

Review Article

Prevalence and Associated Economic Losses of *Fasciolosis* Isolated from the Liver of Meat Cattle at Municipal Abattoirs in Ethiopia: A Systematic Review and Meta-Analysis

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A B S T R A C T

Fasciolosis is a prevalent disease that significantly impairs the health and productivity of cattle and causes significant economic damage. Beyond the individually available studies with varying prevalence rates, there are no pooled national prevalence studies on bovine fasciolosis. Therefore, the aim of the current study was to determine the pooled magnitude and economic significance of fasciolosis among cattle in postmortem examination. Cochrane's Q, inverse variance (I^2), sensitivity analysis, funnel plots, Begg's test, and Egger's regression test were used to assess heterogeneity and publication bias. A random-effects model was used to calculate the pooled burden of fasciolosis among cattle. The pooled prevalence of fasciolosis among cattle in postmortem examination was 31.77% (95% CI=27.82–35.71). Among a total of 14965 livers of slaughtered cattle examined in municipal abattoirs, *Fasciola hepatica* (54.4%) was the predominant fluke identified compared to *F. gigantica* (24.6%). Mixed infections by both species and unidentified immature flukes were detected in 12.4% and 7.6%, respectively, of the affected livers. Concerning the severity of the pathological lesions observed, 30.5%, 44.3%, and 25.2% of the livers were lightly, moderately, and seriously infested, respectively. The total annual economic significance of fasciolosis among cattle from 40 reported studies was approximately 40,833,983.15 ETB (6,417, 847.73 USD). Therefore, bovine fasciolosis requires integrated control methods to address its influence on animal health and economic impact.

Keywords: Bovine Fasciolosis, Liver Fluke, Municipal Abattoir, Postmortem Inspection, *Fasciola*, Ethiopia

Introduction

Fasciolosis is a prevalent disease that significantly impairs the health and productivity of ruminants ¹. According to

previous research ², two kinds of liver flukes (*Fasciola*) induce bovine fasciolosis: *Fasciola hepatica*, which is found above 1800 m above sea level (m.a.s.l.), and *Fasciola gigantica*, which is found below 1200 m.a.s.l. The amphibious *L.*

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truncatula and the aquatic *L. natalensis* snail species are necessary for the survival of *F. gigantica* and *F. hepatica*³. Both species of *Fasciola* can infect humans, a wide range of domesticated animals, and wildlife. Compared to other animals, domestic ruminants, such as cattle, sheep, and goats, are more vulnerable. It causes hypertrophy and other pathological liver damage in infected ruminants, which leads to condemnation of the liver during slaughter and significant financial loss for farmers and the livestock production industry⁴. It also affects humans, causing harm to the bile duct and liver tissues, which in turn causes inflammation, hepatomegaly, or liver cirrhosis, which is then accompanied by anemia and diarrhea.⁵

The global agricultural sector is predicted to lose US\$2000 million a year as a result of domestic animal fasciolosis.⁶ According to,⁷ fasciolosis causes significant financial losses in many countries, including the UK and Ireland alone, where losses exceed £18 million annually. A Swiss study estimated that the disease causes losses of €52 million annually, or €299 per diseased animal, primarily from subclinical infection. In Kenya, liver condemnations in slaughtered cattle result in losses of approximately 0.26 million USD annually. Furthermore, the scientists reported that cattle slaughtered at some Iringa, Tanzania, abattoirs had a high liver condemnation rate of up to 100%. According to their study conducted in the Adwa municipal abattoir in North Ethiopia, the average yearly financial loss resulting from condemnation of the liver due to fasciolosis was 4674.2 USD. Other researchers from Haramaya.¹ and Wolaita Sodo,⁸ Ethiopia, reported annual losses of \$4414.523 and 43024.458 USD, respectively, in liver condemnation associated with *Fasciola* in slaughtered cattle.

Despite the fact that the majority of Ethiopia's economy is based on agriculture and that *Fasciola* is widely distributed there,⁹ *Fasciola* also poses a significant threat to the country's economy indirectly by reducing the number of laborers needed to track cattle, lowering milk and meat production, decreasing feed conversion efficiency, causing animals to die and become less fertile, and increasing treatment costs.¹⁰⁻¹³ Conventionally, it was projected that the fasciolosis effect on animal productivity would cause an annual economic loss of more than USD 3.2 billion.¹⁴ In addition, a recent study conducted by the WHO revealed that 2.4 million people have fasciolosis, and 180 million people are at risk of developing this illness.¹⁵ Officially, fasciolosis is acknowledged as a newly discovered human illness.¹⁰ reported that the global incidence of *Fasciola* infection in humans is predicted to range from 2.4 to 1.7 million people, 180 million of whom are at risk.

