South Asian Journal of Parasitology

Volume 7, Issue 1, Page 12-18, 2023; Article no.SAJP.95663

A Survey of Gastrointestinal Helminth Parasites and Haemoparasites of *Tilapia zilli* in Anambra East Local Government Area of Anambra State

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/95663

Original Research Article

Received: 28/10/2022
Accepted: 30/12/2022
Published: 09/01/2023

ABSTRACT

The survey was carried out to determine prevalence of gastrointestinal helminth parasites and haemoparasites of *Tilapia zilli* in Anambra East Local Government Area of Anambra State. Fishes are good sources of quality proteins, but various diseases including helminth parasitic infections pose serious threats to them, which are valuable sources of income, food and employment opportunity in developing countries. A total of one hundred and ninety-two (192) *Tilapia zilli* of both sexes were selected randomly for this survey. Samples were collected, processed and examined. Parasites were isolated, identified, and preserved. Out of 83 males examined, 59(71.1%) and out of 109 females examined, 72(66.1%) which was higher than the males. Statistically, there was no significant difference (P = 0.5) between prevalence of gastrointestinal helminth parasites and haemoparasites in relation to the sex and weight. *Acanthocephala sp, Diphylobothrium sp, Capillaria*

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sp, Gnathostoma sp, Trypanosoma sp, Babesioma sp and Myxosoma sp respectively were recovered. *Acanthocephala sp* had the highest mean intensity for both sexes, (1.41) and *Myxosoma sp* had the lowest mean intensity, (2.00) respectively. In the research area, the prevalence of gastrointestinal helminth parasites and haemoparasites was high. Adequate monitoring and management of water bodies for fishes to strive for the sustainability of aquatic resources should be encouraged.

Keywords: Acanthocephala sp.; Diphylobothrium sp.; Capillaria sp.; Gnathostoma sp.; Trypanosoma sp.; Babesioma sp.; Myxosoma sp.

1. INTRODUCTION

Fish farming is seriously threatened by a number of diseases brought on by parasitic infections, according to research by Kawe et al. [1] and Olugbotemi et al. [2]. Fish is an important source of protein and money in underdeveloped nations like Africa [3].

In addition to causing farmers financial harm, several helminth parasites, particularly trematodes, are significant zoonotic agents. Human infections from eating raw, partially cooked, or processed fish have been recorded in various geographical locations [4]. According to estimates from the World Health Organization (WHO), more than 18 million individuals are already sick with fish-borne trematodes, and many more are at danger [5].

Infections from parasites found in fish have been recognized as a significant public health issue with significant economic consequences in terms of morbidity, lost productivity, and medical expenses [6]. The development of fish-borne parasitic illnesses has been driven by unhygienic conditions and regional fish processing and preservation techniques [7].

In the life cycles of many species of helminth parasites, fish can act as a final or intermediate parasitic (transport) host. The majority of these parasites can be recognized under a microscope, and just like with parasites of mammals, accurate recognition and comprehension of their life cycles are crucial for either outbreak management or prevention [8].

In practically all fish organs or gastrointestinal tracts, helminth parasites can be found as larvae or adults. Although the majority can be classified as trematodes, nematodes, cestodes, or acanthocephalans, precise identification typically requires using sophisticated staining methods or cleaning specimens [8].

The majority of fish *Trypanosome* species are known to produce severe illnesses with significant medical and economic repercussions. The signs of piscine trypanosomiasis range from mild anemia linked to low parasitaemia levels to serious pathological alterations brought on by a high parasite burden [9]. Trypanosomiasis frequently causes leukocytosis, hypoglycemia, and hypocholesterolemia [10].

Nearly 100 species of Cichlid fish from the Tilapiine tribe go by the common name *Tilapia*. Their primary habitats are shallow streams, ponds, rivers, and lakes; brackish water is less frequently where they can be found [11]. *Tilapia* consume algae or any other plant-based food, which exposes them to sources of fish parasite infection (De Silva et al., 2004).

Foodborne and waterborne outbreaks are becoming more commonplace, which is challenging for parasitologists. helminth and protozoa infections like *Acanthocephala sp*. and *Trypanosoma sp*. are responsible for the majority of these outbreaks. In endemic and developing nations, parasites have regularly been documented. However, over the past few decades, these parasites have become more common in the developed world.

