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Research Article

Prevalence Study of Internal and External Parasitic Disease of Fish in Selected Lakes of South Wollo Zone, North East Ethiopia

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ABSTRACT

A cross-sectional study was conducted in different Lakes of South Wollo Zone of the Eastern Amhara Regional State of Ethiopia, from November 2018 to April 2019, with the aim of determining the prevalence and identifying the species of internal and external parasites from fresh water fish. A total of 506 *Oreochromis niloticus* and 215 *Cyprinus carpio* fish (n=721) were collected and examined for the presence of fish helminthes parasites. The prevalence of parasites in Lake Luggo, Ardibo, Golbo and Maibar were found to be 49.4%, 41.7%, 46.7% and 36.0% respectively. The overall prevalence of parasites of both fish species was 45.1%. The prevalence of parasites in *O. niloticus* was found to be 42.3% and that of *Cyprinus carpio* was 51.6%. There was statistical significant difference (X^2=5.311, p= 0.021) between the two fish species in the overall prevalence of the parasite infestations. However, the difference in prevalence of parasites among study site was not statistically significant X^2=3.263, p=0.064). In this study, five parasites namely *Contracecum* spp and *Camallanus* spp. (nematoda), *Clinostomum* spp., *Diplostomum* spp. (eye fluck) and *Posthodiplostomum* spp. (Black spot), (trematoda) were recovered with a prevalence of 29.4% (n=212), 13.2% (n=93), 25.3% (n=183), 2.5% (n=18), and 14.8% (n=107) with the overall prevalence of 45.1% (n=325) respectively. There was a statistically highly significant difference (X^2=126.504, p=0.000) in the prevalence and distribution of parasite between the study area. No significant variations (P>0.05) in prevalence of helminthes parasite were noticed in relation to sex and study sites of fishes, but in case of age significant variation was observed (p<0.05) except in which prevalence was observed to significantly increase when age is decreased. Among the parasites recovered *Clinostomum* spp. and *Contracaecum* spp. have been reported to be zoonotic and therefore, more research is required to characterize them and determine their zoonotic importance. Meanwhile, the present study revealed that helminthes parasites are among the major health constrains of fishes in the aforementioned water bodies, demanding an urgent control Intervention.

Keywords: Prevalence; Helminthes parasites; Fish; Amhara; *Contracaecum* spp.

INTRODUCTION

The Ethiopian economy is heavily dependent on the agricultural sector, which has suffered from recurrent droughts and extreme fluctuations of output [1]. In addition, the country depends on inland waters for the supply of fish as a cheap source of animal protein. Ethiopia has a number of lakes and rivers with substantial quantity of fish stocks.

The country has a surface area estimated at 7334 Km^2 of major lakes and reservoirs and 275 Km^2 of small water bodies with 7185 Km of rivers within the country [2]. As a result of these ecological variations, Ethiopia has been the home of highly diversified flora and fauna. More than 200 species of fish are known to occur in lakes, rivers and reservoirs in Ethiopia [3]. The country depends on its inland water bodies for fish supply to its population. Several of these water bodies serve as sources of fish for the country. Fish production system in Ethiopia is

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mainly fish catch type, but there are very limited recent developments in fish farming. In all production systems, subsistence and artisanal fisheries are pre-dominantly practiced [4]. Exceptional to this are Lake Tana, Lake Lugo, Lake Chamo, Lake Awassa and Lake Ziway which are widely commercialized [5]. Micro and macro-dam construction and river impoundment have created innumerable large and small water bodies. Both inland capture fisheries and aquaculture activities are concentrated around the many lakes and rivers in the Rift valley, as well as around the Blue Nile, which supplies water to the country's largest water body, lake Tana [6].

Recently, the data of ministry of agriculture and rural development [7] stated that the total catch of fishes increase from 14,000 in 1998 to 24,257 tons in year 2011. Since then, there was a plan to raise the annual fish production to over 65,000 tons per year. To achieve the plan, there are new constructions of reservoirs and dams throughout the country, to mention some of them: Tendaho reservoir, Tekeze dam, Gilgel Gibe-I, II and III dam, and also the great renaissance dam [8]. These newly constructed reservoirs and dams are stocked by highly productive imported or locally selected fish breeds [9]. There are also emerging commercial river fisheries and aquacultures in some parts of the country.

Aquaculture is growing rapidly worldwide than all other food animal producing sectors. The production has increased from representing 9% of the fisheries resources in 1980 to a current 43%, actual figure, and it is thought that production will need to double in the next 25 years. It promotes not only for being an important source of money, but also for its great contribution to food security and social development of the countries [10]. Fishes are the major sources of food accounting from some 25%to 30% of the total animal protein consumed. Even when consumed in small quantities, fish often comprises a nutritionally important part of many people's diets in developing countries. It is a vital source of protein and micronutrients, and improves the quality of protein in largely vegetable and starch based diets by providing essential amino acids [11].

