Survey of *Fasciola, Dicrocoelum* and *Paramphistomum* in Ruminants at Debre Zeit Industrial Abattoir, Ethiopia

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Key words: Bovine, Debre Zeit, goats, Helmex, prevalence, sheep, trematodes

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Page No.: 19-23
Volume: 15, Issue 4, 2016
ISSN: 1680-5593
Journal of Animal and Veterinary Advances

Abstract: In this study, investigation and determination of the prevalence of parasitic trematodes and assessment of risk factors of trematode infection in cattle, sheep and goats were conducted from December, 2010 to April, 2011 in Hashim Nur's Ethiopian livestock and meat export (HELMEX) abattoir at Debre Zeit, Ethiopia. One thousand one hundred fifty two samples of ruminants consisting of bovine (153), ovine (493) and caprine (506) were analyzed for the present of one or more trematods. The overall prevalence of trematodes in the study was 21% (242/1152). The specific prevalence of trematodes was found to be 3.6% (41/153) in bovine, 9.6% (111/493) in ovine and 7.8% (90/506) in caprine. Statistically analysis showed that there was significant difference ($p<0.05$) on the prevalence of trematodes among species. The 241 trematods isolates were identified by their morphologies for species assignment. The identification result of trematodes proved highest prevalence of *fasciola hepatica* (6.4%). The lowest prevalence of trematode infection from species assignment of the study was known to be *Dicrocoelium dendriticum* (2.3%). The prevalence of *fasciola gigantica*, *Paramphistomum* and mixed infection with one or more species was proved to be 2.5, 5.8 and 4%, respectively. Statistical analysis of the result showed the presence of significance difference ($p<0.05$) on the prevalence of trematodes in ruminants examined in this research. The high level of trematode isolate found in these ruminant samples in the present study represent high rate of infection and public health risk to the consumer (*Fasciola*). This suggests the need to implement strict control and prevention methds through implementation of recommended method in order to guarantee the quality of these highly popular meat and meat products in Debre Zeit, Ethiopia.

INTRODUCTION

Africa has high population of ruminants but productivity is generally low with low contribution to the total GDP. Similarly, Ethiopia owns huge number of ruminants having high contribution for meat consumption and generates cash income from export of live animals, meat, edible organs and skin. Hence, an increase in ruminant production could contribute to the attainment of food self sufficiency in the country particularly in response to the protein requirement for the growing human population as well as to increase foreign exchange earnings. In spite of the presence of huge ruminant population and contribution of the livestock sub sector to the national economy, Ethiopia fails to optimally exploit these resources. This has been determined due to a number of factors including ill health, poor production infrastructures problem, rampant animal disease, zoonotic and food borne illness, poor nutrition, poor husbandry, shortage of trained man power and lack of government policies for disease prevention and control (ILRI 2009).

In subtropical and tropical countries, prevalence of gastrointestinal helminthes in ruminants has been reported in different times at different places. Among the helminthes, trematode parasites of ruminant livestock have a worldwide distribution and even have a zoometric importance (Raza *et al*., 2009).

Concurrent infections of *Fasciola*, *Dicrocoelium* and *Paramphistomum* are common, since, they share the same intermediate snail host and/or similar transmission sites. As result, they are thought to be a major cause that hindering the development of livestock population causing losses in the form of mortality, poor health condition, retarded growth, lower output of work and decrease the production of milk and meat (Gryseals, 1988). In spite of the aforementioned prevailing situation and the presence of a number of problems due to trematode parasitic infection there is paucity of well-documented information on the occurrence of trematodes in ruminants in Ethiopia. Therefore, this study was designed to investigate and determine the prevalence of parasitic trematodes and to evaluate risk factors associated with trematodes infection in cattle, sheep and goats slaughtered in the abattoir.

MATERIALS AND METHODS

Study area: The study was conducted at Hashim Nur's Ethiopian livestock and meat export (HELMEX) abattoir. The abattoir is found in Debre Zeit town, from October, 2010 to April, 2011. Debre Zeit is located about 45 km South-east of Addis Ababa, just on the escarpment of the Great Rift Valley and the geography of the area is marked by creator lakes. It is found at 9°N latitude and 40°E longitude and at an altitude of 1850 m above sea level in the central high lands of Ethiopia. It has a human population of about 95,000. It experiences a bimodal pattern of rainfall with the main rainy season extending from June to September (of which 84% of rain is expected) and a short rainy season from March to May with an average annual rainfall of 800 mm. The mean annual minimum and maximum temperatures are 12.3 and 27.7°C, respectively with an overall average of 18.7°C. The mean relative humidity is 61.3% (CSA, 2006).

