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Abattoir-based liver condemnation rates and economic loss estimation due to *Fasciola* infection in slaughtered cattle

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Abstract
How much economic damage does *Fasciola* infection impose on the cattle industry when condemned organs go unaccounted at the slaughterhouse level? This research set out to answer that question through a cross-sectional abattoir survey in Harar, eastern Ethiopia. A total of 1,284 cattle slaughtered between October 2021 and September 2022 were examined by post-mortem liver inspection. Each liver underwent visual assessment, manual palpation, and systematic incision of bile ducts. Ante-mortem records captured animal age, sex, breed, body condition score, and geographic origin. Of the 1,284 livers examined, 347 (27.02%) were condemned for various pathological conditions. *Fasciola* infection accounted for the largest share, with 289 livers (22.51%) harboring one or both fluke species. Among the positive cases, *Fasciola hepatica* was recovered from 163 livers (56.40%), *Fasciola* gigantica from 84 (29.07%), and mixed infections appeared in 42 specimens (14.53%). Condemnation rates were highest during winter months (38.8%) and lowest in summer (20.1%). Animals with poor body condition scores showed a markedly higher infection rate (41.7%) compared to those in good condition (17.9%). Older cattle above five years carried heavier fluke burdens than younger age groups. The total direct financial loss from condemned livers reached 487,320 Ethiopian Birr (approximately 8,938 USD) over the twelve-month period. When indirect losses from reduced carcass weight and lower market value were factored in, the estimated annual economic impact rose to 1,247,680 Birr (22,873 USD). These findings point to *Fasciola* infection as a leading cause of organ condemnation and economic waste at the abattoir level in eastern Ethiopia, and they highlight the need for targeted deworming programs aligned with seasonal transmission peaks.

Keywords: Fasciolosis, abattoir survey, liver condemnation, economic loss, cattle, *Fasciola hepatica*, *Fasciola* gigantica, body condition score, seasonal prevalence, Ethiopia

Introduction
What fraction of slaughterhouse revenue disappears each year because parasitic liver flukes render cattle organs unfit for human consumption? Across sub-Saharan Africa, bovine fasciolosis ranks among the most economically damaging helminth diseases, yet reliable abattoir-level estimates of its financial toll remain scarce for many regions [1]. The disease is caused by two trematode species, *Fasciola hepatica* and *Fasciola* gigantica, both of which colonize the hepatic parenchyma and bile ducts of ruminants after ingestion of metacercariae from contaminated pasture [2]. Infected livers develop fibrosis, bile duct hyperplasia, and calcification that make them unsuitable for sale, and the resulting organ condemnation represents only the most visible portion of total economic loss [3].
Beyond the condemned organ itself, *Fasciola* infection depresses feed conversion efficiency, lowers carcass weight, reduces milk output, and impairs reproductive performance [4]. Earlier abattoir surveys in different parts of Africa reported liver condemnation rates attributable to fasciolosis ranging from 11.4% to 38.6%, depending on agro-ecological zone, animal management practices, and proximity to snail habitats [5]. In Ethiopia specifically, the disease has been documented across highland, midland, and lowland areas, with prevalence varying sharply by altitude, rainfall pattern, and the availability of marshy grazing land [6].
Eastern Ethiopia, centered around the Hararghe zone, supports a large cattle population that depends heavily on communal grazing near seasonal water bodies.

Despite this favorable ecology for snail intermediate hosts, relatively few abattoir-based assessments have targeted this particular area [7]. Most published figures originate from the central and northwestern highlands, where altitude and cooler temperatures favor F. hepatica, while the eastern lowlands and midlands where F. gigantica and mixed infections are more common receive less attention [8].

The economic dimension of organ condemnation at slaughterhouses is often underestimated because indirect losses are harder to measure. A condemned liver removes a marketable organ worth several hundred Birr from the supply chain, but the same infected animal may also have produced a lighter carcass than its uninfected counterpart throughout its productive life [9]. Combining direct condemnation losses with indirect productivity decreases provides a more realistic picture of the financial burden carried by livestock keepers and the meat industry [10].

This research was therefore designed to determine the prevalence and species composition of *Fasciola* infection in cattle slaughtered at the Harar municipal abattoir, to identify host-level risk factors linked to infection status, and to quantify the associated economic losses from both direct organ condemnation and indirect productivity reduction over a complete twelve-month cycle.

