

Gut parasites have been recognized as a major constraint to fish production in developing countries. The aim of this research was to determine the prevalence of gut parasites of selected freshwater fish species from River Kaduna. Results showed that 145 fishes out of the 200 examined were infected, giving an overall prevalence (72.5%) of freshwater fish species sourced from a segment of River Kaduna. *Oreochromis niloticus* was significantly higher ($p < 0.05$) in female (83.6%) than in males (75.6%), similarly *Mormyrus rume* was higher in females (68.2%) than in males (62.5%). The difference in prevalence of gut parasites between the different body weight and length of the freshwater fish species were not statistically significant ($p > 0.05$). The parasites identified comprised of three taxonomic groups, the nematodes were *Contracaecum* species (35.0%) and *Capillaria* species (15.6%), Cestode was *Diphyllobothrium latum* (25.0%) and Trematode was *Clinostomum* species (25.0%). There was no significant difference ($p > 0.05$) between parasite load and the freshwater fish species of parasites identified from River Kaduna. The intestines harboured the highest number of parasites (91) than stomach, oesophagus and rectum and parasites identified comprised of three taxonomic groups. It is recommended that public enlightenment should be embarked on to educate on the dangers of indiscriminate waste

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disposal and other unhealthy human activities on the aquatic environment which may affect the health of the fish.

Keywords: Gut Parasites, Freshwater Fish, River Kaduna, Fish Health.

INTRODUCTION

Fish is one of the most important species of aquatic animal commercially and is found in fresh water and salt water worldwide. It is among a class of aquatic vertebrates which is an important source of protein in human diet. It contains about 80% of water in its fresh state and it is a highly perishable food product with a very short shelf life. While living through the water, the fish takes a large number of parasites into its gut from water sediment and food [2]. They are organisms that live in or on fish and cause harm to the fish through their attachment, feeding activities, movement, and reproduction among other physiologic actions [20]. Parasitic diseases of fish are very common all over the world and are of particular importance in the tropics [26]. The flesh of fish is also readily digestible and immediately utilizable by the human body, which make it suitable and complementary for regions of the world with high carbohydrates diet [13]. Due to global population expansion, demand for high quality animal protein especially from aquatic source is rising. Increasing the aquaculture production is clearly needed to meet this demand in the third millennium, especially as the capture fisheries resources are declining due to over fishing, habitat destruction and pollution [11].

Some parasites have been discovered to have zoonotic potential, thereby making them of public health importance, some parasites may be highly pathogenic and contribute to high fish mortalities and economic loss, while in natural systems they may threaten the abundance and diversity of indigenous fish species [18]. Fish are intensively cultured and this culture system has created a need for more information on fish parasites. All species of fish are vulnerable to invasion by parasites depending on the species, size of fish and type of habitat where they live [22]. Parasites in fish have been a great concern since they often produce disease condition in fish, increase their susceptibility to other diseases and cause nutritive devaluation of fish and fish loss [22].

MATERIALS AND METHODS

Study Area

The study was conducted along Kudenda of River Kaduna, which has an approximate landmass of about 431 km^2 and located between latitude 10^o 52’ N and 10^o 30’ N and longitude 7º 15’ E and 7º 45’ E. The area is situated on a relatively low plain liable to flood. The river divides the Kaduna metropolis into two major areas, Kaduna North and Kaduna South [8]. The vegetation cover is Sudan savannah type, characterized by scattered short trees, shrubs and grasses. The soil is mostly loamy to sandy type and a substantial amount of clay is also found [19].

Collection of Samples

The samples were collected for a period of six months (July to December 2022) to identify the parasites from fish in the study site. The fish were collected from the local fishermen which caught it at Kudenda along River Kaduna. Collection was in the morning between 7:30am to 10am during each sampling occasion and was transported in a plastic bucket which contained clean water to the Postgraduate laboratory, Department of Biological Sciences Kaduna State University.

Morphometric Measurement

The total length of each fish sample was obtained by placing the fish laterally on the dissecting board, using meter rule to measure from tip of the snout to the end of the tail fin, while the standard length was determined by measuring from the tip of the snout to the end of the caudal peduncle. Length measurements were recorded in centimetres. The weight of each fish was determined with the aid of weighing balance (YP-B10002) which was in gram [7].

Determination of Sex

The sex of the fish was also determined by physical examination of the genita papillae which was long in males, while it was rounded and reddish in matured females. Sex was confirmed by internal examination for the presence of testes in males and ovaries in females [14].

