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Survey of Parasites Infesting the Nile Tilapia (*Oreochromis niloticus* Linnaeus, 1758) from Lake Alau, Maiduguri, Nigeria

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ABSTRACT

In this study the prevalence of ecto, endo, and haemo--parasites infecting *Oreochromis niloticus* was investigated in Lake Alau, Maiduguri, between January and April, 2013. A total of 80 randomly sampled *Oreochromis niloticus* was procured from fishermen and examined for parasites using standard parasitological methods, out of which 21 (26.3%) were infested with six parasites belonging to helminths namely: *Paracamallanus spp, Pleuroocercoid*, *Contracaecum shop*, with incidences of 9 (42.9%), 7 (33.3%) and 5 (23.8%) and haemoparasites namely *Haemogregarina spp. Babesioma spp. and Trypanosoma spp*, and with incidences of 12(57.1%), 2(9.5%) and 1(4.8%) respectively. Parasitic infestations in the female was significantly higher 12 (26.7%) than in the male 9(25.7). There was a significant difference between incidence of infestation and standard length and body weight of *Oreochromis niloticus* while there was no significant difference (p> 0.05) between incidence of parasitism and total length of the fishes.

Key Words: Survey, Parasites, *Oreochromis niloticus*, Lake Alau, Maiduguri, Nigeria.

INTRODUCTION

Fishes are an important source of income and food in Nigeria and other countries in the sub-Saharan Africa, where about 35 million people depend wholly or partly on the fisheries sector for their livelihood (FAO 1996). Fish has continued to be the most affordable source of animal protein (which contains lipids, minerals and vitamin) to the average Nigerian family (Haruna, 2006). Consumption and demand for high fish protein is increasing due to its affordability. Fish occupies several levels of the aquatic food chain and makes up more than 40% of the world vertebrate species. Nigeria has an estimated 12.5mha of freshwater surface area of lakes, reservoir and ponds (Ibeun, 2006) which are capable of producing 521,000 metric tonnes of fish but have not succeeded in attaining fish sufficiency (FAO, 1996).

Fish are continuously exposed to stressful procedures in rearing and in natural e.g. overcrowding and food shortage (Barton, 1991). One stressor influencing fish health is that imposed by parasites. Parasite

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infection in fish refers to a diseased condition resulting from organism living in or on the fish (Bassey, 2011). The relationship between the fish and parasite is referred to as parasitism. In this relationship, the host (fish) suffers while the parasite benefits. Parasites play an important role in the ecology of aquatic ecosystems as well as in the aqua and marine culture industries. Parasites could either be ecto, endo or haemoparasites, and some factors that enhance parasite infection in fishes includes reduced oxygen content of water, increase in organic matter in the water and poor environmental conditions. (Edema *et al.*, 2008).

Parasite of fish are of concern since they often produce a weakening of the hosts immune system thereby increasing their susceptibility to secondary infection by disease causing agents (e.g. fungi, bacteria and viruses) resulting in the nutritive devaluation of fish and subsequent economic losses Onyedineke *et al.* (2010) by presenting marketing problems for commercially exploited species (Peterson *et al*., 1993).

Oreochromis niloticus is now one of the most widely distributed exotic fish in the world, second only to common carp, as their introduced range now stretches to nearly every continent and include 90 different countries. (Intervet, 2006). It is widespread in the tropics and sub-tropics because they are highly adoptable and highly fecund with high fry availability (Seafood Watch, 2006).

This study was designed to determine the incidence of endo, ecto and haemoparasites infesting *Oreochromis niloticus* at Lake Alau landing site as the first step towards proffering a solution to parasitic infection.

MATERIALS AND METHODS

Collection and study of fish specimen:

A total of 80 samples were purchased alive from the fisher folks at the landing site of Lake Alau. They were transported on ice to the Parasitology Laboratory in the Department of Veterinary Microbiology and Parasitology in plastic containers for examination.

Sexing and size determination in relation to length (cm), width (cm) and weight (grams)

The sex of *Oreochromis* was determined only after dissection and noting the presence of testes or ovaries (Imam and Dewu, 2010). The standard length (from the tip of snout to the end of the base of the caudal peduncle) and total length (from the tip of the snout to the extreme end of the caudal fin) were measured in centimetre using a half metre rule dissecting board (Lowe McConnell, 1972). The weight of each fish was measured using a sensitive weighing balance (Mettler) to the nearest 0.1 gram (Imam and Dewu, 2010). Body width was measured at the first ray of the dorsal fin using a calliper graded in millimetres (mm) (Lowe McConnell, 1972).

