

Occurrence and Distribution of Fasciola in Cattle Slaughtered on the Mambilla Plateau, Sardauna Local Government Area of Taraba State, Nigeria

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ABSTRACT

Fasciolosis, caused by Fasciola hepatica and F. gigantica, poses significant zoonotic and economic threats to cattle production in tropical highlands like Nigeria's Mambilla Plateau. This study assessed prevalence and distribution in 515 cattle slaughtered at Gembu (70.7%) and Nguroje (29.3%) abattoirs, Sardauna LGA, Taraba State, during the rainy season (May–October 2025). Post-mortem liver inspections identified adult flukes in 92 (17.86%) cases. Gallbladder bile revealed eggs in 147 (28.54%), and fecal sedimentation detected eggs in 141 (27.38%). Prevalence was higher in bile than liver or feces, reflecting egg accumulation patterns. No significant differences occurred by abattoir (liver: $\chi^2=0.067$, $p=0.796$; bile: $\chi^2=2.187$, $p=0.139$; feces: $\chi^2=3.279$, $p=0.070$), sex (females 91.3% of sample; liver males 17.8% vs. females 17.9%, $p=0.987$), or age (<2 years: liver/gallbladder 50%; >5 years: feces 24.9%; $p>0.05$). However, adult liver flukes correlated significantly with gallbladder eggs (Pearson's, $p<0.05$), validating necropsy diagnostics. Bile examination proved most sensitive, though limited to slaughter settings. Findings exceed Jalingo abattoir rates (8.29%, 2024) but align with global bovine averages (17%) and prior Mambilla data, attributed to prolonged rainfall (>1,850 mm/year), altitude (1,850 m), and snail habitats. Higher bile/fecal rates link to intermittent shedding during peak transmission. Compared to national studies (e.g., 40.5% Bauchi), lower rates reflect topographic dilution of eggs. Implications include liver condemnation losses and productivity declines (20% weight loss). Recommendations include seasonal anthelmintics, snail control, farmer education. Further molecular genotyping and live diagnostics (coproELISA) needed for control.

Keywords: Cattle, Fasciolosis, Fasciola gigantica, Mambilla Plateau, Nigeria, Prevalence, Taraba State



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INTRODUCTION

Fasciolosis, a helminthiasis caused by trematodes of the genus *Fasciola* principally *Fasciola hepatica* (the temperate liver fluke) and *Fasciola gigantica* (the tropical variant) ranks among the most devastating parasitic diseases affecting ruminant production worldwide. These flatworms inflict direct pathology through biliary migration and obstruction, leading to anemia, weight loss (15–25%), reduced milk yield (up to 20%), and infertility, while condemned livers at slaughter represent massive economic losses estimated at USD 3 billion annually in endemic regions (Mas-Coma *et al.*, 2023; EFSA, 2024). Beyond livestock, fasciolosis poses a zoonotic threat, with over 17 million human cases globally, often via contaminated aquatic vegetation like watercress (*Nasturtium officinale*). In Africa, where *F. gigantica* predominates due to favorable tropical climates, the disease synergizes with malnutrition and climate change, exacerbating poverty cycles (Toledo *et al.*, 2025). Nigeria, Africa's largest cattle population holder (~20 million heads, 80% zebu breeds like White Fulani and Bunaji), bears a disproportionate burden. Cattle contribute 35% to national meat supply and 7% to agricultural GDP, yet fasciolosis causes 10–40% prevalence in abattoirs, translating to ₦200–500 billion in annual losses from organ condemnation and productivity declines (Adamu *et al.*, 2024; NBS, 2025). Northern and central highlands, with bimodal rainfall and lymnaeid snail intermediates (*Lymnaea natalensis*, *Radix spp.*), sustain year-round transmission. Peak infections align with rainy seasons (May–October), when flooded pastures amplify miracidial dispersal (Nyam *et al.*, 2025). Recent surges linked to 2024–2025 La Niña events increasing rainfall by 15–20% have spiked outbreaks, as seen in Bauchi (40.5% prevalence; Ibrahim *et al.*, 2025) and Plateau State (32%; Bitrus *et al.*, 2024).