In most parts of the world, fish production is mainly from the wild [12]. However, as the world's population grows, fish resources are being depleted at an increasing rate as a result of environmental degradation, over harvesting, water pollution and diseases, thus fish production could no longer meet the demand of the stakeholders. Poor environmental conditions and pollution which often results in reduced immunity in fish and higher susceptibility to internal and external parasitic diseases are among the problems facing the fish sector [13]. Parasitic diseases reduce fish production by affecting the normal physiology and if left uncontrolled, it can result in mass mortalities or in some cases, can be served as a source of infection for human and other vertebrates that consumed fish [14,15].

Parasites are important components of host biology, population structure and indeed ecosystem functioning. They can be found in any fish species and within any type of aquatic and culture system [16]. They range from protozoans to metazoans including myxozoans, trematodes, cestodes, acantho-cephalans, nematodes, and crustaceans. The knowledge of the status of parasite diversity in the tropics is still inadequate.

Studies on fish parasites in Ethiopia are very scarce and very few research articles deal with parasites in larger water bodies including a report of fish in lake Tana, lake Ziway and Koka dam [17-19]. This indicates a slow progress in research in fish diseases and parasites. There are also some recently published articles on fish parasites of Ethiopian water bodies such as lake Lugo, lake Small Abaya, lake Ziway and lake Awassa [20,21]. This study therefore aimed to identify the most common economically important parasite of fish and to assess the prevalence and the associated risk factors of the parasite in the aforesaid study lakes.

MATERIALS AND METHODS

Study area

A cross sectional study was conducted from November, 2018 to April, 2019 in selected Lakes such as lake Hayk, Ardibo, Golbo and Maibar the four major lakes found in South Wollo zones of the Amhara regional state, Ethiopia.

Lake Hayq (also called Loggo is a freshwater lake and located in northern Ethiopia, Amhara regional state, South Wollo Administrative zone 433 km far from Addis Ababa the capital city of Ethiopia. Lake Hayq is one of the highland lakes of Ethiopia at an altitude of 2,030 masl. The lake lies between latitude of 11° 15'N and a longitude of 39° 57' E. Also the surface area, mean and maximum depth of the lake is 23 km^2, 37 m and 88.2 m, respectively. The study area is categorized as sub-humid tropical with an annual rainfall of 1173 mm and a mean temperature of 18.2°C. The major rainy season is from July to September. The Lake has no visible outlet and the water is described as clear and greenish. Lake Lugo (Hayke provides a habitat to different fish species, water birds and aquatic organisms. It also plays an economical role *via* tourism and fishery. The fishes that inhabit Lake Lugo are *Oreochromis niloticus* (Nile Tilapia, *Clarias gariepinus* (African catfish, and *Cyprinus carpio* (Common carp.

Lake Ardibo; is situated in the North Eastern part of Ethiopia, South Wollo Administration Zone of the Amhara regional state. It is located at 110 10' 26.9" N, 390 45' 19.2" E at an altitude of 2000 masl. The lake area and its watersheds are about 21 km^2 and 52.6 km^2 in that order. Lake Ardibo water shed is relatively well protected as compare to the nearby lake, lake Haik and the area is over all high elevation/ altitude described by spread trees and bushes as well as natural-grazing field. The climate is sub humid with regular yearly temperature and precipitation of 18°C and 1158 mm, respectively. The surface oxygen is about 4.15 mg/L and surface temperature is relatively colder than lake Hayq (16.3°C).The lake is more turbid with vertical visibility of 1.4 m. Ankerka River flows out of lake Ardibo and drain into lake Hayq (lugo).

Golbo lake is located in Wichale, Ambasel district, at a terrain elevation of above 1894 meters above sea level. It is situated at an altitude of 11°25'0.01" and longitude of 39°35'59.99".

Lake Maibar is located in the North Eastern part of the central Ethiopian highlands situated within the Albuko district, South Wollo, 20 km South-East of Dessie (Figure 1).

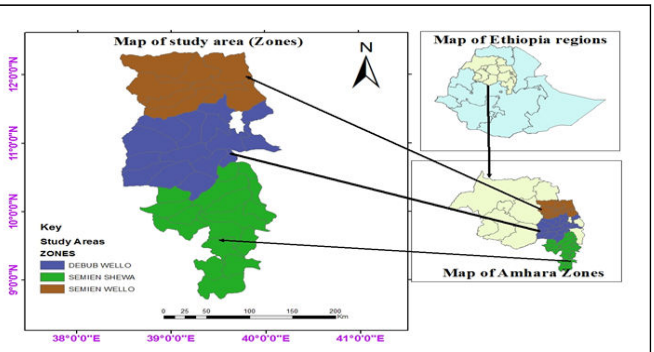

Figure 1: Location of the study area.

