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Original article

Parasites associated with wild and cultured fish in selected parts of Niger State, Nigeria

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ABSTRACT

Parasites in fish is of great concern as it affects its host and consumers, despite its high benefits to man, they are faced with different infections which could mostly be due to human activities around its environment or through fish handling. This study assessed parasites infecting 5 different fish host namely *Mormyrus rume*, *Lates niloticus*, *Bagrus bayad*, *Clarias gariepinus* and *Heteroclarias* (hydrid) which were collected randomly from three sampling stations (a dam and two ponds) in Niger State, Nigeria over a period of 8 months to determine the prevalence of parasite infection in the various fish host. Fish specimen were collected using line and cast net. All fish samples collected were transported to the laboratory for parasitological examinations. Sites examined for parasites were gill, stomach and intestine. Analysis of parasites found in both environments revealed significant ($p<0.05$) difference between parasites in fishes. *Opisthorchis sp* (21.49 %) was higher compared to other parasites species of which *Trichodina sp* (3.51 %) is the least from the wild. *Capillaria sp* from the ponds studied had higher percentage of infection in the fishes although pond B (58.33 %) recorded little higher than pond A (50 %) followed by *Camallanus sp* with pond A (36.61 %) having higher percentage compare to pond B (16.67 %). C. gariepinus (75 %) had the highest number of parasite infection compared to *Heteroclarias* (25 %). This study revealed the presence of parasites infection from the study areas which are indicators of potential organisms that can cause harm if not properly managed. Routine research is encouraged to monitor various water bodies either, rivers, dams and ponds in the State to reduce health risk, fish loss and economic loss.

Keywords: Parasite, Fish, Wild, Cultured and Pond.

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INTRODUCTION

Fish is found both in lentic and lotic environment making it very accessible. According to fossil records, fish have been on earth for more than 500 million years and over 33,000 species are in existence and more are being discovered all the time (11) they are greater than the total numbers of all other vertebrate species combined together. In cognitive and physical development in human especially children, fish plays an important role in healthy diet as it provides nutrients and micro-nutrients which the body needs also fish oil is known for lowering the possibility of coronary heart disease (CHD) in man. Report from Healthfacts.org review that fish provides essential vitamins, minerals and oil vital for human balanced diets. When compared to the different animal protein source available, it is seen as one of the cheapest and excellent source of protein that man can get as both the rich, middle class and poor citizens can afford it. In Nigeria, research on fish shows that majority of Nigerians eat fish as one of their main requirements for protein because it digests faster, its contents contains balanced amino acids and have low cholesterol level (6) (2).

Fish farming appears to be one of the prospects in Nigeria and Africa at large promising investments over the years, fish farming continues to grow due to high demand for fish and remains the most efficient and reliable sector in providing fishes for the over growing population as the wild cannot meet up the demand for humans and livestock. (14) mentioned that around 200 million Africans benefit nutritional security and food from the fisheries sector in addition, it creates economic benefits for more than 10 million individuals who are into fish production, processing and marketing. In spite of all the benefits of fish to man, like every other living things, fish harbour both external and internal parasites which cause a vast number of pathological weaknesses. These parasites have a significant impact on them and a detrimental influence on their profitability and cause ailment in different areas of the world (21). Parasites dwell close in touch and get nutrition advantages from their host usually without killing its host. These parasites use up energy responsible for the growth, sustenance, development and reproduction of the fish hosts and this can damage its hosts and have effect on fish production in many ways. It is said that parasites are significant part of water environment and form an important role to aquatic life which influence their host or the environment directly or indirectly (23). Parasites are significant components of host biology, population structure and useful ecosystem. They can be seen in any fish species and within different wild and culture environments (13). Parasites are invertebrate, of which some live freely which may later become opportunistic parasites while the obligate parasites require hosts for survival either as obligate or opportunistic, parasites are found in fish hosts though most parasitic diseases in fish are generally caused by the obligate ones (6). Since fish parasites like Nematodes, Cestodes and Trematodes are zoonotic to man, this study was carried out to assess possible parasites occurring either on and in the internal organs of some fish species that are associated with the wild and cultured fish in their environments.

MATERIALS AND METHODOLOGY

Study Area

Three locations were targeted for the study which include Shiroro dam in Zumba village,

Water resources Aquaculture and Fisheries Technology Gidan kwanu, Federal University Technology Minna fish farm and Lapan-gwari fish farm all in Niger State.

Shiroro dam is a man-made producing hydro-electric power generation dam of Kaduna River in Niger State with an installed power generating capacity of 600 MW (12). It is sited on latitude 9°57′ N longitude 6°13′ E. The dam covers roughly 320 km^2 of land, has a maximum length of 32 m (26). Minna is located in Nigeria's North Central geopolitical zone at latitude 9^o 36′ N and longitude 6^o 34′ E (Figure 1). It has an estimated human population of about 348, 788 people and spans an area of 88 square kilometers. The climate shows two separate seasons, rainy season is usually between April or May to October while dry season is between November and March each year.

