PREVALENCE OF *CLINOSTOMUM TILAPIAE* METACERCARIAE IN WILD NILE TILAPIA, *OREOCHROMIS NILOTICUS,* FROM DUGUDU LAKE, IGBO-ETITI LOCAL GOVERNMENT AREA, ENUGU STATE, NIGERIA

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ABSTRACT

Clinostomid metacercariae are common parasites of fish in many natural and artificial aquatic systems. In aquaculture, infection by clinostomid metacercariae reduces fish quality and causes production losses resulting from the discard of infected fish. Also, clinostomid metacercariae are of zoonotic importance because man can become the final host following consumption of raw or undercooked infected fish. This study investigated the prevalence of Clinostomum tilapiae metacercariae in Oreochromis niloticus sampled from Dugudu Lake, Enugu State, Nigeria. 120 individuals were examined from February to May 2018. Sex, total length (TL) and weight of fish, as well as number of parasites were recorded. A prevalence of 64.17 % was observed with mean intensity and mean abundance values of 18.22 ± 21.92 parasites/fish and 11.69 ± 19.59 parasites/fish respectively. Abundance of parasites increased as total length of fish increased. Sites of infection include intestines, gills, skin, eyes, body cavity and heart. Findings of the present study contribute to existing knowledge on the distribution of clinostomid metacercariae in O. niloticus in Nigerian water systems. This is the first documentation of this parasite from O. niloticus in Dugudu Lake, Enugu State, Nigeria.

Keywords: *Clinostomum tilapiae*, Metacercariae, *Oreochromis niloticus*, Dugudu Lake, Prevalence

INTRODUCTION

The genus *Clinostomum* houses digenetic trematodes that use mollusc and fish as their first and second intermediate host respectively, while piscivorous birds such as cattle egrets and herons are their definitive hosts (Dias *et al.,* 2003). *Clinostomum* metacercariae have been reported in many fish species (Caffara *et al*., 2017), where they inhabit different micro-habitats namely intestines, skin, muscles, behind the buccal cavity, operculum and eyes. As a result, infected fish are not suitable for human consumption (Paperna, 1991) and also serve as sources of infection to humans when eaten raw or undercooked (Park *et al.* 2009). In the artificial environment, source of infection to fish is the wild-caught juvenile fish which may be infected with parasites at point of introduction to ponds and tanks (Martens and Moen, 1995).

Clinostomum tilapiae metacercariae has been reported in cichlids from different fish species in Nigerian water systems including lakes (Ukoli, 1966; Okaka and Akhigbe, 1999; Agbede *et al*., 2004; Olurin and Somorin, 2006; Echi *et al.,* 2009a,b; Olurin *et al.* 2012; Echi *et al.,* 2012; Okoye *et al*., 2014; Caffara *et al*., 2017). Lakes in the Southeastern region of Nigeria are ascribed socio-cultural values by

host communities, for example, the Iyi-ocha Lake in Amaokpala and Ezu Lake in Agulu, both in Anambra State are centers for spiritual and therapeutic activities (Odum, 2018). This has aided in the conservation of aquatic animals, some of which are regarded as totems, e.g. crocodiles, tortoise etc in these spiritual lakes (Odum, 2018). This study investigated the occurrence of the parasite - *Clinostomum tilapiae* metacercariae in the Nile Tilapia, *O. niloticus,* from Dugudu Lake, a spiritual lake in Igboetiti Local Government Area of Enugu State, Nigeria. To the best of our knowledge, no scientific or ecological data has been documented from this lake. Thus, this work is the first of its kind conducted in this aquatic system. Results of this study will add to the existing records on the prevalence of *Clinostomum tilapiae* metacercariae in Nigerian aquatic ecosystems, and will be helpful in the control and monitoring of fish diseases as well as in public health education.

