Journal of Animal and Veterinary Advances 10 (12): 1592-1597, 2011
ISSN: 1680-5593

Major Trematode Infections of Cattle Slaughtered at Jimma Municipality Abattoir and the Occurrence of the Intermediate Hosts in Selected Water Bodies of the Zone

[1]Abebe Fromsa, [2]Behablom Meharenet and [2]Berhanu Mekibib
[1]College of Agriculture and Veterinary Medicine, Jimma University, P.O. Box 307, Jimma, Ethiopia
[2]Department of Veterinary Medicine, Hawassa University, P.O. Box 05, Hawassa, Ethiopia

Abstract: The study was conducted to estimate the prevalence of major trematodes of cattle slaughtered in Jimma Municipality Abattoir and to detect the occurrence of the intermediate snail hosts at selected water bodies of the area. The finding demonstrated the occurrence of fasciola, paramphistomum and shistosoma. Out of the total of 583 cattle examined with coproscopy (n = 198) or postmortem (n = 525), 264 (45.28%) were positive for fasciola and 313 (53.685%) were positive for paramphistomes. Of the total cattle slaughtered and examined at postmortem (n = 525), 253 (48.19%) and 302 (57.52%) were found positive for fasciola and paramphistomum, respectively. From the total of 253 livers found positive for fasciola infection, 91 (35.97%) harbored only *F. gigantica*, 86 (33.99%) harbored mixed fasciola infection and 76 (30.04%) harbored only *F. hepatica*. Similarly, out of the total of 302 fore-stomachs and duodenum infested with rumen fluke, 229 (75.83%) harbored *P. cervi* and the remaining 73 (24.17%) harbored undifferentiated *Paramphistomum* species. From the total of 198 faecal samples examined, 104 (52.53%) were positive for trematode eggs of which 44 (42.31%), 46 (44.23%) and 14 (13.46%) were positive for fasciolosis, paramphistomum and schistosoma infections, respectively. Coproscopic examination further showed mixed trematod infections with a frequency of 8.08, 4.04 and 0.51% for paramphitomum with fasciola, schistosoma with paramphistomum and schistosoma with fasciola, respectively. Among the considered risk factors, body condition of the examined cattle significantly affected ($p<0.05$) the prevalence of trematod infection. From malacological survey, the study further indicated the presence of *Bulinus globusus*, *Bulinus truncatus*, *Biomphlaria pfeiriferi*, *Lymnea truncatula* and *Lymnea natalensis* which are potential intermediate hosts of different trematodes. Trematodes are major obstacles for livestock production and productivity by inflicting remarkable direct and indirect losses in the study area. Control strategy to be implemented in the study area must also consider concurrent existence of trematode parasites in affected cattle population.

Key words: Trematode, cattle, coproscopy, necropsy, prevalence, snail, Ethiopia

INTRODUCTION

Trematode parasitism is one of the major problems lowering ruminant productivity around the world (Vercruysse and Claerebout, 2001). In Ethiopia, the rich potential from livestock sector is not efficiently and fully exploited due to several constraints like malnutrition, traditional management practice, poor genetic makeup and prevailing diseases (Bekele *et al*., 1992). Among the prevailing diseases in the country, trematodes are one of the main parasitic problems of cattle and other ruminants (Yilma and Malone, 1998).

These parasitic diseases are found in vast water lodged and marshy grazing field, a condition anticipated to be ideal for the propagation and maintenance of the intermediate host snails and hence high prevalence of trematode infection (Solomon and Abebe, 2007). Except some studies performed on the prevalence of fasciolosis (Solomon and Abebe, 2007; Abunna *et al*., 2010), information on the prevalence, potential risk factors, species and geographic distribution of snails involved is scanty. Moreover, accurate data has not yet been produced on the occurrence of schistosomes and paramphistomums in Jimma and other regions of Ethiopia. Therefore, the objective of this study was to estimate the prevalence of major trematodes in cattle slaughtered at Jimma municipality abattoir and to identify the major risk factors associated with trematodes infection.

