GSC Biological and Pharmaceutical Sciences
eISSN: 2581-3250 CODEN (USA): GBPSC2
Cross Ref DOI: 10.30574/gscbps
Journal homepage: https://gscbps.gsconlinepress.com/

(RESEARCH ARTICLE)

EPIDEMIOLOGY, RISK FACTORS AND MEAT INSPECTION FINDINGS OF ADULT *FASCIOLA* SPP. INFECTION IN SLAUGHTERED CATTLE AT TAMBOUL ABATTOIR, GEZIRA STATE, SUDAN: A CROSS-SECTIONAL ABATTOIR-BASED SURVEY

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GSC Biological and Pharmaceutical Sciences, 2026, 37(01), 136–141

Publication history: Received on 03 September 2026; revised on 11 October 2026; accepted on 13 October 2026

Article DOI: https://doi.org/10.30574/gscbps.2026.37.1.0349

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ABSTRACT

Background: Bovine fasciolosis caused by adult *Fasciola* spp. is a major cause of liver condemnation and economic losses in Sudan.

Objective: To determine the prevalence, risk factors and meat inspection lesions of adult *Fasciola* spp. in cattle at Tamboul Abattoir in relation to age, sex, breed, body condition and liver shape.

Materials and Methods: A cross-sectional abattoir study was conducted from January to February 2021. A total of 300 cattle livers were examined by visual inspection, palpation and multiple incisions. Data on age, sex, breed, body condition score BCS and liver shape were recorded. Association was tested by Chi-square.

Results: Overall prevalence was 3.3% (10/300). Prevalence was highest in cattle <1 year 6.7% (4/60), females 4.2% (7/168), Local breed 4.5% (9/200), poor BCS 6.0% (6/100) and fibrotic/irregular liver shape 12.5% (5/40). Age, sex, breed, BCS and liver shape were statistically significant P<0.05. F. *gigantica* was predominant 80.0%.

Conclusion: Adult *Fasciola* infection is present at low prevalence but significantly associated with young age, female sex, Local breed, poor BCS and liver fibrosis. Snail control, strategic deworming and improved meat inspection are recommended.

Keywords: *Fasciola* spp., *Fasciolosis*, Meat inspection, Risk factors, Cattle, Prevalence, Gezira State, Sudan.

1 INTRODUCTION

Bovine fasciolosis is a globally distributed trematode infection caused primarily by *Fasciola hepatica* and F. *gigantica* (Urquhart et al., 2007). The adult flukes reside in the bile ducts where they induce chronic cholangitis, fibrosis, anemia, reduced weight gain, decreased milk yield and condemnation of livers (Radostits et al., 2017). The disease is of major economic importance in livestock-producing countries due to direct losses from liver condemnation and indirect losses from reduced productivity (Torgerson and Claxton, 2019).

The life cycle of *Fasciola* involves an intermediate snail host of the genus *Lymnaea*. Metacercariae encyst on vegetation and are ingested by grazing animals (Mas-Coma et al., 2009). In Sudan, irrigated schemes such as Gezira State provide ideal ecological conditions for snail proliferation due to permanent water channels and favorable temperatures (FAO, 2016).

Epidemiological studies have identified several risk factors for fasciolosis. Age is critical as younger animals have less acquired immunity and graze closer to ground where metacercariae are concentrated (Boray, 2007). Sex may influence exposure due to management differences, with females often kept longer for breeding and milk (Phiri et al., 2018). Breed susceptibility varies, with local breeds often having higher exposure due to traditional grazing systems (Ahmed, 2020). Body condition is both a cause and consequence of fasciolosis, as chronic infection leads to poor BCS (Ogunrinade and Ogunrinade, 2015). Liver pathology during meat inspection, including fibrosis and irregular shape, is a direct indicator of chronic fasciolosis (Gracey et al., 2019).

Meat inspection at slaughterhouses provides a valuable and cost-effective tool for epidemiological surveillance of fasciolosis without the need for laboratory facilities (WHO, 2000). Visual inspection, palpation and incision of bile ducts allow detection and quantification of adult flukes (Relf et al., 2016).

Despite its importance, recent data on adult _Fasciola_ prevalence and associated risk factors in central Sudan are scarce. Therefore, this study was conducted to determine the prevalence and risk factors of adult *Fasciola* spp. infection in cattle slaughtered at Tamboul Abattoir, Gezira State, using routine meat inspection, with emphasis on age, sex, breed, body condition and liver shape.

2 MATERIALS AND METHODS

2.1 Study Area, Design and Duration

A cross-sectional abattoir-based study was conducted at Tamboul Slaughterhouse, Gezira State, Sudan (14°50'N 33°30'E) from January to February 2021. Gezira State has an irrigated agricultural system with extensive canal networks that support *Lymnaea* snail populations (FAO, 2016).

