

A Study on Prevalence of Fasciolosis at Sebeta Municipal Abattoir and Sensitivity of Coprological Test

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How to cite this paper

Kebanu, M., Rebuma, T., & Pal, M. (2024). A Study on Prevalence of Fasciolosis at Sebeta Municipal Abattoir and Sensitivity of Coprological Test. *International Journal of Livestock Research*, 14 (2), 9-15.

Received : Jan 04, 2024

Accepted : Feb 26, 2024

Published : Feb 29, 2024

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Abstract

Fascioliasis is an important helminthic zoonosis that is reported in many countries of the world. The cross-sectional study was carried out from November 2013 to April 2014 to determine the prevalence of fasciolosis, evaluate risk factors associated with it, and assess the sensitivity of coprological tests for diagnosing fasciolosis in cattle and sheep that were slaughtered in the municipal abattoir in Sebeta. A total of 384 animals, which comprised 212 cattle and 172 sheep were randomly selected from the slaughtered animals and sent for post-mortem and coprological examination. From the total of 384 animals examined, 150 were found to be positive for fasciolosis, with an overall prevalence of 39.1%. The prevalence in adults and young was 39.4% and 38.1%, respectively. The difference between them was not significant ($p > 0.05$). The prevalence of fasciolosis is significantly higher in ($p < 0.05$) animals with poor body condition than in medium and good body condition scores. Taking liver examination as the gold standard for diagnosis of fasciolosis, the sensitivity of sedimentation was found to be 62.67% and the sensitivity of 100%, with substantial agreement ($kappa = 0.67$) between them. The high prevalence of fasciolosis in cattle and sheep in the present study represents the high rate of infection and causes high economic losses to the area. The level of infection observed in this study revealed the existence of favorable climatic conditions for the development and survival of the parasite in the area of origin of the study animals. So strategic helminthic treatment with appropriate flukicide drugs should be practiced twice a year, before and after the rainy season, to eliminate the fluke burden, reduce the number of snails becoming infected, and improve drainage and fence off wet areas with poor drainage to reduce snail problems.

Keywords: Abattoir, Coprological, Fasciolosis, Prevalence, Sebeta, Sensitivity.

Introduction

Zoonotic diseases are described as those diseases that are naturally transmitted from animals to humans (Pal, 2007). Presently, over 300 zoonoses of multiple etiologies are reported from many countries around the world (Pal, 2013). Zoonotic parasitic diseases are transmitted to humans either by ingesting environmentally robust transmissive stages (spores, cysts, oocysts, ova, larval, and encysted stages) or by eating raw or undercooked meat containing infective tissue stages. Humans can be final, intermediate paratenic (maintenance), or accidental hosts. The transmissive stages of some of these zoonoses can be transmitted directly (e.g., by animal-human contact or through contact with contaminated feces, soil, and herbage), or they can also be transmitted through contaminated water and food (Pal, 2005; Dorny *et al.*, 2009).

Among the animal diseases that hinder animal health are parasitic infections that have a great economic impact, especially in developing countries (Sultan *et al.*, 2010). Parasites pose a subtle economic loss and are major factors responsible for the lowered level of production in tropical and subtropical regions, particularly helminth infections, which are among the most preventable and widely distributed ones (Soulsby, 1982). Parasitic helminth worms comprise a diverse group of metazoan organisms, which represent an enormous burden on human and ruminant health in most tropical countries and can cause serious diseases in infected populations (Allen and Maizels, 1997; Pal, 2007).

Fasciolosis is one of the most common helminth parasites that affects cattle and sheep and can result in productivity losses, impacting the economy of the livestock industry. Economic losses include costs of anthelmintic and land drainage and losses in productivity as a result of mortality, including reductions in meat, milk, and wool production (Salehaa, 1991). Fasciolosis is an important parasitic zoonosis and a serious economic disease of cattle and sheep caused by the liver flukes *Fasciola hepatica* or *Fasciola gigantica*, with a worldwide distribution (Andrews, 1999; Mas-Coma *et al.*, 2005; Pal, 2007).

