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Prevalence And Diversity Of Internal Cestode Parasites Of The Nile Tilapia (Oreochromis Niloticus) And African Catfish (Clarias Gariepinus) In Different Altitudes And Ponds In Kenya

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***Abstract:** This research study focused on how altitudes and ponds of fresh water affect prevalence and diversity of internal cestode parasites in the (O. niloticus) and (C. gariepinus) in Kenya. This study was designed to find the source of high mortality and retarded growth of fish farmers farming industry of these two commercial species in fresh water ponds. In many part of Kenya majorities of fish farmers complained with small and low production of quality fish. A total 520 fish samples of fresh water from farmer ponds were examined between January to June 2016 for internal cestode parasites, 100 fish were C. gariepinus and 420 of O. niloticus. These fish were collected from three counts; Kirinyaga, Kisii, and Uasin gishu. The sampled fish were placed in transportation containers (1MX1Mx1M) a half filled with water and transported alive to the laboratory for parasites examination. The specimens were slaughtered and dissected by sterilized knifes and pair of scissors from anus to the lower jaw. Three internal cestode parasites of Diphyllobothrium latum, Proteocephalus species and Caryophyllaeidea species were recovered and recorded from this study sites. The prevalence of internal cestodes parasites indicated high at Kisii 36% and Kirinyaga 35.40%, and lower in Uasin Gishu 27.70%. The study also indicate that there was a significant relationship between altitude and the number of parasites (p=0.0010); there was no significant relationship (p=0.06657) between the nature of ponds constructed and cestodes parasites prevalence and diversity. The study concluded that, this variation of altitudes and ponds had effect on parasites prevalence and diversity between sites and fish.*

***Keywords:** Internal cestode parasites, altitudes, diversity, Tilapia and prevalence.*

I. INTRODUCTION

Kenya's fish farming has experienced great growth since 2009 as a result of the Economic Stimulus Program (Charo-Karisa and Gichuri, 2010; Musa *et al.*, 2012). Increasing fish production without improving management of the fish farm may result in bacterial, viral, fungal and parasitic origin infestations. On average 80% of fish diseases are parasitic especially in warm water fish, and severe fish mortalities as a result of parasites have been reported (Shalaby and Ibrahim, 1988; Eissa, 2002 and Amare *et al.*, 2014). Fish parasites specifically cestodes are known to inhibit fish nutrient absorption and is more pronounced in cultured species due to overstocking coupled with poor water quality management (Edema *et al.*, 2008; El-seify *et al.*, 2011). Most species of fish are vulnerable to various parasitic infections depending on the species. When parasites are numerous they cause stress that may lead to fish deaths (Bellay *et al.*, 2012b). Research findings indicate that in fresh water parasites, only larvae of *Diphyllobothrium dendriticum* and *Diphyllobothrium latum* infect people. The cysts of *D. dendriticum* live in a number of fish species. When *D. dendriticum* consumed by human, the cysts walls are digested and larvae emerge that grow into mature tapeworms in the infected individual’s intestine.

Parasites constitute more than half of all biodiversity and form an integrative core of biodiversity survey and inventory, conservation and environmental integrity as well as ecosystem functioning (Toft, 1986). Fish parasite biodiversity and species composition in the aquatic environment depends on host species richness and their ecosystem (Palm, 2011). There are 1211 known freshwater fish's parasite species representing 5 phyla and 11 classes of invertebrates (Bykovskaya *et al.*, 1964). The major parasitic groups found in the freshwater fishes include trematodes, nematodes, acanthocephalans and cestodes. These complete their life cycles through intermediate hosts such as piscivorous birds (Schmidt, 1990). In nature, parasites are known to serve as host population regulators and pose serious threats to human health, agriculture, natural systems, conservation practices, and the global economy (Horwitz and Wilcox, 2005; Brooks and Hoberg, 2006).