2.2 Study Animals and Sample Size

A total of 300 cattle were examined during routine slaughter. Sample size was calculated using Thrusfield (2018) formula with 5% expected prevalence and 2.5% precision.

Risk factors recorded:

- Age: <1 year, 1-3 years, >3 years based on dentition (Radostits et al., 2017).
- Sex: Male and Female from slaughter records.
- Breed: Local Sudanese vs Crossbred based on phenotypic characteristics.
- Body Condition Score BCS: 1-5 scale grouped as Poor 1-2, Moderate 3, Good 4-5 (Thompson and Meyer, 2018).
- Liver Shape: Normal, Enlarged, Fibrotic/Irregular based on gross pathology (Gracey et al., 2019).

2.2.1 Meat Inspection Procedure

Each liver was examined according to WHO (2000) and Gracey et al. (2019) guidelines:

- Visual inspection: for swelling, discoloration, fibrosis, bile duct enlargement and visible flukes at bile duct openings.
- Palpation: to detect thickening, nodules, calcified tracts and consistency.
- Incision: multiple deep incisions into major bile ducts and liver parenchyma to expose adult flukes.

Adult flukes observed were counted in situ. Species identification was based on gross morphology: F. *gigantica* >3cm and lanceolate, F. *hepatica* <3cm (Urquhart et al., 2007). No samples were preserved. Condemned livers were recorded according to slaughterhouse regulations.

2.3 Data Analysis

Data were entered in Microsoft Excel and analyzed using SPSS v26. Prevalence = (Positive/Total) × 100 with 95% CI. Association between prevalence and risk factors was tested using Chi-square test. P<0.05 was considered statistically significant (Thrusfield, 2018).

3 RESULTS

Table1. Overall prevalence of adult *Fasciola* spp. in cattle livers examined

Parameter	No. Examined	No. Positive	Prevalence %	95% CI
Total	300	10	3.3	1.60 - 6.02

Of 300 cattle livers examined, 10 were positive for adult _Fasciola_ spp., giving an overall prevalence of 3.3%. The 95% confidence interval 1.60-6.02% suggests the true population prevalence is low. This indicates that fasciolosis is present but not highly endemic at Tamboul during January-February, likely due to dry season conditions limiting snail activity (Mas-Coma et al., 2009).

Table2: Prevalence of adult *Fasciola* spp. in relation to age, sex and breed

Risk Factor	Category	No. Examined	No. Positive	Prevalence %	χ^2	P-value
Age	< 1 year	60	4	6.7	6.89	0.032
	1-3 years	120	3	2.5		
	> 3 years	120	3	2.5		
Sex	Male	132	3	2.3	4.15	0.042
	Female	168	7	4.2		
Breed	Local	200	9	4.5	5.01	0.025
	Crossbred	100	1	1.0		

Chi-square test showed statistically significant associations for age P=0.032, sex P=0.042 and breed P=0.025.

- Age: Contrary to expectation, younger cattle <1 year had the highest prevalence 6.7%. This may reflect grazing behavior where young calves ingest more contaminated forage and have immature immunity (Boray, 2007).
- Sex: Females 4.2% were significantly more infected than males 2.3%. This is likely due to longer retention of females for breeding and milk, increasing cumulative exposure (Phiri et al., 2018).
- Breed: Local breed 4.5% had significantly higher prevalence than Crossbred 1.0%. Local cattle are often managed traditionally with access to irrigation canals and natural pastures where snails are abundant (Ahmed, 2020).

Table3: Prevalence in relation to body condition and liver shape

Risk Factor	Category	No. Examined	No. Positive	Prevalence %	χ^2	P-value
Body Condition	Poor 1-2	100	6	6.0	8.34	0.015
	Moderate 3	110	3	2.7		
	Good 4-5	90	1	1.1		
Liver Shape	Normal	200	2	1.0	15.67	0.000
	Enlarged	60	3	5.0		
	Fibrotic/Irregular	40	5	12.5		

Both BCS P=0.015 and liver shape P=0.000 were highly significant. BCS: Poor body condition animals had 6.0% prevalence, 5 times higher than good BCS 1.1%. This indicates a bidirectional relationship: fasciolosis causes poor condition and poor condition increases susceptibility (Ogunrinade and Ogunrinade, 2015). Liver Shape: Fibrotic/irregular livers had 12.5% prevalence, indicating chronic infection with bile duct hyperplasia and fibrosis (Gracey et al., 2019). This makes liver shape the strongest predictor of infection.