The geographical range of *F. hepatica* has expanded over the last 500 years due to the ongoing export of livestock and global colonization by Europeans, despite the species European origins. There have now been reports of *F. hepatica* infections in cattle on every continent (except Antarctica), with temperate nations like Bolivia, Peru, Iran, Portugal, Egypt, and France having the greatest infection rates (Garcia *et al.*, 2007). The flukes can develop, mature, and produce viable offspring even in very recently encountered species such as llamas and alpacas in South America, camels in Africa, and kangaroos in Australia (Mas-Coma *et al.*, 2005). *Fasciola hepatica* also infects a wide variety of wild animals, including deer, rabbits, hares, boars, beavers, and otters, which, collectively, are major reservoir host populations that contribute significantly to the worldwide dissemination of the disease and to its local transmission patterns (Pal, 2007).

Fasciola gigantica is the most common parasite illness affecting cattle and water buffalo in Asia and the Far East. It is thought to have split from *F. hepatica* around 17 million years ago (Irving *et al.*, 2003). Together with *F. gigantica*, *F. hepatica* infects around 300 million cattle and 250 million sheep globally, resulting in substantial economic losses to agriculture that are estimated to be worth more than US\$3 billion yearly due to decreased milk and meat yields (Mas-Coma *et al.*, 2005).

Both sheep and cattle can contract fasciolosis as an acute or chronic illness, and the severity of the condition is influenced by the host's nutritional status (George, 1985). According to Urquhart and others (1996), they cause widespread illness and death in sheep and cattle, which is manifested as hypoproteinemia and weight loss anemia. The impact can also be described in terms of poor birth weight, infertility, and liver condemnation at the butcher (Njau and Scholtens, 1991).

Therefore, the objectives of this study were to determine the prevalence, assess possible risk factors for the cause of disease, and evaluate the sensitivity of a coprological test for fasciolosis.

Materials and Methods

Study Area Description

The study was conducted at Sebeta Municipal Abbatior, which is located in Sebeta town. Sebeta town is located in

Oromia regional state, in the special zone of Oromia surrounding Finfine. Sebeta town is located 25 km southwest of Addis Ababa. Geographically, it is located at 8° 9' N and 45° 5' E of latitude and longitude, respectively.

Study Animals

The study populations were cattle and sheep of different ages and body conditions brought from different parts of the country to the abattoir for meat production. A simple random sampling method was used to select the study units. The study animals were classified into two age categories (adult and young). Cattle greater than four years and sheep greater or equal to two years were categorized as adult and cattle less than or equal to four years and sheep less than two years were categorized as young. Similarly, the samples were grouped into three categories of body condition namely poor, medium, and good.

Study Design

A cross-sectional study was conducted from November 2013 to March 2014 to determine the prevalence of fasciolosis in cattle and sheep at the Sebeta municipal abattoir, compare fecal smears, and assess possible risk factors associated with fasciolosis.

Sample Size Determination

By using simple random sampling methods and a 95% confidence interval with the required 5% precision and the assumption of 50% expected prevalence, the sample size was determined by the formula of (Thrusfield, 2005).

$$n = \frac{1.96^2 P_{exp} (1 - P_{exp})}{d^2}$$

Where; n= required sample size, P_{exp} =expected prevalence, d= required precision

Therefore, based on the above formula, the total sample size was calculated to be 384.

Sample Collection

A total of 384 samples were collected from the selected animals to determine the prevalence of fasciolosis in the abattoir. All of the collected samples were male. The species, age, and body condition of the animal were considered potential risk factors for the occurrence of fasciolosis. Fecal samples were taken from the rectum of 384 animals (212 cattle and 172 sheep) randomly selected from those brought for slaughter and subjected to liver inspection. The collected fecal samples were taken to the laboratory in tightly closed universal bottles.

Study Methodology

Post-mortem Examination

During the study, first the liver was removed from the main body and examined carefully for the presence of fasciola by incising the bile ducts and opening the gall bladder. Major bile ducts were opened with a knife and checked for the presence of fasciola. Making multiple deep incisions of the lobes and making a deep cut with a number of small subcuts.