Study population

The fish populations that inhabit the lake were so far reported to be the Nile Tilapia (*Oreochromis niloticus*), *Cyprinus carpio*, the African cat fish (*Clarias gariepinus*) and *Barbus* spp. with the Nile Tilapia being the dominant population. However, due to the extreme reduction in the fish population of the lake, only Nile tilapia and *Cyprinus carpio* were the available species included in the current study. Neither African cat fish (*Clarias gariepinus*) nor the *Barbus* spp. was not reachable for sampling during the study period.

Study design

A cross sectional study was conducted from November 2018 to April 2019 at lake Hayik, lake Golbo, lake Ardibo and lake Maibar to identify and assess on the prevalence and risk factor associated with internal and external helminthes parasites infesting fishes.

Sample size determination

The sample size was determined using the formula recommended by Reshid M, et al. Since in lake Maibar, Ardibo and Golbo Lake there was no a any obivious previous investigation conducted on the same title, and expected prevalence of fish parasite was 50% [24]. Thus, by giving attention to this consideration the sample size was calculated based on the 95% confidence limit and 5% sampling error according to the following formula.

$n=z^2$ Pexp (1-Pexp)/d^2

$n=1.962$ Pexp (1-Pexp)/d^2

Where,

n=Required sample size

z=Statistic for a level of confidence

d=Desired absolute precision

Pexp=Expected prevalence

Therefore using the above mentioned formula and the given figures, the sample size was calculated to be 384.

Sampling strategy

All fish samples were randomly selected from the identified important fish species in the area and purchased from fishermen present around the selected lake.

Sex and age determination

The sexes of each fish were determined after dissection and noting the presence of testes or ovaries according to Imam, and Dewu. The weight of each fish was measured and recorded following the procedures described by Paperna and the fishes were categorized into four age groups based on their weight. Accordingly, fish weighing 0.08 kg-0.1 kg were classified as the fingerlings, 0.11 kg-0.2 kg as juvenile, 0.21 kg-0.3 kg as young and >0.31 kg as adult fish.

Sample collection and parasites identification

A total of 721 fish samples were bought following their harvest and rapped within small transparent plastic bags and immediately transported in icebox to the parasitology laboratory of the school of veterinary medicine at Wollo university for their parasitological examination. The species, sex, possible sites of infestation, age of the fish, were initially assessed and recorded. Each sample of fish was evaluated visually and postmortem examination was done using appropriate postmortem kits referring standard evisceration technique previously described by Zhokhov, Mironovsky. All the collected parasites were preserved in 70% ethanol and fixed in Alcohol Formalin Acetic acid (AFA) and glycerin for further identification [16]. The parasites were identified under stereo-microscope by using the standard keys in the literature; and in both study sites and in the laboratory, the age, the species, sex and site of infection were identified and recorded.

Data management and analysis

All the data obtained from the study were analyzed using SPSS statistical software (version-20). Accordingly. Descriptive statistics including frequencies, percentages and the *chi-square* were used for possible explanation of associations to the prevalence of parasites between the selected variables (body weight, length, sex and fish species) for sampled fish. For all statistical analysis, 95% of confidence interval and p-value less than 0.05 ($P<0.05$) was considered statistically significant.

RESULTS

From a total of 721 fish examined, 45.1% (n=325) were found to harbor one or more helminthes parasite species that were located in the mesentery and gastrointestinal tract brachial cavity, between the pharyngeal teeth and ventral side of cranium, gills, stomach, intestines ovary, air sac and liver. The prevalence of parasites infestation was higher in *Cyprinus carpio* 51.6% (n=215) than *Oreochromis niloticus* 42.3% (n=506) fishes. This result shows a significant difference ($P<0.05$) in the prevalence of Helminthes parasite among the two species of fish. Similarly, female 48.8 had higher prevalence of parasites than

male fishes 40.9%; and the difference was statistically significant (p<0.05) (Tables 1).

Table 1: Prevalence of difference risk factor associated with parasitic helminthes infestation.

