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Detection of Blood parasites (*Trypanosoma* spp) in Nile Tilapia (*Oreochromis niloticus* Linnaeus, 1758) in Zobe Reservoir, Katsina State

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Abstract

A Three (3) months survey was done to detect the prevalence of blood parasites on *Oreochromis niloticus* from Zobe Reservoir, Katsina State, Nigeria. A total of 108 fish samples were randomly selected comprising male and female. Experimental fish samples were purchased from four major landing sites of the reservoir from July to September 2023. The fish were transported alive to the Fish Biology Laboratory, Federal University Dutsin-Ma, for the blood parasites inspection. Fish were identified at each of the four landing sites of the reservoir. Samples of fish were measured for length and weighed. Blood parasites were identified and counted. Blood parasites were different in size, shape, and staining reaction. Male samples had a higher percentage of infestation (6.82%) than female samples (5.00%). The highest prevalence was recorded in sample location C while the lowest was recorded in sample location B, while *Oreochromis niloticus* was free from trypanosomes this could be due to the absence of bloodsuckers in the sample location.

Keywords: Blood, detection, Nile tilapia, *Trypanosoma* spp, *Oreochromis niloticus*

Introduction

Freshwater fishes have been regarded as a vital of nourishment for human beings in addition to domestic animals as they are rich in amino acids (essential and nonessential), mineral elements, and vitamins, and help/assist as a good source of omega-3 fatty acids (Alhayali et al., 2023). Tilapia species (*Oreochromis niloticus*) are freshwater fish belonging to the family of Cichlidae and are regarded as hardier/hardy related to other species of cultivated fish (Akoll et al., 2012). Like entirely wild animals, freshwater fishes could be infested with numerous parasitic worms leading to pathogenic infections and profitable failures due to reductions in the heaviness and nutritious value of infested fish (Alhayali et al., 2023). Haemoparasites or blood parasites in fish (*Trypanosoma* spp) are flagellated parasitic protozoans that prey mostly on wild fishes similarly have in recent times been labeled distracting/disturbing fishes in aquaculture (fish farm) (de Jesus et al., 2018). Evidence about illnesses caused by hemiparasites and their influence on fish well-being is limited (Lourenço et al., 2014), particularly evidence associated with parasitic worms of the genus *Trypanosoma* species of this genus are everywhere parasites that can disturb both salt and freshwater fish species (de Jesus et al., 2018), but generally in wild environs. *Trypanosoma* spp. is categorized in a big host diversity; they could transmit a disease to entire orders of vertebrates, comprising reptiles (Marcili et al., 2013), amphibians (Lemos et al., 2013), birds (Svobodová et al., 2015), mammals (Lima et al., 2015) in addition fishes (Kovacevic et al., 2015), and their lifespans contain interchanging among host invertebrates and vertebrates, such as arthropods (Ooi et al., 2015) and annelids (Fermino et al., 2015). On the other hand, the whole report on the lifespan of *Trypanosoma spp.* is not well known in fish farming. Whatever appears to be the agreement between scientists is that parasites (leeches) are the intermediary host for fish trypanosomiasis in addition to that these parasitic worms penetrate/enter the host via suction injury or wounds (Corrêa et al., 2016). In the host, this parasitic worm reproduces and is discovered in huge amounts in the veins (bloodstreams) of the fish in addition, it, disturbs entirely structures (organs) (de Jesus et al., 2018). Blood parasites (protozoans) such as *Trypanosoma* spp., *Babesiosoma* spp., and *Haemogregarina* are of huge attraction to scientists in line for to their diversity in addition to pathogenicity in fresh water and marine water fish species. *Babesiosoma spp.* Parasitize both flowing (circulating) erythrocytes and erythrocytes from reticuloendothelial muscles then, to complete their lifespan, need leeches as an intermediary host. *Trypanosoma* spp. is a haemoflagelate that looks like the group/genus that infects the blood of aquatic animals and other mammals (Alhayali et al., 2023). Parasitic worms in the blood capillaries (stream) could trigger a variety of signs from mild anemia, connected with low levels of parasitization, to critical immunological changes, due to a heavy parasitic worm load, and life-threatening sicknesses that may cause ascites, exophthalmia, anorexia, with edema and splenomegaly, in addition even mortality (Alhayali et al., 2023). *Haemogregarina* parasites (protozoans) have a sausage-like (structure) and are malaria-like (structure) parasitic worms of fish erythrocytes. *Haemogregarina* species are inadequately examined parasitic sporozoans of the family Haemogregarinidae (Alhayali et al., 2023). The growth of *haemogregarines* is difficult or complex and appears via two kinds of hosts: blood-sucking vertebrates and invertebrates, including fish species (Khamnueva & Baldanova, 2016). Haema parasites or blood parasitic worms are of research/veterinary attention because their host inhabitants may be human diet sources. In addition, there is inadequate evidence obtainable on these parasitic worms (Al-Niaeemi et al., 2020). Up until nowadays, little has been known about the pathologies that strike the hosts of *trypanosoma* spp. Because it is rare to find an infestation of this parasite in such conditions. Although most of the fish infected by trypanosomiasis are asymptomatic, the high number of parasites in the bloodstream can severely affect the health of the host, causing anemia, leukocytosis, hypoglycemia, splenomegaly (Su et al., 2014) and a massive reduction of thrombocytes (Fink et al., 2015). Thus, the contemporary findings were intended to investigate and then report the blood parasites of the genera *Trypanosoma spp* disturbing Nile tilapia in Zobe Reservoir, Dutsin-Ma, Katsina State, Nigeria

