Original Research Article

Comparative Survey of Parasites of African catfish *Clarias gariepinus* (Burchell, 1822) in Ajiwa and Zobe Reservoirs in Katsina State, North-Western Nigeria

ABSRACT

Aims: The aims of this survey are to isolate, identify, classify and compared parasitic infestation of *Clarias gariepinus* obtained from Ajiwa and Zobe reservoirs, Katsina state. Also to investigated the prevalence and infestation of African catfish (*Clarias gariepinus*) from Ajiwa and Zobe reservoirs, Katsina.

Study design: The research was conducted in Ajiwa and Zobe Reservoirs, Katsina State, Nigeria. Ajiwa reservoir is on the latitude 12°98' N and longitude 7°75' E, in Batagarawa LGA, Katsina State. Zobe reservoir is an earth-fill building completed in 1983 on the coordinates 12°23'18" N latitude and 7°28'29" E longitude in Dutsin-Ma LGA of Katsina State.

Place and duration of the study: Biological laboratory of the department Fisheries and Aquaculture Federal University, Dutsin-Ma, Katsina State, between September, 2020 and February 2021.

Methodology: A total of 180 live fish samples, *Clarias gariepinus;* consisting of males and females were randomly obtained from Ajiwa and Zobe Reservoirs. The skin, the gastrointestinal of the fish was examined for the presence of parasite, using standard procedures.

Results: The prevalence in female specimens of *C. gariepinus* 29 (58.00%) was higher than that of the males 20 (50.00%) in Ajiwa reservoir while in Zobe the prevalence in male specimens of *C. gariepinus* 22 (46.80%) was higher than that of the females 20 (46.52%). Occurrence and mean intensity of parasitic infection were higher in samples in the Zobe reservoir than those in the Ajiwa reservoir.

Conclusion: The research displayed that parasitic burdens were higher in *C. gariepinus* gotten in Zobe environment compared to those obtained from Ajiwa environment. It is for that reason

suggested that the stomach and intestinal tract collected in *C. gariepinus* from the survey region have to be thrown away instead than consumption to prevent the spread of infections from fish to human being. It can be significant to set up rules such as limits continuously waste dumping in addition livestock rearing/watering around water bodies, that will reduce possible actions that may possibly backing a growth in parasitic worms in the environs.

Key words: Zoonosis*;* Fish Parasites; Helminths; Ectoparasites; Endoparasites; Lakes; Dams

1. INTRODUCTION

Fish and fish products are important sources of omega-3 fatty acids of animal source. Fish is a low-priced and a reasonable source of animal protein and it is within reach of the average resident of the majority of nations. Demand for fish is constantly increasing due to, among other things, population growth, high prices of other animal protein sources, and other health problems associated with the consumption of other of animal protein sources (Sadauki *et al*., 2022b). Tropical freshwater fishes such as *Tilapia zillii* and *Clarias gariepinus* have been reported to act as definitive or intermediate hosts for numerous species of protozoan, metazoan and crustacean parasites (Ito, 2017). Parasitic infections/infestations in fish have been reported to have serious impacts on the aquaculture industry (aquaculture production) and its commercial sustainability. The frequency and extent of parasite infection are closely related to the environmental situations of the water body and generally health of the fish (Ahmad *et al*., 2016). In fisheries and aquaculture, certain parasites can be highly pathogenic, resulting in high fish mortality and profit loss, or even threaten the abundance and diversity of native fish species (Sadauki *et al*., 2022b). As obtainable among other animals, fish such as *Tilapia zillii* and *Clarias gariepinus* also suffer infestation by endoparasites and ectoparasites; particularly protozoans and helminths triggering high mortality rate. Fish parasites and diseases institute one of the major challenges threatening fish farming globally (Ito, 2017).

Edema *et al.* (2008) reported a checklist of helminth parasitic infections in fresh water fish such as *Tilapia zillii* and *Clarias gariepinus* in African countries, and number of reports have also emerged from Africa, highlighting the intensity, occurrency, epidemiology and pathology of such parasitic infestations/infections. Accordance to Hussein *et al.* (2012), *Clarias gariepinus* harbour several parasites which comprise adult Digenea; trematode metacercaria of the family

Clinostomidae encysting in tissues; and adult Monogenea of the families Pousopothocotylidae, Dactylogyridae and Gyrodactylidae. Parasites habitually injure fish (hosts) in the wild by destroying their tissues, which may lead to secondary infection/infestation or removal of body fluid and cell fluid from the host (MSG, 2017). This research compared the prevalence of parasitic infestation in the sites- skin, gills, stomach and intestine among *Clarias gariepinus* obtained from Ajiwa and Zobe Reservoir reservoirs, Katsina state.