MATERIALS AND METHODS

Study Area: Information on study area was obtained through interview of informants (indigenes of Umunko), direct observation and photographic documentation. Dugudu Lake is a spiritual lake associated to the Dugudu deity of Umudimewa Clan of Umunko, Igbo-Etiti LGA of Enugu State. It is regarded as an abode of the afore-mentioned deity, who is believed by the worshippers to have helped their ancestors in times of war and in moments of need. Hence, the lake has a low level of anthropogenic disturbance, except for the occasional fishing by local fisherman and watering of cattle by Fulani herdsmen. The Lake lies between latitude 6°48'N and 6°49N and longitude 7°24' E and 7°25'E in Igbo-Etiti LGA (Figure 1a). Along with other aquatic systems (Odome Lake and certain rivers such as Ezebinagu, Ngwogoro, Ofie, Iyi-Ogbakpi and Ebuyi) in Igbo-Etiti LGA, Dugudu Lake is located at a lower escarpment reserved for agricultural activities (Itanyi, 2009; Onubulueze and Agbowo, 2009). The water is dark in colour, surrounded by riparian forests (Figure 1b), and serves the people in the surrounding communities in many socio-economic activities.

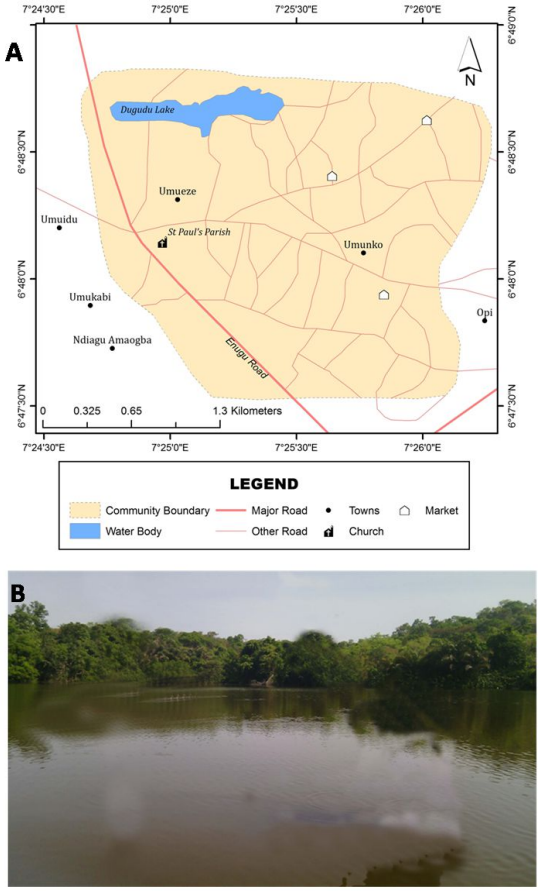

Figure 1: (A) Map of Igbo-Etiti LGA, Enugu State, Nigeria showing the location of Dugudu Lake (Source: GoogleEarth, 2019) and (B) picture of Dugudu Lake taken during the study

The climate of the area has two seasons namely, dry season (October/November – March) and rainy season (April – September/ October), with annual rainfall of 1567 mm and temperature of 26.2°C (Climate-Data.Org, 2019). Coordinates were captured from GoogleEarth Map API Library (GoogleEarth, 2019), keyed into Arc Global Information System (GIS) version 10.7 (ESRI, 2019) and used to digitise a map of Igbo-Etiti Local Government Area showing the location of the Lake.

Sample Collection: 120 fish were sampled from February to May 2018. They were caught alive with hook and line using earthworm as bait, and immediately transported to a cold

room for preservation. Before dissection, individuals were allowed to thaw and their total lengths (TL in cm) were measured from the snout to the tip of the caudal fin using a meter rule and a thread. Weight (g) and sex were also recorded. Sex was determined by the presence of testis and ovary for males and females respectively after dissection. Fish specimens were carefully examined for the presence of ecto- and endo- parasites. Following dissection, organ squashes were made on slides, covered with cover slips and examined with a light microscope (Motic, China). Recovered parasites were counted and recorded for use in the calculation of descriptors of parasite populations namely prevalence, mean intensity and mean abundance (Bush *et al*., 1997).

Preservation and Identification of Parasites: Parasites were fixed in 70 % ethanol, stained in haematoxylin and mounted on slides. They were viewed under a light microscope (Motic, China) at x100 and x400 magnification. Identification was done using appropriate keys (Yamaguti, 1961; Khalil, 1971) and micrographs were taken using a camera (Moticam, China) attached to the microscope.

Statistical Analysis: Data was analyzed using Chi-square test (VassarStats, 2019) to determine the sex prevalence of *C. tilapiae* metacercariae. P-value of ≤ 0.05 was considered significant. Graphs were produced in Microsoft Office Excel 2007 package.