Corresponding Author: Abebe Fromsa, College of Agriculture and Veterinary Medicine, Jimma University, P.O. Box 307, Jimma, Ethiopia

MATERIALS AND METHODS

Description of study area: The study was conducted at Jimma municipality abattoir and around major water bodies in the zone. Jimma town which is the capital of Jimma zone is located in Oromia Regional Administration at 346 km South West of Addis Ababa. The town has a latitude of about 7°36'-8°56'N and longitude of about 35°52'-37°37'E and an elevation ranging from 880-3360 m.a.s.l. The study area receives a mean annual rain fall of about 1530 mm which comes from long and short rainy seasons. The average minimum and maximum annual temperature ranges between 14.4 and 26.7°C, respectively (Tolossa and Tigre, 2007).

Study design and study animal: Cross-sectional study design was used and fecal and parasitic samples were collected from cattle slaughtered at abattoir and snails for malacological survey from main water bodies found surrounding the town. Cattle of sexes, all breeds and age groups brought to the municipal abattoir for slaughter were the study population and the studied animals were sampled randomly. However, number of slaughtered female cattle was insignificant.

Study methodology: Each animal selected for the study was further identified by providing a unique identification number that could be used for both ante and post mortem examinations of the animal. The sampled cattle were examined for the presence of the major trematodes of interest by coproscopic and post mortem examination. The origin, age, sex, body condition score and general health condition of each study animal were recorded. The age of the animals was estimated by means of their dentition as described by Pasquini *et al.* (2003). The body condition score were estimated using technique recommended by Nicholson and Butterworth (1986). Each scoring were given number from 1(L-, very lean) to 9 (F+, very fat). Finally, for the ease of presentation these nine scores were included under the three main body conditions; poor, medium and good.

Coproscopic examination: Faecal samples were collected directly from the rectum using sterile gloves. The collected faecal samples were placed in clean universal bottle preserved with 10% formalin and closed with screw top in air tight condition. The universal bottles were labelled with the unique identification number which matched with the detailed data recorded using the standard format. The collected faecal samples were transported to Jimma University, Veterinary Parasitology Laboratory for gross and microscopic examination. For qualitative study, sedimentation technique was routinely used as described by Taira *et al.* (1983).

Necropsy/postmortem examination: After evisceration, liver, large bile ducts, rumen and reticulum, duodenum, mesenteric veins and portal veins of 525 cattle were thoroughly and systematically examined for trematode infestation as these organs are known potential predilection sites for adult and young trematodes. Liver fluke recovery was conducted following the approach of Hammond and Sewell (1974). Similarly, mesenteries of the large intestine and the portal vein were cut into small pieces and were immersed in large glass bowls containing normal saline and left undisturbed for four to 5 h to recover the adult blood flukes (Sumanth *et al.*, 2004). The findings were properly recorded to correlate with coproscopic findings and information collected during antemortem examination.

Malacological study: Snail samples were collected by gloved hand picking or scooping method from representative water bodies of the study area where cattle commonly graze and water. Ninety nine snails were collected from Gibbe dam, Awetu, Kito and Boye river areas where there are many agricultural activities with frequent interaction between humans, snails and cattle. The molluscs collected were placed in plastic bag (containers) with fresh algae, aquatic vegetation and aerated water. The samples were transported to Jimma University Veterinary Parasitology Laboratory for Identification.

Data management and analysis: Data obtained from history, necropcy and coproscopic examination and snail survey was recorded on spreadsheet of microsoft excel and analyzed with the appropriate statistical method (StataCorp, 2001).

RESULTS AND DISCUSSION

Out of the total of 583 cattle examined with coproscopy and/or postmortem, 264 (45.28%) were positive for fasciolosis and 313 (53.68%) were positive for paramphistoms.

Prevalence of the major trematodes examined

Prevalence of trematodes on coproscopic examination: From the total of 198 faecal samples of cattle examined, 104 (52.53%) were positive for trematod infection. Of these, 44 (42.31%) were found positive for fasciola, 14 (13.46%) were positive for schistosoma and 46 (44.23%) were positive for paramphistomum. There was a statistically significant difference ($p<0.05$) in the prevalence of these parasites among the three body conditions (Table 1).

