



Research Article

Prevalence of *Fasciola* and *Dicrocoelium* species infection in Ruminants at Slaughter in Jos Metropolis and Mangu Abattoirs, Plateau State, Nigeria

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ABSTRACT

The significance and impact of liver fluke infection in ruminants and livestock farming cannot be overemphasized. The study aimed to determine the occurrence and prevalence of *Fasciola* and *Dicrocoelium* species in cattle, sheep and goats in Jos metropolis and Mangu, Plateau State, Nigeria. Selected abattoirs and slaughterhouses were visited for collection of bile samples from the slaughtered ruminants between 6–9 a.m. on sampling days. A total of 237 bile samples, comprising 111 cattle, 75 sheep and 51 goats, were obtained and examined for the eggs of liver flukes using the sedimentation technique and microscopy. The prevalences of *Fasciola* and *Dicrocoelium* species were 7(6.31%) and 31(27.93%) for cattle; 5(6.67%) and 13(17.33%) for sheep; and 0(0.00%) and 12(23.53%) for goats, respectively; with overall prevalence in the ruminants for *Fasciola* and *Dicrocoelium* being 5.06% and 23.63%, respectively. This difference was significant ($t = -44.92$, $p = 0.04$). The prevalence of *Fasciola* infection had insignificant ($p > 0.05$) associations with cattle ($OR = 1.630$) and sheep ($OR = 1.58$), but there were no positive samples from goats; for *Dicrocoelium* species, the infection was insignificantly ($p = 0.190$) associated with cattle ($OR = 1.56$) only. Prevalence for both liver flukes was higher and associated with Mangu abattoir, which was significant for fascioliasis in sheep ($OR = 19.33$, $p = 0.005$) and for dicrocoeliasis in goats ($OR = 9.52$, $p = 0.004$). Whereas fascioliasis was associated with male ruminants, dicrocoeliasis was associated with females, implying that a cost-effective control of liver flukes can be achieved by selective targeted treatment of male ruminants for fascioliasis and females for dicrocoeliasis in the study area.

Keywords: Association; *Dicrocoelium*; *Fasciola*; Plateau State; Prevalence; Ruminants

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INTRODUCTION

Fascioliasis and dicrocoeliasis are significant helminthic diseases of ruminants, especially livestock. These parasites primarily infect the hepatobiliary system causing damage to the liver (Garza-Moreno and Quílez, 2026). Fascioliasis is a plant and waterborne zoonotic parasitic disease caused by a trematode of two species: *Fasciola hepatica* in Europe, Asia, Africa, Americas and *F. gigantica*, which is strictly present in Africa and Asia. It is also known

as the common liver fluke and sometimes sheep fluke classified among the neglected tropical diseases (NTDs) and a zoonosis. NTD are often overlooked or ignored zoonoses that have significant social and economic impacts worldwide, primarily affecting vulnerable and low-income communities in tropical and subtropical regions (Ca *et al.*, 2024). Both parasites affect humans and ruminants worldwide (Arbabi *et al.*, 2025; Branda *et al.*, 2025; Oyebamiji *et al.*, 2021). Livestock affected by this parasite include

cattle, sheep and goats, which constitute major sources of animal protein in Nigeria and worldwide (Yaro *et al.*, 2022), hence the disease is of veterinary and economic importance. Livestock become infected when they come in contact with and ingest forage or water contaminated by the infective metacercariae deposited by snails, which serve as intermediate hosts (Iyaji *et al.*, 2018). Pathologies caused in the liver parenchyma of infected livestock are a result of migratory activities of the adult parasite, which causes tissue erosion and lead to clinical signs such as anaemia due to direct blood loss, impaired bile production, depression, bottle jaw, weakness, delayed weight gain, impaired milk production in dairy cows, condemnation of liver during meat inspection or eventual mortality of the ruminant.