Variable	Sample examined	No. positive prevalence (%)	95% CI	X^2	P-value
Sex					
Male	342	140 (40.9%)	(37-54.1)	0.82	0.25
Female	379	185 (48.8%)	(26.9- 47.7)		
Age					
Fingerlings	42	35 (83.3%)	(35.5-75.1)	14.3	0.005
Juveniles	155	93 (60%)	(39.8-61.7)		
Young	269	110 (40.8%)	(25.3 -45.5)		
Adult	255	87 (34.1%)	(33.4- 37.6)		
Study site					
Hayik	314	155 (49.4%)	(33.2 -82.1)	3.6	1.41
Ardibo	132	55 (41.7%)	(39.1 -72.5)		
Golbo	150	70 (46.7%)	(33.7- 48.9)		
Maibar	125	45 (36.0%)	(32.6 -45.6)		

Age specific prevalence shows, fingerlings and juvenile age groups of fish are more exposed for parasitic infestation than young and adult groups and the variation was statistically significant, (P<0.05). Concerning the study water bodies, the prevalence of internal parasites of fish was found to be higher in lake Hayik (49.4%), followed by lake Golbo (46.7%), lake Ardibo (41.7%), and finally lake Maibar (36.0%). But the differences were not statistically significant (P=1.41). Four species of internal parasites and one external parasite were identified based on the morphology of their larval and adult stages as shown in Table 1. The species of important parasites recovered from *Oreochromis niloticus* and *Cyprinus carpio* fishes were, *contracaecum* spp., *Clinostomum* spp., *Camallanus* spp., *Diplostomum* spp. and *Posthodiplostomum* with a prevalence of 34.52% (n=212), 29.64% (n=182), 15.47% (n=95), 2.93% (n=18) and 17.42% (n=107), respectively.

The distribution of clinostomum parasites (trematodes) is significantly varied between the different age groups (p=0.00). There was a significant variation in distribution of Diplostomum spp. (trematodes) between the different sex groups, however, there is no significant difference (p>0.05) in the prevalence of *Contracecum* spp., *Clinostomum* spp., *Camallanus* spp., and *Posthodiplostomum* spp. when sex of the fishs is concerned. There is a significant difference between *C. Carpio* and *O. niloticus* fishes in parasite infestation (p<0.05), except *Camallanus* spp. and *Diplostomum* spp. (p>0.05).

In addition, the prevalence of *Posthodiplostomum* blackspot was significantly higher in Ardibo (20.5%) and Golbo lakes (20.0%) than lake Hayik (11.1%) and Maibar lakes (12.0%). *Diplostomum* spp. was identified from lake Hayik (4.1%) and lake Maibar (2.5%) and there was statistically significant difference in distribution of parasites between the studies water bodies (p=0.008) (Table 2). The frequency of occurrence and prevalence of different fish parasites identified in this study is summarized on Table 3. The present study also revealed mixed infestation of *contracaecum*, *Clinostomum*, and black spot, and *Contracaecum* and *Diplostomum*, *Contracaecum* and *Camallanus*, with a prevalence of 5.22%, 4.6%, and 2.5%, respectively.

Table 2: Prevalence of helminthes parasites in fish in the selected water bodies of south Wollo (n-721) during the study periods.

Parasite species	Taxonomic group	Number of fish infested (%)		Total parasites distribution (%)	Parasites burden (%)	χ^2 (p-value)
		Oreochromis niloticus	*Cyprinus carpio*			
Contracaecum spp.	Nematoda	135 (26.7%)	77 (35.8%)	212 (34.52%)	359 (40.47%)	6.065, p=0.014)
Clinostomum spp.	Trematoda	118 (23.3%)	64 (29.5%)	182 (29.64%)	284 (32.01%)	5.804, p=0.055)
Camallanus spp.	Nematoda	70 (13.8%)	25 (11.6%)	95 (15.47%)	105 (11.83)	0.642, p=0.423
Diplostomum spp. (eye flukes)	Trematoda	13 (2.6%)	5 (2.3%)	18 (2.93%)	32 (3.60%)	0.037, p=0.848
Posthodiplostomum (Black Spot)	Trematoda	64 (12.6%)	43 (20.0%)	107 (17.42%)	107 (12.06%)	6.453, p=0.011
Total		400 (65.14%)	214 (34.85%)	614 (100%)	887 (100%)	

Table 3: Prevalence of helminthes parasites of fish in different lakes of the eastern Amhara regional state, South Wollo zone.