Bovine fasciolosis is an animal and public health problem in Ethiopia, and its prevalence varies throughout the country. However, in Ethiopia, the prevalence of fasciolosis among

cattle and the evaluation of its financial consequences are not collected, well organized, or recorded as a systematic review and meta-analysis. As a result, the purpose of this study was to provide evidence on the overall prevalence and economic significance of fasciolosis among cattle using previously published research found in different regions of Ethiopia. Furthermore, the results obtained in the current investigation could contribute significantly to policymakers, development planners, and animal health practitioners.

Materials and Methods

Search strategy

A systematic search of research articles was carried out in registers and databases (PubMed/Medline, Web of Science, ScienceDirect, Cochrane Library, EMBASE, Google Scholar, and ResearchGate), as well as other sources (websites, organizations, and citation searching). The following key terms and phrases were used in combination or separately with Boolean operators ("OR" or "AND") to search for research articles: "Prevalence," "Epidemiology," "Cattle," "Bovine," "Fascioliasis," "Liver Fluke," "*Fasciola*," "Helminths," "Autopsy," "Postmortem Inspection," "municipal Abattoir," "Economic Significance," and "Ethiopia." The search strategy was carried out from September to November 2023.

Inclusion and exclusion criteria

The inclusion criteria were as follows: (a) original articles with observational designs; (b) studies performed in cattle; (c) studies conducted in Ethiopia; (d) municipal abattoir-based studies; (e) studies assessing postmortem examination; and (f) studies published with full texts available for searches; (g) studies assessing associated economic losses.

The exclusion criteria for individuals were as follows: (i) reported the knowledge, attitudes, and practices of the municipal administrator or cattle husband toward fasciolosis; (ii) studies conducted outside the municipal abattoir; and (iii) had published coprological examinations only.

Data extraction

The data abstraction process was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA-2020) guidelines as recommended by Page et al.¹⁶ The collected articles were evaluated by four independent authors (AX, BX, CX, and DX) following the inclusion and exclusion criteria. These four authors extracted the necessary data using a standardized data extraction format in Microsoft Excel 2021. The following information was extracted from the studies: study (first author and publication year), region of study, study setting, study design, sampling method, sample size, cases, prevalence (postmortem examination), and financial loss

per annum. When the four authors disagreed, a fifth author (EX) was consulted, and disagreements were resolved through consensus and discussion.

Quality Assessment Tool

The overall quality of the evidence was assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) tool.¹⁷ The tool contains three main assessment instruments—methodological quality, comparability, and research outcome and statistical analysis—for determining the quality of each study. Each criterion received two points. Publications receiving a total score of 0–3 points were considered low-quality publications, 4 points were considered medium-quality publications, and 5–6 points were considered high-quality publications. DX and EX, two reviewers, independently selected the articles and evaluated their quality. Once a consensus was reached, the articles were added, and differences among the reviewers were settled through discussion.

Data analysis

The data were exported to STATA software version 14 for analysis after all pertinent findings had been extracted and placed in Microsoft Excel 2021. A 95% confidence interval was used to calculate the pooled prevalence of fasciolosis. The funnel plot and Begg and Egger's regression tests were used to screen for publication bias, with a p value of less than 0.05 indicating statistical significance.^{18–20} The Cochrane Q statistic was used to determine whether between-study heterogeneity existed. I^2 was used to quantify the degree of heterogeneity among the studies; values of 25, 50, and 75% indicated moderate, medium, and high heterogeneity, respectively.^{21,22} A random-effects model was used to estimate the pooled prevalence of ixodid ticks, and a forest plot was generated to visually assess the presence of heterogeneity.²³ Subgroup analysis was conducted based on region, publication year, sampling method, and sample size to identify potential sources of heterogeneity. Sensitivity analysis (using Duval and Tweedie's Trim and Fill analysis in the random effect model).²² was used to investigate how one study affected the overall prevalence of fasciolosis in the meta-analysis.

