

Prevalence, Associated Risk Factors and Gross Pathological Lesions of Bovine Fasciolosis in Adaba Abattoir, West Arsi, Ethiopia

Kirubel Paulos Gutama¹ and Mahendra Pal*²

¹Adaba District Livestock and Fishery Development and Resource Office, Oromia, ETHIOPIA

²Founder Director of Narayan Consultancy on Veterinary Public Health and Microbiology, Aangan, Jagnath Ganesh Dairy Road, Anand, Gujarat, INDIA

*Corresponding Author: palmahendra2@gmail.com

How to cite this paper: Paulos Gutama, K., & Pal, M. (2021). Prevalence, Associated Risk Factors and Gross Pathological Lesions of Bovine Fasciolosis in Adaba Abattoir, West Arsi, Ethiopia. *International Journal of Livestock Research*, 11(11), 42-49.

<https://dx.doi.org/10.5455/ijlr.20210919080308>

Received : Sep 19, 2021
Accepted : Nov 27, 2021
Published : Nov 30, 2021

Copyright © Gutama *et al.*, 2021

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
<http://creativecommons.org/licenses/by/4.0/>



Abstract

Parasitic diseases are important causes of morbidity and mortality in livestock. A cross-sectional study was conducted from January 2019 to July 2019 to estimate the prevalence, investigate potential risk factors and characterize hepatic lesions of bovine fasciolosis in Adaba abattoir, Ethiopia. There were 450 samples collected and processed in total. A simple random sample strategy was used to choose the study animals. An ante- mortem examination was used to investigate potential risk factors. Post mortem examination was done by careful examination through palpation and incision of each liver and bile duct. Descriptive statistics were used to summarize the prevalence of bovine fasciolosis and Chi-square (X²) test was applied to compare the infection status with regard to the hypothesized risk factors and (P<0.05) was set for statistical significance. The overall prevalence of bovine fasciolosis was 35.77% (95% CI: 31.46-40.33). Fasciola hepatica was found to be the predominant Fasciola species affecting cattle slaughtered in the study area with 90 (20%), while 42 (9.3%) livers had Fasciola gigantica and 29 (6.4%) were infected by both species (Fasciola hepatica and Fasciola gigantica). Among the positive livers for the parasite, 79 (49.1%), 48 (29.8%) and 34 (21.11%) of the livers had slight, moderate and severe gross lesions, respectively. The disease was statistically significantly associated (P<0.05) with age and body condition scores, but statistically insignificantly associated (P>0.05) with sex. In conclusion, the disease is ubiquitous in slaughtered cattle and is a major cause of liver condemnation at the Adaba abattoir; further extensive investigations on the disease's epidemiology and planned strategies to reduce the disease should be undertaken.

Keywords: Adaba, Abattoir, Bovine Fasciolosis, Hepatic Lesions, Prevalence, Risk factors

Introduction

Helminthic diseases caused by cestodes, nematodes, and trematodes are reported from developing as well as developed nations of the world (Pal, 2007). Fasciolosis is a parasite disease that limits the productivity of ruminants in tropical and subtropical countries. Digenean trematodes of the genus *Fasciola*, also known as liver flukes, cause the condition. The two liver flukes that typically cause fasciolosis in ruminants are *Fasciola hepatica* and *Fasciola gigantica* (Keyyu *et al.*, 2005; Pal, 2007). All domestic animals, including equines and many wild animals, can be infected with *Fasciola*, although chronically infected sheep are the most common source of pasture contamination (Andrew, 1999).

Snails in the *Lymnaeidae* family, notably those in the genera *Lymnaea*, *Galba*, *Fossaria*, and *Pseudosuccinea*, serve as intermediate hosts for *Fasciola* species (CDC, 2013). In different parts of the world, *Lymnaea truncatula* is the most common intermediate host for *Fasciola hepatica* (Njau *et al.*, 1989). *Lymnaea natalensis* and *Lymnaea auricularia* are the most important intermediate hosts of *Fasciola gigantica* (Urquhart *et al.*, 2013). Definitive hosts of the fluke are cattle, sheep, and buffaloes. Wild ruminants and other mammals, including humans, can act as definitive hosts as well (Torgerson and Clayton, 1999).

