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Full Length Research

Prevalence of gastrointestinal helminths of *Tilapia zilli* (Gervias) in Gombe, Northeastern Nigeria

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ABSTRACT: In order to determine the prevalence of gastrointestinal helminths infestation in tilapia species sold in major markets in Gombe, three hundred (300) tilapia fish samples of both sexes and of different age groups were randomly examined. The sample population included 183 adults and 117 juveniles fishes, 157 females and 143 male fishes. Out of the total fishes sampled from three local fish markets, 128 (42.70%) were found to be infested by gastrointestinal helminthes. The prevalence of gastrointestinal helminths in tilapia fishes sampled from Gombe main market (17.0%), Kwadom market (15.0%) and Gombe old market (10.70%) respectively. Three genera of gastrointestinal parasites were encountered at prevalence rates of nematodes (17.70%), trematodes (13.70%) and cestodes (11.30%). The prevalent rates of these gastrointestinal helminths in accordance to sexes of fish shows higher prevalence in female fishes (24.0%) compared to the male fishes (18.70%). There was no statistical significant difference (*P*= 0.52) in the prevalent rates among the two sexes of fish. However, considering the prevalent rates of gastrointestinal helminths in accordance to ages of fishes, higher frequency was found in adult tilapia fishes (31.00%) than in the juvenile fishes (11.70%). There was statistical significant difference (*P*= 0.03) prevalent rates among the two ages of fish. Out of the 128 infected fishes examined, nematodes, cestodes and trematodes were all found in the intestines of 71 (23.70%) infected fishes and also in the stomach of 44 (14.70%) infected fishes but only cestodes was found in the gut of 13 (4.30%) infected fishes, while no helminths was recovered in the gills of all infected fishes. The prevalence of gastrointestinal helminths in tilapia species may be one of the significant constraints to the maximum productivity of the fish in the study area. It is therefore recommended that tilapia culturists should be enlighten on the need to routinely treat their fishes using appropriate antehelminthics for maximum production. Moreover, fishes meant for human consumption should be well cooked to prevent human health hazard of acquiring fish-borne helminthes infections.

Key words: Gastrointestinal parasites, prevalence, Tilapia.

INTRODUCTION

The increase in human population and reports of large numbers of undernourished or starving people, especially in developing countries, has made the need for food production a major worldwide concern (Okechi, 2004). Fish plays a significant role in the economic development of any fish producing country. It is considered a cheap source of high quality nutritive animal protein (Adekoya and Miller, 2004; Ibrahim et al., 2014). Fish has a nutrient profile superior to all terrestrial meats and equally has a high digestible energy that can meet the nutritional requirements of rural population (Amiengheme, 2005). Fish is rich in iron, zinc, magnesium, phosphorous,

calcium, vitamin A and vitamin C, and marine fish is a good source of iodine. Fish also contain fatty acids which are essential for the development of the human brain and body, and are particularly crucial for the diets of babies, children, and pregnant and lactating women (World Fish Center, 2005).

In some developing countries including Nigeria, fish culture is regarded as a source of petty cash and means for poverty alleviation to rural household that engaged in fishing, fish processing, retailing fish and fish products as occupation and business (Gomna, 2005; 2011). Improvement in fish culture and production will go a long away to curb hunger, create jobs to youths and serve as reliable food security (Okechi, 2004; Gabriel et al., 2007; Adewuyi et al., 2010). *Tilapia*s are produced most economically in tropical and sub-tropical countries which have favourable temperatures for their growth (Mensah et al., 2013; Adams et al., 2014). There are over 25 species of tilapias in Nigeria, out of which about six species are used for aquaculture, namely, *Tilapia zilli, T. guineensis* (substrate spawners, macro-phytophagous (generally herbivorous)), *Sarotherodon galilaeus*, *S. melanotheron* (bi-parental mouth-brooders, micro-phytophagous (planktophagous)), *Oreochromis niloticus* and *O. aureus* (maternal mouth-brooders, omnivorous) (Idodo-Umeh, 2003; Adesulu and Sydenham, 2007). They are widely cultivated in ponds, reservoirs and cages in Nigeria (Fagbenro, 2004) and are suited to low-technology farming systems because of their fast growth rate, efficient use of natural aquatic foods, propensity to consume a variety of supplementary feeds, omnivorous food habits, resistance to disease and handling, ease of reproduction in captivity, and tolerance to wide ranges of environmental conditions (Idodo-Umeh, 2003; Adesulu and Sydenham, 2007). The feeding habit of this class of fish exposes them to sources of infection by fish parasites (Biu and Nkechi, 2013). Previous researches have reported that 50 to 90% of Tilapia species harbor at least one species of gastrointestinal parasites (Goselle et al., 2008). Parasitism is much more common and diversified in the wild compared to the farms, ponds and hatcheries. Infections occur not only due to overcrowding but also due to environmental stress. A research finding has shown that parasitic infections of Tilapia tend to decrease the growth rate (Goselle et al., 2008).