Examination of Fish for Parasites

The fish was immobilized by cervical dislocation for easy handling prior to dissection on a dissecting board. It was dissected through the abdomen by making a longitudinal slit on the ventral surface from the anus to the pectoral fins with the aid of sterilized surgical blade. The gastrointestinal was isolated, stretched out and grouped into oesophagus, stomach, intestine, and rectum. Each section was placed into two separate petri-dishes. The sections were slit longitudinally and washed in normal saline [27]. It was centrifuged at 1000rpm for 15minutes and the supernatant was discarded, each drop of the residue was placed on the slide and viewed under x 10 and x 40 objective light microscope. The detected parasites were identified using the keys of freshwater fish parasite pictorial guide [9].

Data Analysis

The results obtained were presented in descriptive statistics all data collected were analyzed using Statistical Package for Social Sciences (SPSS 20.0 software) to determine the association between the prevalence, sex, length and weight. Significant level less than 0.05 (< 0.05) were considered as statistically significant.

RESULTS

An overall prevalence of 72.5% was recorded for gut parasites infestation in the selected fish species collected from River Kaduna, as 145 of the 200 fish samples were infected with the gut parasites. Infection prevalence was higher in *Oreochromis niloticus* than in *Mormyrus rume* with prevalence values of 80%

and 65%, respectively; the difference in prevalence of infection with gut parasites between the two fish species was statistically significant ($p < 0.05$) (Table1).

Table 1: Prevalence of Gut Parasites of Selected Freshwater Fish Species from River Kaduna

Family	Species	Number examined	Number infected	Prevalence (%)
Mormyridae	*M. rume*	100	65	65.0
Cichlidae	*O. niloticus*	100	80	80.0
Total		200	145	72.5

On the basis of sex of fish, infection prevalence with gut parasites among *Mormyrus rume* was higher in females (68.2%) than in males (62.5%). Similarly, the recorded prevalence of gut parasites was higher in females of *Oreochromis niloticus* (83.6%) than in their male counterparts (75.6%). However, in both species of fish, the association of gut parasites with particular sex of the fish was not statistically significant ($p > 0.05$) (Table 2).

Table 2: Prevalence of Gut Parasites of Selected Freshwater Fish Species Based on Sex from River Kaduna

Fish species	Sex	No. examined	No. infected	Prevalence (%)	χ^2	*p*-value
M. rume	Male	56	35	62.5	0.016	0.765
	Female	44	30	68.2		
O. niloticus	Male	45	34	75.6	0.467	1.000
	Female	55	46	83.6		
Total		200	145	72.5		

32 (80.0%) out of the 40 *Mormyrus rume* of lengths 10-20 cm were infected with gut parasites; 15 (53.6%) of the *Mormyrus rume* of body length between 31-40 cm were also positive for gut parasites; 10 (55.6%) of the 18 *Mormyrus rume* that measured between 41-50 cm in length were infected with gut parasites, while 8 (57.1%) of the 14 *Mormyrus rume* caught that measured between 51-60 cm were infected with the gut parasites; the differences in prevalence with gut parasites between that different body length categories were not statistically significant ($p > 0.05$) (Table 4.3). 83.3% (50/60) of *Oreochromis niloticus* that measured between 10 and 20 cm were infected with gut parasites. The prevalence of gut parasite among *Oreochromis niloticus* that measured between 21 and 30 cm was 71.4%, while in those that measured between 31 and 40 cm the prevalence was 83.3% as 10 out of 12 in that length category were

infected with gut parasites. The difference in prevalence of gut parasites among the three body length categories of *Oreochromis niloticus* was not statistically significant ($p > 0.05$)

Table 3: Mean Length Measurement of Selected Freshwater Fish Species from River Kaduna

Family	Species	Length (cm)	Mean	Number examined	Number infected	Prevalence (%)	χ^2 value	*p*-
Mormyridae	*M. rume*	20-30	25	40	32.	80.0	6.649	0.084
		31-40	36	28	15	53.6		
		41-50	46	18	10	55.6		
		51-60	56	14	8	57.1		
	Subtotal		163	100	65	65.0		
Cichlidae	*O. niloticus*	10-20	15	60	50	83.3	1.786	0.409
		21-30	26	28	20	71.4		
		31-40	36	12	10	83.3		
	Subtotal		77	100	80	80.0		
Total			240	200	145	72.		

Out of the 37 *Mormyrus rume* weighing between 150 and 300g, 25 were infected with gut parasites giving a prevalence of 67.6%. Among *Mormyrus rume* that weighed between 301 and 450g, 71.4% (20 out of 28) were positive for infection with gut parasites. Ten (10) of the 15 *Mormyrus rume* fish that weighed between 451 and 600g were infected with guts parasites giving a prevalence of 66.7% for that weight category of *Mormyrus rume* caught. Within the weight categories of 601 to 750 g and 751 to 900 g, the prevalence of gut parasites was 50% each. Thus, the prevalence of gut parasitic infection among *Mormyrus rume* was highest in those with body weight between 301 and 450 g (71.4%), and the least seen among those weighing between 601-750g, and 751-900 g. furthermore, the difference in prevalence of gut parasites between the different body weight categories of *Mormyrus rume* caught during the study was not statistically significant ($p > 0.05$).