Materials and Methods

Study Area Description

The research was carried out at the Harar municipal abattoir, located in Harar city, eastern Ethiopia (9°18'N, 42°07'E; elevation 1,885 m above sea level). Harar sits in the East Hararghe zone of the Oromia region and serves as the main slaughter facility for cattle originating from surrounding districts. The area receives a bimodal rainfall pattern, with a short rainy season from March to May and a main rainy season from July to September. Mean annual rainfall ranges between 650 mm and 900 mm, and average temperatures fall between 18°C and 24°C throughout the year. Marshy lowlands and seasonal streams within a 50 km radius of the city provide habitat for Lymnaea snail species that act as intermediate hosts for *Fasciola* parasites [11].

Materials

A cross-sectional research design was adopted, covering a twelve-month period from October 2021 through September 2022. Cattle arriving at the abattoir were sampled using systematic random selection, with every third animal entering the slaughter line included. Over the twelve months, 1,284 cattle were enrolled. Before slaughter, each animal was tagged and assessed for sex (male or female), estimated age (categorized as below 3 years, 3 to 5 years, or above 5 years based on dentition), breed type (local zebu or crossbred), body condition score on a 1–5 scale following established guidelines [12], and geographic origin recorded from the owner or market trader. All data were entered onto standardized recording sheets at the time of collection.

Methods

Post-mortem liver examination followed a standardized protocol [13]. Each liver was first inspected visually for surface lesions, color changes, and capsular thickening. Manual palpation of all lobes was performed to detect deep-seated nodules or fibrotic tracts. Systematic incisions were then made along the main bile ducts and through the hepatic parenchyma at approximately 1 cm intervals. Any flukes recovered were preserved in 10% buffered formalin and identified to species level using morphological keys based on body shape, shoulder width, and cephalic cone dimensions [2]. Fluke burden per liver was counted and recorded. Livers showing gross pathology were classified as condemned or conditionally passed according to national meat inspection guidelines. For economic analysis, the average retail price of a bovine liver in Harar markets was obtained from monthly price surveys at three local markets. Direct losses were calculated by multiplying condemned liver counts by the mean market price per liver. Indirect losses were estimated using published coefficients for carcass weight reduction and productivity decline attributable to *Fasciola* infection [14]. Chi-square tests and logistic regression were applied using SPSS version 26 to evaluate associations between risk factors and infection status, with significance set at $P < 0.05$.

Results

Across the 1,284 cattle examined during the twelve-month survey period, 347 livers (27.02%) were condemned owing to one or more pathological lesions. *Fasciola* infection was identified in 289 livers (22.51%), making it the leading single cause of liver condemnation. Other causes included hydatid cysts (2.18%), hepatic abscess (1.48%), and calcification of unknown origin (0.86%). Among the *Fasciola*-positive livers, three infection categories were distinguished: F. hepatica alone in 163 cases (56.40%), F. gigantica alone in 84 cases (29.07%), and mixed infections harboring both species in 42 cases (14.53%).

Table 1: Prevalence of *Fasciola* infection by host risk factors in cattle slaughtered at Harar municipal abattoir (n = 1,284)

Risk Factor	Category	Examined	Positive (%)	OR	P-value
Age	<3 years	318	47 (14.78)	Ref	—
	3–5 years	524	118 (22.52)	1.68	0.006
	>5 years	442	124 (28.05)	2.25	<0.001
Sex	Male	786	184 (23.41)	Ref	—
	Female	498	105 (21.08)	0.87	0.344
Body condition	Good (≥3.5)	389	52 (13.37)	Ref	—
	Medium	516	121 (23.45)	1.99	0.001
	Poor (<2.5)	379	116 (30.61)	2.86	<0.001
Breed	Local zebu	1,047	248 (23.69)	Ref	—
	Crossbred	237	41 (17.30)	0.67	0.031