Fasciolosis is a zoonotic infection that only infects people seldom (Okewole *et al.*, 2000), however, it has recently been identified as an emerging foodborne parasite disease (Pal *et al.*, 2014). *Fasciola hepatica* may be acquired by man, but not directly from cattle. To become infected, the human must consume the metacercaria (Mas Coma *et al.*, 1999). Mortality, morbidity, reduced growth rate, liver condemnation, higher susceptibility to secondary infections, and the cost of control treatments all contribute to the economic losses caused by fasciolosis (Malone *et al.*, 1998).

Several studies conducted by Equar *et al.* (2012) at Municipal abattoir, Mekelle, Kebede *et al.* (2013) at ELFORA abattoir, Gondar, Petros *et al.* (2013) at Municipal abattoir, Nekemte, Yusuf *et al.* (2016) at Municipal abattoir, Haramaya, Alemneh and Ayelegne, (2017) at ELFORA Abattoir, Kombicha and Yitayal and Taddie (2020) at Municipal abattoir, Bahirdar have reported the prevalence of bovine fasciolosis in abattoirs of Ethiopia. Despite the previous investigations, the disease has not been thoroughly investigated, and data on its prevalence and related risk factors in and around Adaba is still lacking. Therefore, the objectives of this study are to estimate the prevalence, investigate potential risk factors, and characterization of hepatic lesions of bovine fasciolosis in cattle slaughtered at Adaba town abattoir in Ethiopia.

Material and Methods

Study Area Description

Adaba town is located in the west Arsi Zone of Oromia regional state, Ethiopia. It is situated 250 km south-west of Addis Ababa (the capital city of Ethiopia) and is located between latitude: 7° 00' 0.00"N and longitude: 39° 29' 59.99" E. Adaba is bordered on the southwest by Nensebo, on the west by Dodola, on the northwest by the Shebelle River which separates it from the Gedeb-Asasa, and on the east and south by Bale zone. Mean maximum temperature of Adaba is 21°C, while the mean minimum temperature is 10.4°C. According to a survey of land, 16.9% of the land in this woreda is arable or cultivable, 23.3 percent grazing, 52.2 percent woodland, and the remainder 7.6% is swampy, mountainous or otherwise unusable. The Adaba abattoir provides fresh meat for different organizations such as hotels, restaurants and butchereries (AWAO, 2019).

Study Animals

The study animals were crossbred and indigenous zebu cattle breeds of both sexes brought to the Adaba town abattoir for slaughter. The majority of the slaughtered animals were brought in from various markets in and around Adaba. It was difficult to pinpoint the origin of all animals slaughtered at the abattoir and link it to fasciolosis results in a specific location. However, certain attempts found that the majority of them were procured from surrounding markets (Dodola, Bale and Gadab-Asasa).

Study Design

A cross-sectional study was conducted from January, 2019 to July, 2019 to estimate the prevalence, investigate

associated risk factors and characterize pathological lesions of bovine fasciolosis in Adaba town abattoir considering the age, sex and body condition of the animals.

Sample Size Determination

The sample size was calculated according to formula by Thrusfield and Christley (2018). 50% expected prevalence is taken to determine samples size with 95% confidence interval (CI) and 5% desired absolute precision.

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

Accordingly, based on the above formula a sample size of 384 was calculated, but to increase the level of precision sample size had been increased to 450.

Sampling Method

Simple random sampling technique was employed in the lairage to select study animals. Female and exotic cattle presented for slaughtering in the study area were, however, few, so they were all included. In the lairage, a simple random sampling procedure was used to pick research animals. Female and foreign cattle were, however, in short supply in the research location, therefore they were all included. Each selected animal was given an identity number and data on its sex, age, and body condition was recorded prior to sampling. The Ethiopian Ministry of Agriculture Meat Inspection Regulation was followed for inspecting meat for fasciolosis (1972).

Methods of Data Collection and Procedures

Ante-mortem Examination

The unique marks on each animal's body, which were tagged before slaughter, were used to identify it. During the antemortem inspection, the study animals' age, sex, and body condition were documented. The age of the animals was determined by examining the eruption of their teeth (De Launta and Habel, 1986). There were two age groups considered: those over the age of five and those under the age of five. On the basis of muscle mass and fat cover on the ribs, hip, between hooks, pins, spine, and transverse processes, study animals were divided into three basic categories: poor, medium, and good (Nicholson and Butterworth, 1986).