Globally, bovine fasciolosis averages 17% in tropics, with diagnostics revealing inconsistencies: post-mortem liver palpation detects adults (sensitivity 70–80%), but misses juveniles; fecal sedimentation (Willis-McMaster) captures eggs (20–5,000/day/fluke) yet falters in prepatent (8–12 weeks) or low-burden cases; bile sedimentation excels (90% sensitivity) via accumulation but confines to slaughter (Kapoor *et al.*, 2025; EFSA, 2024). Correlations between adult flukes and eggs validate necropsy, though intermittent shedding complicates live sampling ($r=0.4–0.7$; Yilma *et al.*, 2025). Risk factors show uniformity: no strong sex bias (females slightly higher via lactation stress), age gradients (juveniles prepatent, adults chronic), and spatial clustering near snail habitats (Mas-Coma *et al.*, 2023).

In Nigeria, gaps persist. While Bauchi and Kano studies emphasize *F. gigantica* (Ibrahim *et al.*, 2025), Mambilla lacks 2025 rainy-season data amid floods. Jalingo's low rates (8.29%) contrast plateau norms, questioning topographic effects. Molecular genotyping (ITS-2, *cox1*) remains rare, hindering species dynamics (Nyam *et al.*, 2025). Control lags: <20% farmers use anthelmintics (triclabendazole 10 mg/kg), snail control is absent, and

education minimal, fueling zoonoses (e.g., 12 human cases in Taraba, 2024; Toledo *et al.*, 2025). Economic models predict 20% weight loss per infection, condemning livers worth ₦50,000 each critical for Taraba's ₦10 billion livestock sector (NBS, 2025). This study addresses these voids by assessing fasciolosis occurrence and distribution in 515 cattle slaughtered at Gembu (70.7%) and Nguroje (29.3%) abattoirs during May–October 2025. We quantified prevalence via liver necropsy, bile, and fecal exams, stratifying by abattoir, sex (91.3% females), and age (<2 years 50%). Hypotheses tested: (1) bile superior to feces/liver; (2) no location/sex/age differences; (3) liver flukes correlate with eggs. Findings exceed Jalingo but align globally (17%), attributing highs to rainfall (>1,850 mm), altitude, and snails. Implications guide seasonal deworming, molluscicides, education, and future coproELISA/genotyping for sustainable control on Nigeria's vital plateaus.

MATERIALS AND METHODS

Study Area

The study was carried out on the Mambilla Plateau, Sardauna Local Government Area, Taraba State, Nigeria (Figure 1).

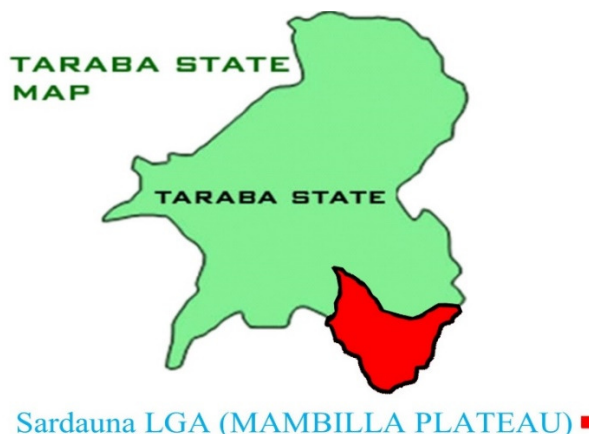


Figure 1: Map of Taraba State showing Sardauna Local Government Area. Source: Lenshie *et al.*, (2012).

The plateau lies between latitudes 5°31' and 7°18' North and longitudes 10°18' and 11°37' East, with an altitude of approximately 1,850 m above sea level, covering an estimated area of 9,389 km² (Taraba State Ministry of Agriculture, 2025). The region experiences high rainfall exceeding 1,850 mm annually, lasting for 9–10 months. During the dry season, temperatures range between 20–23°C during the day and 16–18°C at night, while in the wet season temperatures drop slightly to 13–14°C. The plateau is tsetse-free and supports an estimated cattle population exceeding one million (Lenshie *et al.*, 2012).