Of the 40 *Oreochromis niloticus* that weighed between 150 and 300g, 50 (87.5%) were infected with gut parasites; 25 (83.3%) of the 30 *Oreochromis niloticus* that weighed between 301 and 450g were also positive for gut parasites; 10 (62.5%) of the 16 *Oreochromis niloticus* that weighed between 451 and 600g were infected with gut parasites, while 7 (77.8%) of the 9 *Oreochromis niloticus* that weighed between 601 and 750g were infected with the gut parasites; 3 (60%) out of the 5 *Oreochromis niloticus* that weighed between 751 and 900g were also infected with the gut parasites. The difference in prevalence of gut parasites among the weight categories of *Oreochromis niloticus* was not statistically significant ($p > 0.05$) (Table 4).

Table 4: Mean Weight Measurement of Selected Freshwater Fish Species from River Kaduna

Family	Species	Weight (g)	Mean	Number examined	Number infected	Prevalence (%)	
			χ^2	*p*-value			
Mormyridae	*M. rume*	150-300	225	37	25	67.6	6.624
0.157							
		301-450	376	28	20	71.4	
		451-600	526	15	10	66.7	
		601-750	676	8	4	50.0	
		751-900	826	12	6	50.0	
	Subtotal		2629	100	65	65.0	
Cichlidae	*O. niloticus*	150-300	225	40	35	87.5	5.955
0.203							
		301-450	376	30	25	83.3	
		451-600	526	16	10	62.5	
		601-750	676	9	7	77.8	
		751-900	826	5	3	60.0	
	Subtotal		2629	100	80	80.0	
Total			5258	200	145	72.5	

Three taxonomic groups of gut parasites were identified, namely, nematode, trematode, and cestode, with nematodes constituting the highest group (Table 4.5). The nematodes identified were *Contracaecum* species and *Capillaria* species, while *Clinostomum* species and *Diphyllobothrim latum* were the trematode and cestode, respectively, identified. The highest parasite load of gut parasites was due to the nematode *Contracaecum* species with a parasite load of 35.0% while the least was due to another nematode *Capillaria* species with a parasite load of 15.6%. The parasite loads due to *Diphyllobothrim latum* (cestode) and *Clinostomum* species (trematode) was 25.0% respectively. The difference in parasite loads between the parasite species was not statistically significant ($p > 0.05$).

Of the four regions examined for gut parasite infestation, the highest prevalence was recorded at the intestine with a prevalence of 58.3% as 96 of the 156 gut parasites were located within the intestines of fish sampled (Table 4.6). The prevalence of gut parasites with the stomach of fish was 33.3% as 20 of the 156 gut parasites identified were resident with that part of the GIT of the fish sampled. In the oesophagus, the prevalence was 7.3% while that least prevalence of 3.1% was recorded in the rectum of the fish. The difference in prevalence of gut parasites within the four portions of the GIT of *Mormyrus rume* and *Oreochromis niloticus* considered was statistically significant ($p< 0.005$).

Table 5: Parasites identified and Parasite Load of Gut Parasites from Selected Freshwater Fish Species River Kaduna

Species	Taxonomic group	Parasite identified	Number of parasites	Parasite load (%)
Mormyrus rume	Nematode	*Contracaecum* species	21	35.0
	Trematode	*Clinostomum* species	12	20.0
	Cestode	*Diphyllobothrium latum*	16	26.7
	Nematode	*Capillaria* species	11	18.3
Subtotal			60	100
O. niloticus	Nematode	*Contracaecum* species	33	34.4
	Trematode	*Clinostomum* species	24	25.0
	Cestode	*Diphyllobothrium latum*	24	25.0
	Nematode	*Capillaria* species	15	15.6
Subtotal			96	100
Total			156	100

Table 6: Prevalence of Gut Parasites of Selected Freshwater Fish Species in Relation to Gut Part from River Kaduna

Species	Location	Number of parasites	Prevalence (%)	χ^2	*p*-value
M. rume	Oesophagus	3	5.0	0.015	0.001
	Stomach	20	33.3		
	Intestine	35	58.3		
	Rectum	2	3.3		
Subtotal		60	100		
O. niloticus	Oesophagus	7	7.3	0.052	0.005
	Stomach	30	31.3		
	Intestine	56	58.3		
	Rectum	3	3.1		
Subtotal		96	100		
Total		156	100		

DISCUSSION

In this study, the overall prevalence (72.5%) of gut parasites of the freshwater fish species; *Mormyrus rume* and *Oreochromis niloticus* could be attributed to high level of pollutants accumulation as a result of long-distance flow of river as well as the influx of pollutants from their several tributaries [17]. This differs from the 63.0%, infection reported by [1] in *Clarias gariepinus* from River Gudi, Nasarawa State, and 33.75% in natural habitat [3]. The findings opined that the higher prevalence reported might be due to many factors such as feeding habit of fish, pollution of water bodies, and availability of inter-mediate hosts such as copepods, insects and molluscs which harbor the infective larval stage of some of these parasites making them available to fish in the water [15].