Post-mortem Examination

The liver of each study animal was carefully examined through palpation and incision on each liver and bile duct for presence of lesions indicative of Fasciola infection. Liver flukes were recovered for differential count by cutting the infected liver into fine, approximately 1 cm slices with a sharp knife. Then, positive livers with adult parasites were collected by squeezing into universal bottle containing 10% formalin preservative and then examined to identify the involved fluke species by their size and morphological character based on criteria of Soulsby, (1982). Characterization of gross liver lesions in Fasciola positive livers were further grouped in to three different pathological categories depending on the severity of damage inflicted by the parasite as lightly affected, moderately affected and severely affected. The task of categorization was based on the criteria forwarded by Ogurninade and Ogurninade (1980).

Data Management and Analysis

The data gathered was coded and saved in a Microsoft Excel spreadsheet. STATA Version 14.0 (Stata Corp. College Station, TX) was used to conduct the statistical analysis. The prevalence of Fasciola infection was determined as a percentage value using descriptive statistics. The infection status was compared with the hypothesized risk factors using the Chi-square (X^2) test, with a significance level of ($P < 0.05$) set for statistical significance.

Results

Prevalence of Bovine Fasciolosis

Of the total 450 cattle examined during routine meat inspection at Adaba Abattoir, the overall prevalence of bovine fasciolosis were 35.77% (95% CI: 31.46-40.33) (161/450) (Fig.1). The prevalence of *Fasciola* species is described below (Table 1).

Table 1: Prevalence of *Fasciola* species

Species of Fasciola	Number of Examined Animal	No. of Positive Animals	Prevalence (%)
<i>Fasciola hepatica</i>	450	90	20
<i>Fasciola gigantica</i>	450	42	9.3
Mixed infection	450	29	6.4

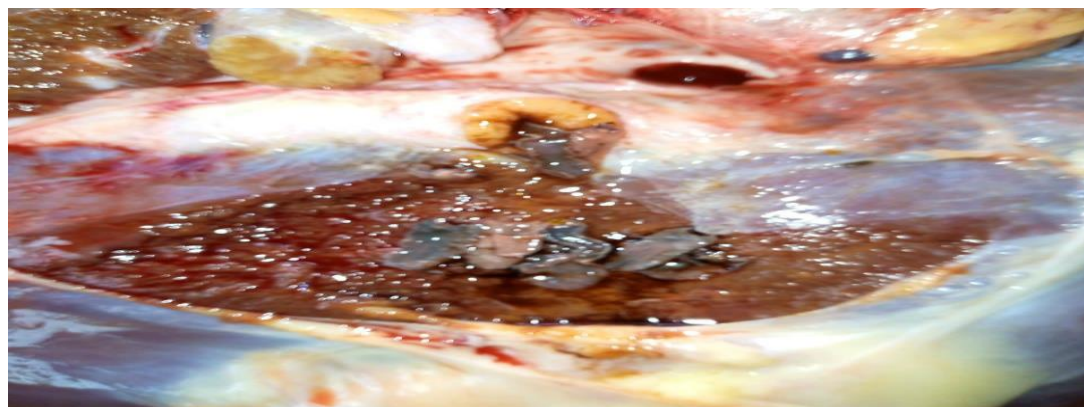


Figure 1: Bovine liver from Adaba slaughter house showing mature *Fasciola*.

Gross Hepatic Lesion Characterization

Hepatic lesions were characterized based on the severity of the lesions. The classification of the lesions is described below (Table 2).

Table 2: Classification of liver based on the extent of gross hepatic lesion

Extent of Hepatic Lesions	Number of Livers	Prevalence (%)
Lightly affected	79	49.1
Moderately affected	48	29.8
Severely affected	34	21.1
Total	161	100

Risk Factors Associated with Bovine Fasciolosis

In this study, the infection rate among different body condition of the cattle examined were found to be statistically significant ($P < 0.05$) with the highest prevalence in poor (53.23%) followed by medium (22.16%) than the good (20.55%) (Table 3).

Table 3: The prevalence bovine fasciolosis in cattle slaughtered at Adaba abattoir in relation to their body condition

Variables	Categories	Animal examined	Number of positive	Prevalence (%)	χ^2	P-value
Body condition	Poor	201	107	53.23	48.2312	0
	Medium	176	39	22.16		
	Good	73	15	20.55		

In the present study, the infection rate among different age groups of examined animals were found to be statistically significant ($P < 0.05$) with the highest prevalence in animals aged >5 years (39.12%) than the animals aged ≤ 5 years (25.45%) (Table 4).