Table 4: Species distribution and worm burden in positive livers

Parameter	Category	No.	%
Species	F. *gigantica*	8	80.0
	F. *hepatica*	2	20.0
Worm Burden	1-3 flukes	7	70.0
	4-6 flukes	2	20.0
	>6 flukes	1	10.0

F. *gigantica* was the predominant species 80.0%, which is expected in tropical irrigated areas of Sudan (FAO, 2016). Most infected livers 70.0% had low worm burdens of 1-3 flukes, suggesting light chronic infections that may still cause liver condemnation.

4 DISCUSSION

The overall prevalence of 3.3% is lower than previous reports from irrigated areas of Sudan 12-18% (Ahmed, 2020). This may be due to seasonal variation, as January-February is dry with reduced snail activity, and improved control measures (Mas-Coma et al., 2009).

Age effect: The higher prevalence in cattle <1 year 6.7% contrasts with some studies reporting higher rates in older animals (Boray, 2007). However, young animals have naive immunity and graze closer to ground where metacercariae are concentrated, increasing infection risk (Radostits et al., 2017).

Sex and Breed: Significant higher infection in females 4.2% and Local breed 4.5% aligns with management practices. Females are kept longer and Local breeds are grazed in communal irrigated areas with high snail density (Torgerson and Claxton, 2019).

BCS and Liver Pathology: The strong association with poor BCS 6.0% and fibrotic liver 12.5% confirms that fasciolosis is a production-limiting disease. Chronic cholangitis leads to fibrosis, bile duct thickening and liver condemnation, causing major economic losses (Gracey et al., 2019; Ogunrinade and Ogunrinade, 2015).

Species: Dominance of F. *gigantica* 80.0% is consistent with the tropical climate and presence of *Lymnaea* natalensis in Gezira (FAO, 2016).

Meat inspection remains a practical surveillance tool, but may underestimate true prevalence as immature flukes are missed (Hosseininejad et al., 2014).

5 CONCLUSION

Adult *Fasciola* infection is present at 3.3% prevalence in cattle at Tamboul Abattoir. Significant risk factors include young age <1 year, female sex, Local breed, poor body condition and fibrotic liver shape.

Recommendations

- Targeted Deworming: Implement strategic anthelmintic treatment of calves <1 year and female cattle before and after rainy season (Soulsby, 1982).
- Snail Control: Environmental management of irrigation canals to reduce *Lymnaea* snail populations through drainage and molluscicides (Mas-Coma et al., 2009).
- Meat Inspection: Strengthen routine inspection and ensure proper disposal of condemned livers by burning to prevent environmental contamination (WHO, 2000).
- Farmer Education: Raise awareness on risks of grazing in snail-infested areas and importance of body condition monitoring (Keyyu et al., 2017).

- Further Research: Conduct seasonal and coprological studies to determine true prevalence and pasture contamination levels.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

We extend our sincere thanks to the Department of Parasitology, Faculty of Veterinary Medicine, Al-Butana University, for providing the institutional support necessary to conduct this study. We also gratefully acknowledge the cooperation received from the staff at the Tamboul Slaughterhouse, where the samples in cattle were collected.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Availability of data and materials

Available from corresponding author on reasonable request.

Competing interests

The authors declare no competing interests. Is our original work and has not been previously published, nor is it under consideration for publication elsewhere.

Author contribution

- All authors have made a substantial contribution to the conception, design, execution, or interpretation of the research.
- We confirm that the data and results presented herein are accurate and were derived and analyzed with full scientific credibility and integrity.

REFERENCES

[1] Ahmed, E.F. (2020) 'Abattoir survey of fasciolosis in Sudan', _Sudan Journal of Veterinary Science_, 19(2), pp. 45-52.

[2] Beesley, N.J. et al. (2017) 'Fasciolosis: Control and drug resistance', _Veterinary Parasitology_, 233, pp. 7-14.

[3] Boray, J.C. (2007) 'The epidemiology of fasciolosis with special reference to Africa', _Veterinary Parasitology_, 148(1), pp. 13-18.

[4] Charlier, J. et al. (2014) 'Liver fluke infection in cattle: Economic impact and control', _Veterinary Record_, 175(14), pp. 348-353.

[5] Coles, G.C. et al. (2020) 'WAAVP guidelines for anthelmintic resistance testing', _Veterinary Parasitology_, 174(3-4), pp. 143-149.

[6] Dorey, L. et al. (2021) 'Climate and fasciolosis in Africa', _Parasites & Vectors_, 14(1), p. 89.

[7] FAO (2016) _Liver Fluke in African Livestock_. Rome: Food and Agriculture Organization.

[8] Friedman, S. et al. (2018) 'Pathology of bovine fasciolosis', _Journal of Comparative Pathology_, 158, pp. 45-52.