RESULTS

Out of the 120 individuals examined in the study, 105 were males and 15 were females. Length of fish ranged from 12.2 to 24.1 cm and *C. tilapiae* had positive relationship with length ($y = 0.112x + 4.870$, $R^2 = 0.040$) (Figure 2). The weights of fish ranged from 34 to 179 g and *C. tilapiae* had positive relationship with weight ($y = 0.1166x + 4.6385$, $R^2 = 0.0428$) (Figure 3). *C. tilapiae* metacercaria abundance ranged from 0 to 116 with a mean of 11.69 ± 19.59 parasites/fish (Figure 4). Prevalence and mean intensity values were observed to be 64.17 % and 18.22 ± 21.92 parasites/fish respectively. Prevalence was higher in females (66.67 %) than in males (63.81 %), though not significantly ($x^2 = 0.05$, df = 1, p = 0.82).

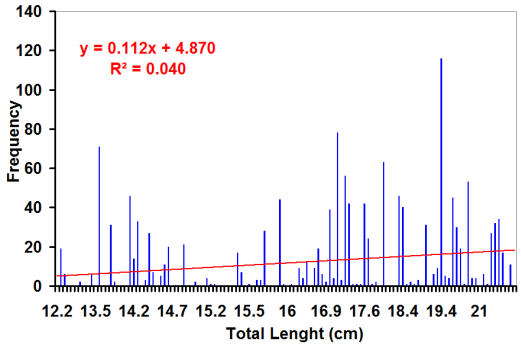

Figure 2: Frequency distribution of total length (cm) for *O. niloticus* collected from Dugudu Lake, Umunko, Igbo-Etiti Local Government Area, Enugu State, Nigeria from February to May 2018

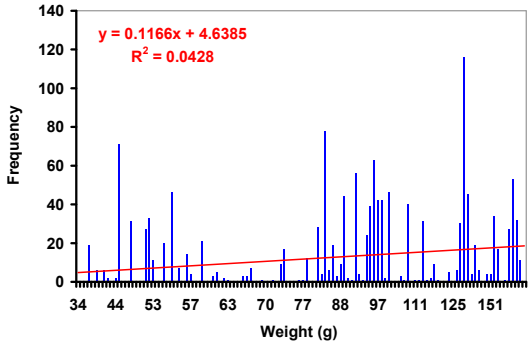

Figure 3: Frequency distribution of weight (g) for *O. niloticus* collected from Dugudu Lake, Umunko, Igbo-Etiti Local Government Area, Enugu State, Nigeria from February to May 2018

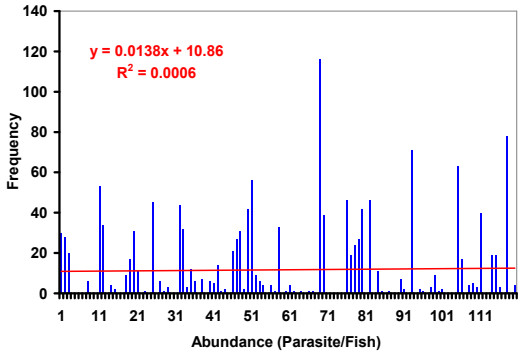

Figure 4: Frequency distribution of *C. tilapiae* metacercaria abundance in *O niloticus* collected from Dugudu Lake, Umunko, Igbo-Etiti Local Government Area, Enugu State, Nigeria from February to May 2018

C. tilapiae metacercariae were found in different body organs namely intestines, operculum, skin, body cavity, eyes and heart with the highest proportion observed in the intestines (Figure 5).

Light micrographs of the anterior and posterior regions of *C. tilapiae* metacercariae reveal the presence of oral and ventral suckers, ceaca and genital complex (Figure 6).