Study animals: The study animals were cattle, sheep and goats which were brought to the abattoir for slaughtering purpose.

Study type and sample size determination: A cross- sectional study was conducted from October 2010 to April 2011. A total of 1152 samples comprising of bovine (153), ovine (493) and caprine (506) were collected from the selected animals to determine the prevalence rate of the targeted trematodes in the abattoir. To calculate the total sample size, the following parameters were used: 95% level of Confidence (CL), 5% desired level of precision and with the assumption of 50% expected prevalence of trematodes, the sample sizes were determined using the formula given by Thrusfield (2005):

$$n = \frac{1.96^2 \times Pexp(1\text{-}Pexp)}{d^2}$$

Where:
n = Required sample size
Pexp = Expected prevalence
d = Desired absolute precision

Therefore, based on the formula the total sample size calculated was 384. But for the sake of high precision the total sample was increased to 1152.

Sampling technique: Stratified random sampling method was used to select animals in the lairage and grouped into agro-climatic zones, different age groups and species to conduct cross sectional study.

Study methodology: Routine inspection of liver, gall bladder, oesophagus and stomach (rumen and reticulum) of each animal was carried out to check for the presence of trematode flukes. First, a gross visual inspection and palpation of all the organs was carried out and then each organ was dissected carefully. Livers were inspected by cutting the lobes twice and making a deep cut with a number of small subcuts. Gall bladders were opened using a knife and thoroughly investigated. Quantification and identification of the targeted trematodes were done with reference to their morphological characteristics.

Identification of trematodes: Final identification of the targeted trematode parasites (*Fasciola, Dicrocoelium* and *Paramphistomum* species) were conducted following the standard guidelines proposed by Urquhart *et al.* (1994).

Data analysis: All raw data that were recorded from this study were entered in to Microsoft excel data base system and using SPSS computer program, data were summarized and analyzed. Chi-square (χ^2) test was used to determine the variation in infection prevalence between different peasant associations, species and sex, age and body conditions. A 5% significant level was used to determine whether there are significant differences between the parameters measured between the groups.

RESULTS AND DISCUSSION

Prevalence of trematodes: The overall prevalence of trematodes in the study was 21% (242/1152). The specific prevalence of trematodes were found to be 3.6% (41/153) in bovine, 9.6%(111/493) in ovine and 7.8% (90/506) in caprine. Statistically analysis showed that there was significant difference ($p<0.05$) on the prevalence of trematodes among species (Table 1).

The specific prevalence of trematodes was found to be 15.8% (733/1152) in adult and 5.2% (419/1152) in young. Statistically analysis showed that there was ($p<0.05$) significant difference on the prevalence of trematodes between ages (Table 2).

High infections of trematodes were observed in good body condition group of animals with prevalence of 13.5% (874/1152). The prevalence of trematodes were found to be 5.7% (219/1152) 1.8% (59/1152) in medium body condition and in poor body condition animals respectively. In this work statistically significance difference ($p<0.05$) was observed on the infection of trematodes between the three different body condition of animals examined (Table 3).

Table 1: Prevalence of trematodes in relation to species of animals

Species of animal	Examined	Prevalence (%)	χ^2- value	p-value
Bovine	153	3.6	-	-
Ovine	493	9.6	6.930	0.031
Caprine	506	7.8	-	-
Total	1152	21.0	-	-

Table 2: Prevalence of trematodes in relation to age

Age	Examined	Prevalence (%)	χ^2- value	p-value
Young	419	5.2	-	-
Adult	733	15.8	17.746	0.000
Total	1152	21.0	-	-

Table 3: Prevalence of trematodes in relation to body condition

Body condition	Examined	Positive	Prevalence (%)	χ^2- value	p-value
Good	874	155	13.5	-	-
Medium	219	66	5.7	24.206	0.000
Poor	59	21	1.8	-	-
Total	1152	242	21.0	-	-

The identification result of trematodes proved highest prevalence of *F. hepatica* (6.4%). The lowest prevalence of trematode infection from species assignment of the study was known to be *D. dendriticum* (2.3%). Statistical analysis of the result showed the presence of significance difference ($p<0.05$) on the prevalence of trematodes in ruminants examined in this research (Table 4).

According to the origin of animals the highest prevalence of trematodes (3.5%) was recorded in animals that came from Borena where as the lowest (1.9%) was identified to be in animals that originated from Ginir. Statistical analysis of the findings showed that there were no significant difference ($p>0.05$) on the prevalence of trematodes among ruminants on the basis of their origins (Table 5).