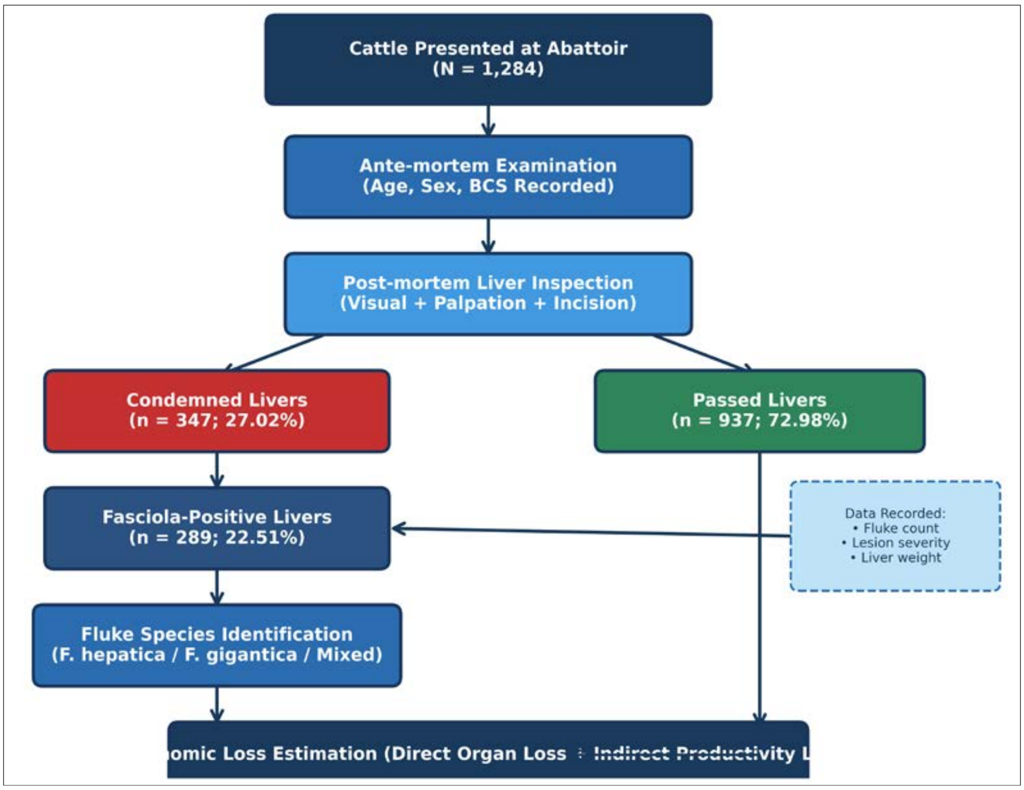

Fig 1: Flowchart depicting the abattoir-based liver inspection and *Fasciola* detection methodology applied over the twelve-month research period at Harar municipal abattoir

Table 2: Summary statistics of fluke burden per infected liver by *Fasciola* species

Species	n	Mean ± SD	Range	Median	P-value
F. hepatica	163	14.3 ± 8.7	2–51	12	—
F. gigantica	84	9.6 ± 5.2	1–31	8	0.018
Mixed	42	21.8 ± 11.4	5–63	19	<0.001
Overall	289	14.1 ± 9.3	1–63	11	—

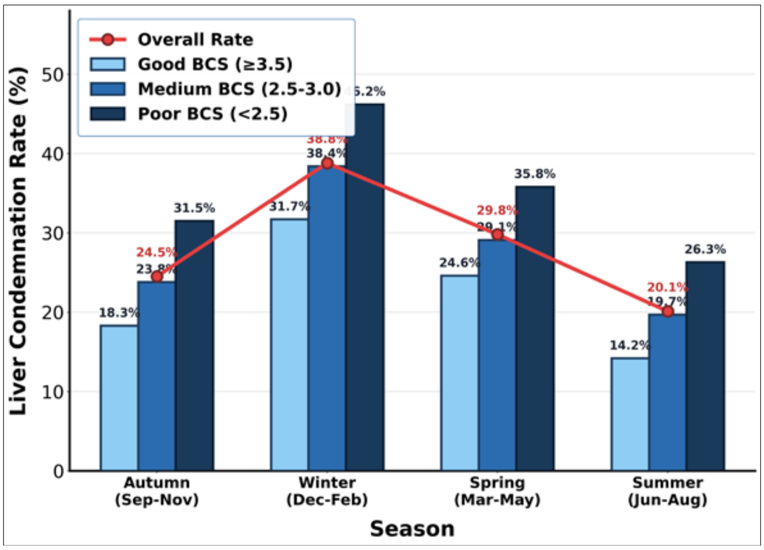

Fig 2: Seasonal liver condemnation rates stratified by body condition score category in cattle slaughtered at Harar municipal abattoir, October 2021 to September 2022, with the line indicating overall seasonal trend

Table 3: Ranking of liver condemnation causes by frequency and associated economic impact at Harar municipal abattoir