Dicrocoelium, a small trematode, also known as the lancet fluke or small liver fluke, is commonly assumed to be a non-pathogenic fluke which may be responsible for the paucity of information on the parasite; hence, little work has been carried out on the parasite in West Africa (Odei, 2016). *Dicrocoelium hospes* and *D. dendriticum* cause liver fluke disease in ruminants and has significant economic importance. Concurrent infections with *Fasciola* and *Dicrocoelium* species are closely associated with populations that are engaged in agricultural occupation, lack of access to potable drinking water, poor sanitation and hygiene practices (Herrera-Torres *et al.*, 2025). These two trematode genera are primarily parasites of both domestic and wild ruminants including cattle, sheep and goats, wild ungulates such as camelids, cervid and buffalo, and occasionally occur in aberrant non-ruminant herbivore hosts, including equids, lagomorphs, macropods and humans causing fascioliasis (Mas-Coma, *et al.*, 2022). Snails are the intermediate hosts, mainly the family Lymnaeidae especially *Lymnaea*, *Galba*, *Fossaria* and *Pseudosuccinea*. Several species of snails have been identified as intermediate hosts for one or more *Fasciola* species which differ with respect to their suitability for *F. hepatica* or *F. gigantica*. The adult stage of these fasciolids infects the biliary canals and gallbladder of the liver of herbivore mammals, as well as omnivores such as humans and pigs (Andrews *et al.*, 2021). There is yet ongoing research on the host ranges of intermediate hosts for both *Fasciola* species. In the agricultural sector, economic losses are estimated at USD 3.2 billion per annum. The ability of the parasites to infect and multiply in their intermediate snail hosts, and their adaptability to a wide variety of mammalian

definitive hosts including wild ungulates contribute to their high transmissibility and distribution (Lalor *et al.*, 2021). *Dicrocoelium* species, which cause liver fluke disease in ruminants, many a time exists as co-infection with *Fasciola* species, as reported by Iyaji *et al.* (2018), Dada and Jegede (2019), and Yaro *et al.* (2022) in Nigeria, as well as in Cameroon (Siama *et al.*, 2025). Adamu *et al.* (2025) reported a prevalence of 19.5%, 17.8% and 11.5% in Cattle, sheep, and goats, respectively, of fascioliasis in ruminants in Jos, Plateau State, Nigeria. From an economic viewpoint, *D. dendriticum* causes a lot of damage to the livestock industry every year.

Infections with *Fasciola* species manifest in three forms: acute, subclinical, and chronic disease. There are limited reports and data on the epidemiology of these economic diseases in Plateau State.

This study aimed to investigate the occurrence and prevalence of fascioliasis and dicrocoeliasis among ruminants slaughtered in some abattoirs and slaughter houses in Plateau State, Nigeria. Consequently, it is hoped that this study will provide current data and information on the prevalence and co-infection of these parasitic diseases in ruminants slaughtered in Plateau State that will be useful for strategic planning of control and mitigation of these infections.

MATERIALS AND METHODS

Study Area

The study was conducted in selected abattoirs and slaughterhouses in Jos metropolis and Mangu, Plateau State in Northern Nigeria. The study populations consisted of cattle, sheep and goats presented for slaughter.

Collection of Samples

Purposive sampling method was adapted for collecting samples from cattle, sheep and goats. Abattoir visits on sampling days were made between the hours of 6-9 am. Sampling was carried out for a total period of three (3) months, from July to September. Animals were examined to determine sex and species before sampling. Livers of animals slaughtered were eviscerated, incised and examined for the presence of adult parasites. Gallbladders from examined livers were carefully removed to avoid breakage and spillage. They were cut open from the end of the duct and emptied into clearly pre-labelled sampling bottles and transported in cold boxes to the parasitology laboratory at the National Veterinary Research Institute (NVRI), Vom, Jos, Plateau State, Nigeria.

The samples were sorted and stored in the refrigerator at 4°C to prevent degradation and maintain the integrity of the bile components until they were required for examination and parasite detection. Bile samples were poured into centrifuge tubes pre-labelled with the samples' identification numbers and centrifuged at 1500 rpm for 5 minutes. The supernatant was decanted, the sediment was resuspended in a few drops of normal saline, placed on a clean glass slide, covered with a cover slip and examined using a light microscope at magnifications of $\times 100$ and $\times 400$ as required for clarity. Eggs of liver flukes were identified morphologically as described by Hussein *et al.* (2010) and Santo-Silva *et al.* (2025).

