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STUDIES ON SOME FISH PARASITES OF PUBLIC HEALTH IMPORTANCE IN SOHAG GOVERNORATE, EGYPT

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ABSTRACT

While fish serve as an important source of animal protein for humans, parasitic diseases can have a detrimental effect on their production and public health. The main focus of this study was to quantify the spread of parasitic infections in some freshwater fish and to evaluate the range of zoonotic parasites present in them. In Sohag Governorate, a total of 123 freshwater fish—91 Nile tilapia (*Oreochromis niloticus*) and 32 catfish (*Clarias gariepinus*)—were randomly chosen from natural sources and markets. Fish were examined visually and microscopically. Out of 123 examined fish, 81 were infected by parasites with a prevalence of 66%. Microscopic encysted metacercariae were detected in 46.2% of the total examined fish. In tilapia, the macroscopic EMC *clinostomum* was 18.7%, and *contarcecum* 17.6% were observed, while in catfish, trematodes, *Orientocreadium batrachoides* 12.5% and nematode, *paracamalans* 3%, were detected. These findings demonstrated a wide range in the prevalence of different zoonotic parasites across two species of fish, highlighting the potential hazards to human health when consuming raw or inadequately cooked fish.

Keywords*:* Tilapia, Catfish, Microscopy, zoonotic parasites, prevalence

INTRODUCTION

In human diets, fish are one of the primary sources of animal protein, providing necessary nutrients and a valuable resource (Hadyait *et al.*, 2018). Fish meat promotes human health, as it is rich in beneficial components like polyunsaturated fatty acids, minerals, omega-3 and omega-6 fatty acids, antioxidants, and lipid-soluble vitamins. These components are essential for overall well-being and play a crucial role in the prevention of various chronic diseases (Mahmoud *et al.*, 2018).

Fish act as hosts for various parasites. The main route of infection for humans is the consumption of uncooked or undercooked fish (Shamsan *et al.*, 2018). Thus, the

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potential for the spread of parasites from fish to humans is a concern that needs to be monitored (Eissa *et al., 2*013). Moreover, parasites impact the fish industry through various means, such as retarding their size, behavior, and immunity. This can lead to higher mortality rates and result in significant financial losses for fish farmers due to tissue damage and deaths (Thomas *et al.*, 2014; El Asely *et al.*, 2015).

In Egypt, fish farming accounts for 73.3% of the total fish production in 2016. The rest of the fish production from all other natural resources represented by the sea, lakes, the Nile River, and its branches amounted to about 391.8 thousand tons, representing about 26.7% of the total fish production **(**Hassan *et al.*, 2019**)**. Tilapia and catfish are both very important species in terms of food production and consumption for Egyptians **(**Talab *et al.,* 2016).

Metacercaria of digenetic trematodes are the most significant and commonly found in various species of fish. They can cause considerable economic losses in terms of both aquaculture and open water resources in Egypt. So, this study aimed at screening the prevalence of parasitic infection in tilapia and catfish in the Sohag governorate, Egypt.

MATERIALS AND METHODS

Ethical Considerations

This study was approved by the research ethics committee of the Faculty of Veterinary Medicine, Assiut University, Egypt, under the number (06/2024/0237).

Area of study and gathering samples

A total of 91 *Oreochromis niloticus* (Tilapia) and 32 *Clarias gariepinus* (catfish) were obtained from different fish retailers in Sohag, located in the central part of Egypt, on the banks of the river Nile, with Latitude: 26° 33' 25.02" N, Longitude: 31° 41' 41.21" E, and 26° 32' 59.9964" N. Fishes were collected by fishermen from the River Nile and fish markets during the period of May 2023 to April 2024 and then brought to the laboratory either in a live form (in containers containing water from their source with oxygen pumps) or as freshly dead fish (in ice bags). The fish were identified according to a method published by Paugy *et al.* (2003**)**. The total length, standard length, and body weight of each fish were estimated and recorded. (Helmy *et al.*, 2022)

Clinical examination

The fish were examined macroscopically; each fish's length and weight were measured in the lab. After that, an incision was made from the fish's anus extending along the ventral side of the fish, towards the gills. Additionally, two more lateral incisions were performed to expose the body cavity, digestive system, and internal organs. Inspection of the external surface, fins, gills, muscles, intestine, and body cavity ws performed for any macroscopic parasites by the naked eye.