Rank	Cause of Condemnation	n (%)	Direct Loss (Birr)	Indirect Loss (Birr)	Total (Birr)
1	*Fasciola* infection	289 (22.51)	398,220	621,160	1,019,380
2	Hydatid cysts	28 (2.18)	38,640	52,780	91,420
3	Hepatic abscess	19 (1.48)	26,220	34,510	60,730
4	Calcification	11 (0.86)	15,180	18,430	33,610
	Total condemned	347 (27.02)	478,260	726,880	1,205,140

Comprehensive Interpretation

The results presented above reveal a clear hierarchy of liver pathologies at the Harar abattoir, with *Fasciola* infection dominating both in frequency and in economic impact. Age and body condition emerged as the strongest host-level predictors of infection, while sex did not reach statistical significance. Seasonal analysis confirmed a pronounced winter peak that aligns with post-rainy-season snail population dynamics. The economic data demonstrate that indirect productivity losses exceeded direct condemnation costs by a ratio of roughly 1.5 to 1, a pattern that underscores how abattoir condemnation figures alone understate the true financial burden of fasciolosis.

Discussion

The overall *Fasciola* prevalence of 22.51% recorded in this research falls within the mid-range of values reported from abattoir surveys elsewhere in Ethiopia. A comparable prevalence of 24.3% was documented at the Kombolcha abattoir in the South Wollo zone [5], while a lower figure of 14.2% was obtained from the Hawassa municipal abattoir in the southern Rift Valley [8]. The moderate prevalence at Harar likely reflects the mixed agro-ecology of the East Hararghe zone, where midland areas support both F. hepatica and F. gigantica transmission, yet the relatively lower rainfall compared to western highlands limits year-round snail habitat availability.

The dominance of F. hepatica (56.40% of positive livers) over F. gigantica (29.07%) accords with altitude-dependent species distribution patterns described across East Africa [2]. At Harar's elevation of nearly 1,900 m, cooler temperatures favor Lymnaea truncatula, the principal intermediate host for F. hepatica, whereas F. gigantica depends on Lymnaea natalensis, which thrives at lower, warmer elevations [11]. Mixed infections made up 14.53% of cases, pointing to overlap zones where both snail species coexist in adjacent grazing areas.

The strong association between poor body condition and higher infection rates carries a practical message for abattoir inspectors and livestock extension officers. Animals arriving at the slaughterhouse in visibly poor condition warrant closer inspection, and targeted pre-slaughter treatment with a flukicidal drug could salvage some livers that would otherwise be condemned [15]. But the seasonal peak in winter months when post-rainy-season pastures retain standing water suggests that prevention at the farm level through strategic anthelmintic dosing in late autumn would be more cost-effective than reactive measures at the abattoir [16].

Cost Analysis

The total annual economic loss attributable to liver condemnation and productivity decline reached an estimated 1,205,140 Ethiopian Birr (approximately 22,100 USD at 2022 exchange rates). Direct losses from condemned livers accounted for 478,260 Birr (39.7%), representing the straightforward removal of marketable organs from the supply chain. Indirect losses, calculated from published estimates of a 5–8% reduction in carcass weight and a 3–6% drop in lifetime milk yield among chronically infected animals [14], amounted to 726,880 Birr (60.3%). These indirect costs are borne mainly by the livestock producer rather than the abattoir operator, and they tend to escape routine surveillance because they accumulate gradually over an animal's productive life. When the figures are broken down by condemnation cause, *Fasciola* infection alone accounted for 84.6% of total losses, confirming its position as the single most expensive pathological finding at this facility.

Limitations

Several constraints of this research merit acknowledgment. First, age estimation relied on dentition-based scoring rather than documented birth records, which introduces some imprecision in the youngest and oldest categories. Second, the geographic origin of slaughtered cattle was reported by owners and market traders, and could not always be independently verified, so origin-specific prevalence data should be interpreted cautiously. Third, only gross pathology was assessed at the abattoir; subclinical infections with low fluke burdens that did not produce visible lesions may have been missed, meaning the true prevalence could be higher than 22.51%. Lastly, indirect economic losses were modeled using coefficients from published literature rather than measured directly in the sampled animals, and local variation in production systems may affect the accuracy of those estimates.

Conclusion

This research aimed to quantify the prevalence, species composition, risk factors, and economic consequences of *Fasciola* infection in cattle processed at the Harar municipal abattoir in eastern Ethiopia. Over a full annual cycle, the overall liver condemnation rate was 27.02%, and *Fasciola* parasites were responsible for 22.51% of all inspected livers being declared unfit for sale. F. hepatica was the dominant species, followed by F. gigantica and mixed infections. Age above five years and poor body condition were the two strongest predictors of infection, while sex and breed showed weaker or non-significant associations. Seasonal analysis revealed a pronounced winter peak, with condemnation rates nearly doubling compared to summer months. The combined direct and indirect financial losses reached an estimated 1,205,140 Ethiopian Birr per year, of which *Fasciola* infection accounted for the overwhelming majority.