Table 1: Prevalence of the three trematodes in cattle grouped under the different cateories of the risk factors considered-coproscopy (n = 198)

	Trematodes eggs					
	Fasciola		Rumen fluke		Schistosoma	
Risk factors	No. of examined	Positive (%)	No. of examined	Positive (%)	No. of examined	Positive (%)
Age group						
Young (≤5 years)	29	31.03	29	37.93	29	0.00*
Adult (>5 years)	169	21.30	169	34.91	169	8.28
Body condition						
Poor	42	30.95	42	69.05	42	23.81
Medium	102	22.55	102	32.35	102	3.92
Good	54	16.67*	54	14.81*	54	0.00*
Site						
Agaro area	109	23.85	109	35.78	109	4.59
Jimma area	89	21.35	89	34.83	89	10.11

*Significant variation ($p<0.05$)

Table 2: The prevalence of single and mixed infection with the trematodes considered on coproscopic examination (n = 198)

Trematode egg encountered	No (%) positive	Cumulative frequency
Free	94 (47.47)	47.47
Shistosoma	5 (2.53)	50.00
Fasciola	28 (14.14)	64.14
Paramphistomum	46 (23.23)	87.37
Paramphitomum and fasciola	16 (8.08)	95.45
Schistosoma and paramphistomum	8 (4.04)	99.49
Schistosoma and fasciola	1 (0.51)	100.00

Coproscopic examination further showed mixed trematod infections with a frequency of 8.08, 4.04 and 0.51% for paramphitomum with fasciola, schistosoma with paramphistomum and schistosoma with fasciola, respectively. However, none of the examined cattle was positive for all trematodes (Table 2).

Prevalence of trematodes based on necropsy (postmortem): Of the total cattle slaughtered and examined (n = 525) for the presence of the major trematodes, 253 (48.19%) and 302 (57.52%) were found positive for fasciloa and paramphistomum, respectively. Necropsy diagnosis made for schistosoma at mesenteric and portal veins yielded no parasite even if their eggs had been diagnosed at coproscopy.

From the total of 253 livers found positive for fasciola infection, 91 (35.97%) harbored only *F. gigantica*, 86 (33.99%) harbored mixed fasciola infection and 76 (30.04%) harbored only *F. hepatica*. Similarly, out of the total of 302 fore-stomachs and duodenums examined for rumen fluke, 229 (75.83%) harbored *P. cervi* and remaining 73 (24.17%) harbored undifferentiated *Paramphistomum* species.

Risk factor analysis in relation with coproscopy and post mortem

Coproscopy: Statistical analysis made to assess the association between trematode infection with the recorded variables revealed significant variation in the prevalence between body condition scores ($p<0.01$). Prevalence of trematodes was significantly lower in cattle with good body conditions when compared to cattle with poor body condition (Table 3).

Postmortem: The prevalence of fasciola and paramphistomum infection was highest in cattle with poor body condition score than in cattle with medium and good body conditions. Moreover, there exist significant variation ($p = 0.000$) among these groups for both infections (Table 4).

Malacological survey result: From the total of 91 snails collected randomly from 4 selected biotopes (watering and grazing sites) for malacological study, *Bulinus globusus*, *Bulinus truncatus*, *Biomphlaria pfeiriferi*, *Lymnea truncatula* and *Lymnea natalensis* were identified.

The finding of the present study revealed the prevalence of fasciolosis to be 48.19% based on postmortem study alone, 22.22% by coproscopic study alone and 45.28% by either methods. This is comparable with the results of previous study conducted by Tolossa and Tigre (2007) who reported a prevalence of 46.58% on postmortem examination of livers from the same study area. However, prevalence rates of 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. The lower prevalence of fasciolosis reported in the current study using coproscopy indicates the lower sensitivity of this procedure in detecting the disease due to the intermittent nature of the expulsion of the eggs through the feces. Therefore, worm counts at liver necropsy can only be considered as a gold standard if the livers are sliced and soaked for through examination.

