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Studies on parasitic infestation and prevalence in *Clarias gariepinus* (Burchell, 1822) from Zobe reservoir, Katsina State, Nigeria

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Target Audience: *Fish Mongers, Fish Parasitologists, Fisheries Scientists and Researchers.*

Abstract

The current study was undertaken between September, 2020 and February, 2021 to determine the prevalence of fish parasites infesting catfish Clarias gariepinus and the associated risk factors in Zobe reservoir Dutsinma, Katsina State, Nigeria. A total number of 90 fish samples were collected and examined from Zobe reservoir. Out of 90 fish samples from Zobe, 47 were male and 43 were female. Fish parasites recovered and their prevalence among Clarias gariepinus obtained from Zobe reservoir: Digenean genera; Astiotrema sp. 5 (5.82%), Miracidium larvae 3 (3.48%), Metacercariae sp. 8 (9.31%), Cestode genera; Monobothrium sp. 21 (24.42%), Pleurocercoid or Coradium sp. 5 (5.82%), Nematode genera; Ascaris eggs 20 (23.26%), Capilaria sp. 14 (16.28%), Camallanus sp. 8 (9.31%), Ascaridods or Anisakis sp. 2 (2.33%). The prevalence of parasites recovered from the fish species in this study was high. In conclusion, Clarias gariepinus from Zobe reservoir were infected by several parasites that are of economic importance. The findings suggest that the observed parasitic infections may adversely affect C. gariepinus and if not well managed, could also infect human beings who consume the fish. It is therefore recommended that communities along the reservoir should desist from activities likely to increase parasite load, also, the gastro-intestinal tract of harvested fishes from the study area should be discarded rather than consumed to prevent zoonotic diseases.

Keywords: *Clarias gariepinus; Ectoparasites; Endoparasites; Zobe Reservoir*

Description of Problem

Parasites are invertebrate organisms; some are free-living and can become opportunistic parasites while the obligate parasites require hosts for their survival and reproduction. Both opportunistic and obligate parasites are found in fish hosts but most parasitic diseases in fish are generally caused by obligate parasites (1). In fisheries, some parasites may be highly pathogenic and contribute to high fish mortalities and economic losses or threaten the abundance and diversity of indigenous fish species (2, 3).

The clariids especially *Clarias gariepinus* and *Heterobranchus* spp. are the most popular sources of fish protein for humans and are thus common candidates for aquaculture seed (4) to augment artisanal catches. Fish interacts with the various levels of food chain and influences the structures of rivers, lakes, streams and estuaries, since they are usually restricted to particular modes of life related to their food sources and reproductive requirements (5). Deleterious anthropogenic activities coupled with poor environmental conditions often subject fish to parasitic and other diseases (6). Poor environmental conditions and pollution which often result in reduced immunity in fish and higher susceptibility to parasites and diseases are among the problems facing the major fish sector (7).

In view of the importance of catfish to food production and the increasing interest in aquaculture sub-sector in Nigeria, it is necessary to investigate the prevalence of ecto-and endo-parasites in *C. gariepinus* in Zobe reservoir in Katsina State, Nigeria.

Materials and Methods

Study Area

Zobe Reservoir

The study area; Zobe reservoir (Figure 1) is located between latitude 12°’20’34.62” N to 12°23’27.48” N and between longitude 7°27’57.12”E to 7°34’47.68”E, in Dutsin-ma Local Government Area of Katsina State. It covers an approximate area of 968.544km^2. Zobe reservoir has two major tributaries which comprises of Rivers Karaduwa and Gada. The dam was constructed on Karaduwa River and extends for about 7 km long and covers a surface area of about 4,500ha. Annual rainfall in the area varies from 600-700mm, while mean annual temperature is about 25°C (8). For the purpose of this study three landing sites around the dam were selected namely; Raddawa, Makera and Tabobi.