Preliminary studies in some parts of Nigeria revealed that parasitic organisms which are of medical importance that have been found in Tilapia are helminth parasites which belong to genera trematoda, cestoda and nematode (Amare et al., 2014). These parasites are found in different parts of the gastrointestinal tracts and the burden of parasitic helminths varies according to age, sex and agricultural practices. Some Tilapia parasites are important diseases causing agents to man. Among the trematodes, *Apophallus* and other *Heterophyids* probably develop in the intestine of man, and their ova is trapped in the villi, move into the circulatory system and is filtered out in various organs, including vital organs in the human body (Goselle et al., 2008). Therefore, accurate identification of parasites is important so that a build-up of parasite numbers can be prevented (Goselle et al., 2008). Various researches have been conducted and have reported varying prevalent rates of gastrointestinal helminths of *Tilapia* species in some parts of Nigeria, 37.09% was reported by Goselle et al. (2008) in Jos, Onyedineke et al. (2010) reported 60.6% in Edo State, 56.4% reported by Amaechi (2014) in Ilorin, Bichi and Ibrahim (2009) reported 43.3% in Kano, 45.3% was reported by Olofintoye (2006) in Ekiti, 18.7% was reported by Biu and Nkechi (2013) in Maiduguri, Uhuo et al. (2014) reported 19.8% in Eboyi State. Other researches by Oniye et al. (2004) in Zaria; Akinsanya et al. (2007) in Lagos State, Awharitoma and Ehigiator (2012) in Southern Nigeria and Olurin et al. (2012) in Ibadan South west Nigeria are of great value. There is paucity of information on helminths of *Tilapia* in Gombe; hence this study was designed to determine the prevalence of gastrointestinal helminths in this class of fish.

MATERIALS AND METHODS

Study area

The study was carried out within Gombe metropolis, Gombe State, Nigeria. Gombe township lies between Latitude 10^{o} 08' N and 11^{o}24' E and longitude 11^{o} 02' N and 11^{o} 18' E of the Greenwich Meridian. The size of the town is 20,265 km^2, with a population of about 200,000 inhabitants. Gombe town is between 400 to 450 feet above sea level.

Sampling of fish

Tilapia species were sampled from three main fish markets in Gombe namely: Gombe main markets, Gwadon market and Gombe old market which are located at strategic areas and serves as major collection center for majority of the fishes cultured in Gombe.

Transportation and preservation

Fish markets were visited in the morning; both live and freshly death tilapia fishes of various sizes were purchased from retailer at each sampled market, once dead fishes were preserved in ice pack cooler while the live ones are placed in a plastic rubber containing water and transported immediately to the research laboratory in Department of Zoology, Gombe State University for dissection and parasitology. In the laboratory, dead fishes were removed from the collections and examined

immediately while the live ones were preserved in a plastic aquaria containing dechlorinated tap water and examined subsequently.

Measurement for age determination

The length of each fish was aseptically measured using a measuring tape. Based on length variation each fish sample was categorized into juvenile (3 to 5 cm) and adults (6 to 9 cm) (as previously described by Goselle et al. (2008)).