The results of the present study which was conducted based on post mortem examination revealed the prevalence of tematodes to be 21%. The specific prevalence of fasciolosis was confirmed to be 6.4% (74/242). The present finding was found to be lower than the results of previous study conducted by Tolossa and Tigre (2007) who reported a prevalence of 46.58% on postmortem examination of livers from Jimma and Agaro. similarly, prevalence as high as 80% and as low as 4.9% were recorded by Dagne (1994) and Abunna *et al*. (2010) from Debre Berhan (central highland areas) and Wolaita Soddo (Southern highland), respectively. The variation observed in these studies could be due to the increasing climate change, the availability of a suitable habitat for the vectors, the method employed for the diagnosis and the increasing trend of animal deworming by farmers.

Paramphistomum species were demonstrated in 5.8% of inspected fore-stomach and duodenum. This finding was lower than the prevalence of paramphistomum reported by Abebe *et al*. (2011) (53.68%) from Jimma Fromsa *et al*. (2011) municipal abattoir. These different prevalences of *Paramphistomum* in these reports could be explained either by the different parasitological

Table 4: The prevalence of trematodes

Trematode	Positive	Prevalence (%)	χ^2- value	p-value
F. hepatica	74	6.4	-	-
F. gigantica	29	2.5		
Dicrocoelium	26	2.3	1.111	0.000
Paramphistomum	67	5.8	-	
Mixed	46	4.0	-	
Total	242	21.0	-	-

Table 5: The prevalence of trematodes with respect to origin

Origin	Examined	Prevalence (%)	χ^2- value	p-value
Borena	183	3.5	-	-
Harar	119	2.2	-	-
Awash	141	2.6	-	-
Metehara	145	2.4	28.333	0.780
Arbaminch	178	3.0	-	-
Jinka	152	2.7	-	-
Meso	147	2.7	-	-
Ginir	87	1.9	-	-
Total	1152	21.0	-	-

techniques used in these studies, differences in the origin of the samples or by geographical differences. Other factor which attributes for such a difference could be due to conductive ecological factors for the snail intermediate host of paramphistomum in these areas.

The prevalence of *Dicrocolium Dendedriticum* during the post mortum examination was proved to be 2.3% (26/242) in domestic ruminant. This was slightly higher than previous study conducted by Daryani *et al. (*2006) who reported prevalence of 1.00 and 0.80% in cattle and sheep in Shiraz, respectively. Abu Zinada (1999) recorded prevalences of 40, 26 and 2% in Somalian, Turkish and native breed sheep, respectively. Jithendran and Bhat (1996) revealed that 8.1% of sheep and 4.1% of goats were positive for dicrocoeliosis in Himachal Pradesh in India. These different prevalences of *Dicrocolium* in these reports could be explained either by the different parasitological techniques used in these studies, differences in the origin of the samples or by geographical differences. Other factor which attributes for such a difference could be due to conductive ecological factors for the snail intermediate host of *Dicrocolium* in these areas.

Gargili *et al.* (1999) reported that the prevalence of fasciolosis and dicrocoeliosis in Turkey, were 3.99 and 23.55% in sheep and 0.48 and 2.65% in cattle, respectively. Daryani *et al.* (2006) reported prevalence of dicrocoeliosis in cattle and sheep to be 10.6 and 6.8%, respectively.

There was statistical variation in the prevalence of fasciolosis between the origins of animals which cou8ld be attributed to the presence of different elevation and ecology of the areas which are required for the survival of the snail host of fasciola. As the body condition increases infection with fasciola and other trematod decreases because fasciola and other trematodes are known to suck blood and tissue fluid and even damage the parenchyma of the liver (immature *Fasciola*) and the duodenum (immature *Amphistomes*) which ultimately deplete protein from the host (Marquardt *et al*., 2000).

CONCLUSION

Moreover, cholangitis and liver cirrhosis induced in chronic fascioliasis could reduce bile flow to the duodenum and hence reduced lipid emulsification, digestion and absorption of fatty acid and lipid soluble vitamins. But there was no stastical variation among species of animals and age.

ACKNOWLEDGEMENTS

The research incorporated in this thesis was undertaken using the externship research grant allocated by School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University. The researchers are grateful to the University in particular and government of Ethiopia in general, for providing me the research fund. I wish to extend our profound gratitude to Hashim export abattoir without the cooperation and enthusiasm shown by it, the study would not have been possible.

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