Table 3: Logistic regression analysis of various risk factors and association with the occurrence of trematode infection on coproscopical findings (n = 198)

		Trematode examined					
		Fasciola		Paramphistomum		Schistosoma	
Risk factors	Observation	Positive (%)	Adjusted OR (95% CI)	Positive (%)	Adjusted OR (95% CI)	Positive (%)	Adjusted OR (95% CI)
Age group							
Young (<=5)	29	31.03	1 (1)	37.93	1 (1)	0.00	1(1)
Adult (>5)	169	21.30	2.09 (0.00, 0.77)	34.91	1.06 (0.41, 2.73)	8.28	0
Body condition							
Poor	42	30.95*	1 (1)	69.05	1 (1)	23.81	1 (1)
Medium	102	22.55	1.19 (0.47, 3.04)	32.35	4.11 (1.74, 9.69)	3.92*	9.95 (2.07, 47.83)
Good	54	16.67	2.26 (0.73, 6.98)	14.81*	12.18 (4.14, 12.59)	0.00	0
Site							
Agaro area	109	23.85	1 (1)	35.78	1 (1)	4.59	1(1)
Jimma area	89	21.35	3.37 (1.28, 8.83)	34.83	1.32 (0.62, 2.84)	10.11	4.47 (0.99, 20.11)

* Statistically significant (p<0.05)

Table 4: Logistic regression analysis of various risk factors and association with the occurrence of trematode infection on necropsy findings (n = 525)

		Trematod examined						
		Fasciola				Paramphistomum		
Risk factors	Observation	Positive (%)	Adjusted OR (95% CI)	p-value	Observation	Positive (%)	Adjusted OR (95% CI)	p-value
Age group								
Young (<=5)	92	42.39	1 (1)	0.220	92	50.00	1 (1)	0.109
Adult (>5)	433	49.24	1.33 (0.84, 2.09)	0.220	433	59.12	1.45 (0.92, 2.27)	0.109
Body condtion								
Poor	113	66.67*	1 (1)	0.000	113	90.74	1 (1)	0.000
Medium	250	45.60	2.36 (1.58, 3.60)	0.000	250	53.60	8.48 (4.72, 15.25)	0.000
Good	162	27.43	5.29 (3.12, 8.96)	0.000	162	18.58*	42.93 (21.07, 87.50)	0.000
Site								
Agaro area	277	49.10	1 (1)	0.660	277	54.51	1 (1)	-
Jimma area	248	47.18	1.08 (0.77, 1.52)	0.660	248	60.89	1.30 (0.92, 1.84)	0.140

*Statistically significant (p<0.05)

The absence of statistical variation in the prevalence of fasciolosis between the origins of animals may be due to the similar elevation and ecology of both areas (Jimma and Agaro) 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). Moreover, cholangitis and liver cirrosis 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.

The coproscopic examination in this study further showed the occurrence of mixed trematod infections with a frequency of 8.08, 4.04 and 0.51% for paramphitomum with fasciola, schistosoma with paramphistomum and schistosoma with fasciola, respectively. However, none of the examined cattle was positive for all trematodes. Yabe *et al*. (2008) also reported mixed trematode infections in cattle from Zambia where *Fasciola gigantica* and Amphistomum dual infections were the highest (34%) while *F. gigantica* and schistosoma dual infections were the lowest (0%). Yabe *et al*. (2008) however, reported 32% mixed trematode infections with all three trematodes in 50 randomly selected trematode-infected cattle. The absence of mixed trematode infections with all three trematodes in this study may be ascribed to the overall lower prevalence of Schistosoma in this study.

At postmortem, only fasciola and paramphistomum were detected from the liver and fore-stomach and duodenum, respectively. Despite the presence of eggs in the faeces, the effort made to detect schistosoma or schistosoma induced lesion on mesenteric and portal veins was not successful. This might be related to low intensity or number of adult blood flukes in mesenteric or portal veins. Furthermore, it might be related to the difficulty of detecting the small lesions induced by the parasite on the necked eyes. Marquardt *et al*. (2000) also emphasized that the host immunity against schistosoma (adult) and stage of infection should be considered especially at endemic areas.