Fish parasites infect and/or kill economically significant fish. A Fish parasite study has been done in Anambra East Local Government Area, but further research needs to be conducted on this topic to produce more data and close the knowledge gap. In view of this, the present research was designed to survey gastrointestinal helminth parasites and haemoparasites of *Tilapia zilli* sold at Aguleri fresh fish market in Anambra State.

2. MATERIALS AND METHODS

Anambra East Local Government Area in Anambra State's Aguleri Area served as the site of the study. Latitude 6.33^0 N and Longitude 6.88^0 E are the coordinates of its location [12]. Approximately twenty (20) weeks were spent

conducting the study (August to Novembe, 2021). The *Tilapia zilli* utilized were purchased alive from the Aguleri fresh fish market in the Anambra East Local Government Area of Anambra State. In order to generalize from a random sample and prevent sampling errors or biases, a random sample was adequately employed due to the absolute size of the sample chosen relative to the complexity of the population. Increasing sample numbers decreases sampling error, but at a diminishing pace [13]. There are numerous statistical formulas that can be used to calculate the sample size. The sample size for an infinite population can be determined using a variety of methods that incorporate several formulas.

The sample size was determined by using the formula described by Cochran, [14], Jossy, and Daniel, [15] using a 95% confidence level and 5% at 50% expected gastrointestinal helminth parasites and haemoparasites of *Tilapia zilli* sold at Aguleri fresh fish market.

A total of one hundred and ninety-two (192) *Tilapia zilli* of both sexes were selected randomly for this research work. According to Cochran, [14], infinite population is calculated by using the following formula:

$$S= Z^2 * P * (1- P)/M^2$$

Where: S= is the sample size for infinite population, Z= is the Z score (1.96), P= is the population proportion (assumed to be 50% = 0.5), M= is the margin of error (0.05). The fish were obtained at the Aguleri Fresh Fish Market and transported alive to the Faculty of Biosciences' Zoology Laboratory at Nnamdi Azikiwe University in Awka in a white plastic bucket filled with water. The fish's urogenital system was visually inspected to determine the sexes. Fish sex was determined using their external reproductive organs. *Tilapia zilli* males and females were easily separated from one another. Behind the anus, the males have a prominent sexual papilla that is clearly visible. This feature, which lies roughly between the pelvic fins, is missing in females [16].

After being divided into different sizes, the fish were killed using the techniques outlined by Olugbotumi et al. [2]. Based on the exterior morphological characteristics mentioned by Kawe et al. [1] fish identification was done. A ruler calibrated in centimeters (cm) and an electric kitchen scale (QE-KE-4) were used to measure the lengths and weights of the fishes, respectively.

The length was calculated as the distance between the tip of the snout and the caudal fin. The measurement was recorded to the closest centimeter (cm), to the nearest gram, fish were weighed (body weight) (grior to dissection on a sterile dissecting board, the fish were immobilized by cervical dislocation for simple handling. Using a surgical scissor, a longitudinal cut was made on the ventral surface from the anus to a point level with the pectoral fins to dissect the fishes through the abdomen [8]. The stomach, oesophagus, and intestines were each isolated, stretched out, and grouped together. These were put into three different petri dishes that each contained 0.6 percent saline. One gram of feces was dissolved in ten milliliters of distilled water after each of these was longitudinally cut. The mixture was added to a 15 ml centrifuge tube (with a cap) until it was one-half to three-quarters full, and it was then correctly spun at 500 revolutions per minute for three to five minutes. The test tubes were separate to three layers when they were taken out of the centrifuge: an upper layer made up of fat and debris; a middle layer made up of water and fine particles, and a bottom layer made up of sediment. The test tubes' top debris plug, which had clung to the sidewalls, was removed using a sterile applicator stick. The supernatants were then discarded, leaving only the bottom sediments behind. The sediments were re-dissolved in a few drops of distilled water, one or two drops of which were placed on a slide, clipped, and viewed under a microscope at tenfold magnification.

Following Hassan et al. (2007), the blood was drawn from the caudal peduncle using a 23gauge plastic syringe. From the samples that were taken, blood smears were made. The blood films were promptly air-dried to protect them from flies and other insects after being preserved in 100% methanol for 5 minutes. Films were flooded with a 1:20 dilution of stock Giemsa stain in distilled water (slides were placed in staining jar). They were discolored for thirty minutes. Using distilled water, the spots were gradually removed. They were air-dried, and the parasite cytoplasm was coloured blue, while the nuclei were stained magenta. With the help of a light microscope's 100x and 40x objectives, the stained blood films were examined [8].