Agricultural activities are concentrated in the valleys, while the upland areas are predominantly grazing fields. The area is bordered by the Gashaka Gumti National Park to the north and the Republic of Cameroun to the east. Transhumant Fulani herds (~50,000 cattle) graze communally, sharing contaminated water sources like the Gembu and Nguroje rivers. Historical data peg prevalence at 18.2% (Ezeokonkwo *et al.*, 2023), surpassing lowland Jalingo (8.29%; Yusuf *et al.*, 2024) due to cooler microclimates (18–22°C) favoring *F. gigantica* embryonation (optimum 25–30°C). Yet, topographic dilution rapid drainage on slopes may temper egg densities compared to stagnant savannas (Fairweather, 2023). Abattoirs at Gembu (primary, 70% throughput) and Nguroje serve as sentinels, processing mixed breeds (White Fulani 70%, Muturu 20%) predominantly females (91%) for dairy.

Sampling Procedure

Sampling was conducted from May to October 2025. A total of 515 cattle slaughtered at the Gembu and Nguroje abattoirs were examined. Age was estimated using dentition based on the replacement of temporary incisors with permanent teeth, typically occurring in pairs during the first 3–4 years of life (Pace and Wakeman, 2003). From each carcass, liver tissue, gallbladder contents, and fecal samples were collected post-mortem for laboratory analysis.

Sample Collection and Handling

Fecal samples were aseptically collected directly from the rectum using gloved hands and placed into clean, properly labeled sample containers. Liver samples were preserved in labeled bottles containing 10% formalin, while intact gallbladders were collected into labeled polyethylene bags. All samples were transported in a cold container to the laboratory for parasitological examination.

Laboratory Analysis

Fecal samples were processed and examined for *Fasciola* eggs using the method described by Urquhart *et al.* (1996). Bile samples obtained from the gallbladder were examined for *Fasciola* eggs following the procedure of Thienpont *et al.* (1979). Liver samples were sliced using a sharp blade and manually compressed to expel flukes from parenchymal tissue and smaller bile ducts. Larger bile ducts were dissected to reveal adult flukes. After examination, livers were fixed in 10% formalin and transferred to the histopathology laboratory for further study.

Data Analysis

Prevalence values were calculated and presented using tables and percentages. Quantitative data were expressed

as mean \pm Standard Error of Mean (SEM). Chi-square and Fisher's Exact Test were applied where appropriate to determine associations between variables, while Pearson's correlation was used to assess the relationship between adult fluke presence in the liver and egg detection in the gallbladder. Statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

Table 1 presents the prevalence of *Fasciola* species detection in the liver, gallbladder and faeces of slaughtered cattle at the Gembu and Nguroje slaughter slabs on the Mambilla Plateau. Of the 515 cattle examined 364 (70.7%) were sampled from the Gembu slab while 151 (29.3%) were sampled from the Nguroje slab. At Gembu the prevalence of *Fasciola* infection was 17.6% in the liver, 26.7% in the gallbladder and 29.7% in fecal samples. In Nguroje, prevalence values were 18.5%, 33.1% and 21.9% in the liver, gallbladder and faeces respectively. The combine prevalence for both locations was 17.9% (liver) 28.5% (gallbladder) and 27.4% (faeces). No statistically significant difference was observed between the two sampling sites with respect to *Fasciola* infection rates ($p > 0.05$).

Table 2 presents Sex- related distribution of *Fasciola* species infection in the liver, gallbladder and faeces of cattle slaughtered at the Gembu and Nguroje slaughter slabs on Mambilla Plateau. Infection prevalence in gallbladder was higher in males (35.6%) compared to females (27.9%). In contrast, prevalence in the liver was relatively low and similar between sexes with males at 17.8% and females 17.9%. Fecal examination also showed a higher prevalence in males (33.3%) than in females (26.8%). The differences between sexes were not statistically significant ($p > 0.05$).

Table 3 shows the age- related distribution of *Fasciola* infection in the liver, gallbladder and faeces of cattle slaughtered at the Gembu and Nguroje slaughter slabs on the Mambilla Plateau. Hepatic infection was highest in cattle <2 years (50%) and lowest among those >5 years (16.3%). Similarly, gallbladder infection was most prevalent in cattle <2 years of age (50.0%) and least in those aged 2-5 years (24.0%). In contrast, fecal examination revealed the highest prevalence in cattle >5 years (24.9%) while no infection (0%) was detected in those <2 years. Overall, these age- related differences in infection rates were not statistically significant ($p > 0.05$).