Table 4: The prevalence of bovine fasciolosis in cattle slaughtered at Adaba abattoir in relation to their age

Variable	Categories	Animal examined	Number of positive	Prevalence (%)	X^2	P-value
Age	≤ 5 years	110	28	25.45	6.7524	0.009
	>5 years	340	133	39.12		

In the current study, the infection rate among different sex groups of examined animals were found to be statistically insignificant ($P > 0.05$) with the highest prevalence in male animals (36.22%) than the female animals (32.76%) (Table 4).

Table 4: The prevalence of bovine fasciolosis in cattle slaughtered at Adaba abattoir in relation to their sex

Variable	Categories	Animal examined	Number of positive	Prevalence (%)	X^2	P-value
Sex	Male	392	142	36.22	0.2641	0.607
	Female	58	19	32.76		

Discussion

The present study showed that the overall prevalence of bovine fasciolosis in Adaba abattoir was 35.77% (161/450). This finding is comparable with reports of Mihrete *et al.* (2010) at Adwa Municipal abattoir (32%), Equar *et al.* (2012) at Mekelle Municipal abattoir (35.2%) Daksa *et al.* (2016) at Guduru and Chomman Abay Abattoirs (32.6%) and Gojam and Tulu, (2018) at Ambo municipal Abattoir (39.1%). The present finding is lower when compared with a study conducted by Alemneh and Ayelegne, (2017) at Kombolcha Elfora Abattoir (53.97%) and Yitayal and Taddie, (2020) at Bahirdar Municipal abattoir (56.4%). However, it is higher than reports of Petros *et al.* (2013) at Nekemte municipal abattoir (21.9%) and Abunna *et al.* (2009) at Wolaita Soddo municipal abattoir (14%). These discrepancies in Bovine fasciolosis prevalence could be due to variances in the study areas' agro-ecology, management practices, and veterinary service and drug availability.

Species identification revealed that *Fasciola hepatica* was more prevalent as compared to *Fasciola gigantica* and certain proportion of animals harbored mixed infestation. This finding is in line with Ibrahim *et al.* (2010) at Kombolcha Industrial abattoir, Abera *et al.* (2015) at Bedele municipal abattoir and Yusuf *et al.* (2016) at Haramaya Municipal abattoir. The presence of favorable ecological biotopes for the intermediate host *Lymne truncatula* may be linked to the higher occurrence of *Fasciola hepatica*. Mixed infection by both *Fasciola* species could be attributable to the fact that cattle for slaughter typically come from diverse marketing areas with different weather conditions and altitudes known to be conducive to the development of both *Fasciola* species and intermediate hosts.

Current study revealed that the prevalence of bovine fasciolosis was statistically significantly varied with the body condition scores in which it was highest in animal in poor body condition followed by those with medium and good body conditions. This finding corresponds with the reports of Yitayal and Taddie, (2020) at Bahirdar Municipal abattoir and Hagos (2007) at Mekelle Municipal abattoir. This is because animals in poor body condition are typically less resistant and thus more prone to infectious diseases. It's also possible that the animals in poor body condition had previously experienced food or health problems. In relation to age of the animals, the prevalence of bovine fasciolosis was statistically significantly higher in those <5 years old than ≥ 5 years old animals. This finding corresponds with the observations of Petros and co-workers (2013) at Nekemte Municipal abattoir and Kasaye and others (2012) at Addis Ababa Abattoir. This could be attributed to older cattle having more exposure to illness while grazing outside and younger cattle being kept indoors and receiving adequate management, as well as having poorer immunity to infection.

This study revealed that there is no statistically significant association between bovine fasciolosis and sex of the animals. This finding is similar to the observations of Zewde and others (2019) at Wolaita sodo municipal abattoir

and Asefa and co-investigators (2015) at Inchini town. This could be because both males and females are equally susceptible to the disease and exposed to it. It could also be related to the study period's small number of female animals slaughtered at the abattoir.

Conclusion and Recommendations

The current study confirmed that bovine fasciolosis is a significant disease in Adaba town abattoir, resulting in significant revenue loss due to the condemnation of the affected livers and carcass weight reduction. *Fasciola hepatica* was the most common *Fasciola* species found in condemned livers. Body condition and age are statistically significantly associated with the prevalence of bovine fasciolosis, while sex is not. As a result, the following recommendations are made based on the aforementioned conclusion:

- Educating and informing the farmers about the need of disease management programs and frequent deworming of animals before and after the rainy season.
- Keeping animals away from marshy areas inhabited by intermediate hosts by fencing these harmful zones.
- More epidemiological research is needed to determine the factors that influence the occurrence of bovine fasciolosis in the study area.