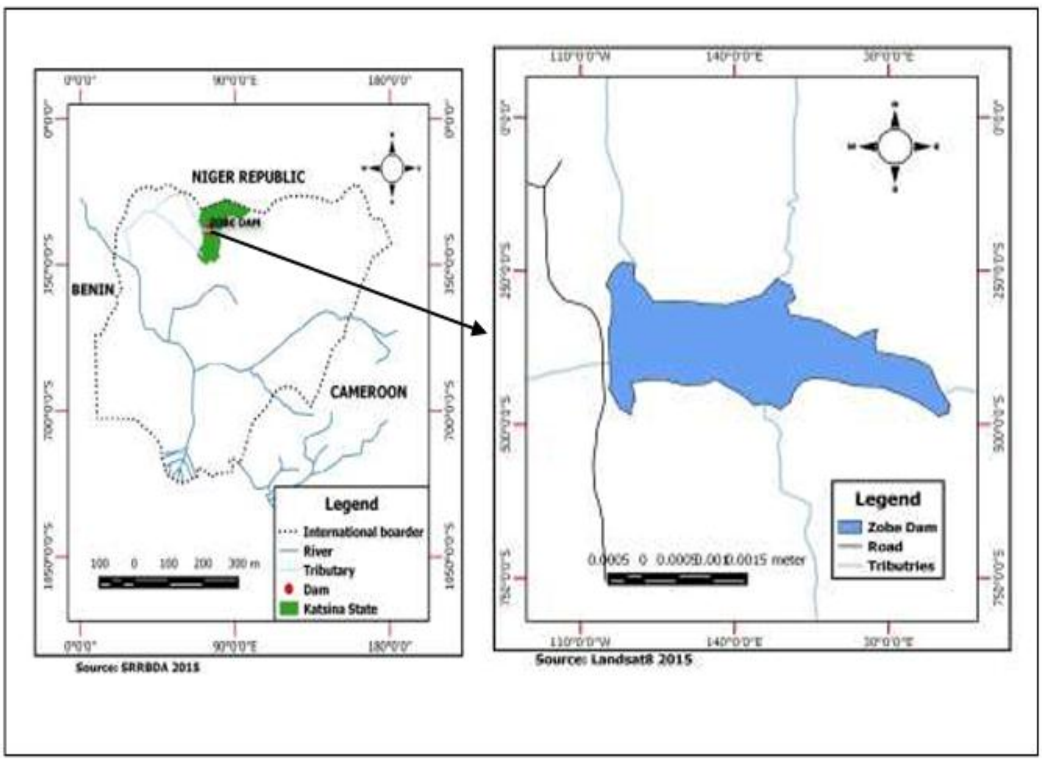

Figure 1: Zobe Reservoir in Katsina State

Sample Collection and Identification of Clarias gariepinus

Fish samples were collected from the selected study area for period of (6) months. Five (5) samples were collected from 3 different sample locations (Raddawa, Makera, and Tabobi), Raddawa is located at the entry of the reservoir on the channel of River Karaduwa, where fishing activities take place, Tabobi is located at the middle of the reservoir where human activities is minimal except agriculture and irrigation, and Makera is located at extreme end of the reservoir where farming, irrigation and a lot of fishing activities take place. Live fish samples were transported to the Biology Laboratory, Federal University Dutsinma, Katsina State, in a 25litre capacity plastic container almost filled with water, for identification, and basic morphometric evaluation before parasitic examination, collection and identification.

Identification of Clarias gariepinus

The experimental fish were identified using the description of Teugels (9).

Sexing of Experimental Fish

Sexing of sampled fish was done by physical observation of the urogenital papillae. Observation of the testes in male and ovaries in the female was confirmatory (10).

Morphometric Determination of Experimental Fish

Standard morphometric measurements of body weight were measured using top loading sensitive weighing balance (GT4100 model) and the total and standard lengths of sampled fish were measured with a meter rule.

Examination of Experimental Fish Samples for Ectoparasites

Examination of the skin, fins and gills were first carried out using hand lens for detection of parasitic manifestations. Gills were subsequently cut out and placed into separate Petri dishes and observed with hand lens for parasites. Parasites were collected and fixed in buffered formalin for further processing and specimen identification using the method of Paperna (11). A scalpel blade was used to obtain the slime substance on the skin of *Clarias gariepinus*, and skin smear was made.

The procedure was performed using a spatula by which the skin scrapings (smears) from the head to the tail were obtained, mucus mixed with epidermal cells. Thereafter, the scraped samples of mucus together with the tissues were placed on a Petri-dish containing 3mls of 0.9% saline solution and stirred using a mounted pin (12), followed by the addition of 1ml of saline solution for examination using hand lens.