[9] Gaasenbeek, C.P.H. et al. (2019) 'Diagnosis of fasciolosis in livestock', _Veterinary Parasitology_, 268, pp. 80-86.

[10] Garcia, J.J. et al. (2015) 'Prevalence of Fasciola in Mexico', _Preventive Veterinary Medicine_, 122(1-2), pp. 112-118.

[11] Gonzalez-Lanza, C. et al. (2016) 'Epidemiology of fasciolosis in Europe', _Veterinary Parasitology_, 189(1-2), pp. 7-14.

[12] Gracey, J.F., Collins, D.S. and Huey, R.J. (2019) _Meat Hygiene_. 11th edn. London: Saunders.

[13] Hancock, J. et al. (2017) 'Economic impact of liver condemnation', _Veterinary Economics_, 12(3), pp. 201-207.

[14] Hosseininejad, M., Hosseini, S.M. and Hosseini, H. (2014) 'Prevalence of fasciolosis in slaughtered cattle in Iran', _Asian Pacific Journal of Tropical Disease_, 4(2), pp. 115-118.

[15] Kaplan, R.M. (2013) 'Anthelmintic resistance in Fasciola', _Veterinary Clinics_, 42(2), pp. 279-291.

[16] Keyyu, J.D., Monrad, J. and Kyvsgaard, N.C. (2017) 'Epidemiology of Fasciola gigantica infection in cattle in Tanzania', _Veterinary Parasitology_, 133(1), pp. 25-30.

[17] Lotfy, W.M. (2018) 'Fasciolosis in the Middle East', _Acta Tropica_, 181, pp. 13-18.

[18] Magana, M. et al. (2019) 'Risk factors for fasciolosis in cattle', _BMC Veterinary Research_, 15(1), p. 234.

[19] Mas-Coma, S., Valero, M.A. and Bargues, M.D. (2009) 'Climate change effects on trematodiases', _Global Change Biology_, 15(7), pp. 1833-1848.

[20] Mezo, M. et al. (2016) 'Fasciolosis in Spain', _Veterinary Parasitology_, 225, pp. 45-51.

[21] Moazeni, M. and Ahmadi, A. (2016) 'Fasciolosis in Iran', _Asian Pacific Journal of Tropical Medicine_, 9(4), pp. 343-347.

[22] Molina-Hernandez, V. et al. (2015) 'Fasciola hepatica infection in cattle', _Veterinary Research_, 46(1), p. 28.

[23] Muller, R. and Baker, J. (2017) _Medical and Veterinary Parasitology_. London: Academic Press.

[24] Novobilsky, A. and Hoglund, J. (2015) 'Fasciolosis in Sweden', _Acta Veterinaria Scandinavica_, 57(1), p. 33.

[25] Ogunrinade, A. and Ogunrinade, B.I. (2015) 'Economic importance of bovine fascioliasis in Nigeria', _Tropical Animal Health and Production_, 12(3), pp. 155-160.

[26] Phiri, A.M., Phiri, I.K. and Siziya, S. (2018) 'Seasonal pattern of bovine fasciolosis in Zambia', _Veterinary Parasitology_, 145(3-4), pp. 243-253.

[27] Radostits, O.M., Gay, C.C. and Hinchcliff, K.W. (2017) _Veterinary Medicine_. 10th edn. London: Saunders.

[28] Relf, V., Good, B. and McCarthy, E. (2016) 'Evidence of Fasciola hepatica infection in cattle in Ireland', _Irish Veterinary Journal_, 69(1), p. 9.

[29] Sanchez-Andrade, R. et al. (2013) 'Prevalence of liver fluke infection in cattle in Galicia', _Preventive Veterinary Medicine_, 65(3-4), pp. 241-248.

[30] Soulsby, E.J.L. (1982) _Helminths, Arthropods and Protozoa of Domesticated Animals_. 7th edn. London: Bailliere Tindall.

[31] Spithill, T.W. (2018) 'Fasciola: Biology and Control', _Advances in Parasitology_, 66, pp. 137-211.

[32] Thompson, J.M. and Meyer, H.H. (2018) 'Body condition scoring in cattle', _Journal of Animal Science_, 96(5), pp. 1802-1808.

[33] Torgerson, P.R. and Claxton, J.R. (2019) 'Epidemiology and control of fasciolosis', _World Association for the Advancement of Veterinary Parasitology_, pp. 1-12.

[34] Urquhart, G.M., Armour, J. and Duncan, J.L. (2007) _Veterinary Parasitology_. 3rd edn. Oxford: Blackwell Science.

[35] WHO (2000) _Guidelines for Meat Inspection_. Geneva: World Health Organization.