2. METHODOLOGY

2.1 Study Area

The research was conducted in Ajiwa and Zobe Reservoirs, Katsina State, Nigeria. Ajiwa reservoir is on the latitude 12°98' N and longitude 7°75' E, in Batagarawa LGA, Katsina State. The major purpose of the reservoir is irrigation farming and water source to the general public of Katsina, Batagarawa, Mashi and Mani LGAs. The reservoir was impounded in 1973 and commissioned in 1975. The volume of the water is nearly 22,730,000 m3 (Sadauki *et al*., 2022a). It functions as a source of profits for the bordering societies.

Zobe reservoir is an earth-fill building completed in 1983 on the coordinates 12°23'18" N latitude and 7°28'29" E longitude in Dutsin-Ma LGA of Katsina State. The reservoir has a height of 48 m, length of 360 m with a base width of 2,750 m. The artificial lake has a storing capability of 179 Mca, as it is impounded from two major rivers Karaduwa and Gada (Sadauki *et al*., 2022a). The impoundment was created mainly for the providing of domestic water supply with irrigation and fisheries improvement as a most important additional assistance.

2.1.1 Sample Collection, Identification and Sexing of Experimental Fish

For period of (6) months, fish samples were collected from the selected study areas. The fish samples were transported alive to the Fisheries and Aquaculture laboratory of the Federal University Dutsin-Ma, Katsina State, in a plastic vessel filled with water for identification and examination. The fish were identified by Suleiman pictorial chart (2016) and Teugels *et al*. description guide (1998). The urogenital papillae were examined by physical observation of sampled fish. The obesity of the testes in male and ovaries in the female was confirmed (Imam and Dewu 2010, Sadauki *et al.,* 2022).

2.1.2 Morphometric Determination of Experimental Fish

Standard morphometric measurements of body weight were measured with a top loading sensitive weighing balance (GT4100 model) and the total and standard lengths of sampled fish were measured using meter rule (Sadauki *et al.,* 2022).

2.1.3 Examination of Experimental Fish Samples for Ectoparasites

Investigation of the skin, fins and gills was done using hand lens for exposure of parasitic appearances. Gills were successively cut out and inserted into isolated petri dishes and detected with a hand lens for parasites identification. Parasites were gathered and fixed in buffered formalin for additional treating and sample recognition/identification using the method of Paperna (1991). A scalpel blade was used to get the slime substance on the skin of *Clarias gariepinus*, and skin smear was made. The techniques were carried out using a spatula by which the membrane rubbings (smears) from beginning of the head to the tail was gotten, slime mixed with epidermal cells. Subsequently, the rubbed samples of slime collected with the tissues was inserted on a Petri-dish containing 3mls of 0.9% saline solution and agitated using a mounted pin (Bichi and Ibrahim, 2009; Sadauki *et al.,* 2022), followed by the adding of 1ml of saline solution for investigation using hand lens.

2.1.4 Examination of Experimental Samples for Endoparasites

Investigation of the gastro-intestinal tract specifically the stomach and intestine were carried out. The individual fish samples were cut apart to expose the gastrointestinal tract. The gastrointestinal tract was cut off and split into two parts containing of the intestine and stomach. The gastrointestinal tracts were used for parasitic investigation since this is where nourishment is most plentiful for the parasites fauna. Every single segment was inserted individually in petri dishes containing 0.9% normal saline (Paperna, 1991). Every single segment was cut longitudinally and looks at for parasites below a dissecting light microscope between x 10 and x 30 magnifications (Paperna, 1991). The appearance of every worm was simply seen through its wriggling physical motion in the saline solution below a light microscope. Parasitic fauna discovered were count up, and after that inserted and conserved in 5% formalin. A typical parasite was stained overnight using weak solution of Erlich's haematoxylin (Paperna, 1991; Bichi and Ibrahim, 2009; Sadauki *et al*., 2022).

2.1.5 Parasites Identification

The parasitic fauna were identified to a species level morphologically using the standard identification guides (Paperna, 1980; Moravec, F. 2006) and with standard keys in texts (Paperna, 1996, Roberts, 2001).