The study was aimed investigating the effect of diversity and prevalence of internal cestodes parasites in different altitudes and ponds of cultured *O. niloticus* and C. *gariepinus* in fresh water in Kenya. The study was designed to cast out the prevailing cultured fish health status specifically in relation to parasite load fish farming ponds, and altitude on domesticated fish of *O. niloticus* and *C. gariepinus*.

II. MATERIALS AND METHODS

STUDY DESIGN AND SAMPLING METHODS

The study used experimental and cross-sectional study designs for sample collection. Sampling sites was undertaken due to climate, time limitation and financial constrain. Purposive selection ensured that the samples were representative of area under study with sample error minimized and that all samples had equal chance of selection on the following specific objectives: To evaluate the effects of the nature of ponds constructed and altitudes found on the diversity and prevalence of parasites in *O. Niloticus* and *C. gariepinus*in fresh water ponds. The study was involved 15 farmers and 17 fresh water ponds. A total of 520 live fish comprising of 420 *O. niloticus* and 100 *C. gariepinus* were sampled and examined for internal cestodes parasites. 144 *O. niloticus* and 40 *C. gariepinus* were sampled in Kirinyaga, 162 *O. niloticus* and 30 *C. gariepinus* in Kisii while in Uasin Gishu, a total of 114 *O. niloticus* and 30 *C. gariepinus* were sampled and examined for internal cestodes. The sampled fish were placed in transportation containers (1MX1Mx1M) a half filled with water and transported alive to the laboratory for parasites examination. 144 *O. niloticus*, 40 *C. gariepinus*, 162 *O. niloticus* and 30 *C .gariepinus* and 114 *O. niloticus* and 30 *C. gariepinus* were sampled in Kirinyaga, Kisii and Uasin Gishu Counties respectively for parasite analysis. *O. niloticus* and *C. gariepinus* fish species that were bought from farmers ponds during sample collection period. Five fish farmers were selected randomly from each of the three study counties. The fish were sampled from 17 ponds. The respondents (farmers) were selected using purposeful and judgmental sampling techniques. GPS were used to allocate the study ponds. The altitudes of all counts were obtained from fisheries officers. This study involved both qualitative and quantitative data collections techniques. Questionnaires and face-to-face interview to provide qualitative data and laboratory experiment to give quantitative data. The sample size for the field study was calculated using formula developed by Mathenge (2010).

DATA ANALYSIS

The data of altitudes (Sites) and ponds of all counts collected from field were coded and stored in Microsoft excel. Finally these data were analyzed using MINITAB- Statistic software, Statistical Significance was tested at 0.05, Fisher Exact test were used to test for significance between sites (altitude) and ponds in comparison to parasites. Chi square test were used to check Likelihood Ratio and Linear by Linear association of parasites by sites.

III. RESULTS

Parasites * Altitude Cross tabulation

	Parasites range	Percentage count	Altitude (Sites) 1280m	1700m	2100m	Total
Parasites	0	Count	108	79	93	280
		% within Parasites	38.60%	28.20%	33.20%	100.00%
	Between 1 and 4	Count	68	65	82	215
		% within Parasites	31.60%	30.20%	38.10%	100.00%
	Between 5 and 8	Count	13	0	9	22
		% within Parasites	59.10%	0.00%	40.90%	100.00%
	Between 9 and 12	Count	3	0	0	3
		% within Parasites	100.00%	0.00%	0.00%	100.00%
Total		Count	192	144	184	520
		% within +None Parasites	36.90%	27.70%	35.40%	100.00%

Table 1: Cross tabulation between altitudes of three counts and prevalence and diversity of internal cestode parasites

The results shows that the high number (82, 38.10%) of fish parasites observed in altitude 2100m at the range of 1to 4 per fish. However when the number of fish count between 3 to13, the number of parasites counts per fish increases between 5 to 12 respectively (table 1).