Acknowledgements

The authors are very thankful to Prof. Dr. R.K. Narayan for his suggestions during the preparation of manuscript and Anubha Priyabandhu for computer help. This paper is dedicated to the scientists who made important contribution in the field of parasitic zoonoses.

Contribution of Authors

All the authors contributed equally. They read the final version, and approved it for the publication.

Conflict of Interests

There is no conflict of interest.

Publisher Disclaimer

IJLR remains neutral concerning jurisdictional claims in published institutional affiliation.

References

1. Abera, Y., Woldemariam, T. and Pal, M. 2015. Prevalence of Bovine Fasciolosis and its Economic Importance in Bedele, Ethiopia. *Haryana Veterinarian* 54:7-10
2. Abunna, F., Asfaw, L., Megersa, B. and Regassa, A. 2009. Bovine Fasciolosis: Coprological, Abattoir Survey and its Economic Impact due to Liver Condemnation at Soddo Municipal Abattoir, Southern Ethiopia. *Tropical Animal Health and Production* 42: 289-292.
3. Adaba Woreda Agriculture Office (AWAO). 2019. Adaba Woreda Agriculture Office, annual report, Adaba, Ethiopia.
4. Andrews, S. 1999. *The Life Cycle of Fasciola hepatica* (3rd ed.), Wallingford, CABI publishing.
5. Assefa, A., Assefa, Z., Beyene, D. and F. Desissa, F. 2015. Prevalence of Bovine Fasciolosis in and Around Inchini Town, West Showa Zone, Ada'a Bega Woreda, Central Ethiopia. *Journal of Veterinary Medicine and Animal Health* 7:241-248.
6. Ayelign, M. and Alemneh, T. 2017. Study on Prevalence and Economic Importance of Bovine Fasciolosis in Three Districts of North-East Amhara Region, Ethiopia. *Journal of Infectious and Non-Infectious Disease* 3:24.
7. Berhe, G., Berhane, K. and Tadesse, G. 2009. Prevalence and Economic Significance of Fasciolosis in Cattle in Mekelle area of Ethiopia. *Tropical Animal Health and Production* 41:1503-1405.