Risk factor and variables		No. of fishes	Prevalence (%)	*Contracaecum* spp.	*Clinostomum* spp.	*Camallanus* spp.	*Diplostomum*	*Posthodiplostomum* (Black spot)
Area	Hayk	314	155 (49.4%)	98 (31.2%)	90 (28.6%)	49 (15.6%)	13 (4.1%)	35 (11.1%)
	Ardibo	132	55 (41.7%)	44 (33.3%)	33 (25.0%)	16 (12.1%)	0 (0.0%)	27 (20.5%)
	Golbo	150	70 (46.7%)	40 (26.7%)	30 (20.0%)	15 (10.0%)	0 (0.0%)	30 (20.0%)
	Maibar	125	45 (36.0%)	30 (24.0%)	30 (24.0%)	15 (12.0%)	5 (4.0%)	15 (12.0%)
Total		721	325(45.1%)	212 (29.4%)	183 (25.3%)	95 (13.2%)	18 (2.5%)	107 (14.8%)
P-value			0.064	0.287	0.509	0.359	0.008	0.014
Species	*O. niloticus*	506	214 (42.3%)	135 (26.7%)	118 (23.3%)	70 (13.8%)	13 (2.6%)	64 (12.6%)
	C. carpio	215	111 (51.6%)	77 (35.8%)	65 (30.3%)	25 (11.6%)	5 (2.3%)	43 (20.0%)
Total		721	325 (45.1%)	212 (29.4%)	183 (25.3%)	95 (13.2%)	18 (2.5%)	107 (14.8%)
P-value			0.021	0.014	0.055	0.423	0.848	0.011
Sex	Male	342	140 (40.9%)	89 (26.0%)	84 (24.6%)	40 (11.7%)	4 (1.2%)	53 (15.3%)
	Female	379	185 (48.8%)	123 (32.5%)	99 (26.2%)	55 (14.5%)	14 (3.7%)	54 (14.2%)
Total		721	325 (45.1%)	212 (29.4%)	183 (25.3%)	95 (13.2%)	18 (2.5%)	107 (14.8%)
P-value			0.034	0.058	0.583	0.264	0.03	0.638
Age	Young	361	179 (49.6%)	116 (32.1%)	118 (32.7%)	46 (12.7%)	5 (1.4%)	45 (12.5%)
	Adult	360	146 (40.6%)	96 (26.7%	65 (18.1%)	49 (13.6%)	13 (3.6%)	62 (17.2%)
Total		721	325 (45.1%)	212 (29.4%)	183 (25.3%)	95 (13.2%)	18 (2.5%)	107 (14.8%)
P-value			0.015	0.107	0	0.73	0.055	0.072

DISCUSSION

The overall prevalence of internal parasitic helminthes of fish in the four selected water bodies (lakes) was found to be 45.1% recovered from *Oreochromis niloticus* and *Cyprinus carpio* species of fish that were located in the mesentery and gastrointestinal tract brachial cavity, between the pharyngeal teeth and ventral side of cranium, stomach, intestines, gills, kidney and muscle. The common parasites were recorded as *Contracaecum*, *Camallanus* (*nematodes*), *Clinostomum*, *Diplostomum* (eye flukes) and *Posthodiplostomum* (black spot) (trematoda). The prevalence of the parasite was found in different rate such as 29.4%, 25.3%, 13.2%, 2.5% and 14.8% respectively. The current findings were relatively higher than the findings of, who had reported a prevalence of 10.6%, 20.83%, 30.9% and 20% from lakes Elan, Ziway, Gilgel-Gibe Ethiopia and Lekki Lagoon, cross river flood system, Southeastern Nigeria, respectively. However, the finding of the present study was lower than the finding of and, who reported 66.3% and 47.8%, from Koka reservoir and Lake Lugo (Hayke) Ethiopia, respectively. The differences might be due to the differences in composition of the water, (dissolved oxygen, temperature, salt content, pH and eutrophication), climatic conditions of the areas, season and host parasite relationships.

The most abundant parasitic species in the study site was *Contracaecum* parasites, which is isolated with a prevalence of (35.8%) from *Cyprinus carpio* and (26.7%) from *Oreochromis niloticus*. This may be attributed to the fact that this parasite has and infests wide range of final and intermediate hosts such as fish eating birds (cormorants and pelicans) and larval stages are seen in cyprinds (carp and related species), channel catfish and tilapia. The differences in prevalence among the different study sites were not statistically significant ($p>0.05$), except for trematodes species such as *Diplostomum* and *Posthodiplostomum* which has a significant variation in prevalence ($p=0.008$) and ($p=0.014$) respectively. The prevalence of *Contracaecum* parasites in our results is lower when comparing with other works, like the work of Abera L, 39.9% in northern Tana, other works in lake Naivasha 85% in lake Baringo 70% and in lake Magadi 80% were reported by Onyedineke N, in southern gulf of lake Tana (59.77%) in Ethiopia at Lake Awassa.

In the present study 70 (13.8%) *Camallanus nematode* parasitis was recovered from *O. niloticus* and 25 (11. 6%) recovered from *Cyprinus carpio* at the study lakes. *Nematode* usually considered as the most economically important parasite of fishes of the world.