Higher prevalence observed for the female than the male could be due to the physiological state of the female, most gravid females could have reduced resistance to infection by parasites [12]. This work correlated with [30] who obtained 80.3% and 73.3% on sexes of fish species from Niger and Benue rivers in Lokoja, but [15] reported 67.9% and 67.3% on sexes of *C. gariepinus* from FCT Abuja. The increased rate of food intake by the female fish to meet their food requirements for the development of their eggs might have exposed them to more contact with the parasites [12], [23].

The length of the fish species had higher infection rate than the large fish in the findings of the present study. This agrees with the work of [1] that reported prevalence of 90.3% and 70.0% body length between 26-30 and 36-45 in *Clarias gariepinus* from River Gudi, Nasarawa State but contrary to the

findings of [5] that reported a prevalence of 20.8% and 27.3% body length of 20-30cm and 31-40cm of *C. gariepinus* caught from selected point along Kaduna River. [24] reported that the increase in fish size is a reflection of increase in length and weight, which is considered as a measure of age.

The smaller freshwater fish species has high prevalence infection rate than the bigger ones could be due the low level of immunity in the smaller sized fish [4]. This corroborates with the findings of [3] with a prevalence of 83.3% and 88.8% weight range between 500-599 and 400-499 of *C. gariepinus* in natural habitat and [21] that reported a prevalence of 70.0% and 94.4% in body weight of 300-399 and 600-699 of *Cantharis obscura* and *Heterotis niloticus* from Anambra River. The older fish have longer time to accumulate parasites than younger ones and may provide more internal and external space for parasite establishment and therefore tend to have heavier worm burden because they eat more parasitized prey and offer large surface area for skin attaching parasites [25].

The taxonomic groups of the parasites identified from gut parasites in the fish species were Nematode, Cestode and Trematode. The presence of Nematodes and Cestodes could result to huge losses in fish productivity as they are reported to interfere with the absorption of nutrients in the intestine of fish and may reduce food intake. The metabolites produced by some of these parasites could adversely affect vital systems of the fish [6]. Similar parasites species was reported in a study carried out on *Clarias gariepinus* from three fish farms in Uyo and recovered *Paracamallanus* species (17.14%), *Contraceacum* species (14.29%) and *Clinostomum* species (21.43 %) by [29]. [28] reported the presence of *Diphyllobothrium* species (32.40 %), *Camallanus* species (16.20 %) and *Capillaria* species (16.20 %) in Tilapia zilli from Ebonyi River.

The highest number of parasites harbored by the intestines in this study could be due to the conducive nutritional advantage presented by the host's intestine to the parasites and the availability of the intermediate host, mesocyclops (copepod) in the environment. However, according to [10] could be attributed that some of these intestines were dumped by the fishermen at the river side and such were washed off by surface run off water into the river and there is a likelihood that these fishes could just ingest this same parasite through those intestinal contents. These fish species are equally carnivorous in nature, once part of the fish is washed into the river, the fishes could eat those part together with all the intestinal contents including the parasites. This was in contrast with the findings of [1] in their study recorded a prevalence of 36.0% intestine, stomach (33.30 %), oesophagus (23.30 %) and rectum (6.60 %). The recovery of Cestode parasite from the intestine could be attributed to lack of digestive system in Cestode and so they obligatorily depend on end product of digested food in host which is absorbed through the body surfaces, hence they are localized in the host intestine where their nutritional requirements are satisfied [21].

CONCLUSION

The study showed a high prevalence (72.5%) of infection in the gut parasites associated with selected freshwater fish species from River Kaduna. There was significantly higher ($p < 0.05$) in female (83.6%) than in males of freshwater fish species from River Kaduna. The difference in prevalence of gut parasites between the different body weight and length of the freshwater fish species were not statistically significant ($p > 0.05$) and the parasites identified are three taxonomic groups. The Nematode was *Contracaecum* species and *Capillaria* species, Cestode *Diphyllobthrium latum,* and

Trematode *Clinostomum* species. Nematode has the highest infection rate more than Cestode and Trematode. The parasite load observed during the study from River Kaduna was not statistically significant ($P > 0.05$).

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