Ruminant shistosomiasis infection is widely distributed in Africa, Mediterranean and Meddle East (Makundi *et al*., 1998). According to Makundi *et al*. (1998), bovine schistosomiasis is an endemic disease in Tanzania and other East African countries. Despite the report of some unpublished researches, the prevalence of bovine shistosomiasis in Ethiopia especially at current study area (Jimma area) is unknown. The result of the current study suggested that the presence of bovine shistosomiasis at the study area was 7.07% at coproscopy. The current finding was low when compared with the reported prevalence rate of 22% reported from Kafue and Zambezi river basins of Zambia by Yabe *et al.* (2008) and 33.9% from endemic areas of Tanzania by Makundi *et al.* (1998). This difference could be attributed to the difference in the ecology of the study sites, the age of the animals diagnosed or worm control practice in the area. The cattle studied by Yabe *et al.* (2008) were from areas where worm control was not routinely practised. A longitudinal survey performed by De Bont *et al.* (1995) at endemic area revealed a significant decline in infection prevalence in cattle >3 years of age. However, all of the cattle included in the current study were >3 years of age which could potentially affect the actual prevalence in the study area.

Rumen fluke infection has a worldwide distribution as it is adapted to wide ranges of snails (Urquhart *et al.*, 1996). From the current study, *P. cirvi* and other undifferentiated species/immature or juvenile stages were demonstrated in 57.52% of inspected fore-stomach and duodenum, respectively. There was no previous report on the prevalence of bovine paramphistomosis from Ethiopia and the current study area. According to Keyyu *et al.* (2006) however, bovine paramphistomosis was endemic disease in Tanzania and other East African countries. The current findings generally suggest that the presence of bovine paramphistomosis at the study area was relatively low (57.52% at postmortem, 44.23 at coproscopy and 53.68% overall) when compared with other studies (91.3 and 78.5%) performed in two endemic areas of Tanzania (Keyyu *et al.*, 2006). The difference may be ascribed to variation in the year and season of the study period. Rangel-Ruiz *et al.* (2003) studied the seasonality of paramphistomosis and reported that livestock infected with *P. cervi* occurred more frequently during the rainy season (July-October) and a decrease in the infection figures during the second year of the study. The significantly higher prevalence of paramphistomosis observed in cattle with poor body condition (14.81%, OR = 12.18, CI 4.14, 12.59) could be explained by the fact that the fluke causes high protein loss in ruminants especially in young animals (Urquhart *et al.*, 1996).

One of the most important factors that influence the occurrence and prevalence of trematodes in an area is availability of suitable snail habitat (Soulsby, 1982; Urquhart *et al.*, 1996). The result of the present study on malacolgical investigation revealed the existence of *Bulinus globusus*, *Bulinus truncatus*, *Biomphlaria pfeiriferi*, *Lymnea truncatula* and *Lymnea natalensis.* From this study, highly dominant snails were *Lymnea* species which are potential intermediate hosts for fasciola. Others are incriminated as intermediate hosts for paramphistomum and schistosoma. According to Urquhart *et al.* (1996), water snails, principally under the genus *Biomphlaria* and *Bulinus*, shares some similarity in maintaining paramphistomum and schistosoma with much known variations.

CONCLUSION

In general, it can be concluded that trematodes are major obstacles for livestock development in the area due to the presence of biotype suitable for the development of snail intermediate hosts.

RECOMMENDATION

Strategic use of antihelminthics, applications of molluskicide and fencing of water bodies should be practiced to reduce pasture contamination with fluke eggs.

REFERENCES

Abunna, F., L. Asfaw, B. Megersa and A. Regassa, 2010. Bovine fasciolosis: Coprological, abattoir survey and its economic impact due to liver condemnation at Soddo municipal abattoir, Southern Ethiopia. Trop. Anim. Health Prod., 42: 289-292.

Bekele, T., O.B. Kasali and W. Woldemariam, 1992. Endoparasite prevalences of the highland sheep in Ethiopia. Prev. Vet. Med., 13: 93-102.