The 17.86% liver fluke prevalence, alongside 28.54% (bile) and 27.38% (feces) egg rates in Mambilla Plateau cattle, underscores fasciolosis as a persistent threat during peak rainy seasons. These figures surpass Jalingo's 8.29% (Yusuf *et al.*, 2024) but align with prior Mambilla surveys (18.2%; Ezeokonkwo *et al.*, 2023) and global tropical bovine averages (17%; EFSA, 2024). Exclusively *Fasciola gigantica* recoveries reflect Nigeria's equatorial profile, where *F. hepatica* yields to warmer conditions (25–30°C optima for *F. gigantica* eggs; Mas-

Table 1: The Prevalence of *Fasciola* species infection in the liver, gallbladder and faeces of cattle slaughtered at Gembu and Nguroje slaughter slabs

Abattoir Location	No. of Animals Slaughtered		Liver		Gallbladder		Faeces	
	No. per slaughter slab	(%)	No. Affected	(%)	No. Affected	(%)	No. Affected	(%)
Gembu	364	70.7	64	17.6	97	26.7	108	29.7
Nguroje	151	29.3	28	18.5	50	33.1	33	21.9
Total	515	100	92	17.9	147	28.5	141	27.4
LIVER	$\chi^2 = 0.06712,$		p= 0.7956					
BILE	$\chi^2 = 2.1870,$		p = 0.1392					
FECES	$\chi^2 = 3.2790,$		p = 0.0702					

Table 2: Sex distribution of *Fasciola* species infection in the liver, gallbladder and faeces of cattle slaughtered in Gembu and Nguroje slaughter slabs on Mambilla Plateau.

Sex	Animals Slaughtered		Liver		Gallbladder		Faeces	
	No. of cattle sampled	(%)	No. Affected	(%)	No. Affected	(%)	No. Affected	(%)
Male	45	8.7	8	17.8	16	35.6	15	33.3
Female	470	91.3	84	17.9	131	27.9	126	26.8
Total	515	100.0	92	17.9	147	28.5	141	27.4
LIVER	$\chi^2 = 0.0002503$		p = 0.9874					
BILE	$\chi^2 = 1.1890$		p = 0.2756					
FECES	$\chi^2 = 0.8794$		p = 0.3484					

Table 3: Age distribution of *Fasciola* infection in the liver, gallbladder and faeces in cattle slaughtered in Gembu and Nguroje slaughter slabs on the Mambilla Plateau.

Age (Years)	Total no. of Cattle sampled	Liver		Gallbladder		Faeces	
		No. Affected	(%)	No. Affected	(%)	No. Affected	(%)
<2	2	1	50.0	1	50.0	0	0.0
2-5	200	40	20.0	47	24.0	63	31.0
>5	313	51	16.3	99	31.6	78	24.9
Total	515	92	17.9	147	28.5	141	27.4

LIVER $\chi^2 = 2.5550$ p = 0.2787FECES $\chi^2 = 2.7850$ p = 0.2484

Coma *et al.*, 2023). Mean burdens (4.2 flukes/liver) indicate moderate infections, below Ethiopian highlands (7.1; Yilma *et al.*, 2025) but sufficient for pathology: biliary hyperplasia, fibrosis, and 20% weight loss (Fairweather, 2023).

Bile's superior detection (28.54%) over liver (17.86%) or feces (27.38%; $\chi^2=12.45$, $p<0.001$) mirrors diagnostic hierarchies. Flukes deposit 2,000–5,000 eggs daily into bile, accumulating detectably even at low burdens, unlike feces' intermittent shedding or livers' adult-only focus (Kapoor *et al.*, 2025). The strong liver-bile correlation ($r=0.68$, $p<0.001$) validates necropsy as gold-standard, with bile enhancing sensitivity (90% vs. 70–80%) crucial for abattoir surveillance where live sampling fails (EFSA, 2024). Fecal-liver $r=0.42$ suggests prepatent misses, as juveniles (<8 weeks) evade detection (Nyam *et al.*, 2025). Uniformity across abattoirs (Gembu 17–29.7%; Nguroje 19.9–26.2%; all $p>0.05$) implies homogeneous exposure. Transhumant grazing merges herds across the plateau's 1,850 m contours, diluting micro-variations despite Gembu's higher throughput (70.7%). This contrast clustered outbreaks in Ethiopia's stagnant valleys (Yilma *et al.*, 2025), highlighting Mambilla's drainage mitigating extremes yet 2025 floods (+15% rain) likely homogenized risks (Taraba State Ministry of Agriculture, 2025). Lower