Results

Studies included

In total, 3049 articles on the prevalence of fasciolosis and associated economic losses were recovered across the globe. A total of 576 records were removed before screening (duplicate records removed (n = 400), records marked as ineligible by automation tools (n = 123), and records removed for being out of scope (n = 53). Of the remaining 1620 articles, 853 studies conducted outside Ethiopia were further excluded. The remaining 499 articles were not found in registers, databases, or other methods. Of the 1121 articles, 1081 were further excluded after

observation and review according to the inclusion and exclusion criteria used. Finally, 40 articles were included as criteria for the current systematic review and meta-analysis (Figure 1).

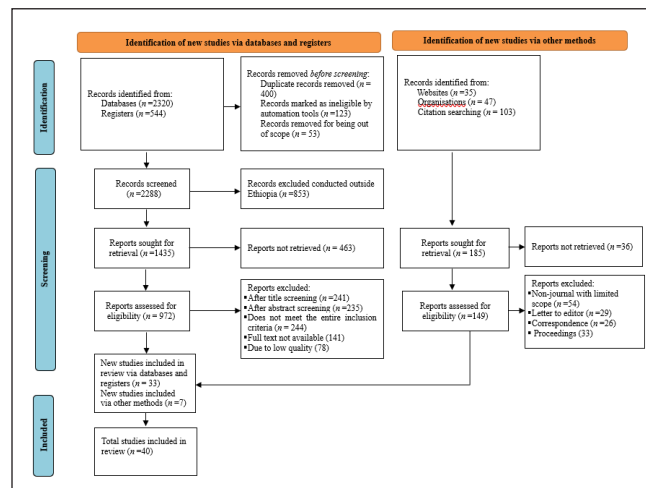


Figure 1. PRISMA-2020 flow diagram of eligible studies

Causative agents and severity of fascioliasis among cattle

Pathology was also conducted on a total of 21004 livers of slaughtered cattle in municipal abattoirs to determine the causative agents of fascioliasis in Ethiopia. *Fasciola hepatica* (54.4%) was the predominant fluke identified compared to *F. gigantica* (24.6%). Mixed infections by both species and unidentified immature flukes were detected in 12.4% and 7.6%, respectively, of the affected livers (Table 1). Concerning the severity of the pathological lesions observed, 30.5% (995/3265), 44.3% (1447/3265), and 25.2% (823/3265) of the livers were mildly, moderately, and seriously infested, respectively (Table 1).

Characteristics of the included studies

All studies included in the current review employed a cross-sectional study design. Eighteen studies were in the Southern Nations Nationalists and Peoples Region (SNNPR); nine each were in the Amhara and Oromia regions; three were in the Tigray region; and one was in the Dire Dawa. The sample sizes of the studies ranged from 215 to 3251, and the prevalence rates of fasciolosis within the studies ranged from 14.0 to 68.72%. All studies were assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) tool and yielded low risk scores (Table 2).

Meta-analysis

The pooled prevalence of fascioliasis among cattle in Ethiopia is presented in the forest plots in Figure 2. A random effects model showed that the pooled prevalence of fascioliasis among cattle was 31.77% (95% CI = 27.82–35.71; $I^2=95.0\%$).

Table 1. *Fasciola* species infecting the livers of slaughtered cattle at municipal abattoirs

<i>Fasciola</i> species encountered	Frequency (n)	Percentage (%)	Included studies
<i>Fasciola hepatica</i>	3775	55.4	2,7,8,24-60
<i>Fasciola gigantica</i>	1674	24.6	2,7,8,24-60
Mixed infections by both species	847	12.4	2,7,24-41,43,44,46-52,54-56,58,60
Unidentified immature flukes	521	7.6	2,7,24,25,28-32,35-38,40,43,44,47,49,52,54,56,57,60
Severity of infection	Frequency (n)	Percentage (%)	Included studies
Lightly	995	30.5	7,10,24,30-32,44,48,50,52,53,60
Moderately	1447	44.3	
Severely	823	25.2	

Table 2. General characteristics of the studies included in the systematic review and meta-analysis