Coprological Examination

The collected fecal samples were processed by sedimentation technique as described by Hansen and Perry (1994) in the laboratory. The sensitivity and specificity of the method were computed by taking liver inspection at the postmortem as the gold standard for the diagnosis of fasciolosis. The Kappa statistic was used to determine the degree of agreement between the two methods of liver fluke diagnosis. The kappa value was interpreted as: slight agreement ($k < 0.2$); fair agreement ($k = 0.2-0.4$); moderate agreement ($k = 0.4-0.6$); substantial agreement ($k = 0.6-0.8$); and almost perfect agreement ($k > 0.8$) (Thrusfield, 2005).

Data Analysis

The data that was recorded during the study period was entered into a Microsoft Excel sheet. The data were summarized and analyzed using the SPSS version 16 computer program. Pearson's chi-square test at a significance level of 5% and a 95% CI was used to determine the differences in the prevalence of fasciolosis infection among different species, between ages, and among body conditions in cattle and sheep. A significant level was used to determine the differences in the prevalence of fasciolosis infection among different species of ruminants, between ages, and among body conditions. The difference was considered statistically significant if the p-value was less than 0.05.

Results

Post Mortem Examination

The overall prevalence of fasciolosis in the study was 39.1% (150/384). The specific prevalence of fasciolosis was 40.6% and 31.6% in cattle and sheep, respectively. The prevalence difference between cattle and sheep was statistically not significant ($P > 0.05$). The prevalence of fasciolosis was found to be 39.4% and 38.1% in adult and young animals, respectively. However, the prevalence difference between them was statistically not significant ($P > 0.05$). The prevalence of fasciolosis is significantly higher in animals that have poor body condition than in animals that have medium or good body condition. The prevalence was 52.4% in animals in poor body condition, 37.8% in animals in medium body condition, and 27.8% in animals in good body condition.

Table 1: Prevalence of fasciolosis based on species

Species of animal	Number of examined	Positive	Prevalence (%)	X ²	P-value
Bovine	212	86	40.6	0.449	0.503
Ovine	172	64	37.2		
Total	384	150	39.1		

Table 2: Prevalence fasciolosis based on age

Age	Number of examined	Positive	Prevalence (%)	X ²	P-value
Young	105	40	38.1		
Adult	279	110	39.4	0.057	0.812
Total	384	150	39.1		

Table 3: Prevalence fasciolosis based on body condition

Body condition	No. of examined	Positive	Prevalence %	x ²	P-value
Poor	84	44	52.4	9.78	0.008
Medium	206	78	37.9		
good	94	28	27.8		
Total	384	150	39.1		

Table 4: The presence or absence of *Fasciola* species eggs in the faces with and without *Fasciola* in the liver

Coprological examination	Post mortem examination		Total
	Fluke present (+)	Fluke absent (-)	
Eggs present (+)	94	0	94
Eggs absent (-)	56	234	290
Total	150	234	384

Result and Sensitivity and Specificity of Coprological Test

The sensitivity and specificity of the direct sedimentation technique were calculated from the results in Table 4, which sets out the numbers of positive and negative tests in animals with and without flukes in their livers (Smith,

2005). Out of the 384 cattle subjected to both fecal and liver examinations, 150 had flukes in their livers, but only 94 showed fasciola eggs in their feces. Accordingly, the sensitivity of a single examination by the sedimentation method was found to be 62.7% and the specificity was 100%, with substantial agreement ($k = 0.67$) between the two tests.

Discussion

In this study, the overall fasciolosis prevalence was 39.1% (150/384). This prevalence was higher than the findings of Yemisrach and Mekkonen, (2012) and Ayalew and Endalkachew, (2013), who recorded the overall prevalence was 21% in the Debre Zeit abattoir and 31.1% in the Bahir Dar abattoir, respectively. Variations in the management and control systems may also contribute to these discrepancies, although the main causes are likely agroecological and climatic variations across the geographic sites, such as variations in altitude, rainfall, and temperature. The ecology of the snail's intermediate host has a major role in the spread of fasciolosis. The presence of a suitable habitat for the vectors is one of the most significant factors influencing the occurrence of fasciolosis in a given location (Urquhart *et al.*, 1996).