Parasitological examination

Internal organ examination

1. Gastrointestinal tract

The gastrointestinal tract was isolated from the other internal organs, with the stomach and intestines being stretched out over a glass plate for examination. During this process, any changes in size, color of contents, and the presence of nodules or external parasites were noted. The gastrointestinal tract was then segmented and placed in Petri dishes containing physiological saline to help dislodge any remaining particles or mucus attached to parasites. The parasites were extracted and placed in universal bottles filled with 15 milliliters of 70% alcohol for identification under a microscope. (Abd El-Lateif, 2004).

2. Respiratory Organs

The operculum was removed with scissors to expose the gills and auxiliary respiratory organs. The gills were examined for signs of hemorrhage, unusual pigmentation, parasite cysts, and excess mucus. A wet mount from gills and associated respiratory organs were prepared to be examined under a microscope for the presence of parasites (Abd El-Lateif, 2004).

3. Muscles

The collected samples from fish muscles were inspected for visible cysts. For microscopic examination, small muscle samples were taken from various body regions (tail, head, and trunk), compressed between two glass slides, and observed under a microscope (Aly *et al.,* 2005).

Statistical analysis:

Data were verified, coded, and analyzed using IBM SPSS.

RESULTS

1-Demographic data of examined fish

The length, weight and sexing of the examined fish are summarized in Table (1).

Table 1: demographic data of the examined fish

	Male		Female	
	Length	**Weight**	**Length**	**Weight**
Tilapia	23.1±0.8 (10-36)	199.2±2 (15-660)	22.2±0.7 (16-33)	265.8±30 (86-1146)
Catfish	35.5±0.6 (26-50)	319.3±2 (119-1200)	35.1±0.4 (30-40)	308.9±5.5 (252-360)

2-Total parasitic infection:

The prevalence of total parasitic infection in the examined freshwater fish was 66%. The prevalence rate of total parasitic infection in tilapia was 70%, including *Contracecum* (17.6%), *clinostomum* (18.7%), and micro-scopic encysted metacercaria (46.2%). The prevalence rate of total parasitic infection in catfish was 53%, including *Orientocreadium batrachoides* (12.5%), *paracamallanus* (3%), and microscopic encysted metacercaria (47%).

3-Prevalence of total parasitic infection in Tilapia and Catfish in relation to sex, season, and infection burden

As presented in Table (2), the infection rate in females was 75%, which was higher than in males at 63%. In tilapia, the highest infestation rate among seasons was in Autumn, 89%. While in catfish, the highest was in summer at 70%. There is no significant difference between fish infected with a single parasite and those infected with more than one.

Table 2: Prevalence of parasitic infection in Tilapia and Catfish in relation to sex, season, and infection burden

Criteria		Tilapia (t=91)	Catfish (t=32)	Total (t=123)	P value[#]
Gender	**Male**	49/70(70%)	11/25(44%)	60/95(63.2%)	0.021*
	Female	15/21(71.4%)	6 /7(85.7%)	21/28(75%)	0.45
	P value	0.038*	0.105	0.013*	
Season	**Spring**	18/33(54.6%)	0/4 (0%)	18/37 (48.7%)	0.012*
	Summer	13/18(72.2%)	11/16(70%)	24/34 (70.6%)	0.001**
	Autumn	24/27(89 %)	1 /2 (50%)	25/29 (86.2%)	0.007**
	Winter	9 /13 (69.2%)	5 /10 (50%)	14/23 (60.9%)	0.034*
	P value	0.9	0.051	0.25	
infection burden	**Single**	31 (34.1%)	10 (31.3%)	41 (33.3%)	0.446
	Mixed	33 (36.3%)	7 (21.9%)	40 (32.5%)	
	P value	0.724	0.005**	0.875	

n/t (%): number of positive/total examined (percentage). (@) Differences in prevalence of tilapia and catfish in the different genders, different seasons, and infection burden. (#) Differences in prevalence between tilapia and catfish in the same gender, same season, and infection burden. * Statistically significant difference ($p<0.05$) by Chi square of independence. ** Statistically high significant difference ($p<0.001$) by Chi square of independence.