Study	Region	Study setting	Study design	Sampling method	Sample size	Cases	Postmortem inspection prevalence (95% CI)	Financial Loss per annum	QS
Abebe et al. 2010 ²⁴	SNNPR	Hawassa municipal abattoir	CS	Simple random	3251	931	28.63 (23.3–34.7)	106, 400 ETB (8,312.5 USD)	6
Abunna et al. 2010 ²	SNNPR	Wolaita Soddo municipal abattoir	CS	Simple random	406	57	14 (9.8–20.2)	51,200 ETB (4,000 USD)	6
Bekele et al. 2010 ⁷	Tigray	Adwa Municipal Abattoir	CS	Simple random	768	248	32.3 (27.4–38.3)	57,960 ETB (4,674.2 USD)	6
Wondwosen et al. 2012 ²⁵	SNNPR	Wolaita Soddo municipal abattoir	CS	Systematic random	300	76	25.33 (20.2–31.7)	1,574,482 ETB (87,471 USD)	5
Nega et al. 2012 ²⁶	Amhara	Gondar ELFORA abattoir	CS& RS	Simple random	400	119	29.75 (24.8–35.8)	32, 075.41 ETB (2,566 USD)	5
Regassa et al. 2012 ²⁷	Oromia	Bishooftu municipal abattoir	CS	Simple random	1151	249	21.6 (16.5–27.8)	232,232 ETB (13,364.72USD)	6
Belay et al. 2012 ²⁸	Amhara	Dessie municipal abattoir	CS	Simple random	500	126	25.2 (20.3–31.5)	2,495, 346.13 ETB (143,604.68 USD)	6

Demssie et al. 2012 ²⁹	Oromia	Jimma municipal abattoir	CS	Systematic random	382	208	54.5 (49.4–60.6)	2,570,396 ETB (151,200 USD)	6
Terefe et al. 2012 ³⁰	Oromia	Jimma Municipal	CS	Systematic random	761	407	53.48 (48.5–59.6)	3,003,488.1408 ETB (172,847.75 USD)	6
Equar et al. 201 ³¹	Tigray	Mekelle municipal abattoir	CS	Simple random	1000	352	35.2 (30.1–42.3)	224,539.20 (2,245 USD)	6
Sisay & Nibret 2013 ³²	Amhara	Bahir Dar municipal abattoir	CS	Systematic random	384	174	45.3 (40.2–51.4)	198,457.80 ETB (11,421.61 USD)	6
Kebede et al. 2013 ³³	Amhara	Gondar Elfora abattoir	CS	Simple random	402	97	24.13 (19.1–30.3)	2,910.80 (300 USD)	6
Petros et al. 2013 ³⁴	Oromia	Nekemte municipal abattoir	CS	Systematic	384	84	21.9 (16.9–28.1)	63,072 ETB (1,182,600 USD).	6
Mebrahtu and Beka 2013 ³⁵	Dire Dawa	Dire Dawa municipal abattoir	CS&RS	Simple random	450	110	24.44 (19.3–30.5)	2,029,872.10 ETB (124,151.2 USD).	5
Asrese & Ali 2014 ³⁶	SNNPR	Wolaita Soddo municipal abattoir	CS	Simple random	384	78	20.3 (15.3–26.7)	3,711,246 ETB (201,111.5 USD)	6
Fetene & Addis 2014 ³⁷	Amhara	Dangila municipal abattoir	CS	Simple random	384	116	30.21 (25.3–36.7)	945,270 ETB (48, 431 USD)	6
Zelege et al 2014 ³⁸	Oromia	Mettu municipal abattoir	CS & RS	Simple random	663	312	47.1 (42.1–53.2)	513,720.00 ETB (51,372.00 USD)	5
Abera et al. 2015 ³⁹	Oromia	Bedeke municipal abattoir	CS	Simple random	455	148	32.53 (27.6–37.8)	228,360.6 ETB (13,591 USD)	6
Alemu & Abebe 2015 ⁴⁰	SNNPR	Wolaita Soddo municipal abattoir	CS	Simple random	500	143	26.8 (21.8–32.8)	3,564,990.00 ETB (187,631.053 USD)	6
Nebyou et al. 2015 ⁴¹	SNNPR	Areka municipal abattoir	CS	Systematic random	400	120	30 (24.9–36.1)	47,124 ETB (24,06.74 USD)	6
Girmay et al 2015 ⁴²	Tigray	Hawzien municipal abattoir	CS	Simple random	215	46	21.39 (16.4–27.6)	885,500 ETB (45,224.69 USD)	5
Abebe et al. 2016 ⁴³	SNNPR	Bonga municipal abattoir	CS	Systematic random	384	63	16.4 (11.4–22.6)	66,420 ETB (33,92.23 USD)	6