Examination of Experimental Samples for Endoparasites

Examination of the gastro-intestinal tract specifically the stomach and intestine were carried out. The fish was dissected to reveal the alimentary canal. The alimentary canal was removed and sectioned into various parts consisting of the stomach and intestine. The gut was used for parasitic examination because this is where food is most abundant for the parasites. Each section was placed separately in petri dishes containing 0.9% normal saline (11). Each section was slit longitudinally and examined for parasites under a dissecting microscope between x 10 and x 30 magnifications (11). The emergence of any worm was easily noticed by its wriggling movement in the saline solution under a microscope. Parasites found were counted, and thereafter fixed and preserved in 5% formalin. Representative parasites were stained overnight with weak solution of Erlich's haematoxylin (11, 12).

Parasites Identification

There are several morphological criteria which allow recognition of helminth parasites of most families and even some genera, and identification in this particular research study referred to identification guides (13, 14) and with standard keys in literature (15, 16).

Data analysis

Prevalence and intensity of infection were calculated using percentage (%) distribution. Chi-square test was employed to determine the relationship between the parasites recovered and the parameters of interests; using GraphPad Prism version 9.0.0.121. Level of significance was set at $p \leq 0.05$.

Results and Discussion

A total number of 90 samples were collected and examined from Zobe reservoir. Out of 90 samples from Zobe 47 were male and 43 were female. Male fish tended to have a relatively higher number of infestations 22 (46.80%) while the female fish recorded 20 (46.52%). Data analysis showed that the result was no significant association ($p > 0.05$) between sexes (Table 1). Among the *Clarias gariepinus* sampled from Zobe Reservoir, the parasite that had the highest occurrence was *Monobothrium* sp. 21 (24.42%). Some of the infested fishes had double infestation. A total of 86 adult worms, larval and eggs were found in the sampled fishes investigated, out of which *Ascaris* eggs were 20 (23.26%), *Capilaria* sp. 14 (16.28%), *Metacercariae* sp. 8 (9.31%), *Camallanus* sp. 8 (9.31%) *Pleurocercoid* or *Coradium* 5 (5.82%), *Astiotrema* sp. 5 (5.82), *Miracidium* larvae 3 (3.48%) and followed by *Ascaridods* or *Anisakis* 2 (2.33%) as the least parasitic infestation. The identified parasites were cestodes, digeneans and nematodes, respectively (Table 2).

Table 1: Prevalence of parasites of *Clarias gariepinus* in relation to sex in Zobe reservoir

Sex	No examined	No infested	% of host infested
Male	47	22	46.80
Female	43	20	46.52
Total	90	42	46.66

χ^2 (1, N=90) = 0.0003, P = 0.986

Table 2: Prevalence of parasites of *Clarias gariepinus* in Zobe reservoir

Parasite	Taxonomic Group	Rate of parasitic Infestation	% of host infested
Monobothrium sp.	Cestoda	21	24.42
Capilaria sp.	Nematoda	14	16.28
Metacercariae sp.	Digenea	8	9.31
Camallanus sp.	Nematoda	8	9.31
Ascaridods	Nematoda	2	2.33
Miracidium larvae	Digenea	3	3.48
Pleurocercoid	Cestoda	5	5.82
Ascaris eggs	Nematoda	20	23.26
Astiotrema sp.	Digenea	5	5.82
Total		86	100

In the sampled *Clarias gariepinus* from Zobe reservoir, the intestine was the most infested 51 (59.3%) of all the organs investigated, followed by the stomach with 35 (40.69%). No parasite was found in the gills and on the skin (Table 3). This finding is similar to the finding of a researcher in River Yamuna who reported (0%) infection from skin and gill of African catfish (17). Out of the 90 fish collected and examined from 3 sample locations in Zobe reservoir, an overall prevalence of 42 (44.66%) was recorded (Table 4). Although, there was no significant difference (P>0.05) in prevalence among fish from the various sample locations, *Clarias gariepinus* obtained from Tabobi 18(60.00%) harboured the relatively highest percentage of parasites, followed by Raddawa 14 (46.66%), while those sampled from Makera location had the least percentage infestation 10 (33.33%). The expected influence of anthropogenic activities especially defecation in enhancing parasitic infestation was not observed in this study. This probably denotes that the parasites observed in the *Clarias* were not linked to man and thrived most in the least disturbed region of the water body i.e. Tabobi.