The prevalence of *Contracaecum* parasite of Africa cat fish was also lower than the previous report at Lake Chivero (42.6%), Zimbabwe and 46% from lake St. Lucia. The current study was in compass with the work of Chandra K in lake Alau (23.8%), and prevalence reported by Yohanes Tafere, 27.60% at lake Awasa Ethiopia. In the contrary the current prevalence was higher than the prevalence recorded from lake Ziway 5.33% in Ethiopia, and the work of Barson M in the same lake 8.60%and the findings of Fasil N, 12.62% in lake Zeway. This high discrepancy in prevalence of parasitic nematode might be due to the geographical variation, difference offering suitable ecological niches for the parasite. As described by Reshid M Paperna, the present of intermediate hosts and prevailing physiochemical factors will affect parasitic diseases. Moreover, the hygienic conditions and the prevailing climatologically factors may affect the distribution of parasites.

As described earlier the differences in prevalence among the different study sites were not statistically significant, although, the highest prevalence was recorded in lake Hayik (49.4%), followed by lake Golbo (46.7%) and lake Ardibo (41.7%) and the list lake Maibar (36.0%). This difference might be due to differences in overcrowding, poor environmental conditions and pollution levels of the different study sites which often result in reduced immunity of fish and higher susceptibility to parasites and other diseases.

In the current study, female had higher prevalence of internal parasitic helminthes (48.8%) than male fish (40.9%), but the difference between sexes was not statistically significant ($p>0.05$). This finding agrees with the finding of in lake Lugo (Hayke), in lake Babogaya, in lakes Chamo, Hawassa, Ziway and Tana, in lake Tana. This might be due to the fact that female can exposed for different stressing factor acquiring from searching of shelter and feed for preparing themselves to be ready for ovoposition, this may decrease the immune system which leads easily to parasitic infestation. It was justified by Emere, M.C, et al. to be due to female fish especially the gravid once are susceptible to helminthes infections as the physiological state could reduce their resistance. However, the result was contradicted with the findings in lake Ziway, Ethiopia, in small Abaya lake, Silte Zone, Ethiopia; in lake Elan, Ethiopia and in the Mid Cross river flood system, Southeastern, Nigeria. This might be due to the exhaustion of male's immunity by frequent insemination of females when the fish stock is available.

The current study revealed that there is statistical significant difference in the infection rate of parasite helminthes between *O. niloticus* (42.3%) and *C. caprio* (51.6%). These findings agree with the finding of Yanong RPE who is reported 42.27% from Koka reservoir, Ethiopia, from lake Tana Ethiopia, who had reported 24.64%, prevalence of *Contracaecum nematode* in *C. caprio* fish and 42.3% in *O. niloticus* fish species. The highest parasitic infections in *C. caprio* in the present study could be associated with the highest number of sampling Nile tilapia during the study period and with the prevalence and intensity dependent on factors of parasite species and their biology, host and its feeding habits and presence or absence of the intermediate hosts in the study ponds and rivers. Similar finding had been reported from lake Lugo (Hayke), Ethiopia with the highest number of parasites was recovered from *C. caprio* (61.95%) than in *O. niloticus* (5.15%) by Amare, A, et al.

In the present study, the highest prevalence was recorded in fingerlings and juvenile age groups as compare to adult and older groups. This finding was agrees with Akinsanya B, et al. who stated that the low level of immunity in the smaller sized fish could explain the high prevalence of helminthosis, but contradicts with the findings of Allumma MI, et al. and Amare A, et al. who had explained that the older the fish, the more exposed to parasite infection, as adult fish consumes a great variety of foods and exhibit a great variety of feeding styles that leads them to the ingestion of intermediate or paratonic hosts

harboring infective stages of helminthes parasites inside their body.

The most common parasite genera encountered in the present study were *Contracaecum* (29.4%) followed by *Clinostomum* (25.3%), and *Camallanus* (13.2%). Similar results were reported by Yanong RPE, et al. who had documented a prevalence of 24.8% for *Contracaecum* followed by *Clinostomum* (27.4%) and *Camallanus* (2.73%) from *Oreochromis niloticus* fish in Koka reservoir, Ethiopia. and Amare A, et al. who had also reported a prevalence of 42.6% for *Contracaecum* and 38.6% for *Clinostomum* in lake Lugo, Ethiopia. Also reported a prevalence of 62.50% from *Contracaecum* and 31.25% from *Clinostomum* at lake Ziway, Ethiopia. The higher prevalence of *Contracaecum* might be due to the fact that the parasite has a wide host range of aquatic birds that can serve as final and intermediate hosts (cormorants and pelicans) and larval stages are known to occur in most African fresh water fish, including carp and related species, channel catfish and tilapia.