4- The prevelance of microscopic EMC in Tilapia and Catfish within different body regions relative to sex:

As presented in Table (3**),** the highest incidence rate of microscopic encysted metacercaria in both tilapia and catfish was in muscles, 36% and 40%, respectively, followed by their incidence in gills. The prevalence of EMC infection in males was higher than that in females.

Table 3: Prevalence and diversity of microscopic EMC in Tilapia and Catfish in relation to sex.

fish spp.	diversity of EMC	male t=70		female t=21		total t =91		P value
		No.inf	%	No.inf	%	No.inf	%	
Tilapia	muscle	28	40	5	23.8	33	36.3	o.176
	gill	18	25.7	4	19	22	24.9	0.531
	intestine	2	2.9	2	9.5	4	4.4	0.066
fish spp.	diversity of EMC	male t=25		female t=7		total t=32		P value
		No.inf	%	No.inf	%	No, inf	%	
Cat fish	muscle	8	32	6	85.7	14	43.8	0.011*
	gill	3	12	0	0	3	9.4	0.336
	intestine	4	16	0	0	4	12.5	0.258

5-prevalence of trematode and nematode infection in Tilapia and Catfish in relation to sex:

As presented in Table (4), in tilapia, there are no obvious differences between male and female infection rates of both trematodes and nematodes. While, in catfish, females had a higher infection rate of trematodes than males and posed the only infection in nematodes.

Table 4: The prevalence of trematode and nematode infection in Tilapia and Catfish in relation to sex.

Fish species	Male t=70		Female t=21		Total t =91		P value
Tilapia	No.	%	No.	%	No	%	
trematode digeanea *clinostimum*	13	18.6	4	19	17	18.7	0.961
nematode *contracecum*	12	17	4	19	16	17.6	0.841
	male t=25		female t=7		total t=32		
Catfish	No.	%	No.	%	No	%	
trematode *digeanea orientocreadium*	2	8	2	28.6	4	12.5	o.146
nematode *paracamallannus*	0	0	1	14.3	1	3.1	0.055

6- The recovered parasites can be identified morphologically **(Figure 1).** Larva of *contracecum* were seen grossly in the body cavity of tilapia (Fig 1a & b). Yellow nodule of *clinostomum* Emc. Embedded in the branchial arch of tilapia (arrow) (Fig 1c). The excysted *clinostomum spp* was demonstrated between two slides (Fig 1d).

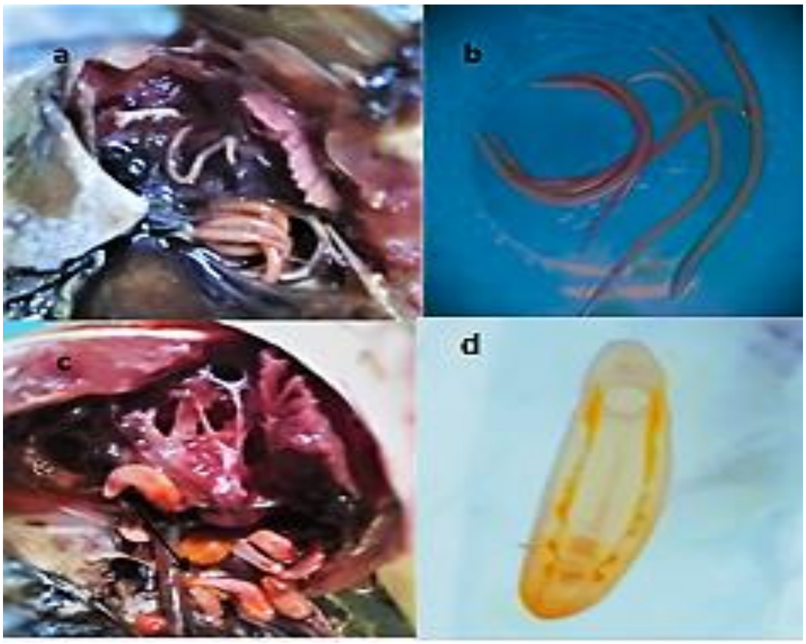

Figure 1: Showing (a & b): Larva of *contracecum* in the body cavity of tilapia X 4. (c): Yellow nodule of *clinostomum Emc.* Embedded in branchial arch of tilapia (arrow) X4. (d): Excysted *clinostomum spp* between two slides X40.