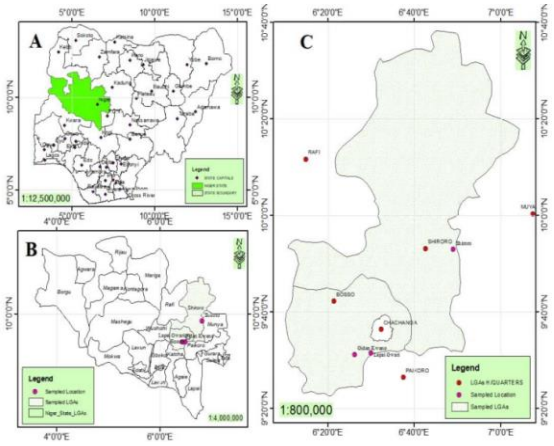

Figure 1: Map of study area.

Sample collection

A total number of two hundred and forty (240) fish samples were collected from the three sampling locations, five each of the mentioned four species of fish (*Lates niloticus, Mormyrus rume, Bagrus bayad* and *Clarias gariepinus*) was from Shiroro dam making it twenty fish samples and five each from the WAFT fish pond and Lapan Gwari pond (*Clarias gariepinus* and *Heteroclarias* sp (hybrid)) making 10, having 30 per month, the fish were captured with the help of fishermen using line and cast net once in a month over a period of eight months (December, 2019 to September, 2020). Samples were transported in ice box to the WAFT laboratory for identification and examination. Fish samples were identified using guidelines by (17). Sex of fish were determined by morphological examination. Fish Weight, Standard length (SL) and Total length (TL) were taken and recorded as described by (21).

Parasite Survey and Identification

With the help of a dissecting kit, fish body cavity was opened from the genital papillae down to the gill region. Each fish intestine, stomach, and gill was removed and open up then placed in separate petri-dishes containing 3 mls of 0.9 % saline solution. Smears from each site was placed on a clean slide then viewed using a light microscope to check for parasites. The parasites of each organ recovered were identified, counted, recorded, photomicrographed and preserved in vials with 70 % ethanol (20) (3). The keys of fresh water fish parasite pictorial guide were used for the identification and comparison of each parasites (24).

Data Analysis

Chi-square was used to determine the prevalence of parasites in the fish from wild and cultured environments.

RESULTS

Prevalence of fish parasites found in the wild environment

Analysis of parasites found in wild environment revealed significant ($p<0.05$) difference between parasites in fish. *Opisthorchis* sp (21.49 %) was higher compared to other parasite species of which *Trichodina* sp (3.51 %) was the least of all. Parasite species with high prevalence include *Diphillobothrium* sp (19.74 %), *Camallanus* sp (18.86 %) and *Capillaria* sp (17.11 %) (Table 1). Also there was significant ($p<0.05$) difference in the site of infection with the intestine (54.39 %) having the highest number of infection followed by the stomach (26.32 %) while the gut recorded (19.28 %). Analysis shows *Clarias gariepinus* (32.46 %) was the most infected fish species, meanwhile no significant ($p>0.05$) difference in infection rate between the other fish species, *Mormyrus rume* (22.81 %), *Bagrus bayad* (22.81 %) and *Lates niloticus* (21.93 %) (Table 2).

Table 1: Prevalence of fish parasites found in wild environment in relation to species

Parasite Species	Location of parasites					
	Gills (%)	Stomach (%)	Intestines (%)	Total (%)	$\chi 2$ – value	P – value
Capillaria sp	3(7.68)	21(53.85)	15(38.46)	39(17.11)		
Camallanus sp	6(13.95)	21(48.84)	16(37.21)	43(18.86)		
Trichodina sp	2 (25)	0 (0.00)	6 (75)	8 (3.51)		
Cestode sp	9 (45)	6 (30)	5 (25)	20 (8.77)		
Eimeria sp	21(87.5)	3(12.5)	0 (0.00)	24(10.53)		
Opisthorchis sp	0(0.00)	5(10.20)	44(89.79)	49 (21.49)		
Diphillobothrium sp	3 (6.67)	4(8.89)	38(84.4)	45(19.74)		
Total	**44(19.28)**	**60(26.32)**	**124(54.39)**	**228(100)**	**154.64**	**21.03**

Table 2:- Prevalence of parasites found in fish species from wild environment

Fish species	Location of Parasites					
	Gills	Stomach	Intestines	Total	χ2 – value	P – value
	(%)	(%)	(%)	(%)		
Mormyrus rume	7(13.46)	16(30.77)	29(55.77)	52(22.81)		
Bagrus bayad	6(11.54)	13(25)	33(63.46)	52(22.81)		
Lates niloticus	11(20)	14(28)	25(50)	50(21.93)		
Clarias gariepinus	20(27.02)	17(22.97)	37(50)	74(32.46)		
Total	**44(19.29)**	**60(26.32)**	**124(54.39)**	**228(100)**	**7.06**	**12.59**

Prevalence of fish parasites found in culture environment

Analysis revealed significant ($p<0.05$) difference in parasite species from the ponds, *Capillaria* sp from the two ponds had higher percentage of infecting the fishes although pond B (58.33 %) recorded little higher than pond A (50 %) followed by *Camallanus* sp with pond A (36.61 %) having higher percentage compare to pond B (16.67 %). *Trichodina* sp (2.77 %) was the least parasite recorded in pond A while the cestodes sp was least in pond B. (12.5 %). However, the following parasites were absent in Pond A *Cestode* sp and *Eimeria* sp., while *Trichodina* sp, *Eimeria* sp. and *Opisthorchis* sp. were absent in pond B. analysis shows no significant ($p>0.05$) difference in *Capillaria* sp. infection in both ponds. Analysis of fish species reveled that *C. gariepinus* (75 %) had the highest number of parasite infection compare to *Heteroclarias* (25 %). (Table 3 and 4).