Prevalence of *Contracaecum* in lake Lugo, Ardibo, Maibar, and Golbo lake was 31.2%, 33.3%, 26.7% and 24.0% respectively. This result was lower than the result of others reported in lake Tana by Tesfaye G, et al. which was 59.77% and Tefera W, et al. that was reported 68.7% for the same lake and fish species, but the current prevalence was much higher than reported in lake Hawassa and Chamo by Tefera W, et al. which was 10.6%. The different results obtained may be related to the abundance of the first intermediate host, which is more seasonal, and the difference in sampling habitats.

The most prevalent trematode species was the genus *Clinostomum* which was recovered from the brachial cavity of *Oreochromis niloticus* (23.3%) and *Cyprinus carpio* (30.3%). The helminthes larval parasites belonging to genera *Clinostomum* species are known to occur in most African freshwater fish. The finding of the present study was lower than the findings of Tefera W, et al. In lake Awassa reported *Clinostomum* metacercaria with prevalence rate of 75.67% in *Oreochromis niloticus*. Tefera W, et al. reported metacercaria of *Clinostomum* with prevalence rate of 60.98% and 74.32% respectively. Amare A, et al. recorded *Clinostomum* species in lakes Awassa and Chamo with prevalence rate of 63.2%. However, the finding of the present study was higher than the prevalence reported by Wudneh, T, et al. 9.86% and the 9.09% Barson M, et al. prevalence reported by Barson M. Other prevalence which is lower than the current findings were also reported by Reshid M, et al. with a prevalence of 18.8% in Small Abaya lake, with a prevalence of 20% in Wonji cages and 23.3% in Yemlo pond. The difference could be due to the longtime interval between the previous studies and the dynamic nature of intermediate host (snail) and the presence of large population of snails and aquatic birds around the lake that harbor adult parasites. In addition, this might also be due to the effect of pollutants that arise from floriculture near the lake and disposal of fish offal into the lake. Fish in polluted waters tend to harbor more endoparasites than those from less polluted environments.

Diplostomum spp. (eye flukes) metacercariae were found free in the vitreous humor of the eyes. and recovered 13 (2.6%) from *O. niloticus* and 5 (2.3%) from *Cyprinus carpio* which is lower than that of Barson M, et al. who reported a prevalence of 41.97% from *O. niloticus* and *Cyprinus carpio* fish in lakes Ziway. This variation may be attributed to the availability of piscivorous birds and snail intermediate host. However the presence of large number of eye fluke in the eye can lead to blindness and susceptible to predation and reduced growth rate. The free metacercaria are known to cause severe damage to the lenses Paperna I, et al. and hence lens cataract and consequently blindness follows.

In the current study black spot digenean trematodes were recovered from *O. niloticus* and *Cyprinus carpio* of fish species with a prevalence of 12.6% and 20.0% respectively. The prevalence of this trematode is much lower than study conducted by Paperna I, et al. This variation may be attributed to the presence of intermediate and definitive hosts Eshetu Yimer, et al. and water quality parameters in the study water bodies. The parasite mainly attack skin, gills and fins of the fish. The skin, fins, muscle, in visceral districts and gills are the predilection sites where black spot metacrcaria parasites insisted on the fish. The black spot appearance is the result of cysts consolidation around these metacercariae incorporate dermal melanophores and other chromophores. Even if infestations of these parasites causes relatively little damage to the fish, there is some evidence that heavily infected juvenile fish may suffer stress, weight loss and even death.

In the present study, single infection was the predominant case. Mixed infection was common due to the fact that the environment supports several parasites species there by exposing the host to concurrent infections. It might also be due to the presence of one parasite and its activity within the host weakens the resistance of the host fish which leads to concurrent infection development.

CONCLUSIONS

The results of the present study in Lake Lugo, Ardibo, Maibar and Golbo entailed that the importance of external and internal parasitic infestation as it affects health, palatability, productivity, market and aesthetic value of fish. The prevalence of external and internal parasitic infestations was very high and the study determined five parasitic species present in fish. In the present study showed that different genera of parasites were identified in *O. niloticus* and *Cyprinus carpio* fish. The nematode *Contracaecum* spp. was found to be the most dominant internal parasite of *O. niloticus* and Cyprinus carpio in the study area. *Clinostomum* spp. was also the common Digenean parasites recovered from *O. niloticus* and *Cyprinus carpio*. The observed infection rate were predominantly related on the distribution of piscivorours (pelicans) birds which are abundant in area where there is high fishing activities and increase number of discarded filleted wastes. More over the presence of the parasite has zoonotic importance and decrease the market value of commercially important fish species. Therefore, based on the above conclusion, the following recommendations were forwarded:

- The nearby fisher men should be aware of fish parasites and at the time of gutting and filleting they should not throw offal to

the water bodies so as possible to minimize infection and the number of piscivorous birds visiting the area.