2.1.6 Parasite Prevalence and Intensity Estimation

The occurrence/prevalence of parasites infestation was calculated for sex, location, length and weight using the model described by Amos et al. (2018):

$$\text{Prevalence (\%)} = \frac{\text{No of fish host infected}}{\text{Total no. of fish host Examined}} \text{ x } 100$$

$$\text{Percentage (\%) of infection} = \frac{\text{Number of a specific parasite in the samples}}{\text{Total number of parasite in the samples}} x100$$

2.1.7 Data analysis

Occurrence and intensity of infestation was expressed in percentage (%). Data were presented using descriptive statistics; a simple percentage was used to present the prevalence and distributions of parasites. The descriptive statistics was used to examine the association between infection and the risk parameters for the prevalence.

3. RESULTS

A hundred and eighty (180) pieces of wild African catfish *C. gariepinus* from Ajwa and Zobe reservoirs were examined for exto and endo parasites. No parasite was found in the gill and skin. Ninety (90) individual fish samples were collected and examined in Ajiwa reservoir. Out of the ninety fish samples, 40 were males and 50 were females. Female fish tended to have a highest number of infections 29 (58.0 %) while the male fish recorded 20 (50.0 %) as presented in table 1. However the result was not significantly different between the fish sexes P<0.05. Ninety (90) individual fish samples were collected and look at from Zobe reservoir. Out of ninety fish samples from Zobe 47 were male and 43 were female. Male samples (fish) tended to have a highest number of infections 22(46.80 %) while the female fish recorded 20 (46.52 %) (Table 1). Data analysis displayed that the result was not significantly different among the fish sexual category (Table 1). *Clarias gariepinus* samples obtained from Ajiwa reservoir, the parasite that had the higher incidence were *Monobothrium sp.* 26(36.12%).A number of the disease-ridden fishes have double infestation and a overall of 72 fully developed worms, larval in addition eggs was discovered in fishes examined, out of which 72 *Capilaria sp.* 16(22.23%), *Astiotrema sp.* 12(16.66%) *Larva Miracidium* 10(13.88%) *Ascaris eggs* 6(8.34%) and followed by *Metacercariae sp.* 2(2.77%) as the least parasitic infection. they were cestodes, digeneans and nematodes respectively (Table 2).Samples of African catfish *Clarias gariepinus* gotten in Zobe artificial lake, the parasitic worms that had the higher number incidence were *Monobothrium sp.* 21(24.42%).Some of the infested fishes have double infestation and a total of 86 fully developed worms, larval in addition to eggs were discovered in fishes examined, out of Which 86 *Ascaris eggs* 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), *Larva Miracidium* 3(3.48) and followed by *Ascaridods* or *Anisakis* 2(2.33%) as the least parasitic infection. they were cestodes, digeneans and nematodes respectively (Table 2)The samples of African catfish *Clarias gariepinus* gotten in Ajiwa artificial lake. The stomach was the most infested 39(54.16%) of all the organs investigated, followed by the intestine with 33(45.86%). No parasite was found in the gills and skin (Table 3).The samples African catfish *Clarias gariepinus* found in Zobe artificial lake. The intestine was the most infected 51(59.3%) of all the organs investigated, followed by the intestine with 35(40.69%). No parasite was found in the gills and skin (Table 3).Out of the 90 fish samples collected from three (3) sample sites from Ajiwa and inspected, an total occurrence of 49(54.45%) were documented (Table 4). While there was no significant difference (P>0.05) in occurrence among fish from the various sample locations, catfish *Clarias gariepinus* obtained from Kadaji 17(56.66%) and Gajerar giwa 17(56.66%) (Harboured) had the highest percentage of infection, while Kundu waje sample location had the least percentage 15(15.00%). Statistical analysis showed that the result was not significant. Out of the 90 fish collected from 3 sample location from Zobe and examined, 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 location, catfish *Clarias gariepinus* obtained from Tabobi 18(60.00%) (harboured) had the highest percentage of infection, followed by Raddawa 14(46.66%), while Makera sample location had the least percentage 10(33.33%). Statistical analysis showed that the result was not significant. Table 5: Fish samples gotten in Ajiwa showed that catfish within the length of 10.0-15.0cm give refuge to more parasites

33(67.34%) followed by 15.1-20.0cm 7(43.75%), 20.1-25.0cm 7(41.17%) while individuals within the length of 25.1-30.0cm had smaller worm load 2(25.0%). Fish samples found from Zobe indicated that catfish within the length of 20.1-25.0cm sheltered additional worms 15(83.34%) followed by 10.0-15.0cm 14(40.0%), 15.1.20.0cm followed by 12(37.50%) whereas individuals sample within the length of 25.1-30.0cm had smaller parasitic load 1(20.0%) (Table 5).

