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Comparative Study on the Prevalence of Gastrointestinal Parasite between Wild and Pond Raised African Sharptooth Catfish *Clarias gariepinus* in Akwa Ibom State

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Authors' contributions

This work was carried out in collaboration among all authors Authors SII, EEA, AHN, ISX and AAE designed the study, conducted the survey, reviewed and edited the manuscript and did funding acquisition. Authors SII and EEA drafted and edited the manuscript and did data analysis. Author EEA reviewed the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

A comparative study on the prevalence of gastrointestinal parasites of *Clarias gariepinus* in selected location in Oron and Uyo, Akwa Ibom state, Nigeria. A total of one hundred (100) samples were used, fifty (50) each from the wild and concrete pond. The wild samples were collected from fishermen in oron river, while pond samples were collected in Dominta farm in Uyo. Both location samples were examined for gastrointestinal parasite using standard scientific methods. The

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parasite obtained where nematode, cestode, and trematode. The research revealed that all the fish samples were infected with at least one of these parasites. Samples from concrete pond had 38%, 24% and 10% of nematode, cestode and trematode respectively while samples from the wild had a prevalence of 34%,24, and 18% of nematode, cestode and trematode. Samples from the river and pond revealed that there was no significant difference (P>0.05) in the prevalence of gastrointestinal parasite. Parasitic infection is a great hinderance to fish growth and therefore have adverse effects on fish productivity. Hence fish farmers should be sensitized about the presence and the effects of gastrointestinal parasite in the aquatic ecosystem. Communities should be enlightened about disposal of waste in the natural water bodies which increases the level of intermediate host that harbors this parasite.

Keywords: Comparison; prevalence; gastrointestinal parasites; concrete ponds; wild; Clarias gariepinus and Akwa Ibom State.

1. INTRODUCTION

Fish is a valuable food source that provides humans with income [1] and high-quality protein and minerals [2]. Fish can fulfil a person's nutritional needs due to their high digestible energy content [3]. According to Ndupuh et al. [4], fish accounts for 40% of the average Nigerian's daily protein intake. The growing demand for animal protein has led to a notable growth in the development of fish farming cultures [5]. According to reports, the African catfish (*Clarias gariepinus*) is a suitable species for aquaculture in Nigeria and other African countries [6]. These favourable characteristics include it ability to withstand a wide range of environmental conditions, its ability to grow quickly, its acceptance of artificial feed and its high fecundity rate. It is a resilient fish that can be raised in locations with scarce water supplies since it can be heavily stocked in low oxygen environments [7]. Due to its extremely high nutritional content, it is also well-liked by Nigerian customers [8]. Parasites are important group of pathogens, causing infection and diseases of fish both in fresh and marine environments [9]. Economic losses have resulted from parasitic infection due to direct fish death, decreased fish development and fecundity and increased fish susceptibility to diseases. Thus, fish health and the production of aquatic crops are increasingly threatened by parasitic infestations [10]. Because fish parasites coexist peacefully with their hosts as a means of survival, fish parasitic diseases are especially significant in tropical regions [11]. However, parasitic disease increases quickly and causes significant mortality in situations where hosts are overcrowded, such as in fish farms or aquaria. In most cases, parasitic disease occurs in the wild as a result of anthropogenic activities and interference, such as pollution, affect the ecosystem and change the natural distribution of their parasite groups [12], hence making the environment conducive for parasite growth and development. Amidst many approaches to mitigate the fish parasite outbreak in Nigeria, data from archives suggest that a wide variety of parasitic infections may be present in both wild and homestead-cultured fish [11]. Since fish cultivation is growing more intensive and popular, there is a need to monitor Nigerian freshwater bodies for parasitic illnesses as they pose a severe health risk to consumers. Furthermore, the intermediate host (crustaceans and aquatic insects) of these parasites are a contributing factor too (Pal and Ghosh, 1985). One reason for the rise in unskilled farmers is the rise in domestic fish farming. Improved agricultural practices for fish farmers must be taught to them [13]. Ineffective and unprofessional methods of fish farming causes stress, disease and ultimately fish mortality. In ponds, compared to the wild, their exposure to parasites is restricted because of their confines. Fish farming has significant challenges as a result of the present economic unrest, including limited financial resources and an increase in new diseases that severely reduce fish market productivity and yield. Therefore, by identifying and contrasting the gastrointestinal parasites of fish bred in the wild and in concrete ponds, this study aims to close the knowledge gap. The fish studied are African Sharp-tooth Catfish (*Clarias gariepinus*) from Uyo, Akwa Ibom State, Nigeria.

2. MATERIALS AND METHODS

2.1 The Study Area

This study was carried out in Uyo (concrete pond) and Oron Local Government Areas(of Akwa Ibom State, Nigeria. Uyo is the capital of Akwa Ibom State which is located in the rainforest zone of the country and lies between

latitude 4°32N and 5°33N.and longitude 7°25E and 8°25E.Domita farm used for this study is located at no 4 Ring Road, Nsukara Offot. Uyo. Akwa Ibom State, Nigeria. Oron Local Government Area is one of the local government areas in Akwa Ibom State, it is a coastal area and the people of this area are majorly fishermen.