Material and methods

Study Area

The survey area; Zobe artificial Lake is situated between latitude 12°'20'34.62" N to 12°23'27.48" N and longitude 7°27'57.12" E to 7°34'47.68" E, in Dutsin-Ma L.G.A of Katsina, Nigeria. It covers a total land area of 968.544 km2. Zobe Artificial Lake has two main streams which include Rivers Gada in addition Karaduwa (Sadauki et al., 2022). The barrier/dam was built on River Karaduwa spreads for about 7 km long and covers a surface area of about 4,500ha. Yearly rainwater in the survey area differs from 600-700mm, whereas the mean yearly temperature is about 25°C (Sadauki et al., 2022). For the reason of this research, 3 (three) major sampling locations nearby the reservoir were carefully chosen viz.; Station A, Station B, and Station C (Sadauki et al., 2022).

Sample Collection

A total of one hundred and Eight (108) life fish samples of Nile tilapia (*Oreochromis niloticus)* of different sizes were bought from local fishermen from three (3) landing sites of Zobe artificial lake (Sample A. sample B and samples C) for three months. The fish samples were transported live to the fish biology laboratory of the Department of Biological Science Federal University Dutsin-Ma, Katsina State. In a plastic container filled with water for identification of blood parasite (*Trypanosoma* spp.)

Identification of fish samples

Experimental fish were immediately identified on the field using the pictorial chart of Suleiman (2016) and the freshwater fish identification guide by Olaosebikan and Raji (2013).

Sexing of Experimental Fish

The sexes of the fishes were done by physical checkup of the external characteristics of the fish samples, where male experimental fish samples were described by protruded and elongated genital papilla and the female experimental fish samples were described with round opening papilla as described by Amos et al. (2018) and Sadauki et al. (2022).

Measurement of Experimental Fish

The standard and total lengths (cm) of the experimental fish samples were measured using a meter rule whereas the weight of the experimental fish samples was measured through top loading sensitive weighing balance through standard techniques described by Amos et al. (2018) and Sadauki et al. (2022).

Examination of Blood Parasite

In the laboratory, the fish were immobilized in a wet fabric for blood sample collection. A Blood sample of the experimental was collected from the caudal vein behind the anal fins with a 21G hypodermic needle and plastic syringe. Thin blood smears were made from the blood samples collected and were immediately prepared. The blood smears were allowed to air dry and fixed in absolute methanol for five minutes. Slides were stained with buffered phosphate-buffered Geimsa and examined under 100x an objective oil immersion microscope. Images were taken using a digital camera (Hassan et al., 2007; Alhayali et al., 2023).