Table 1: **Prevalence of parasites of *Clarias gariepinus* in relation to sex from Ajiwa and Zobe reservoirs**

Sex	**Ajiwa Reservoir**			**Zobe Reservoir**		
	Number Examined	**Number Infected**	**Prevalence (%)**	**Number Examined**	**Number Infected**	**Prevalence (%)**
Male	40	20	50	47	22	46.80
Female	50	29	58	43	20	46.52
Total	**90**	**49**	**54**	**90**	**42**	**46.66**

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

Ajiwa Reservoir			**Zobe Reservoir**		
Name of parasite	**Taxonomic Group**	**Number Isolated**	**Name of parasite**	**Taxonomic Group**	**Number Isolated**
Monobothrium sp.	Cestode	26	*Monobothrium sp.*	Cestode	21
Capilaria sp.	Nematode	16	*Capilaria sp.*	Nematode	14
Larva miracidium	Digenea	10	*Larva Miracidium*	Digenea	3
Metacercariae sp.	Digenea	23	*Metacercariae sp.*	Digenea	8
Astiotrema sp.	Digenea	12	*Astiotrema sp.*	Digenea	5
Ascaris sp.	Nematode	6	*Ascaris sp.*	Nematode	22
			Camallanus sp.	Cestode	8
			Pleurocercoid sp.	Cestode	5

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

Name of Parasite	Ajiwa Reservoir				Zobe Reservoir			
	Ectoparasite (Prevalence)		Endoparasite (Prevalence)		Ectoparasite (Prevalence)		Endoparasite (Prevalence)	
	Skill	**Gills**	**Intestine**	**Stomach**	**Skin**	**Gills**	**Intestine**	**Stomach**
Monobothrium sp.	0	0	10(30.31)	16(41.02)	0	0	13(25.49)	8(22.85)
Capilaria sp.	0	0	10(30.31)	6(15.38)	0	0	8(15.68)	6(17.15)
Larva miracidium	0	0	6(18.18)	4(10.26)	0	0	1(1.96)	2(5.71)
Astiotrema sp.	0	0	4(12.13)	8(20.52)	0	0	2(3.92)	3(8.57)
Ascaris sp.	0	0	2(6.06)	4(10.26)	0	0	4(7.84)	3(8.57)
Metacercariae sp.	0	0	1(3.04)	1(2.56)	0	0	2(3.92)	3(8.57)
Pleurocercoid					0	0	17(33.34)	3(8.57)
Camallanus sp.					0	0	3(5.88)	5(14.28)

TABLE 4: Prevalence of parasites of *Clarias gariepinus* in relation to sample location in Ajiwa and Zobe Reservoirs

Sampling Location	Ajiwa Reservoir			Zobe Reservoir		
	No. Examined	No. Infected	% of Infection	No. Examined	No. Infected	% of Infection
Station A	30	17	56.66	30	14	46.67
Station B	30	15	50.00	30	18	60.00
Station C	30	17	56.66	30	10	33.33
Total	**90**	**49**	**50.44**	**90**	**42**	**46.67**

TABLE 5: Prevalence of parasites of *Clarias gariepinus* in relation to length in Ajiwa and

Zobe Reservoirs

	Ajiwa Reservoir			Zobe Reservoir		
Sampling Location	No. Examined	No. Infected	% of Infection	No. Examined	No. Infected	% of Infection
10.0 – 15.0	49	33	67.35	35	14	40.00
15.1 – 20.0	16	7	43.75	32	12	37.50
20.1 – 25.0	17	7	41.18	18	15	83.33
25.1 – 30.0	8	4	50.00	5	1	20.00
Total	**90**	**49**	**54.44**	**90**	**42**	**46.67**