Tests for association of variables: Fisher and Chi-Square Tests

	Value	df	Statistical Sign(p=) sign(p=) .
Fisher Exact test			0.0010
Chi square test:			
Likelihood Ratio	24.079.23	6	0.001
Linear-by-Linear	0.009	1	0.914
N of Valid Cases	520	-	-

Table 2: Relationship between prevalence of internal cestodes parasites and the altitude

Fisher Exact test indicated that there was significant relationship between altitude (p=0.0010) and the number of parasites, similar results were found in likelihood ratio (p=0.001), however Linear-by-Linear Association had no significant (p=0.914) (table 4).

Crosstab							
			Nature of Pond				Total
			Concrete pond	Earthen pond	Raised pond	Liners pond	
Cestodes	*Caryophyllaeidea species*	Count	13	2	0	3	18
		% within Cestodes	72.20%	11.10%	0.00%	16.70%	100.00%
	Protocephalus species	Count	28	18	16	4	66
		% within Cestodes	42.40%	27.30%	24.20%	6.10%	100.00%
	Diphyllobothrium latum	Count	19	14	6	7	46
		% within Cestodes	41.30%	30.40%	13.00%	15.20%	100.00%
	Double Cestodes In a fish	Count	0	0	1	2	3
		% within Cestodes	0.00%	0.00%	33.30%	66.70%	100.00%
Total		Count	60	34	23	16	133
		% within Cestodes	45.10%	25.60%	17.30%	12.00%	100.00%

Table 3: Relationship between the nature of ponds and internal cestodes parasites prevalence and diversity

The study findings indicate that concrete ponds had high percentage of *Caryophyllaeidea species* 72.20% (13), *Protocephalus species* 42.40% (28) and *Diphyllobothrium latum* 41.30% (19) than other ponds (table 3). Furthermore, one fish sample from raised pond and two in liners pond observed to have double cestodes respectively (table 3).

Crosstab							
			Nature of Pond				Total
			Concrete pond	Earthen pond	Raised pond	Liners pond	
Parasites	None	Count	116	132	24	20	292
		% within Parasites	39.70%	45.20%	8.20 %	6.80%	100.00%
	Between 1 and 4	Count	88	82	27	23	220
		% within Parasites	40.00%	37.30%	12.3 0%	10.50 %	100.00%
	Between 5 and 8	Count	4	4	7	7	22
		% within Parasites	18.20%	18.20%	31.8 0%	31.80 %	100.00%
	Between 9 and 12	Count	0	0	3	0	3
		% within Parasites	0.00%	0.00%	100. 00%	0.00%	100.00%
Total (sampled specimen)		Count	208	218	61	50	537
		%within+none Parasites	38.70%	40.60%	11.4 0%	9.30%	100.00%

Table 4: Relationship between the nature of ponds and distribution of prevalence and diversity number of internal cestode parasites

Table 4. The result shows that increasing the number of fish count on Concrete Earthen ponds, decreasing the number of parasites count. Whereas, decreasing the number of fish count in all four ponds type, the number of parasite count per fish increasing

Tests for association of variables: Fisher and Chi-Square Tests			
	Value	df	Statistical Sign(p=) sign(p=)
Fisher Exact test	-	-	0.06657
Chi square test:			
Likelihood Ratio	39.807	9	0.000
Linear-by-Linear Association	15.824	1	0.000
N of Valid Cases	520	-	-

Table 5: Relationship between the nature of ponds and prevalence and diversity of internal cestode parasites

Table: 5. The results indicate that there is no significant relationship Fisher Exact test (p=0667) Significant found in both Likelihood Ratio (p=0.000) and Linear-by-Linear Association (p=0.000) between the nature of ponds constructed and parasites prevalence.