A standard text book, "Atlas of Animal Parasites and Veterinary Clinical Parasitology," by Heinz, [17], Anne et al. [8], and identification keys were used to identify the parasites based on their physical characteristics. Once fully stretched in 0.09 percent normal saline, the recovered helminth parasites were allowed to die. They were kept in 70% alcohol with up to two drops of glycerin to prevent the worms from contracting and completely evaporating [2]. The data analysis was done with the help of SPSS 23 (Statistical Package for Social Science). Haemoparasites and gastrointestinal helminth parasites were determined to have a mean intensity of prevalence. Additionally, charts and tables were used to present the data. In order to calculate and make a statistical judgment, one-way ANOVA and Chi squares (X) were used [1].

3. RESULTS

For this research, a total of 102 *Tilapia zilli* of both sexes were chosen at random. In *Tilapia zilli*, 59 of the 83 males studied had a prevalence of infection of 71.1%, while 72 of the 109 females examined had a prevalence of infection of 66.1%, which was higher than that of the males. Recovered parasites included *Acanthocephala sp*, *Diphylobothrium sp*, *Capillaria sp*, *Gnathostoma sp*, *Trypanosoma sp*, *Babesioma sp*, and *Myxosoma sp*.

Table 1. Prevalence of Gastrointestinal Helminth Parasites and Haemoparasites of *Tilapia zilli* in Relation to Sex at Aguleri Fish Market in Anambra East Local Government Area of Anambra State

Sex	No examined	No infected	Prevalence (%)
Male	83	59	(71.1)
Female	109	72	(66.1)
Total	**192**	**131**	**(68.2)**

In Table 1 shown above, Male had Prevalence 59 (71.1) while Female had 72(66.1) which was higher than Male. Statistically, there was no Significant Difference (P = 0.46) between the Prevalence of Gastrointestinal and Haemoparasites of *Tilapia zilli* in Relation to Sex

Table 2. Mean Intensity of Gastro intestinal Helminth Parasites and Haemoparasites of Male *Tilapia zilli* at Aguleri Fish Market in Anambra East Local Government Area of Anambra State

Parasites Species	No infected	Mean intensity
Acanthocephala sp	41	1.41±0.13
Diphylobothrium sp	5	8.40±1.43
Capillaria sp	3	12.33±2.33
Gnathostoma sp	2	10.00±1.00
Tryponosoma sp	2	6.50±1.50
Babesiosoma sp	2	1.50±0.00
vMyxosoma sp	1	2.00±0.00
Total	**56**	**3.11±0.49**

Table 2 above. Mean Intensity = Mean ± Standard error of the mean.

Table 3. Mean Intensity of Gastrointestinal Helminth Parasites and Haemoparasites of Female *Tilapia zilli* at Aguleri Fish Market in Anambra East Local Government Area

Parasites Species	No infected	Mean intensity
Acanthocephala sp	50	1.58±0.15
Diphylobothrium sp	10	1.50±0.31
Capillaria sp	5	2.60±0.60
Gnathostoma sp	4	7.25±1.60
Tryponosoma sp	2	11.00±1.00
Babesiosoma sp	2	12.50±2.50
Myxosoma sp	2	6.50±1.50
Total	**75**	**2.61±0.34**

Table 3 shown above, Mean Intensity = Standard Error of the mean.

Table 4. Mean Intensity of Gastrointestinal Helminth Parasites and Haemoparasites of *Tilapia zilli* at Aguleri Fish Market in Anambra East Local Government Area

Parasites Species	No infected	Mean intensity
Acanthocephala sp	91	1.50±0.10
Diphylobothrium sp	15	3.80±0.99
Capillaria sp	8	6.25±1.97
Gnathostoma sp	6	8.17±1.19
Tryponosoma sp	4	8.75±1.49
Babesiosoma sp	4	6.75±3.47
Myxosoma sp	3	5.00±1.73
Total	**131**	**2.82± 0.29**