8. Centers for Disease Control and Prevention (CDC). 2013 Fascioliasis: DPDx –Laboratory Identification of Parasitic Diseases of Public Health Concern. Atlanta, USA.
9. Daksa, G., Abdisa, M., Desalegn, J., Negasa, F. and Asefa, K. 2016. Abattoir Survey on Prevalence of Bovine Fasciolosis in Guduru and Abay Chomman Districts, *World Journal of Agricultural Science* 12:111-118.
10. De Launta, A. and Habel, R. 1986. Applied Veterinary Anatomy, USA.
11. Equar, Y., Gashaw, A., Pal, M. and Girmay, G. 2012. Prevalence of bovine fasciolosis, amplitude of liver condemnation and its economic impact in Municipal Abattoir of Mekelle, Ethiopia. *International Journal of Livestock Research* 2: 196-205.
12. Gojam, A. and Dereje Tulu, D. 2018. Study of Prevalence and Associated Risk Factors of Bovine Fasciolosis in and Around Ambo District Abattoir and Field Survey Western Ethiopia. *Biomedical Journal of Scientific and Technical Research* 11:1-7
13. Hagos, A. 2007. Study on Prevalence and Economic Impact of Bovine Hydatidosis and Fasciolosis at Mekelle Municipal Abattoir, DVM Thesis, FVM, AAU, Debre Zeit, Ethiopia,
14. Ibrahim, N., Wasihun, P. and Tolosa, T. 2010. Prevalence of Bovines Fasciolosis and Economic Importance due to Liver Condemnation at Kombolcha Industrial Abattoir, Ethiopia. *Journal of Veterinary Medicine* 8:2-4.
15. Kassaye, A., Yehualashet, N., Yifat, D. and Desie, S. 2012. Fasciolosis in Slaughtered Cattle in Addis Ababa Abattoir, Ethiopia. *Global Veterinaria* 8:115–118.
16. Kebede, W., Pal, M., Deressa, A. and Dasgupta, R. 2013. Prevalence and Economic Significance of Fasciolosis in Cattle Slaughtered at Elfora Abattoir, Ethiopia. *Journal of Natural History* 9:19-26.
17. Keyyu, J., Monrad, N., Kyvsgaard, C. and Kassuku, A. 2005. Epidemiology of *Fasciola gigantica* and Amphistomes in cattle on traditional, small-scale dairy and large-scale dairy farms in the Southern Highlands of Tanzania. *Tropical Animal Health and Production* 37:303-314.
18. Malone, J., Gommers, R., Hansen, J., Yilma, J., Slingenbergh, J., Snijders, F., Nchet, O. and Ataman, E. 1998. Geographic Information System on the potential distribution and abundance of *Fasciola hepatica* and *Fasciola gigantica* in East Africa based on food and agriculture organization databases. *Veterinary Parasitology* 78:87-101.
19. Mas Coma, S., Barguest, M. and Esteba, J. 1999. Human fasciolosis. Dalton, J.P. ed. UK, LABI publishing, Wallingford.
20. Mihret, B., Haftom, T. and Yahenew, G. 2010. Bovine Fasciolosis: Prevalence and its Economic Loss due to Liver Condemnation at Adwa Municipal Abattoir, North Ethiopia. *Ethiopian Journal of Applied Science and Technology* 1:39-47.
21. Njau, B., Kasali, O., Scholtens, R. and Akalework, N. 1989. The Influence of Watering Practice on the Transmission of *Fasciola* among Sheep in Ethiopian Highlands. *Veterinary Research Community* 13:67-74.
22. Nicholson, M. and Buttrworth, M. 1986. A guide condition scoring of Zebu cattle. International Livestock Center For Africa (ILCA), Addis Ababa, Ethiopia.
23. Ogurinade, A. and Ogunrinade, B. 1980. Economic Importance of Bovine Fascioliasis in Nigeria. *Tropical Animal Health and Production* 12:155–160.
24. Okewole, E., Aogndip, G., Adejimm, J. and Olaniyan, A. 2000. Clinical Evaluation of Chemoprophylactic Regime against Ovine Hementiasis in *Fasciola* Endemic Farm in Ibadan, Nigeria. *Israel Journal of Veterinary Medicine* 5691:15-28.
25. Pal, M., 2007. Zoonoses. Satyam Publishers, 2nd Edition, Jaipur, India.
26. Pal, M., Abdurahman, M. and Zewdu, M. 2014. Growing Significance of Fasciolosis as Emerging Zoonoses. *Ethiopian International Journal of Multidisciplinary Research* 1: 10-13.
27. Petros, A., Kebede, A. and Wolde, A. 2013. Prevalence and Economic Significance of Bovine Fasciolosis in Nekemte Municipal Abattoir. *Journal of Veterinary Medicine and Animal Health* 5: 202-205.
28. Solusby, E. 1982. Helminthes, Arthropod and Protozoa of Domestic Animals. 7th ed. USA, Philadelphia: Lea and Febiger.
29. Thrusfield, M. and Christley, R. 2018. Veterinary Epidemiology. Elsevier 4th edition. Editor Wiley-Blackwell: London.
30. Tolosa, T. and Tigre, W. 2007. The Prevalence and Economic Significance of Bovine Fasciolosis at Jimma Abattoir, Ethiopia. *Journal of Veterinary Medicine* 3:2.
31. Torgerson, P. and Clayton, J. 1999. Epidemiology and Control. In: Dalton, J.P. (Ed) Fasciolosis. Wallingford: CAB International Publishing,
32. Urquhart, G., Armour, J., Duncan, J., Dunn, A. and Jennings, F. 1996. Parasitology (2nd edition), UK, Oxford Longman Scientific and Technical Press.

33. Yitayal, G. and Taddie, W. 2020. Prevalence Bovine Fasciolosis in Postmortem Examination at Bahir Dar Municipal Abattoir, Bahir Dar, Ethiopia. *Journal of Animal Husbandry and Dairy Science*, 4:30-36
34. Yusuf, M., Ibrahim N., Tafese, W. and Deneke, Y. 2016. Prevalence of Bovine Fasciolosis in Municipal Abattoir of Haramaya, Ethiopia. *Food Science and Quality Management*, 48:38-43.
35. Zewde, A., Bayu Y. and Wondimu A. 2019. Prevalence of Bovine Fasciolosis and Its Economic Loss due to Liver Condemnation at Wolaita Sodo Municipal Abattair, Ethiopia. *Veterinary Medicine International*, 2019:95723.