Type of Fish * Parasites Cross tabulation							
			Parasites				Total
			None	Between 1 and 4	Between 5 and 8	Between 9 and 12	
Type of Fish	*O. niloticus*	Count	235	173	12	0	420
		% within Type of Fish	56.00 %	41.20%	2.90 %	0.00%	100.00 %
	C. gariepinus	Count	45	42	10	3	100
		% within Type of Fish	45.00 %	42.00%	10.00 %	3.00%	100.00 %
Total		Count	280	215	22	3	520
		% within Type of Fish	53.80 %	41.30%	4.20 %	0.60%	100.00 %

Table 6: Cross tabulation of type of fish and the percentage internal cestode parasites prevalence

Table 6. The results show that *O. niloticus* were less infected with internal cestodes compared to *C. gariepinus*. While the number of internal parasites loads depend on number of fish, an increasing rate of fish population density, the number of internal parasite load decreasing. Example when fish count of 235 in *O. niloticus* sp none of parasites obtained but when fish count is 12 the parasite load range between 5 and 8 respectively (Table 6).

IV. DISCUSSION

The nature of ponds that were examined in this study indicated insignificant relationship with prevalence of internal cestodes on *O. niloticus* and *C. gariepinus*. High likelihood of harboring internal cestode parasites was observed in concrete, liner and raised ponds compared to the earthen ponds. This outcome was observed in all the three counties of this study. Fish tend to die more in raised, liner and concrete ponds than do in earthen ponds (Edema *et al*., 2008) as a result of poor environmental conditions which encourage the existence of parasites especially internal cestodes that attack fish causing mortality. Unlike raised, liner and concrete ponds, earthen ponds provides a more natural environment which provide a conducive haven for fish to live in comparison to streams, river and lakes to some extent (Edema *et al*., 2008; El-seify *et al*., 2011.) Raised, liner and concrete ponds have a tendency to accumulate organic matter from fish wastes and unfed food that cause high levels of ammonia, low dissolved oxygen and high bacterial load creating a suboptimal environment that can be stressful for the fish and lead to an outbreak of parasitic infections (Abowei *et al*., 2011; Amare *et al*., 2014).The present study observed that there is no significance between ponds and internal cestode parasites hence justified that all ponds have no problem with parasites therefore differ to above studies. The presence poor living environment of fish caused by reduced management is major contributing factors for the development of parasites and their intermediate host.

The Fisher Exact test indicate that there was high significant relationship between altitude and the number of internal cestode parasites in *O. niloticus* and *C. gariepinus* as shown on. The altitudes of all the three study areas had conducive environment for various birds such as kingfishers, herons, cormorants and stocks, copepods and human beings which are known as intermediate hosts of most of internal cestodes that parasitize fish hence maintaining complete life cycle required by parasites to survive. The Cross tabulations between altitude and prevalence and diversity of internal cestode parasites in indicate that *Caryophyllaeidea* species had less prevalence compared to *Proteocephalus* sp and *Diphyllobothrium latumre,* observed on both fish species of *O. niloticus* and *C. gariepinus* and altitudes. This may be because of intermediate host of these parasites possessed less adult worm parasites in their body. The Kisii County observed high intensity of parasites compared to other sites. According to Mdegela *et al* (2011) altitude of the waters have an effect on the likelihood on infection and the number of parasites infecting fishes in fresh water ponds. The source of water of this study observed that farmer use more than 60% of rivers and stream water this may also be another sources of internal cestode parasite from one place to another.

V. CONCLUSION

There is relationship between altitude and the number of internal cestode parasites. Altitudes play a major role in regulating the fish parasites load. On the other hand, population density of fish observed to have an effect on parasite number. There is biodiversity of cestode parasite of significant important in human and animal health. Both two fish types likely attract more parasites of *Protocephalus species* than other species. It is confirm that the nature of ponds determine the internal cestodes parasites sp, prevalence and diversity. This study provides baseline information on prevalence and diversity of internal cestode parasites of the Nile Tilapia (*Oreochromis niloticus) and AfricanCatfish (Clarias gariepinus)* in different Altitudes and ponds in Kenya. There is a need however, for in-depth study of the management of fish farming ponds in general. This may provide information on the source of variation and population density of cestode parasites. Thus provide better option of controlling internal fish cestodes.

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