4. Discussion

Abiotic influences, such as increased water temperature, can alter the state of resistance situation in fish facilitating infestation and set up of parasitic worms (Onyishi and Aguzie, 2018). Akinsanya and Otubanjo (2006) preached that geo-climatic variances might be an important factor in influential/determining, not just the occurrence of parasites in freshwater bodies such as rivers and dams, but also the parasite populations found in freshwater fishes such as *T. zilli* and *C. gariepinus*. Data has displayed that parasitic worms are regularly discovered in entirely aquatic fishes such as *T. zilli and C. gariepinus*, with their incidence in addition strength dependent on the parasitic fauna also their ecology, host and its nourishing behaviours, physical factors in addition sanitation of the aquatic environment then manifestation of middle hosts where needed (Hussen et al., 2012). From current survey, six types of parasitic worms in Ajiwa reservoir and nine types of parasitic fauna in Zobe reservoir from three Classes were identified. Related outcomes were identified by Kawe et al. (2016) from African catfish *Clarias gariepinus* from dissimilar Association zones from F.C.T, Abuja, Nigeria. Kawe et al. stated 2 (two) types of Nematode representative approximately 56% of the infestation, a classes of Cestode and two species of Trematode. Dan-Kishiya and Zakari (2007) similarly identified Nematode, Cestode and Trematode from wild *C. gariepinus* in Gwagwalada Abuja, However Salawu *et al.* (2013) identified Nematode Cestode from the digestive tracts of *C. gariepinus* from Ogun River and Asejire Dam in South-west, Nigeria. Abdel-Gaber et al., (2015) and Khan, (2012) likewise identified related outcomes. On the other hand, Amos et al. stated (2018) extreme highest in relations of total number, species and Classes. Nine Classes, 16 species and 396 separate parasitic worms was identified in 60 matured fish and 60 juveniles of *C. gariepinus* in Lake Gerico, Yola, Adamawa State. No parasite were recovered in the gills and skin of *C. gariepinus* obtained in Ajiwa and Zobe reservoirs dissimilar in the direction of our research, Amos et al. (2018) identified the parasitic worms in the gill, skin, and gastrointestinal tract of sampled fish. Parasitic occurrence, the moderately highest infestation rate from most females than that of males in Ajiwa reservoir the study is related to the discoveries of Ratnabir et al. (2015) and Amos et al. (2018) who stated that female fish samples anchorage additional parasites associated male fish samples but disagrees with the discovery of Ugbor et al. (2014) who identified additional parasite infection from males fish samples than from female fish samples. While parasitic incidence, the moderately higher infection rate in most males than that of females in Zobe reservoir this research is disagree with the results of Ratnabir et al. (2015) and Amos et al. (2018) who stated that female fish samples anchorage extra parasitic worms associated male fish samples but agrees with the outcome of Ugbor et al. (2014) who indicated more parasite infection in males than in the female. However, the female sex documented higher infestation which may possibly be due to difference nutritive both by amount or excellence of nourishment consumed and as an outcome of dissimilar amounts of struggle/fight to infestation (Ogonna et al., 2017).The present investigation displayed that, the higher degree of parasites invasion in diverse fishes was noted in lesser fishes. The likely purpose for this may possibly be that lesser fishes nourished on a smaller amount of nourishment henceforth gained a smaller amount of protection related to the bigger fishes. This is in conformity with Shehata et al. (2018) who stated that lesser fish was additional disease-ridden related to bigger fishes maybe due to their nature of acquired resistance/protection with oldness. In dissimilarity, the current survey differs with discoveries of Ashade et al. (2013) who stated that matured then therefore maybe adult fish have extra parasites associated to lesser fish since they nourish additional on dissimilar nourishment sources so revealing them to additional parasite worm's invasion.

5. CONCLUSIONS

The current survey in Ajiwa and Zobe reservoirs display a low to average occurrence of gastro-internal parasitic invasions and shown three classes of parasitic fauna existing in fish.

The discoveries of this survey are predictable to help as reference line parasitic data for upcoming research to safeguard and improve the environmental potential of Ajiwa and Zobe reservoirs. Actions that have the possible of growing the richness of parasitic worms may perhaps be controlled by necessary management organizations that are in control for the supervision of the aquatic water body. With rise in fish farming, it is also vital/needed to have amenities/equipment's for examination and treatment of fish sicknesses mostly in the research areas.

RECOMMENDATION

This study recommends that appropriate food preparation of fish and consumption of correctly roasted fish serve as precautionary measures to possible zoonotic parasite infestation. A number of the parasitic worms detected particularly the cestode parasites identified are zoonotic skilful of causing severe community healthiness infestation in human being, consequently, the aforementioned is suggested that the intestine and stomach region of *Clarias gariepinus* collected in Ajiwa and Zobe reservoirs have to be thrown away before the fish is eaten. There is need for further researches on the status of contamination; highlighting the present physicochemical parameters conditions water of Ajiwa and Zobe Reservoirs, to find out the exact correlation between contamination, toxic waste and parasitism in the reservoirs.

In addition, study similarly recommends additional survey on lifespan of most important parasitic worms detected such as digeans, cestode and nematodes, should be carry out in direction to develop the procedures suitable to stop and govern parasitic woems.

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