Examination of samples

Ecto-parasites

The fish specimens were killed by pitching using sharp scalpel or scissors after which dissecting instruments were placed in distilled water to prevent contamination 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 was examined under the x10, and x40 lenses of the compound microscope. Parasites found on the skin were collected and placed in a bijou bottle containing 70% alcohol. The name and place where parasite was found (i.e. site on host) was recorded. Gill arches and gill filaments were placed in a Petri dish containing saline after revealing the opercula cavity. The gill arches were examined under the dissecting microscope, and parasites carefully picked out using a pointed needle and placed in a drop of ammonium picrate or glycerin jelly as mounts were made. Smears of the gill scrapings were made and the slides air-dried and then fixed with methanol for further stained with Giemsa. All procedures were carried out as described Yamaguti (1961).

Helminths

The abdominal cavity of each fish was cut open ventrally with a pair of scissors and the internal organs were removed for examination. Organ squash of liver, spleen, heart, and kidney were made and examined as wet mounts under the microscope. The gastrointestinal tract of individual fish was dissected from the rectum to the oesophagus and all helminthes seen were carefully detached. Nematodes, cestodes and trematodes were processed using standard parasitological methods and identified based on their morphological structures (Soulsby, 1982; Kabata, 1985; Paperna, 1996; Olurin and Samorin, 2006).

Haemoparasites

Blood samples were collected by cutting the veins close to the head and taking thin blood impression smears on a glass slide, air dried and stained with Giemsa for 1 hour, rinsed with buffer solution 7.2, air dried and examined for blood parasites at x 100 magnification of the light microscope as described by Soulsby, (1982).

Photomicrographs of parasites and statistical analysis

An Olympus light microscope equipped with digital camera and amplification software STATGRAPHICS plus version 5.0 were used to prepare illustrations and measurements respectively. Data obtained were expressed as simple percentile incidence (%) and severity or intensity of infection expressed as mean ± standard deviation (range). Variation among sex, weight, and length of fish were determined using analysis of variance (ANOVA) and p-values equal to or less than 0.05 regarded as significant (GraphPad Instat software, 2000).

RESULTS

This survey has shown that of the 80 *O. niloticus* examined, the blood parasite *Haemogregania* was observed to be the most prevalent with significantly ($p<0.05$) incidence of 12 (57.1%), compared with *Paracamallanus*, *Pleurocercoid*, *Contracaecum*, *Trypanosoma* and *Babesiosoma* with incidence rates of 9(42.9%), 7(33.3%), 5(23.8%), 2(9.5%) and 1(4.8%), respectively (Table 1).

Table 1: Incidence of parasites isolated from *O. niloticus* caught from Lake Alau

Parasite isolated (n=2)	**No. of fish examined**
Helminths	
Pleurocercoid (cestode)	7 (33.3)[a]
Contracaecum (nematode)	5 (23.8)[b]
Paracamallanus (nematode)	9 (42.9)[c]
Haemoparasites	1(4.8)[a]
Trypanosoma	2 (9.5)[b]
Babesiosoma	2 (9.5)[b]
Haemogregarina	12 (57.1)[c]

NB: Percentiles with different superscripts are statistically significant ($p<0.05$).

Table 2 show the incidence and intensity of infection of end-oparasites in *O. niloticus* based on the sex. An overall incidence of 21(26.3%) was obtained with 9 (25.7%) infected male, while 12 (26.7) was observed to have infected female fish. Significant variation ($P<0.05$) was observed between end-oparasite infested *O. niloticus.*

Table 2: Incidence and intensity of infection of endoparasites based on the sex of *O. niloticus* examined

Sex	**No. Examined**	**No. infested (%)**	**Parasite burden**	**Intensity of infestation**
Male	35	9 (25.7)[a]	11	2.57
Female	45	12 (26.7)[b]	12	2.67
Total	80	21 26.3)[c]	23	2.63

Table 3 shows the incidence and intensity of endoparasites of *Oreochromis niloticus* according to standard length. Highest incidence of 12 (57.1%) was obtained in *Oreochromis niloticus* within the standard length range of 11.0-13.9cm with intensity of infection as .5.71, compared with the standard lengths of 14.0-16.9, 17.0-19.9, and 20.0-22.9 cm with incidences of 1(4.8%) , 5(23.8%), and 3(14.3%), and intensities of infection as 0.48, 2.38 and 1.43 respectively ($p<0.05$).

Table 3: Incidence and intensity of infection of endoparasites based on the standard length (SL) of *O. niloticus*

Standard Length (cm)	No. (%) infested(n=21)	Parasite burden	Intensity of infestation
11.0-13.9	12 (57.1)[a]	13	5.71
14.0-16.9	1 (4.8)[b]	2	0.48
17.0-19.9	5 (23.8)[c]	6	2.38
20.0-22.9	3 (14.3)[d]	2	1.43

NB: Percentiles with different superscripts are statistically significant ($p<0.05$)

Table 4 shows the incidence and intensity of endoparasites of *Oreochromis niloticus* according to total length. *Oreochromis niloticus* with total length of 14.1-17.0cm having the highest incidence of 13 (61.9%) and an intensity of 6.19 compared with the total length of 26.1-29.0, 23.1-26.0, 20.1-23.0 and 17.1-20.0 cm with incidence rates of 3(14.3%), 2(9.5%), 2(9.5%) and 1(4.8%) and intensities of 1.43, 0.95, 0.95 and 0.48 respectively ($p> 0.05$).