2.2 Ethics and Consent

The ethic and consent concerning the use of fish for this research were deemed unnecessary according to the University of Uyo. Meanwhile, the experimental protocol including the number of fishes used for this research was approved and regulated by the Institute. In addition, all the methods were carried out in accordance with relevant guidelines.

2.3 Collection of Fish Samples

One Fifty (50) *Clarias gariepinus* samples were collected from water bodies in Oron (wild)and 50 from man-made reservoir pond (concrete pond). The concrete pond samples were bought at Domita farm (concrete), Uyo. The fish were harvested using a plastic basket. Harvested fish were put in a plastic bucket and transported alive immediately to the Animal and Environmental Biology laboratory in the Department of Animal and Environmental Biology, Faculty of Biological Science, University of Uyo. Uyo: and examined for the presence of gastrointestinal parasite within 24 hours of collection. Samples of fish from Oron River were booked and bought from local fishermen, they were collected fresh and alive from the fishermen as early as 6:00 am and transported to the laboratory alive in plastic bucket.

2.4 Processing of Samples

At the laboratory, the fishes were rinsed with clean tap water, killed by suffocation and then parameters such as the standard lengths, total length and weights of the sample were measured using a meter rule and a weighting balance respectively. The sexes were determined using urogenital papillae and recorded. The samples were dissected to expose the alimentary canal which was then isolated and placed in petri dish containing physiological saline. The gastrointestinal tract was then slit longitudinally and examined for parasite under a light microscope (OLYMPUS.USA).

2.5 Microscope Examination of Parasite

Gastrointestinal content was placed on a slide, mounted on the microscope stage and viewed under X10 and X40 objective for parasite observation. The parasites seen were identified using the pictural guide manual of Eric (2010).

2.6 Determination of Parasitic Prevalence

The percentage prevalence of parasites was determined using the formula:

(Number of fish infected/ Number of fish examined) × 100

2.7 Statistical Analysis

Descriptive statistical analyses were used to analyse the data obtained and prevalence of the parasitic infection were expressed in percentage. Data analysed were presented in tabular form

3. RESULTS

The results of this study reveal that, all samples were infected with at least one of either nematode, cestode or trematode. Samples from the wild recorded high prevalence of parasite than concrete pond (Table 1).

4. DISCUSSION

This study reveals that the fish were infected with nematode, cestode and trematode which was in conformity with previous researches. This infection was higher in female than in male samples and male than in female samples from concrete pond and wild respectively [6]. Bekele et al. [14] reported higher prevalence in male than female samples of *Clarias gariepinus* in the wild. Williams and Jones [15] suggested that parasitism differs in various aquatic ecosystems and this is determined by the interaction between biotic and abiotic factors. Fish species in good environmental conditions rarely come down with diseases [16]. Reports have recorded helminths to be are found in freshwater fishes, at high prevalence which are dependent on factors of parasite species and their biology, host and its feeding habits, presence of intermediate hosts where necessary, hygiene and physical factors of the water body [17,18,19]. This difference in infection between male and female maybe due to differential feeding habit, either quality or quantity of food eaten or as a result of different degree of

resistance to infection. The high rate of infection could also be attributed to competition for food, mate partner and territorial defense.

The lower prevalence of infection in female sample from wild could also be as a result of physiological status of female fish in which most gravid female could have increased resistance to infection by parasites. However, this report contradicts with the findings of Enyidi et al. [20]; Ambrose et al. (2018) and Adegbaju [21] who reported higher parasitic infection in female *Clarias gariepinus* from wild than male due to their search for food and egg laying habitat. Female *Clarias gariepinus* from wild had more prevalence of parasite than male. This still agrees with Danyaro [22] but contradicts with Bekele et al. [14].

Considering the body weight, these results show that fish from concrete pond weighing 93.5-147.4g had the highest prevalence. This conforms to the study of Ibrahim et al. [23] who reported that fishes (juvenile) with low weight have high parasitic infestation than adult which may have acquired immunity which could be attributed to earlier exposure. High prevalence of parasite could also be attributed to high stocking density of pond [24,25]. Fishes from wild in weight range of 455.5-554.4g had highest prevalence of parasite. This is likely attributed to high stocking density. This report conforms to Iyaji et al. [26] who reported that fishes with weight 542.5-621.4g had high prevalence of parasite due to large surface area and long duration to accumulate parasite than younger ones which provides more internal and external space for parasite residence and therefore tends to have heavier worm burdens because they eat more parasitized prey (foodchain). However, it contradicts with Ibrahim et al. [23] who recorded high prevalence in fishes with low weight [27,28].