Dissection and Identification of sexes

The sex of each sampled fish was determined by dissecting the fish and observing for the presence of the testis (male) or ovaries (female) as previously described by Holden and Reed (1972).

Dissection for parasitology

Using a disposable hand glove, each fish was picked, carefully examined for any abnormalities on its body and then placed on a dissecting board. The body cavity was opened with the aid of sharp scissors by cutting from the anal region up to the throat. The mesentery, connective tissue connecting loops of the gut and the liver were carefully cut and the each organ was separated. The gut was then gently placed in a large Petri dish, stretched out and cut into three anatomic regions which are the stomach, the intestine and the gut. Each section was then placed in a separate dish. Using a scalpel blade, the separated sections were opened longitudinally to expose the inner surface which was washed into test tubes containing normal saline and decanted. A drop of the residue was placed on the slide and examined under x 10 and x 40 objective of the light microscope as described by Goselle et al. (2008). Worms recovered from the intestine were recorded, washed in water to remove debris, flattened on glass slides and then preserved in sample bottle in 5% formalin.

Data analysis

Data collected from the study sites were coded and entered in to a Microsoft excel spread sheet program for analysis. Statistical analysis was done on Statistical package for Social sciences (SPSS) software version 16. Descriptive statistics like percentage was used to express prevalence while chi-square test was used to compare the association between variables and a statistically significant association between variables was considered at $p<0.05$.

RESULTS

A total of 300 *Tilapia zilli* were randomly sampled and examined for the presence of gastrointestinal helminthes. Out of the 300, 128 (42.7%) were found to harbor helminthes. Tilapia sampled from each market showed varying frequency of helminths of which frequency was higher in Gombe main market (17.0%), followed by Gwadon market (15.0%) and Gombe old market (10.70%) respectively (Table 1).

Three genera of gastrointestinal helminths namely Nematodes, Trematodes and Cestodes were recovered in tilapia. Out of the 42.70% prevalent rate recorded, 17.70% were Nematodes, 13.70% were Trematodes while 11.30% were Cestodes in descending order of frequency (Table 2).

Out of the total tilapia examined, the prevalence of gastrointestinal helminthes was higher in the female (24.0%) compared to the males (18.70%). There was no statistical significant difference (P= 0.52) observed in the prevalence rates among the sexes. However, the prevalence of gastrointestinal helminths according to ages of the tilapia examined shows that the adult fishes (31.0%) have the highest infection compared to the Juveniles (11.70%). There was statistical significant difference (P= 0.03) observed in the prevalence rate among the age groups (Table 3).

Out of the 128 infected tilapia examined, nematodes, cestodes and trematodes were found in the intestines of 71 (23.70%) infected tilapia and nematodes, cestodes and trematodes were also found in the stomach of 44 (14.70%) infected tilapia but only cestodes was found in the gut of 13 (4.30%) infected tilapia, while no helminths was recovered in the gills of all the infected tilapia (Table 4).

DISCUSSION

The results of this study revealed 42.70% overall prevalence rate of three genera of gastrointestinal helminths in the *Tilapia zilli* sampled from various fish markets in Gombe. This finding is consistent with report of Goselle et al. (2008), Onyedineke et al. (2010) and Amare et al. (2014) who also reported the presence of these three genera of helminths in Tilapia. The prevalence of gastrointestinal helminths was found to be more frequent in fishes sampled from Gombe main market (17.0%) followed by Kwadon market (15.0%) and Gombe old market (10.70%) in a descending order. Although, the prevalent rate of gastrointestinal helminths in *Tilapia zilli* reported in this current study was lower than the findings of Bichi and Ibrahim (2009) who recorded 53.40% in Kano, 60.23% reported by Olofintoye (2006) in Ekiti and 56.4% reported by Amaechi (2014) in Ilorin. It is however, higher than 18.70% reported by Biu and Nkechi (2013) in Maiduguri and 37.10% reported by Goselle et al. (2008) in Jos.