Table 4 shown above, Mean Intensity = Mean Standard Error of Mean. *Gnathostoma sp* and *Trypanosoma sp* had the highest Mean Intensity of 8.17± 1.19 and 8.75±1.49 while *Acanthocephala sp* had the lowest, 1.50± 0.10. Statistically, there was Significant Difference (P = 0.00) between the Mean Intensity of Gastrointestinal Helminth Parasites and Haemoparasites of *Tilapia zilli.*

Table 5. Distribution of Gastrointestinal Helminth Parasites and Haemoparasites in the Host (*Tilapia zilli)*

Parasites species	Location in Host
Acanthocephala sp	Intestines
Diphylobothrium sp	Stomach
Capillaria sp	Intestines/ Stomach
Gnathostoma sp	Stomach/ Intetine
Trypanosoma sp	Blood
Babesiosoma sp	Blood
Myxosoma sp	Blood

Table 5 shown above, Location of the Parasites in Different Parts of *Tilapia zilli.*

4. DISCUSSION

According to the findings, female *Tilapia zilli* had a higher prevalence of gastrointestinal helminth parasites and hemoparasites (72(66.1%) than male *Tilapia zilli* (59(71.1%) (Table 1). Similar investigations have been conducted throughout the world in various regions and nations. At the Lamingo Dam, Jos, Nigeria, Goselle et al. [18] found that the prevalence of helminth parasites of *Tilapia zilli* was also high in females, 41(51.3%) as opposed to males, 17(53.1%) respectively**.** These findings support the findings of the recently completed research. As a result, statistically, there was no association between *Tilapia zilli* sex and the prevalence of gastrointestinal and hemoparasites (P = 0.5).

The prevalence of gastrointestinal helminths of *Tilapia zilli* in Maiduguri, Nigeria, was higher in males (18(64.3%) than in female (10(35.7%)), Biu and Nkech, (2013). It's possible that variation in environmental conditions, study techniques, and sample sizes among study sites could responsible for the variations in results reported in various locations. Low immunity may be the cause of the female *Tilapia zilli's* high prevalence of gastrointestinal helminths and hemoparasites. According to Emere and Egbe [19], the physiological state of the female may have caused most gravid females to have less resistance to parasitic diseases. Due to the greater number of females investigated than males, this could potentially be ascribed to random selection.

Acanthocephala sp had the lowest Mean Intensity of 1.50± 0.10. Statistically, there was a significant difference (P = 0.00) between the Mean Intensity of the gastrointestinal and haemoparasites of *Tilapia zilli* (Table 4).

This present result and work of Cromptom, (1973) reported that helminths have a preference for the region of attachment in the gastrointestinal tract of fish. The distribution of parasites in the fishes showed a clear preference for the intestine and stomach where there is the highest concentration of the helminths followed by the oesophagus which had a very sparse population of the helminths. The preference for intestine and stomach regions as sites of attachment could be attributed to the availability of food in these regions. The extension of the helminths to the oesophagus occurred when there was a heavy concentration of helminths in the stomach and intestine region as a result of lack of space. Haemoparasites were also found in the blood.

5. CONCLUSION

The present study revealed high prevalence of gastrointestinal helminth parasites

haemoparasites of *Tillapia zill, Gnathostoma sp* and *Trypanosoma sp* had the highest Mean Intensity while *Acanthocephala sp* had the lowest. Statistically, there was significant difference (P = 0.00) between the Mean Intensity of the gastrointestinal and haemoparasites of *Tilapia zill.* Intestine and stomach were the most preferred sites for attachment of the parasites followed by blood and oesophagus respectively. The following recommendations have been made: Adequate monitoring and management of water bodies for fishes should be encouraged in order to work toward the sustainability of aquatic resources, to create efficient controls against parasitic helminth and haemoparasites of fish, and to adopt good culinary practices in order to lower the potential risk to human health.

ETHICAL APPROVAL

Animal Research Ethics Committee (aREC), Nnamdi Azikiwe University, Awka, provided its ethical approval.

ACKNOWLEDGEMENT

We want to thank all the Technologists in the Department of Zoology, including Rev. Canon Ezeh, Mrs. E. Edith, Miss O.P. Chizorom, Mr. N. James, Miss O. Onyinyechi, Mrs. O. Ifeoma, and Mrs. U.C. Ngozi, who helped us in many ways to get the right environment for our laboratory research. We appreciate it.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
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