7- The recovered EMC can be identified microscopically in the muscles and gills of tilapia. Encysted metacercaria in muscles (**Fig 2**a, b) and gill filament (**Fig 2**c) and also *Centrocestus formosanus* (**Fig 2**d).

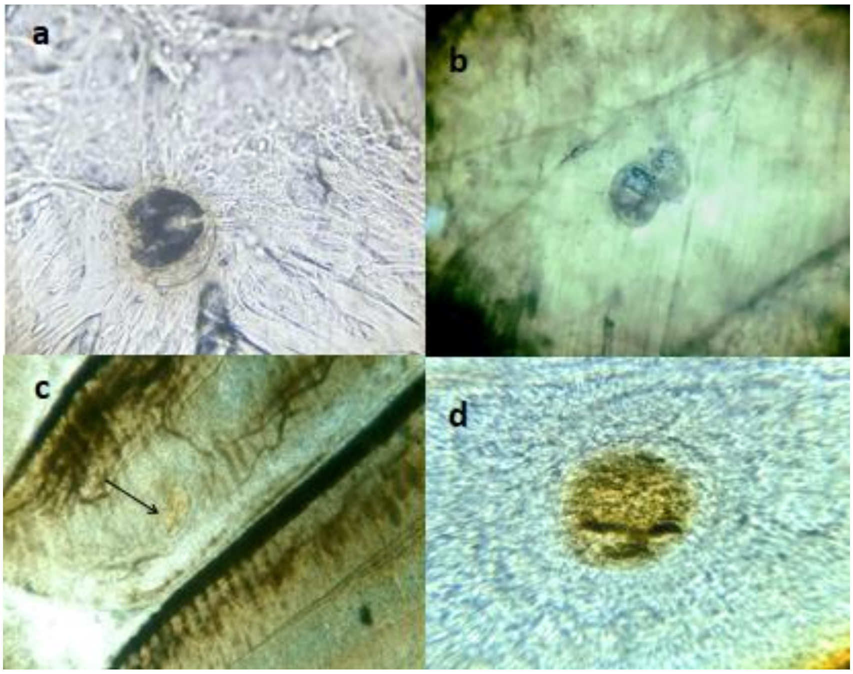

Figure 1: Showing microscopic EMC in muscle and gill of tilapia (a, b): Encysted metacercaria in muscles x100 (c): Encysted meta cercaria in gill filament x 40. (d): *Centrocestus formosanus* x 100.

8- Morphological character of the encysted metacercaria in muscles of catfish (**Fig 2**a). *orientocreadium batrochoides* in catfish intestine (**Fig 3**b,c). note 1- oral sucker, 2- cirus sac 3-ovary 4- egg. *Paracamallanus* sp and in catfish intestine (**Fig 4**d).