- Consumers should not eat uncooked or slightly cooked fish and health education should be given for them on the risk of eating raw and partly cooked fish.
- Effective parasite control program should be incorporated in the management of the lake.

REFERENCES

1. Lamtane HA, Mgaya YD, Bailey RG. Effects of water quality and flooding episode on the yield of *Oreochromis urolepis* from self-stocked ponds. Fish Aquatic Sci. 2017;20(30):75-77.
2. Janko AM. Fish production, consumption and management in Ethiopia. J Agric Environ Manag. 2014;3(9):460-466.
3. Alemu AE, Nuru SM, Gebremeskel DT. Livelihood effects of fishing and constraints affecting participation in Fishing in Tigray. Res J Soc Sci Manag. 2015;9:318-324.
4. Muktar Y, Tesfaye S, Tesfaye B. Present status and future prospects of fish vaccination: A review. J Vet Sci Technol. 2016;7(2):299.
5. Tadlo AM, Mebratu MB. Challenges and possible mitigation of Ethiopia fishery: A review. Int J Fish. 2017;5(1):241-246.
6. Anyamba A, Linthicum KJ, Tucker CJ. Climate-disease connections: Rift valley fever in Kenya. Cad Saude Publica. 2001;17:S133-S140.
7. Hecht T, Endemann F. The impact of parasites, infections and diseases on the development of aquaculture in sub-Saharan Africa. J Appl Ichthyol. 1998;14(4):213-221.
8. Ayotunde EO, Stephen N, Okey IB. Parasitological examinations and food composition in the gut of feral African carp, *Labeo coubie* in the cross river, Southeastern, Nigeria. Afr J Biotechnol. 2007;6(5): 625630.
9. Marcogliese DJ. Parasites of fish in fresh water; EMAN, Canada. Bio Res. 2008;6(1):1-11.
10. Zekarias T, Yimer E. Study on parasites of fish at Lake Awassa, Ethiopia. Bull Anim Health Prod Afr. 2007;55(3):149-155.
11. Yimer E, Mulualem E. Parasites of fish at Lake Tana, Ethiopia. Faculty of science, Addis Ababa University, Ethiopia. In: Sinet: Ethiop J Sci. 2003;26(1):31-36.
12. Jossy B, Daniel H. Prevalence of internal parasites of *Oreochromis niloticus* and *Clarias gariepinus* fish species in Lake Ziway, Ethiopia. J Aquac Res Dev. 2015;6(2):308.
13. Amare A, Alemayehu A, Aylate A. Prevalence of internal parasitic helminthes infected *Oreochromis niloticus (Nile Tilapia), Clarias gariepinus* (African Catfish) and *Cyprinus carpio* (Common Carp) in Lake Lugo (Hayke), Northeast Ethiopia. J Aquac Res Dev. 2014;5(3): 1-5.
14. Reshid M, Adugna M, Redda YT, Awol N, Teklu A. A study of *Clinostomum* (trematode) and *Contracaecum* (nematode) parasites affecting *Oreochromis niloticus* in Small Abaya Lake, Silite Zone, Ethiopia. J Aquac Res Dev. 2015;6:316.
15. Thrusfield M. Sampling. In: Veterinary epidemiology. Black Well Science Ltd, London, 2005.
16. Imam TS, Dewu RA. Survey of piscine ecto-and intestinal parasites of clarias species sold at Galadima Road Fish Market, Kano metropolis, Nigeria. Biosci Res Communicat. 2010;22(4): 209-214.
17. Paperna I. Parasites, infections and diseases of fishes in Africa. An update. 1996:175.
18. Allumma MI, Idowu RT. Prevalence of gills helminth of *Clarias gariepinus* in Baga side of Lake Chad. J Appl Sci Environ. 2011;15(1): 47-50.
19. Zhokhov AE, Mironovsky AN, Miretskaya DA. Methods of the complete Parasitological dissection of fish. Freshwater biology group, JERBE, Moscow–Addis-Ababa. 2007:1-2.
20. Paperna I. Parasites, infections and diseases of fishes in Africa: An update. 1996; 216.
21. Roberts RJ. Fish pathology (Eds). Technical Director, Landa catches Ltd. Scotland, 2001:270-300.
22. Klinger RE, Francis-floyd R. Introduction to fresh water fish parasite. 3rd ed, Florida. 2002;716:1-12.
23. Bedasso GT. Study on the prevalence and temporal abundance of parasites of fishes in Lake Elan. Fish Aquac J. 2015;3(7):265-269.
24. Akinsanya B, Hassan AA, Adeogun AO. Gastrointestinal helminth parasites of the fish *Synodontis clarias (Siluriformes: Mochokidae)* from Lekki lagoon, Lagos, Nigeria. Revista de Biologia Tropical. 2008;56(4):2021-2026.