The specific prevalence of fasciolosis was found to be 37.2% in sheep and 40.6% in cattle. This prevalence difference was not significant. This result was not in agreement with the observations of Ayalew and Endalkachew, (2013) and Yemisrach and Mekkonen, (2012), who reported a higher and more significant prevalence of fasciolosis in cattle than in sheep. This may be due to the sample size. This indicated that the cattle and sheep graze on the same communal grazing land with similar agroecological conditions, so the chance of acquiring the disease and becoming infected is therefore similar. A statistical analysis of infection rates based on age indicated a prevalence of 38.1% and 39.4% in young and adult animals, respectively. There was no significant difference in infection rates ($P > 0.05$) among different age groups. This showed that age groups do not affect the presence or prevalence of fasciolosis; hence, both age groups were equally exposed to infection. This may be young animals grazing similar grazing land with adults and the early release of young stock with adults.

There was a statistically significant association ($P < 0.05$) between *Fasciola* prevalence and the body condition of the animals. The prevalence of fasciolosis was 52.4%, 37.9%, and 27.8% in animals in poor, medium, and good body condition, respectively. There was a higher prevalence of fasciolosis in animals with poor body conditions compared to animals with medium and good body conditions. In support of this finding, a study conducted in Bahir Dar, North Ethiopia (Ayalew and Endalkachew, 2013) and in Debre Zeit, Ethiopia (Yemisrach and Mekkonen, 2012) indicated a statistically significant association between the prevalence of fasciolosis and the body condition of the animals. This may be because animals coming from feedlots, which are expected to be in good body condition, are more likely to be dewormed than cattle coming directly from grazing, which are expected to be in poor body condition. Also, this may be because animals with poor body condition are usually less resistant and consequently susceptible to various diseases, including fasciolosis, or chronic fasciolosis, which is characterized by progressive loss of body condition (Sangster *et al.*, 2021).

In this study, the sensitivity of the sedimentation diagnostic technique was found to be 62.7% concerning the results of the liver examination, and a substantial agreement ($\kappa = 0.67$) was observed between the two tests. However, this test suggests that about 37.3% of infected animals may pass undetected with a single examination of feces by the sedimentation technique. This may be because the sedimentation technique cannot detect infection during the prepatent period. After all, eggs are found in feces when the flukes are already mature (usually between 10 and 14 weeks of infection) (Urquhart *et al.*, 1996). The present sensitivity value (62.7%) was related to the reports of 66.7% in Vietnam (Anderson *et al.*, 1999), 69% in Switzerland (Rapsch *et al.*, 2006), 67.13% in Hawasa (Abebe *et al.*, 2010), and 65.9% in Bahirdar (Ayalew and Endalkachew, 2013). Coproscopy can be very efficient in the case of repeated sampling, resulting in a sensitivity of approximately 92% (Rapsch *et al.*, 2006).

Conclusions and Recommendations

Fasciolosis is one of the most common helminth parasites that affects cattle and sheep and can result in productivity losses that impact the economy of the livestock industry. The high prevalence of fasciolosis in cattle and sheep in the present study represents a high rate of infection and causes high economic losses to the area. The level of infection observed in this study revealed favorable environmental conditions for the development and survival of the parasite in the area of origin of the study animals. Based on the findings from the present study, the following

points were forwarded:

- Strategic anti-helminth treatments with appropriate flukicide drugs should be practiced twice a year, before and after the rainy season, to eliminate the fluke burden on the host animal and reduce the number of snails becoming infected.
- Improve drainage and fence off wet areas with poor drainage to reduce snail problems is required.
- The community should be informed about the disease and the risks associated with acquiring the infection.

Acknowledgments

The authors are very thankful to the abattoir staff for their cooperation during the collection of samples and the laboratory staff for technical assistance.

Contribution by Authors

Equal contribution. All authors declared that ‘written informed’ consent was obtained from the approved parties for the publication of this article and accompanying images.

Conflict of Interests

There is no conflict of interest.

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