Yalew et al. 2017 ⁴⁴	SNNPR	Hawassa municipal abattoir	CS	Systematic random	316	101	31.96 (26.9–38.1)	291,635.00 ETB (12,495.07 USD)	6
Oyda et al. 2017 ⁴⁵	SNNPR	Wolaita Soddo municipal abattoir	CS	Systematic random	415	127	30.6 (25.6–36.8)	115,362 ETB (4,942.67 USD)	5
Eshetu et al. 2017 ⁴⁶	SNNPR	Angacha municipal abattoir	CS	Systematic random	384	156	40.62 (35.6–46.8)	48,744.00 ETB (2,565.47 USD)	6
Getahun et al. 2017 ⁴⁷	SNNPR	Hossana municipal abattoir	CS	Simple random	422	115	27.25 (22.2–33.5)	66,370.10 ETB (3,493.16 USD)	6
Meaza et al. 2017 ⁴⁸	SNNPR	Arba Minch municipal abattoir	CS	Systematic random	600	203	33.83 (28.8–40.1)	726,561.5 ETB (52,649.38 USD)	6
Wolde and Tamiru 2017 ⁴⁹	SNNPR	Wolkite town, community abattoir	CS	systematic random	392	164	41.8 (36.8–47.9)	5167081.92 ETB (240329 USD)	6
Worku et al. 2017 ⁵⁰	Oromia	Assela municipal abattoir	CS	Systematic random	349	105	30.1 (25.1–36.3)	20,00506.2 ETB (85,711.50 USD)	5
Ayelnig & Alemneh 2017 ⁵¹	Amhara	Kombolcha ELFORA abattoir	CS	Simple random	380	205	53.97 (48.9–60.1)	1,601,776.71 ETB (68,627.97 USD)	5
Ayele et al. 2018 ⁵²	Amhara	Debire Birhan municipal abattoir	CS	Simple random	300	176	58.6 (53.5–64.7)	59,387 ETB (2969 USD)	5
Mohammadnur & Geleta 2018 ⁵³	Oromia	Robe Municipal Abattoir	CS	Simple random	502	345	68.72 (63.7–74.9)	2,935,670.4 ETB (108,728.5 USD).	6
Zewde et al. 2019 ⁸	SNNPR	Wolaita Soddo municipal abattoir	CS	Systematic random	247	50	20.24 (15.3–26.5)	1,505,856 ETB (43,024.458 USD)	5
Bekele, 2019 ⁵⁴	Oromia	Lalo municipal abattoir	CS	Systematic random	412	120	29.13 (24.1–35.3)	92,851.86 ETB (3438.95 USD)	6
Kassie and Ali, 2019 ⁵⁵	Amhara	Gondar ELFORA abattoir	CS	systematic random	384	90	23.4 (18.4–29.5)	1,919,640 ETB (65,922 USD).	6
Mequaninit & Mengesha 2021 ⁵	Amhara	Kombolcha industrial abattoir	CS & RS	Simple random	409	143	35 (30.0–41.0)	72,360 ETB (3,206,995.2 USD)	6
Fesseha & Asefa 2022 ⁵⁷	SNNPR	Wolaita Sodo municipal abattoir	CS	Systematic random	384	52	13.54 (8.5–20.1)	242,990 ETB (4,944.03 USD)	6

Japaro 2023 ⁵⁸	SNNPR	Gesuba municipal abattoir and district municipal abattoirs of Kawo koyisha (Lasho) and Bayira koyisha (Baliko sagno)	CS	Simple random	400	58	14.5 (9.5–20.7)	5,614,657.68 ETB (80,209.40 USD)	6
Mathewos et al. 2023 ⁵⁹	SNNPR	Tarcha municipal abattoir	CS	Simple random	384	115	29.94 (24.9–36.1)	2,227,536 2, ETB (47,945.24 USD)	6
Tadesse & Acklock 2023 ⁶⁰	SNNPR	Yirgalem municipal abattoir	CS	Systematic random	400	108	27.0 (22.0–33.0)	945, 999 ETB (18,192.288 USD)	6

SNNPR, Southern Nations, Nationalities and People's Region; CS, cross-sectional; RS, retrospective study; QS, quality score