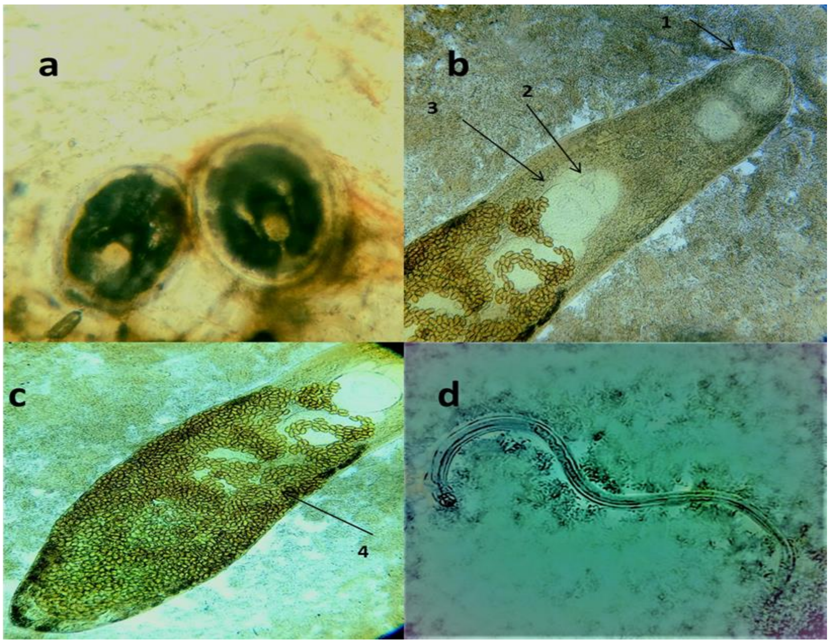

Figure 5: (a): Encysted metacercaria in muscles of cut fish x 100. (b,c): *orientocreadium batrochoides* in catfish intestine x 100, 1- oral sucker, 2- cirus sac 3-ovary 4- egg. (d): *Paracamallanus* sp. In catfish intestine x 100.

DISCUSSION

Fish parasites, particularly freshwater, had significant concern in global aquaculture, posing both a threat to production and a potential zoonotic risk. This study provides baseline data on the prevalence of parasites in Nile tilapia and catfish in Sohag, Egypt.

As noted in this study, the total prevalence rate of parasitic infection in the examined freshwater fish was 66% (81 out of 123); these results are in agreement with those derived from previous research by Khan *et al*. (2003**)** in Pakistan with a 70.51% prevalence rate. The results obtained here are lower than those previously reported in Egypt by Sahar *et al.* (2009) and in Bangladesh by Monir *et al.* (2015); their prevalence was 84.8% and 94.5%, respectively. The present data was higher than the previously reported in Nigeria; 30.9% (Oso *et al.*, 2017).

The prevalence rate of parasitic infestation in tilapia was 70%; this result agreed with a previous study in Upper Egypt (Mahmoud *et al.*, 2011), where the prevalence was 68.8%. The outcome of this study was higher than that in California, USA (Calhoun *et al.*, 2018), in which the prevalence was 60%. This increase in the rate of infestation in Egypt may be a result of fluctuating environmental conditions and high pollution levels, causing a decline in fish immunity and increasing their susceptibility to parasitic infection.

Out of the 91 tilapia fish that were examined, the following parasites were detected: the infection rate of nematode, *Contracecum* spp., was 17.6% (16/91), which was agreed to a study in Ethiopia (18.5%) (Gebreegziabher *et al.*, 2020**)**; the current results were lower than that recorded in El Minia (50.0%) (Hefnawy *et al.*, 2019) and higher than another study (Elseify *et al.*, 2015) in Qena (2.3%).

Clinostomum spp. was identified by 18.7% (17/91); this result was lower than that detected in a study in Banha, 30.5% (Shaheen *et al.*, 2014), and 50% of examined fish in El-Minia (Hefnawy *et al.*, 2019). The prevalence of microscopic EMC was 46.2% (42/91), and this result was lower than a study in Alexandria, which recorded 57.3% (Satour *et al.*, 2019), the current research results were higher than another study in southern Egypt, 29.2% (El-Shahawy *et al.*, 2017).

Out of 32 catfish samples, the prevalence rate was 53%; that is lower than a study in Assiut by Helmy *et al.* (2022) that recorded an 82% parasitic incidence. In the current study, the low infestation rate in catfish might be a result of their relative resistance to infection. The following parasites were detected in catfish: trematode, *Orientocreadium batrochoides* (12.5%), and this result showed a decline compared to what was reported in Qena (27%) by El-Seify *et al.* (2017), but higher than that reported in Lake Manzala (8.33%) by Abdel-Gaber *et al.* (2015); nematode (*Paracamallanus* spp.) infection rate was (3%). The current result revealed a lower prevalence than that recorded in Qena (12%) by Elseify *et al.* (2015). The microscopic EMC infection rate was 47%; this result was similar to another study in EL-Minia (Ahmed *et al.*, 2023) that reported 40% for EMC in catfish in 2022; the current findings demonstrated a lower prevalence of EMC than that reported in El-Minia (70%) (Hefnawy *et al.*, 2019).