Table 3 Prevalence of fish parasites found in culture environment

Location	Parasite Spp Location of Parasites						
		Gills (%)	**Stomach (%)**	**Intestines(%)**	**Total (%)**	**χ2- value**	**P- value**
Pond A	*Capillaria sp*	7(19.44)	8(22.22)	21(58.33)	36(50)		
	C*amallanus sp*	0(0.00)	14(82.35)	3(17.64)	17(36.61)		
	Trichodina sp	2(100)	0(0.00)	0(0.00)	2(2.77)		
	Cestodes sp	0(0.00)	0(0.00)	0(0.00)	0(0.00)		
	Eimeria sp	0(0.00)	0(0.00)	0(0.00)	0(0.00)		
	O*pisthorchis sp*	0(0.00)	1(16.67)	5(83.33)	6(8.33)		
	D*iphillobothrium*	0(0.00)	2(18.18)	9(81.81)	11(15.28)		
	Total	**9(12.5)**	**25(34.72)**	**38(52.78)**	**72(100)**	**29.89**	**21.03**
Pond B							
	Capillaria sp	0(0.00)	3(21.43)	11(78.57)	14(58.33)		
	Camallanus sp	0(0.00)	2(50)	2(50)	4(16.67)		
	Trichodina sp	0(0.00)	0(0.00)	0(0.00)	0(0.00)		
	Cestodes sp	2(66.67)	0(0.00)	1(33.33)	3(12.5)		
	Eimeria sp	0(0.00)	0(0.00)	0(0.00)	0(0.00)		
	Opisthorchis sp	0(0.00)	0(0.00)	0(0.00)	0(0.00)		
	Diphillobothrium	0(0.00)	0(0.00)	3(100)	3(12.5)		
Total		**2(8.33)**	**5(20.83)**	**17(70.83)**	**24(100)**	**19.11**	**21.03**

Table 4. Prevalence of fish parasites found in culture environment in relation to fish species

Fish species	Location of Parasites					
	Gills (%)	**Stomach (%)**	**Intestines (%)**	**Total (%)**	χ2 – value	P – value
Clarias gariepinus	9(12.5)	25(34.72)	38(52.78)	72(75)		
Heteroclarias	2(8.33)	5(20.83)	17(70.83)	24(25)		
Total	**11(11.49)**	**30(31.25)**	**55(57.29)**	**96(100)**	**5.09**	**2.41**

DISCUSSION

Several studies on fish parasites by different researchers propose that parasite load in an ecosystem poses high risk of fish infection and other aquatic organisms also to its consumers especially man (16). The three locations in this study are not left out has some of the fishes were infected with different parasites. Due to seasonal changes in water temperature, abiotic factors could lead to parasitic infection which may have effect on fish and the temperature effect is a significant factor for the prevalence rate of parasites. In this study, most parasites were cited in the intestine followed by the stomach, prevalence of parasites in these regions shows that it is a more favoured place for them, this could be due to the favourable condition in the regions that help these parasites to survive and even reproduce. Similar data from multiple investigators showed that preference for intestine and stomach areas as attachment sites might be due to the supply of food in the regions (4) (9) (7) (27) (15). (2) mentioned that the gills are center for filtering and place for gaseous exchange site so the sieving capacity of the gill rakes contribute to the trapping of certain organisms thereby preventing it from functioning and causing death. High protozoan parasite found in gills is in accordance with studies by (19). who reported high protozoan parasites in the gills of *Clarias gariepinus*. It was observed that nematode occurrence was higher compared to cestode, protozoa and trematode, this discovery confirms the work of (25) (18) (22) (15) recorded nematodes in all the sampled fish species, this shows that this parasite can be found in any type of fish species as reported in the present studied fish species. (2) reveled that the nematodes have been reported to interfere with nutritional absorption in the gut fish and may decrease food intake and bio-use, as well as those that may impair essential fish system due to metabolites generated by certain parasites. This finding is in accordance with previous work reported by (16) (1). *Camallanus* sp. one of the parasites recovered from this study was previously reported by some researchers, the occurrence of this intestinal parasite is in line with the study of other researchers, incidence of *Camallanus sp*. is explained in terms of dietary variations, immune-suppression, or host suitability for establishment of the parasite and various reports show that helminths infections are quite common in fish (8) (10) (16) (15) (22). *Clarias gariepinus* been the most infected fish species could be due that the fish species were more available for infestation.

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