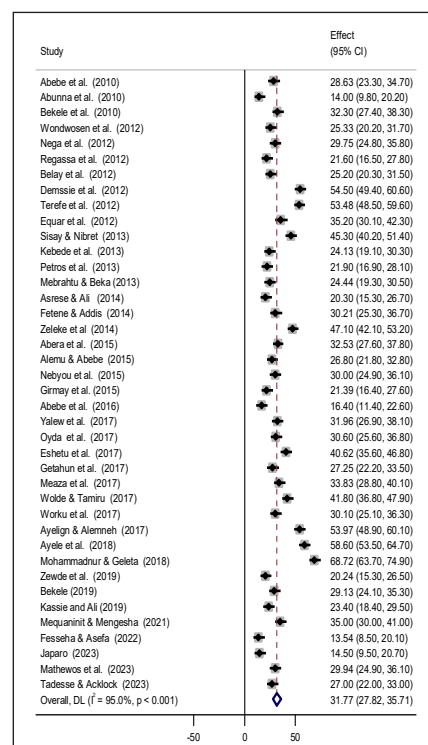


Figure 2. Forest plot of the prevalence of fasciolosis among cattle in Ethiopia

Subgroup analysis

A sample size less than 384 with a pooled prevalence of 37.01 (95% CI: 25.90, 48.12) was comparatively greater than that of their counterparts (sample size greater than or equal to 384), with a pooled prevalence of 30.46 (95% CI: 26.40, 34.51) (Figure 3 and Table 3). With respect to region, 39.89 (95% CI: 29.15, 50.63), 36.17 (95% CI: 27.52, 44.83), 29.58 (95% CI: 21.37, 37.80), 26.26 (95% CI: 22.34, 30.18), and 24.44 (95% CI: 18.84, 30.04) were the pooled prevalence of bovine fasciolosis in Oromia, Amhara, Tigray, SNNPR and the Dire Dawa, respectively (Figure 4 and Table 3). With regard to sampling technique, the pooled prevalence of bovine fasciolosis was greater in the simple random sampling method 31.89 (95% CI: 26.11, 37.66) than in the systematic random sampling method 31.62 (95% CI: 26.26, 36.99) (Figure 5 and Table 3). The prevalence estimate of bovine fasciolosis was greater between 2015 and 2019, with a pooled prevalence estimate of 34.30% (95% CI: 27.94, 40.65) than that in the study period from 2010 to 2014, at 31.37% (95% CI: 25.63, 37.11) and from 2020–2023, at 24.02% (95% CI: 15.68, 32.35) (Figure 6 and Table 3).

Heterogeneity, publication bias, and sensitivity analysis

All the heterogeneity and publication bias of the included studies were evaluated, and high levels of heterogeneity were present ($I^2 = 95.0\%$, $p < 0.001$). The funnel plot revealed an asymmetrical distribution (Figure 7). Egger and Begg tests revealed that there was no substantial publication bias (Figures 8 and 9). To clarify the impact of each study on the size of the pooled effect, a sensitivity analysis was performed by removing each study one at a time. According to the sensitivity analysis, almost all of the studies had no determinant effects on the overall magnitude of fasciolosis among cattle in Ethiopia, except Mohammadnur & Geleta's study.

Economic significance of fasciolosis among cattle

The annual economic significance of fasciolosis among cattle associated with liver condemnation was determined from 40 studies, and results with a pooled estimate of 40,833,983.15 ETB (6,417, 847.73 USD) fasciolosis associated economic losses.

Table 3. Subgroup analysis of the magnitude of fasciolosis among cattle

Variables	Characteristics	Included studies	Sample size	Prevalence (95% CI)	I^2 , P-value
Sample size	<384	8	2489	37.01 (95% CI: 25.90, 48.12)	96.8, $P < 0.001$
	≥384	32	18515	30.46 (95% CI: 26.40, 34.51)	94.1, $P < 0.001$
Region	SNNPR	18	9969	26.26 (95% CI: 22.34, 30.18)	88.7, $P < 0.001$
	Tigray	3	1983	29.58 (95% CI: 21.37, 37.80)	83.9, $P = 0.002$
	Amhara	9	3543	36.17 (95% CI: 27.52, 44.83)	95.4, $P < 0.001$
	Oromia	9	5059	39.89 (95% CI: 29.15, 50.63)	97.1, $P < 0.001$
	Dire Dawa	1	450	24.44 (95% CI: 18.84, 30.04)	–, –
Sampling method	Simple random	22	13726	31.89 (95% CI: 26.11, 37.66)	95.8, $P < 0.001$
	Systematic random	18	7278	31.62 (95% CI: 26.26, 36.99)	93.9, $P < 0.001$
Publication Year	2010–2014	17	11970	31.37 (95% CI: 25.63, 37.11)	94.4, $P < 0.001$
	2015–2019	18	7057	34.30 (95% CI: 27.94, 40.65)	95.7, $P < 0.001$
	2020–2023	5	1977	24.02 (95% CI: 15.68, 32.35)	91.0, $P < 0.001$
	Overall	40	21004	31.77 (95% CI: 27.82, 35.71)	95.0, $P < 0.001$