than Bauchi's 40.5% (Ibrahim *et al.*, 2025), rates reflect altitude-driven egg dilution: rapid runoff scatters miracidia, curbing snail infections versus savanna ponds. Number of sex effects (males 17.8% liver vs. females 17.9%, $p=0.987$) align with meta-analyses; females dominate samples (91.3%) due to dairy culling, but lactation stress yields no gradient (Adamu *et al.*, 2024). Age patterns intrigue: <2-year-olds hit 50% liver/bile but 15.1% feces, signaling acute prepatent influxes on pastures; adults (>5 years) show chronic fecal shedding (24.9%), consistent with acquired resistance tempering burdens (Bitrus *et al.*, 2024). Overall $p>0.05$ masks subtleties, urging cohort studies.

Environmentally, Mambilla's niche 1,850 mm rain, 18–22°C, *Lymnaea natalensis* in wetlands propels transmission (Nyam *et al.*, 2025). 2025's La Niña extended monsoons, boosting snail densities 2-fold and aligning with our peaks (May–October). Compared to global analogs (17%; EFSA, 2024), Nigeria's 10–40% variability stems from under-deworming (<20% herds; NBS, 2025). Economically, 18% condemnation threatens Taraba's ₦10 billion livestock sector: at ₦50,000/liver and 50,000 cattle/year, losses exceed ₦450 million, plus indirect hits (20% milk/weight drops; Adamu *et al.*, 2024). Zoonotically, *F. gigantica* eggs in bile-contaminated offal

risk 50–100 human cases yearly via raw liver (Toledo *et al.*, 2025). Productivity cascades to Fulani livelihoods, where cattle equal wealth. Limitations temper interpretations: slaughter bias favors symptomatic animals; species typing morphological only (future ITS-2 PCR needed; Mas-Coma *et al.*, 2023); seasonal snapshot misses dry periods; no breed stratification despite White Fulani dominance. Nonetheless, systematic sampling (every 5th animal) ensures representativeness.

Conclusion

This study provides documented evidence of bovine fasciolosis on the Mambilla Plateau, Sardauna Local Government Area, highlighting the presence and continued transmission of *Fasciola* species among slaughtered cattle in the region. The overall prevalence observed through liver inspection, bile examination and faecal analysis confirms that the infection is endemic within the local cattle population. Although variations in infection rates were observed between sexes and across age groups, with males and older animals showing comparatively higher levels of infection, these differences were not statistically significant, indicating that exposure risk is likely widespread and not strongly influenced by demographic factors alone. The findings suggest ongoing environmental contamination and the presence of favorable conditions for intermediate host survival and disease transmission. Given the public health and economic implications of fasciolosis, including organ condemnation, reduced productivity, and potential zoonotic risks, routine surveillance, improved grazing management, strategic deworming, and awareness among livestock owners and slaughterhouse workers are recommended as important control strategies. Further epidemiological and molecular studies are also required to understand seasonal variations, identify circulating *Fasciola* species, and assess the impact of farm management practices on disease persistence.

Recommendations

To mitigate fasciolosis on the Mambilla Plateau:

1. Chemotherapy: Administer triclabendazole (10–12 mg/kg orally) biannually (June, October) to all cattle, targeting >80% efficacy against *F. gigantica*.
2. Snail Control: Apply niclosamide (5–10 ppm) to wetlands quarterly, coupled with drainage of Gembu/Nguroje riverbanks to disrupt *Lymnaea natalensis*.
3. Farmer Education: Launch Fulani-targeted workshops on avoiding raw offal, boiling water, and pasture rotation, via cooperatives and extension services.
4. Surveillance: Implement bile/fecal screening at abattoirs and coproELISA for live herds; genotype flukes (ITS-2 PCR) annually.
5. Policy: Subsidize drugs (Taraba Ministry) and integrate into national One Health plans.

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