Table 4: Incidence and intensity of endoparasites based on the total length of *O. niloticus*

Total length (cm) infested	No. infested (n=21) (%)	Parasite burden	Intensity of infestation
14.1-17.0	13 (61.9)[a]	14	6.19
17.1-20.0	1 (4.8)[a]	1	0.48
20.1-23.0	2 (9.5)[a]	2	0.95
23.1-26.0	2 (9.5)[a]	2	0.95
26.1-29.0	3 (14.3)[a]	4	1.43

NB: Percentiles with similar superscripts are statistically not significant ($p>0.05$).

Table 5 shows the incidence and intensity of endoparasites of *Oreochromis niloticus* according to weight. *Oreochromis niloticus* with the weight of 50-99g having the highest incidence of 10 (47.6%) and an intensity of 4.76 compared with the weights of 100-149, 150-199, 200-249, 250-299 and 300-349g with incidence rates of 4(19.1%), 0(00%), 2(9.5%), 5(23.8%) and 0(00%) and intensities of 1.91,0.00, 0.95, 2.38 and 0.00 respectively ($p< 0.05$).

Table 5: Incidence and intensity of endoparasites based on the weight of *Oreochromis niloticus*

Body weight (gram) infested (n=21)	No. of fish (%)	Parasite burden	Intensity of infection
50-99	10(47.6)[a]	11	4.76
100-149	4 (19.1)[b]	4	1.91
150-199	0 (00)[c]	0	00
200-249	2 (9.5)[d]	2	9.5
300-349	5 (23.8)[e]	6	2.38
250-299	0 (00)[f]	0	

NB: Percentiles with different superscripts are statistically significant ($p<0.05$)

DISCUSSION

This study on endoparasites of *Oreochromis niloticus* revealed an incidence rate of 26.3% which was high when compared to the 16.6% reported from Asa River and its impoundment at Ilorin (Obano *et al*., 2010). It is worthy to note that infection rates vary greatly from one area to another, and this may not be unconnected with the fact that a number of factors like availability of intermediate hosts, and susceptibility of definite hosts amongst others determine to a large extent the rate of infection (Obano *et al*., 2010).

The finding of *Trypanosoma* is of zoonotic significance, as man can be infected by eating inadequately cooked fish, causing eosinophilic meningitis and deep cutaneous lesions, particularly around the digits, and on the breasts (Soulsby, 1982). Fish trypanosomosis have resulted in decreased haematocrit and haemoglobin levels and evidence of accelerated haemopoiesis, with*Tilapia* developing tissue pathologies (Eli *et al.*, 2012).

In relation to size (weight and length), weight range of 50-99grams had the highest incidence rate of parasites at 47.6%. Also, the length range of 14.1- 17.0 had highest incidence rate of 61.9%. This means that the smaller/younger fish were more infested than the bigger and older ones. This could be attributed to the fact younger fish have less immunity against parasites whereas bigger and older fish have fully developed immunity against parasitic infestation. This observation is in consonance with Adeyemo, (2001) who investigated the incidence and pathogenesis of *Chrostomium tilapiae* in Oyo State farms and reported that juvenile fish were more susceptible to *C. tilapiae* infection. This is also in consonance with Akinsanya *et al.*, (2007) who reported that the smaller fish were more infested than the bigger ones. In contrast, Kudoro (1995) studied some parasites of culture fish and reported that there was a gradual increase in the percentage infection with increase in length.

From this study, female fish were more parasitized than males. Females had incidence rate of 26.7% whereas males had 25.7%. The analysis of variance for sex was significant ($p<0.05$, $t= 35.37$). This is consistent with the findings of Emere, (2000) who reported differences in the incidence of infestation between male and female fish, which may be due to differential feeding either by quantity or quality of feed, or as a result of different degrees of resistance to infection. Emere and Egbe, (2006) also reported that due to the physiological state of the female, most gravid females could have reduced resistance to infection by parasites.

Amongst the six parasites studied in this study, the protozoa *Haemogregania* had the highest incidence, abundance and intensity. This finding is significant because it has been reported to be scanty in African fishes (Siddall and Desser, 1993). The incidence of the nematode *Paracamallanus* (42.9%) in this study is found to be higher as compared to the reports of Hafiz *et al*. (2006) who reported 32% incidence of the Mangla Lake, Punjab. Ayanda, (2009) also reported 27% prevalence, Nigeria. Nematodes are known to occur in body cavities or found penetrating subcutaneous tissues. In conclusion, fish parasitism constitutes a major threat to fish productivity, and the increased demand on fish as a ready and safe source of protein to humans should trigger further studies on fish fauna and their parasites. It is recommended that landed fish from Lake Alau should be properly cooked to avoid ingestion of parasites by fish consumers.

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