Identification of blood parasites

The blood parasitic worm was identified based on their morphology (Paperna, 1996; Smit et al., 2000). The Trypanosome was categorized by tapering anterior and posterior ends and faintly stained flagella.

Parasite prevalence and intensity estimation

The prevalence of parasitic infestation was calculated for sex, location, length, and weight using the model described by Sadauki *et al.* (2022):

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

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

Data Analysis

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

Results

A total of one hundred and eight (108) life fish samples were examined, out of 108 samples from Zobe 88 were males, and 20 were females. Seven fishes were infected and a total of seven blood parasites were recovered. The overall prevalence of blood parasites was 6.48% (Table 1). Of the 88 male fishes examined, 6 were infected, with a prevalence of trypanosome spp 6 (6.82%) while of the 20 females examined, 1 was infected with a prevalence of 1 (5.00%) (Table 1). A total of 36 samples of experimental were collected from each of 3 sample locations for the presence of blood parasites, but fishes from sample location A were free from any blood parasites 0 (0%) this could be due to the absence of carriers in the sample location (leeches). *Oreochromis niloticus* obtained from sample location C harbored more blood parasites 4 (11.11%), followed by sample location B 3 (8.33%) (Table 2). The prevalence of infection of blood parasites about the length was highest in fishes measuring between 20 and 25cm (Table 3). Fishes measuring between15-20cm had the lowest prevalence of infection, while fishes measuring between 10 and 15 cm were free from infection. In the population of fishes examined, Fishes weighed between 131-160g and 91-130g had the highest 3 (4.54%) and 3 (13.63%) while fishes weighed between 51-90g had the lowest infection 1 (5.00%) (Table 4).

Table 1. Prevalence of Blood parasite of *Oreochromis niloticus* about sex in Zobe reservoir

Sex	No examined	No of infected	% of infection
Male	88	6	6.82%
Female	20	1	5.00%
Total	108	7	6.48%

Table 2. Prevalence of Blood parasite of *Oreochromis niloticus* in relation to sample location in Zobe reservoir

Location	No examined	No of infected	% of infection
A	36	0	0%
B	36	3	8.33%
C	36	4	11.11%
Total	108	7	6.48%

Table 3. Prevalence of Blood parasite of *Oreochromis niloticus* in relation to length in Zobe reservoir

Fish length in Cm	No of examined	No infected	% of infection
10-15	15	0	0%
15-20	59	1	1.70%
20-25	34	6	17.64%
Total	108	7	6.48%

Table 4. Prevalence of Blood parasite of *Oreochromis niloticus* in relation to weight in Zobe reservoir

Fish weight(g)	No examined	No of infected	% of infection
51-90g	20	1	5.00%
91-130g	22	3	13.63%
131-160g	66	3	4.54%
Total	108	7	6.48%