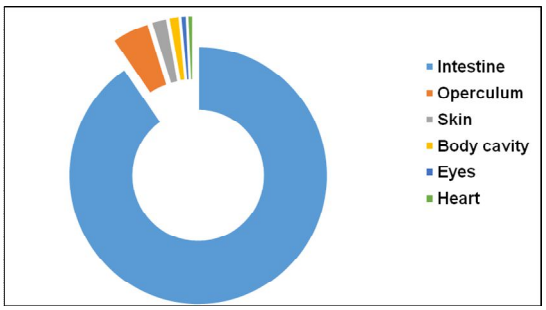

Figure 5: Proportion of *C. tilapiae* metacercariae found in different body organs

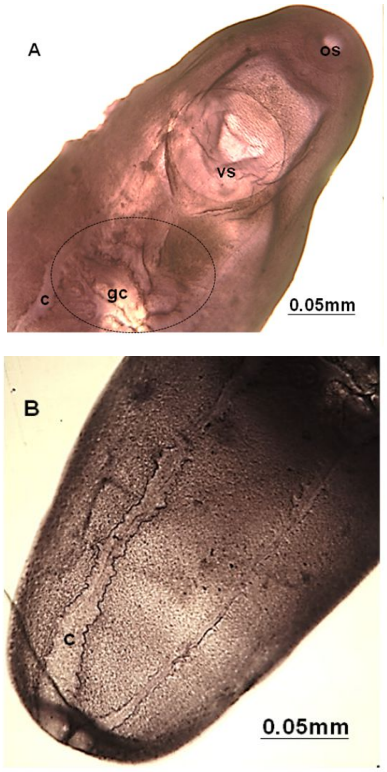

Figure 6: Light micrograph of anterior (A) and posterior (B) sections of *C. tilapiae* metacercaria from haematoxylin-stained slides viewed at x400 magnification. Oral sucker, os; ventral sucker, vs; ceaca, c; and genital complex, gc are shown.

DISCUSSION

There is need for constant surveillance of fish-borne parasites and their epidemiological distribution because of the low literacy level and the lack of awareness of food hygiene in consumers especially in rural settlements such as communities surrounding our study site. As fish remains one of the cheap sources of protein and most highly sought food items in Nigerian dishes, survey of parasites borne by readily available fish species is important because of their deleterious effects on their hosts and their zoonotic potential. *C. tilapiae* has been reported from many African countries including Nigeria (Ukoli, 1966; Okaka and Akhigbe, 1999; Agbede *et al*., 2004; Olurin and Somorin, 2006; Echi *et al.,* 2009a,b; Olurin *et al.* 2012; Echi *et al.,* 2012; Okoye *et al*., 2014; Caffara *et al*., 2017). In Nigeria, it was first described from the intestine of *O. niloticus* (Ukoli, 1966), and subsequent studies have documented its presence in the different organs of fish hosts most especially members of the Family Cichlidae (Okaka and Akhigbe, 1999; Agbede *et al*., 2004; Olurin and Somorin, 2006; Echi *et al.,* 2009a,b; Olurin *et al.* 2012; Echi *et al.,* 2012; Okoye *et al*., 2014). The present study observed *C. tilapiae* metacercariae in the following sites: intestines, operculum, body cavity, heart, skin and eyes. This result agrees with the findings of previous authors. The presence of *C. tilapiae* metacercariae in different organs of fish hosts examined in the study ensures their transmission to the final hosts following consumption of raw or poorly cooked fish.

In the present study, older fish were observed to have more parasites than their younger counterparts, agreeing with Okoye *et al.* (2014) who did not find any *C. tilapiae* metacercarie from sexually immature fish. This is probably because adults feed on a wide range of food and have different feeding styles as well (Hussen *et al*., 2012) and this predisposes them to a variety of infections. Also, Olurin and Somorin (2006) reported a positive relationship between parasite abundance and the length/age of fish hosts. However, Biu and Nkechi (2013) recorded higher prevalence of parasites in smaller fish and attributed this finding to the

low level of immunity in these younger fish. More male fish were infected than females in this study. This could be associated with the breeding habit of *O. niloticus*, in which, during breeding, the male fishes protect the nest, keeping off other fishes including females that are not spawning. As a result, these males spend more time than the females in shallow waters with the snail intermediate hosts which are vital to the life cycle of *Clinostomum tilapiae.*

Conclusion: The study reports the prevalence of *Clinostomum tilapiae* metacercariae in *Oreochromis niloticus* in Dugudu lake; thus contributing to existing knowledge on the distribution of this parasite in Nigeria. To the best of our knowledge, this is the first documentation of this parasite from an aquatic system in Enugu State.

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