SNNPR, Southern Nations, Nationalities and People's Region

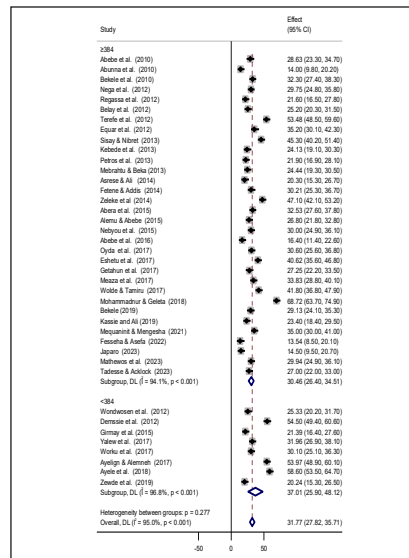


Figure 3. Subgroup analysis by sample size on the pooled prevalence of fasciolosis among cattle in Ethiopia

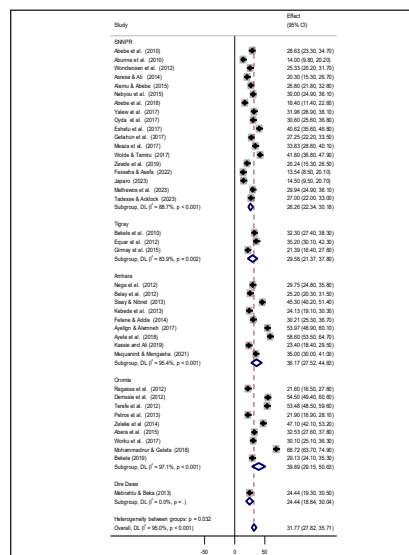


Figure 4. Subgroup analysis by region on the pooled prevalence of fasciolosis among cattle in Ethiopia

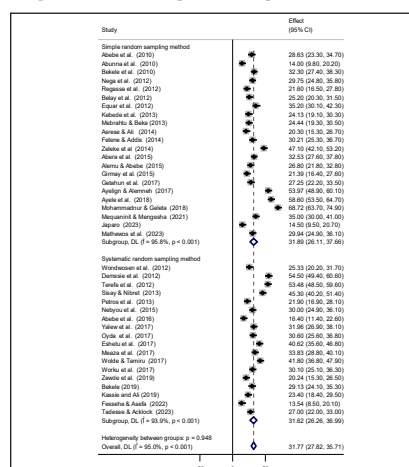


Figure 5. Subgroup analysis by sampling method on the pooled prevalence of fasciolosis among cattle in Ethiopia

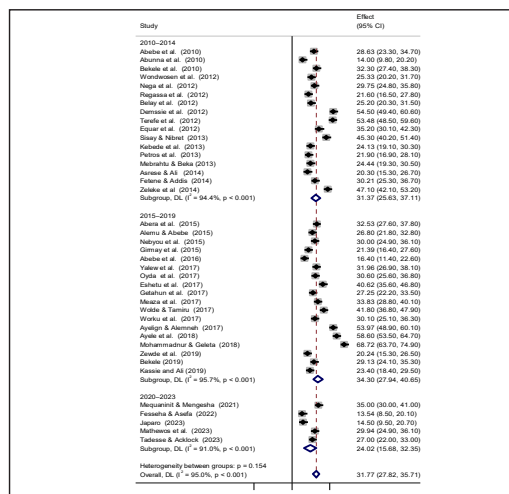


Figure 6. Subgroup analysis by publication year on the pooled prevalence of fasciolosis among cattle in Ethiopia

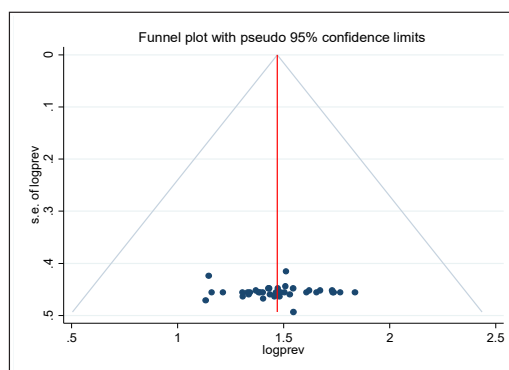


Figure 7. The funnel plot in this meta-analysis indicates publication bias across studies