Table 1: Result of morphometric analysis of *Clarias gariepinus* from wild and concrete pond

Group	Weight(g)	Weight(g)	Standard length(cm)
Wild samples	263.9 ± 67.11	35.74 ± 5.0	30.79 ± 3.99
Concrete samples	216.5 ± 52.43	34.66 ± 4.44	28.52 ± 3.90
Tcal	3.95	1.14	2.91
Df	49	49	49
Ttab	2.01	2.01	2.01
Decision	No significant difference	No significant difference	No significant difference

Table 2. Sex base comparison of the prevalence of gastrointestinal parasite of *Clariasgariepinus* in concrete pond and wild

Pond type	Sex	Number Examined	Number Infected with Nematode (%)	Number Infected with Cestode (%)	Number Infected with Trematode (%)	Total (%)
Samples from Concrete	Male	25	6(24.0)	7(28.0)	2(8.0)	15(60)
	Female	25	13(52.0)	5(20.0)	3(12.0)	21(85)
	Total	50	19(38.0)	12(24.0)	5(10.0)	36(72)
	Chi-Square		4.16	0.439	0.222	
	Df		1	1	1	
	p-value		0.041	0.508	0.637	
Samples from Wild	Male	26	7(26.9)	8(30.8)	7(26.9)	22(84.6)
	Female	24	10(41.7)	4(16.7)	2(8.3)	16(66.7)
	Total	50	17(34.0)	12(24.0)	9(18.0)	38(76.0)
	Chi-Square		1.209	1.361	2.922	
	Df		1	1		
	p-value		0.272ns	0.243ns	0.087ns	

Table 3. A weight-based comparison of the prevalence of gastrointestinal parasite of *Clarias gariepinus* between concrete pond and wild

Pond type	Weight (g)	Number examined	Number infected with Nematode (%)	Number infected with Cestode (%)	Number infected by Trematode (%)
Concrete Pond	93.5-147.4	5	3(60.0)	1(20.0)	0(0.0)
	147.5-201.4	14	4(28.6)	1(7.1)	2(14.3)
	201.5-255.4	21	8(38.1)	9(42.9)	2(8.0)
	255.5-309.4	10	4(40.0)	1(10.0)	1(10.0)
	Total	50	19(38.0)	12(24.0)	9(18.0)
	Chi square		1.572	7.393	0.985
	Df		3	3	3
	P value		0.666ns	0.060ns	0.805ns
Sample from wild.	158.5-257.4	27	9(33.3)	8(29.6)	5(18.5)
	257.5-356.4	19	6(31.6)	3(15.8)	4(21.1)
	356.5-455.4	3	1(33.3)	1(33.3)	0(0.0)
	455.5-554.4	1	1(100.0)	0(0.0)	0(0.0)
	Total	50	17(34.0)	12(24.0)	9(18.0)
	Chi square		1.997	1.63	1.003
	Df		3	3	3
	P value		0.573ns	0.653ns	0.801ns

Table 4. Total length comparison in the prevalence of gastrointestinal parasite in *Clariasgariepinus* between concrete pond and fishes from the wild

Pond type	Total length	Number examined	Number infected with Nematode (%)	Number infected with Cestode (%)	Number infected with Trematode (%)
Concrete sample	25.5-30.4	12	4(33.3)	2(16.7)	1(8.3)
	30.5-35.4	16	6(37.5)	5(31.3)	2(12.5)
	35.5-40.4	17	7(41.2)	4(23.5)	1(5.9)
	40.5-45.4	5	2(40.0)	1(20.0)	1(20.0)
	Total	50	19(38.0)	12(24.0)	5(10.0)
	Chi square		0.194	0.861	1.024
	Df		3	3	3
	P value		0.979ns	0.835ns	0.795ns
Samplefrom wild	25.5-31.4	15	3(20.0)	6(40.0)	2(13.3)
	31.5-35.4	16	8(50.0)	4(25.0)	1(6.3)
	35.5-43.4	15	4(26.7)	1(6.7)	6(40.0)
	43.5-49.4	4	2(50.0)	1(25.0)	0(0.0)
	Total	50	17(34.0)	12(24.0)	9(18.0)
	Chi square		3.951	4.587	7.515
	Df		3	3	3
	P value		0.267ns	0.205ns	0.057ns

Fish with the total length range of 40.5-45.4cm and 30.5-35.4 recorded the highest prevalence (80%) with no significant difference amongst other groups. This report agrees to Akinsanya et al. [29,30], who recorded high prevalence amongst fish with length ranging of 40.0-49.9cm. While fish sample from wild showed high prevalence of parasite in total length range of

31.5-37.4cm and 43.5-49.4 cm. This report shows that there was competition for food and other resources [31,32]. In both the wild and pond, it was observed that fishes of standard-length range of 30-40cm were more infected than those with either lower or higher length [33].

5. CONCLUSION

Gastrointestinal parasites are very important problems of fish production; this is because of therir indirect and direct effect on the productivity of fish, especially from the wild. Parasitic infection presents a threat to the health of fish and as a result of this, an understanding of parasites which are accumulated in the intestine as a result of feeding in the wild and even concrete ponds are pertinent in order to find ways of avoiding fish disease, low productivity and mortality.

The effects of gastrointestinal parasites on fish host in these enclosures may be difficult to isolate and quantify. However, studies of fish in captivity or under culture conditions have provided much information about the effects of parasites on the fish survival.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the first author, (SII) upon request.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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