Discussion

Numerous freshwater artificial lakes vary from each one with a surviving (living) ecosystem. It is moderately natural that the probability of infestation of fishes with trypanosomes (heamoparasites or blood parasites) is dissimilar. To pass on a disease/infests to freshwater vertebrates with (*Trypanosom*e) blood parasites it is needed first of all the circumstances for the growth of which are the carriers or transporters of trypanosomes (blood parasites). These invertebrates (leeches) select healthy heated/warmed channel streams, (waters) or protecting freshwater artificial lakes such as reservoirs, lakes, ponds, and basins with thickets of water or aquatic plant life (vegetation). The additional circumstances for the infestation of fishes with heama parasites/blood parasites (*Trypanosome*) are the occurrence of favorable environmental or water temperature conditions for the growth of these blood-parasitic worms (Huseynov & Seid-Rzayev, 2016). In addition to the conditions for surviving/living of the importers/carriers of blood parasites as well as the development of these parasites, the species diversity of fish *Trypanosome* (blood parasites) in aquatic artificial lakes is governed by its sizes and the number of fish species, residing there. The bigger the aquatic lake and the more fish species living there the more abundant is fauna of blood parasitic worms (Huseynov & Seid-Rzayev, 2016). The occurrence of blood parasites (*Trypanosome*) in fishes is frequently caused by connections with carriers (leeches) (Porter and Vinall, 2009; Alhayali et al., 2023). An additional investigation showed that *Trypanosoma* causes injury or damage to the hematopoietic fleshy tissue, vascular system, kidneys, and others. Fishes with a serious infestation have become lethargic and have sunken eyes, are weak, and emaciated with injury to the excretory portion of the kidney, producing osmoregulatory difficulties (Lom & Dykova 1991; Alhayali et al., 2023). Bloodsuckers/leeches, as soon as distended/engorged with the blood of the fish (host), separate or detached and relax on a sheltered substrate (if at all possible under plant debris or stone and vegetation) in the water pending their next mealtime (Paperna, 1996; Shahi et al., 2013). Letch and Ball (1979) recommended that the anemia in fishes is more the cause of constant feeding of bloodsuckers/leeches (the carrier), than a direct result of the protozoan infestation. The non-appearance of bloodsuckers in the blood of these fishes, in each single or individual incident has its causes. In certain incidents or cases this is associated with investigated fishes were migrant/migratory and semi-anadromous fishes, most of which survive use in an ocean, where fishes may not be infested with blood parasitic worms. Others are lesser in figures and were investigated in a very small number and this reality is not permitted to discover any occurrence of blood parasitic worms in these fishes (Huseynov and Seid-Rzayev, 2016). Paperna (1996), identified the occurrence of infestation by *trypanosome* in African catfish, *C. gariepinus* and silver catfish *Bagrus spp* in Lake Victoria was about 50%. *Nico et al.* (2004) also give an account of a higher infestation level of *trypanosome* with 79% occurrence in *Synodontis spp* and 43% prevalence in *C. gareipinus*. On the other hand, a lower prevalence or incidences of infestation (6.48%) was noticed in the current study in Nile tilapia may probably be due to lower inhabitants of the bloodsuckers (leeches) in Zobe reservoir. In this incident, the lower infestation level may be due to enhanced or developed host (fish) resistance or immunity. The significantly high prevalence of infection in males by *trypanosome* in *O. niloticus* may perhaps also be attributed to random choice due to the bulky figure of male samples investigated as compared with female fish samples. Hassan et al. (2007) stated, the haemoparasite *Trypanosoma* sp in *Synodontis clarias* from Lekki Lagoon, Lagos, Nigeria. Sixteen fishes (9 males, 7 females) were infested with both haemoparasites (*Trypanosoma* sp*)*. The overall *Trapanosoma* infection observed in Nile tilapia *O. niloticus* was 6.48%. The results of this study were lowest compared to a previous report obtained by Shahi et al, (2013); Muhammad (2014); Muhammad et al. (2016); Muhammad et al. (2017); de Jesus et al. (2018); Jarallah (2021) and Alhayali (2023) who found that *Trypanosoma* infection rate in fish was 16%, 41.4% and 23.3% respectively.

Conclusion

In conclusion, the occurrence of *Trapanosoma* spp, in African catfish (*Oreochromis niloticus*) in Zobe artificial Lake, Katsina State, underlines the significance of constant examination as well as assessment of the well-being condition of aquatic environments. The occurrence of these blood parasites raises concerns about the potential impact on the overall well-being of the African catfish (*Oreochromis niloticus*) population in the reservoir. The findings presented in this research contribute valuable information to the understanding of parasitic infections in fish populations, particularly in the context of aquaculture and fisheries management. The identification of *Trapanosoma spp* in African catfish (*Oreochromis niloticus*) calls for attention from both researchers and authorities to implement effective strategies for disease control and prevention in aquaculture practices. Moreover, the study highlights the need for comprehensive studies on the prevalence, transmission dynamics, and potential impact of blood parasites on fish health and productivity in the Zobe reservoir and similar aquatic environments. This knowledge is crucial for the development of sustainable management practices that safeguard the long-term healthiness and viability of fish inhabitants in these environments. Future research endeavors should focus on elucidating the factors influencing the prevalence and transmission of *Trapanosoma spp*, as well as exploring potential mitigation measures to reduce the impact of parasitic infections on African catfish and other fish species in the region.

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Conflicts of Interest

The authors declare that they have no competing interests.

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