Table 1. Prevalence of gastrointestinal parasites of tilapia fish based on Markets in Gombe, Northeastern, Nigeria

Sample location	No. of sample examined (N=300)	No. of sample positive (x)	No. of sample negative (y)	Frequency (%) x/N X 100
Gombe main market	100	51	49	17.0
Gwadom market	100	45	55	15.0
Gombe old market	100	32	68	10.70
Total	300	128	172	42.70

N = Total samples examined.

Table 2. Prevalence of gastrointestinal helminthes of tilapia fish in Gombe Nigeria.

Gastrointestinal parasites encountered	Samples examined (N = 300)	Samples positive	Frequency (%)
Cestodes	300	34	11.30
Trematodes	300	41	13.70
Nematodes	300	53	17.70
Total	300	128	42.70

N = Total samples examined.

Nematodes (17.70%) were found to be the most prevalent helminths in the infected Tilapia compared to trematodes (13.70%) and cestodes (11.30%) in this study. This finding supported previous report by Goselle et al. (2008) who reported higher prevalence of gastrointestinal nematode (36.5%) compared to trematode (33.1%) and cestode (30.4%) in *Tilapia zilli* in Jos and Olofintoye (2006) who also reported higher prevalence of nematodes (32.6%) compared to cestodes (11.1%) in *Tilapia zilli* in Ekiti. This suggests that the occurrence of parasitism varied from one habitat to the other which could be due to host - parasite relationship and abiotic factors such as dissolved oxygen, temperature and pH (Amaechi, 2014; Amare et al., 2014). Several other research findings have also shown that helminths are mostly found in fresh water fishes where factors such as parasite species and its biology, host and its feeding habitats, physical factors, hygiene of the water body and presence of intermediate hosts contribute to their prevalence and intensity (Shukerova et al., 2010; Onyedineke et al., 2010; Hussen et al., 2012; Olurin et al., 2012; Awharitowa and Ehigiator, 2012; Nimbalkar and Deolalikar, 2015). Although, some researches have reported Acanthocephala in *Tilapia* as one of the dominant helminths of fresh water fishes (Olurin and Somorin, 2006; Onyedineke et al., 2010; Uhuo et al., 2014), but none was discovered in this current research.

The findings of this present study revealed that adult Ttilapia (31.0%) had the highest gastrointestinal helminths infection compared to the juveniles (11.70%). This finding is consistent with the report of Goselle et al. (2008) that also indicated highest prevalent rate of gastrointestinal helminths in the adults *Tilapia zilli* (57.78%) compared to the juveniles (55.56%) and Amare et al. (2014) who also reported higher prevalent rate in adult (62.13%) compared to juveniles (46.90%) *Tilapia zilli*. However, the finding of this current study is inconsistent with Biu and Nkechi (2013) who reported higher prevalent rate of helminths in juvenile (60.7%) compared to adult (14.30%) *Tilapia zilli* in Maiduguri. Previous investigations regarding the correlations between ages of fishes and their susceptibility to gastrointestinal parasitic infections have revealed that the differences in prevalence of infection between the juveniles and the adults in relation to their ages (length and weight) may be due to changes in their type of diet from weeds, seeds, phytoplanktons and zooplankton in juveniles to insect larvae, crustacean and worm in adult fishes (Richard, 2008; Bichi and Ibrahim, 2009; Hussen et al., 2012; Amare et al., 2014). Moreover, Olorin and Somorin (2006) and Amare et al. (2014) have also observed increased parasite load and intensity with increased weight, length and size and have noted that increase in weight also increases fish susceptibility to parasitization.

In this present study it was found that the female (24.0%) *Tilapia zilli* had the highest prevalence of gastrointestinal helminths compared to the male (18.70%) fishes. Although, there was no statistical significant difference (P= 0.52) observed in the prevalent rate of helminths in the sexes. This implies that both sexes of fishes share equal chances of getting infection where exposed to the same gastrointestinal helminthes infection. This finding is consistent with that of Amare et al. (2014) who reported higher prevalence in females (48.31%) than in the males fishes (47.40%). This result

Table 3. Some Risk factors associated with the prevalence of gastrointestinal parasites of Tilapia fish in Gombe, Northeastern, Nigeria.