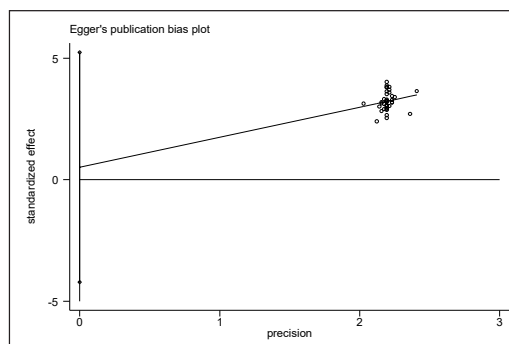


Figure 8. Egger's publication bias plot of included studies on the impact of fasciolosis on cattle pooled magnitude

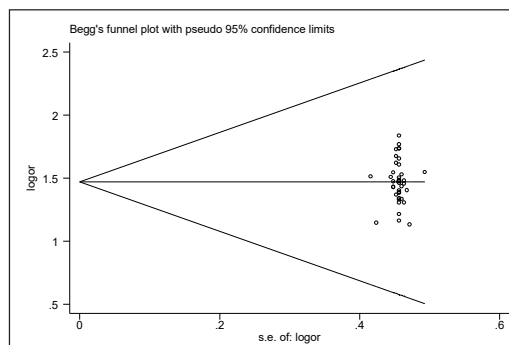


Figure 9. Begg's publication bias funnel plot of the included studies of fasciolosis impact on cattle pooled

Discussion

The prevalence of bovine fasciolosis obtained through postmortem examination of the cattle (31.77%) was consistent with the findings of,^{7,50,54,61,62} who reported a prevalence of 29.13% in Lalo, 32.3% in Adwa, 28.6% in Debre Tabor, 30.83% in Dambi Dollo, and 30.1% in Asella municipal abattoir. However, it was lower than the reports of,⁴⁶ in Angacha municipal abattoir,³⁸ in Mettu municipal abattoir,⁶³ in Jimma municipal abattoir,⁶⁴ Bahir Dar municipal abattoir,⁵³ Robe municipal abattoir and,⁶⁵ in Haranfama municipal abattoir who reported a prevalence of 40.62%, 47.1%, 54.5%, 56.4%, 68.72% and 83.6%, respectively. However, these findings exceeded the reports of,⁶⁶ and,⁶⁷ who documented 7.03% and 9.88%, respectively, in the Wolita Soddo municipal abattoir and Halaba municipal abattoir. This regional disparity in prevalence might be due to variations in ecology, climate, and management practices and may have affected the vector, parasite epidemiology, and risk of infection.

According to,² infections with *F. hepatica* and *F. gigantica* occur in Ethiopia at elevations greater than 1800 m and less than 1200 m, respectively. Postmortem examination of the pooled diseased livers of cattle from different municipal abattoirs revealed that *F. hepatica* was the dominant species (54.73%), followed by *F. gigantica* (23.21%), mixed infection (15.04%) and immature flukes (7.02%). The current data support the findings of,^{7,50,54} who first claimed that the most common species of liver fluke infecting cattle was *F. hepatica*. The results of the present study, however, did not agree with earlier research conducted in several regions of Ethiopia.^{2,43,45} which reported *F. gigantica* to be the most common species of liver fluke affecting cattle. The surrounding ecosystem, which supports the growth of snails, the intermediate hosts of both parasite species, may be the cause of this disparity.⁶⁸

In the present study, all fasciolosis-inflicted liver defects were condemned in the abattoir as unfit for human consumption. According to estimates, the annual direct economic loss resulting from fasciolosis-related liver condemnation was 40,833,983.15 ETB (6,417, 847.73 USD) on average. This figure was greater than that of prior figures from Ethiopia.^{8,58,59}

Conclusion

The current study revealed that bovine fasciolosis was quite prevalent. This led to a large amount of liver damage and condemnation, which had a negative financial impact on the animal production industry and caused losses for livestock farmers. Due to the higher prevalence rate of this disease, control and prevention measures are needed to combat the infection and its subsequent economic impact. These measures include managing grazing, reducing the number

of intermediate hosts, and diagnosing and treating sick animals with anthelmintics.

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