In Sohag, ALY *et al.* (2024) reported that *Clarias gariepinus* had the highest infection rate, 64% (32/50), compared to *Oreochromis niloticus*, 56% (56/100). *Quadriacanthus* spp. (50%), *Contracecum* spp. (50%), *Trichodina* spp. (56%), *Myxobolus* spp. (55%), *Cryptosporidium* spp. (50%), and encysted metacercaria [microscopic (55%) and macroscopic (35%)] were the parasites found in Nile tilapia fish. In contrast, the identified parasites in catfish included microscopic encysted metacercaria (60%) and *Quadriacanthus* spp. (54%), *Trichodina* spp. (64%), *Myxobolus* spp. (44%), *Henneguya* spp. (40%), and *Cryptosporidium* spp. (56%).

The total infestation rate of encysted metacercariae in examined freshwater fish was 60.2%; this result agreed with research in El-Minia by Hefnawy *et al.* (2019), since they recorded 60%, these high results indicate the presence of intermediate and final hosts in the region of study. Microscopic EMC was detected in 46.2% (57/123) and macroscopic EMC in 13.8% (17/123) of all examined fish samples. There is a need to take precautions to prevent outcomes of zoonotic parasite infestation in fish and humans.

The differences in the rate of infection between different fish species could be attributed to a number of factors, including differences in food supply and habitat. In addition, the abundance of both aquatic birds and aquatic snails, both of which are crucial for completing the life cycle of some trematodes. Climatic variations in the areas where the fish were sampled could also contribute to the observed differences in infected rat.

CONCLUSIONS

This study indicates that various parasites are commonly found in freshwater fish. This, in turn, has a direct effect on the production of fish and, therefore, has economic implications for the industry. Since there is a potential for these parasites to be passed from animals to humans, we must consider taking preventative measures to prevent the further spread of zoonotic diseases. These control measures should be implemented to ensure the safety and health of both humans and animals. It is also important to increase public health awareness of the risks posed by consuming raw or undercooked fish.

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دراسات علي بعض طفيليات الاسماك ذات الاهمية الصحية العامة في محافظة سوهاج ، مصر

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تعتبر الأسماك مصدرا هاما للبروتين الحيواني للإنسان، إلا أن الأمراض الطفيلية يمكن أن يكون لها تأثير ضار على إنتاجها والصحة العامة. كان التركيز الرئيسي لهذه الدراسة هو قياس مدى انتشار العدوى الطفيلية في بعض أسماك المياه العذبة وتقييم نطاق الطفيليات الحيوانية المنشأ الموجودة فيها. في محافظة سوهاج، تم اختيار إجمالي 123 سمكة من أسماك المياه العذبة - 91 سمكة بلطي نيلية (*Oreochromis niloticus*) و32 سمكة قرموط (*Clarias gariepinus*) - بشكل عشوائي من المصادر الطبيعية والأسواق. تم فحص الأسماك بصريا ومجهريا. ومن بين 123 سمكة تم فحصها، تبين أن 81 سمكة مصابة بالطفيليات بنسبة انتشار 66%. تم الكشف عن الميتاسركاريا المتكيسة المجهرية في 46.2% من إجمالي الأسماك التي تم فحصها. في البلطي، لوحظ وجود *clinostomum* EMC العيانية بنسبة 18.7%، و *contarcecum* 17.6%، بينما في سمك السلور، تم اكتشاف الديدان المثقوبة 12.5% *Orientocreadium Batrachoides* والديدان الخيطية 3% *Paracamalans*. أظهرت هذه النتائج نطاقًا واسعًا في انتشار الطفيليات الحيوانية المنشأ المختلفة عبر نوعين من الأسماك، مما يسلط الضوء على المخاطر المحتملة على صحة الإنسان عند استهلاك الأسماك النيئة أو المطبوخة بشكل غير كافٍ.