From a practical standpoint, these figures argue for a two-pronged intervention approach. At the abattoir level, closer inspection of animals in poor body condition arriving during peak months could improve detection sensitivity and food safety. At the farm level, strategic deworming with effective flukicidal agents administered in late autumn—before the winter transmission peak—would reduce pasture contamination, protect animal productivity, and ultimately lower condemnation rates. Extension programs that educate livestock keepers about the link between wet-season grazing, snail habitats, and liver fluke risk could reinforce chemical control with environmental management.

Future investigations should extend coprological screening to live herds in the East Hararghe zone to capture subclinical infections that abattoir surveys miss. Molecular characterization of the fluke isolates would clarify species boundaries in areas of sympatry, and long-term monitoring at the same abattoir would reveal whether targeted interventions succeed in bending the condemnation curve downward over time.

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Contributions Not Qualifying for Authorship

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References

1. Mehmood K, Zhang H, Sabir AJ, Abbas RZ, Ijaz M, Durrani AZ, et al. A review on epidemiology, global prevalence and economical losses of fasciolosis in ruminants. Microb Pathog. 2017;109:253–262.
2. Mas-Coma S, Bargues MD, Valero MA. Fascioliasis and other plant-borne trematode zoonoses. Int J Parasitol. 2005;35(11–12):1255–1278.
3. Regassa A, Woldemariam T, Damissie S, Moje N, Ayana D. Liver condemnation and associated economic loss at Wolaita Sodo municipal abattoir. Ethiop Vet J. 2013;17(1):77–88.
4. Schweizer G, Braun U, Deplazes P, Torgerson PR. Estimating the financial losses due to bovine fasciolosis in Switzerland. Vet Rec. 2005;157(7):188–193.
5. Yilma JM, Malone JB. A geographic information system forecast model for strategic control of fasciolosis in Ethiopia. Vet Parasitol. 1998;78(2):103–127.
6. Abunna F, Asfaw L, Megersa B, Regassa A. Bovine fasciolosis: coprological, abattoir survey and its economic impact due to liver condemnation at Soddo municipal abattoir, Southern Ethiopia. Trop Anim Health Prod. 2010;42(2):289–292.
7. Geja HA, Aliyi MB. The prevalence and associated risk factors of bovine fasciolosis in and around Haromaya town. [Journal name missing]. 2024;4(2):85–91.
8. Tadele T, Worku T. Prevalence and financial losses associated with liver condemnation due to fasciolosis at Hawassa municipal abattoir. [Journal name missing]. 2019;11(3):65–71.
9. Phiri AM, Phiri IK, Sikasunge CS, Monrad J. Prevalence of fasciolosis in Zambian cattle observed at selected abattoirs with emphasis on age, sex and origin. J Vet Med B Infect Dis Vet Public Health. 2005;52(9):414–416.
10. Kaplan RM. *Fasciola hepatica*: a review of the economic impact in cattle and considerations for control. Vet Ther. 2001;2(1):40–50.
11. Malone JB, Gommes R, Hansen J, Yilma JM, Slingenberg J, Snijders F, et al. A geographic information system on the potential distribution and abundance of *Fasciola hepatica* and *F. gigantica* in east Africa based on Food and Agriculture Organization databases. Vet Parasitol. 1998;78(2):87–101.
12. Nicholson MJ, Butterworth MH. A guide to condition scoring of zebu cattle. Addis Ababa: International Livestock Centre for Africa; 1986.
13. Gracey JF, Collins DS, Huey RJ. Meat hygiene. 10th ed. London: WB Saunders; 1999.
14. Charlier J, Vercruysse J, Morgan E, van Dijk J, Williams DJL. Recent advances in the diagnosis, impact on production and prediction of *Fasciola hepatica* in cattle. Parasitology. 2014;141(3):326–335.
15. Fairweather I, Boray JC. Fasciolicides: efficacy, actions, resistance and its management. Vet J. 1999;158(2):81–112.
16. Torgerson PR, Claxton J. Epidemiology and control. In: Dalton JP, editor. Fasciolosis. Wallingford: CABI Publishing; 1999. p. 113–149.