Dagne, M., 1994. Survey on prevalence and economic significance of bovine fasciolosis in Debre Berhan region. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University. Debre Zeit, Ethiopia.

De Bont, J., J. Vercruysse, F. Sabbe, V.R. Southgate and D. Rollinson, 1995. *Schistosoma mattheei* infections in cattle: Changes associated with season and age. Vet. Parasitol., 57: 299-307.

Hammond, J.A. and M.M.H. Sewell, 1974. Flotation onto sellotape (demonstration). Trans. R. Soc. Trop. Med. Hyg., 66: 547-547.

Keyyu, J., A. Kassuku, L. Msalilwa, J. Monrad and N. Kyugaard, 2006. Cross sectional preeevalence of helimenth infection in cattle on traditional, small scale dairy farms in Iringa district. Tanz. Vet. Res. Commun., 30: 45-55.

Makundi, E., A. Kassuku, R. Masselle and M. Boa, 1998. Destribution, prevalence and intensity of *S. bovis* infection in cattle in Iringa district. Tanz. Vet. Parasitol., 75: 59-69.

Marquardt, W.C., R.S. Demaree and R.B. Grieve, 2000. Parasitology and Vector Biology. 2nd Edn., Academic Press, London, ISBN-13: 9780124732759, pp: 702.

Nicholson, M.J. and M.H. Butterworth, 1986. A Guide to Condition Scoring of Zebu Cattle. 1st Edn., International Livestock Centre for Africa, Addis Ababa, Ethiopia.

Pasquini, C., T.L. Spurgeon, S. Pasquini, 2003. Anatomy of Domestic Animals: Systemic and Regional Approach. 10th Edn., Sudz Publishing, USA., ISBN-13: 9780962311420, pp: 677.

Rangel-Ruiz, L.J., S.T. Albores-Brahms and J. Gamboa-Aguilar, 2003. Seasonal trends of *Paramphistomum cervi* in Tabasco, Mexico. Vet. Parasitol., 116: 217-222.

Solomon, W. and W. Abebe, 2007. Prevalence study of ruminant fasciolosis in areas adjoining upper Blue Nile Basin, North Western Ethiopia. Ethiop. Vet. J., 11: 68-83.

Soulsby, E.J.L., 1982. Helminthes, Arthropods and Protozoa of Domestic Animals. 7th Edn., Bailliere Tindall, London.

StataCorp, 2001. Stata Statistical Software: Release 7.0. College Station, Texas, USA.

Sumanth, S., P.E. D'Souza and M.S. Jagannath, 2004. A study of nasal and visceral schistosomosis in cattle slaughtered at an abattoir in Bangalore, South India. Rev. Sci. Tech., 23: 937-942.

Taira, N., K. Suzuki and J. Boray, 1983. Detection and quantification of fasciola eggs in cattle using the beads technique. Jpn. J. Vet. Parasitol., 32: 279-286.

Tolossa, T. and W. Tigre, 2007. The prevalence and economic significance of bovine fasciolosis at Jimma abattoir. Int. J. Vet. Med., 3: 1-8.

Urquhart, G.M., J. Armour, J.L. Duncan, A.M. Dunn and F.W. Jennings, 1996. Veterinary Parasitology. 2nd Edn., Black Well Science Ltd., London, UK., pp: 307.

Vercruysse, J. and E. Claerebout, 2001. Treatment vs non-treatment of helminth infections in cattle: Defining the threshold. Vet. Parasitol., 98: 195-214.

Yabe, J., I.K. Phiri, A.M. Phiri, M. Chembensofu, P. Dorny and J. Vercruysse, 2008. Concurrent infections of *Fasciola*, *Schistosoma* and *Amphistomum* spp. in cattle from Kafue and Zambezi river basins of Zambia. J Helminthol., 82: 373-376.

Yilma, J.M. and J.B. Malone, 1998. A geographic information system forecast model for strategic control of fasciolosis in Ethiopia. Vet. Parasitol., 78: 103-127.