Fish samples obtained from Zobe indicated that catfish with lengths of 20.1 - 25.0cm harboured more worms 15 (83.34%) followed by 10.0 - 15.0cm 14 (40.0%), 15.1.20.0cm followed by 12 (37.50%) while those with lengths of 25.1 - 30.0cm had lesser worm burden 1 (20.0%) (Table 5). This study also revealed that the intensity and incidence of infestation increased with the increasing size of *Clarias gariepinus*. This is similar with the findings of certain researchers (18, 19, 20) who revealed that these parameters are synonymous to age, and that the higher infection rate in adults than young ones may be due to longer duration of time the older fish were exposed to the agents in the environment, this increases their chances of acquiring the parasite with time.

Longer fish provides greater surface area for infection than smaller fishes (18), while an increase in the abundance of parasites with host size was also reported (19).

Table 3: Prevalence of parasites of *Clarias gariepinus* in Zobe reservoir in relation to site of infestation

Parasite	Ectoparasite		Endoparasite	
	Skin	Gills	Intestine	Stomach
Monobothrium sp.	0	0	13(25.49)	8(22.86)
Capilaria sp.	0	0	8(15.68)	6(17.15)
Metacercariae sp.	0	0	2(3.93)	6(17.15)
Camallanus sp.	0	0	3(5.88)	5(14.28)
Ascaridods	0	0	2(3.92)	0(0)
Miracidium larvae	0	0	1(1.96)	2(5.71)
Pleurocercoid	0	0	17(33.34)	3(8.57)
Ascaris eggs	0	0	2(3.93)	3(8.57)
Astiotrema sp.	0	0	2(3.93)	3(8.57)
Total	0(0)	0(0)	51(59.3)	35(40.69)

χ^2 (8, N=90) = 14.62, P = 0.067

Table 4: Prevalence of parasites of *Clarias gariepinus* in relation to sample location in Zobe reservoir

Location	No examined	No infested	% of host infested
Raddawa	30	14	46.66
Tabobi	30	18	60.00
Makera	30	10	33.33
Total	90	42	46.66

χ^2 (2, N=90) = 1.571, P = 0.456

Table 5: Prevalence of parasites of *Clarias gariepinus* in relation to fish length in Zobe reservoir

Fish length(cm)	No examined	No infested	% of host infested
10.0-15.0	35	14	40.00
15.1-20.0	32	12	37.50
20.1-25.0	18	15	83.34
25.1-30.0	5	1	20.00
Total	90	42	46.66

χ^2 (3, N=90) = 4.121, P = 0.249

Parasitic prevalence was found to increase as the fish grows and could be attributed to the longer time of exposure to the environment by body size (21). The parasites recovered in the fishes of Zobe reservoir may affect the survival and growth rate of fishes in the reservoir. The fish species examined in this study could have suffered malnutrition due to increase in parasitic infestation since parasites contest with host for its nutritious luminal contents. This condition may result in devaluation of protein content of the fish. Invariably, protein deficiency impairs normal metabolism of the liver, particularly in man. Therefore, the infected fishes which harbour zoonotic parasites such as larvae of *Anisakis* can transmit disease to man resulting to poor human health (22).

The present study shows that, the highest rate of parasitic infestation in the sampled fishes was recorded in the smaller fishes. The possible reason for this relationship could be that small fishes feed on less amount of foods hence gained less immunity compared to the large fishes. This level of infestation observed may also be due to differential feeding habits and as a result of different degrees of resistance to parasitic infections (23). This is in agreement with (24) who reported that smaller fish were more infected compared to larger ones probably due to their nature of acquired immunity with age. In contrast, the present study disagrees with findings of certain researchers who reported that bigger (and therefore possibly mature) fish have more parasites compared to small fish because they feed more on diverse food sources thereby exposing them to more parasitic infestation (5).

Conclusions and Applications

1. The present study in Zobe reservoir show a low to average prevalence of internal parasitic infestations and revealed three classes of parasitic species present in fish.
2. The findings of this study are expected to serve as baseline parasitological information for future studies to protect and develop the ecological potential of Zobe reservoir.

3. An in-depth study of anthropogenic activities within the study area to decipher and restrict those that promote parasitic infestation is recommended.
4. Gastro-intestinal tract of *Clarias gariepinus* harvested from Zobe reservoir should be discarded to prevent zoonotic diseases.

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