Factors	Parameters	No. of sample examined (N = 300)	No. of sample positive (%)	(95% CI)		p- value
				Lower limit	Upper limit	
Sex	Male	143	56 (18.70)	0.6505	0.7800	0.5235
	Female	157	72 (24.0)	0.6217	0.7451	
Age	Juvenile (3-5 cm)	117	35 (11.70)	0.6951	0.8338	0.0280
	Adults (6-9 cm)	183	93 (31.0)	0.6038	0.7190	

Table 4. Predilection site of gastrointestinal parasites in infected Tilapia fishes in Gombe, Nigeria.

Predilection sites	Genera of helminthes recovered	Number of sample infected (*N= 300)	Frequency (%)
Intestines	Nematodes, Cestodes and Trematodes	71	23.70
Stomach	Nematodes, Cestodes and Trematodes	44	14.70
Gut	Cestodes	13	4.30
Gills	None	0	0
Total		128	42.70

*N = Total number of samples examined.

of this present study is also in line with the findings of Bichi and Ibrahim (2009) and Imam and Dewu (2010), that indicated female fishes, were generally more susceptible than males to infestations with cestodes, nematodes and trematodes. But the finding of this study did not correspond with that of Goselle et al. (2008) who reported highest percentage of infection in males (53.13%) fishes than in the females (50.0%) and those of other researchers who have also reported heavy infections of gastrointestinal helminths in male Tilapia than in the females (Ohaeri, 2012; Olurin et al., 2012; Biu and Nkechi, 2013; Amechi et al., 2014). Although, Emere (2000) have also noted the differences in parasitic infestation between males and females and attributed it to differential feeding pattern which could be in terms of quality and quantity. In instances where the female fishes are fed extra ordinarily for maximum productivity could predispose them to higher chances of infection than the males. Although, explanations from literature regarding the scientific relationship between sex and prevalence rate of gastrointestinal parasites in *Tilapia zilli* is yet not very clear. However, Emere and Egbe (2006) have previously reported that, due to the physiological state of the female fish, most gravid females could be more susceptible to infection by parasites.

The result of this current study revealed the highest prevalence of gastrointestinal helminths in the intestines (23.70%) followed by the stomach (14.70%) and the gut (4.30%), no parasites was found in the gills. This finding supported previous report of Goselle et al. (2008) and Onyedineke et al. (2010) who also indicated that the gastrointestinal tract is the most preferred predilection sites for some helminths in infected fishes. Organ specificity of helminths infection in this study revealed that the intestine is the most preferred organ for the gastrointestinal helminths in most infected fishes. This finding could be associated with the fact the stomach act as a temporary food storage cavity while most digestion activity occurs in the intestine, which could probably result in the release of the ova/cysts of parasites in the food the fish swallow. The occurrence of few parasites in the gut may be of those parasites that are migrating out of the intestine towards the fore gut owing to lack of space.

Conclusions

The gastrointestinal parasitic infection recorded in the present study is significant to the *Tilapia* culturist in Gombe. The frequency of gastrointestinal parasites in tilapia fish species is apparently high and may be one of the significant constraints to the maximum productivity of the fish in the study area. It is important to know that gastrointestinal parasitic infections could alter the normal growth of fishes hindering adequate growth and weight gain in adult fish to attain good market value. It could also affect palatability, productivity and aesthetic value of fish. It is necessary to eliminate all conditions that favour parasitic infection. It is therefore recommended that Tilapia fishes culturists should be enlighten on the need to routinely treat their fishes using appropriate antehel-

minthes for maximum production. Moreover, fishes meant for human consumption should be properly eviscerated and well-cooked before consumption to prevent human health hazard of zoonotic fish helminthes.

The prevalence of gastrointestinal helminths in *Tilapia* species is apparently high and may be one of the significant constraints to the maximum productivity of the fish in the study area. It is important to know that parasitic infestation among Tilapia could alter normal growth and hinder weight gain in adult fish to attain good market value. It could also affect palatability, productivity and aesthetic value of fish. Moreover, fishes meant for human consumption should be properly eviscerated and well-cooked before consumption to prevent human health hazards from fish-borne helminths infections.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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