RESULTS

Prevalence of the liver flukes' infection in ruminants in the study area

A total of 237 bile samples were collected from Jos metropolis and Mangu abattoirs of Plateau State, Nigeria. Of these, 111 were from cattle, 75 from sheep, and 51 from goats. The prevalence of *Fasciola gigantica* was generally lower than that of *Dicrocoelium hospes* in all the domestic ruminants examined (cattle, sheep and goats) in Jos metropolis than in Mangu; except for sheep, in which the prevalence of *Fasciola* species (25.0%) was higher than that of *Dicrocoelium* species (18.75%) and was the highest prevalence observed at Mangu for fascioliasis. The highest prevalence for dicrocoeliasis was also observed in goats (58.33%) at Mangu. The two-sample paired t-test analysis assuming equal means showed that the difference in prevalence between fascioliasis and dicrocoeliasis in cattle, sheep and goats in Jos was significant ($p=0.02$), not significant in Mangu ($p=0.28$), and the difference in the overall prevalence in Plateau State was significant ($p=0.04$), as shown in Table 1. However, differences in the prevalence of these trematodes within each location (Jos and Mangu) and overall, as revealed by Chi-square analysis, were not significant (P -values >0.05). Although *Fasciola* species was not encountered in any of the bile samples examined from goats in the study area, the same goat population was infected with *Dicrocoelium* species, as were cattle and sheep.

Mixed infection with *Fasciola* and *Dicrocoelium* species was encountered in only 2 of the 80 female cattle bile samples from Jos abattoir, representing 2.50% of females, 2.20% of the 92 cattle in Jos and 1.80% of the 111 total cattle samples for the study area.

Association of prevalence of the liver flukes infection with sex in cattle

The prevalence of both liver flukes was analysed by sex as a factor for each ruminant to determine the association (influence) of sex with prevalence. Of the 111 cattle examined, 23 were males, and 88 were females, with prevalence of 3 (13.04%) and 4 (4.54%) for *Fasciola* species; and 5 (21.74%) and 26 (29.55%) for *Dicrocoelium* species, respectively. This pattern of higher prevalence in males for *Fasciola* and higher prevalence in females for *Dicrocoelium* species infections was observed across locations (Table 2). The difference in prevalence between males and females across locations was, however, not significant ($p>0.05$). The Odds ratio analysis showed that prevalence was insignificantly associated with males for *Fasciola* and females for *Dicrocoelium* species ($OR>1.0$, $p>0.05$). None of the female cattle samples at Mangu had *Fasciola* species eggs; consequently, Odds Ratio analysis could not be carried out, hence association was not determined.

Association of prevalence of the liver flukes' infection with sex in sheep

For *Fasciola* species infection in sheep, all the male samples were negative; therefore, the associations of prevalence of fascioliasis with sex in the study area could not be determined. For *Dicrocoelium* species infection, however, associations were observed with females in Jos ($OR=3.68$), and with males in Mangu ($OR=2.33$) abattoirs, while the overall prevalence was with female sheep ($OR=1.60$), but these associations were not significant (P -values >0.05), as shown in Table 3.

Association of prevalence of liver flukes' infections with sex in goats

None of the bile samples obtained from goats was positive for *Fasciola* species in both locations; hence, association could not be determined. On the other hand, bile samples from male goats in Jos were negative for *Dicrocoelium* species, the association of prevalence with sex of goats could not be determined. In Mangu, however, the highest prevalence (66.67%) in the study area was observed in 6 of 9 female goats and 33.33% for 1 of 3 male goats. The total prevalence for goats in the study area was 23.53%. Association of prevalence of dicrocoeliasis was observed with female goats in Mangu ($OR=4.00$) and overall ($OR=8.50$) but it was not significant ($p>0.05$), as shown in Table 4.

Table 1: Prevalence of *Fasciola* and *Dicrocoelium* species in cattle, sheep and goats in Jos and Mangu abattoirs of Plateau State, Nigeria

Table 1: Prevalence of <i>Fasciola</i> and <i>Dicrocoelium</i> species in cattle, sheep and goats in Jos and Mangu abattoirs of Plateau state, Nigeria										
Abattoir	Ruminant	Sample size	<i>Fasciola gigantica</i>				<i>Dicrocoelium hospes</i>			
			No. Positive	Prevalence* (%)	χ^2	P-value	No. Positive	Prevalence* (%)	χ^2	P-value
Jos	Cattle	92	5	5.43	3.24	0.20	23	25.00	3.04	0.22
	Sheep	59	1	1.69			10	16.95		
	Goats	39	0	0.00			5	12.82		
	Total	190	6	3.16			38	20.00		
t = -8.05, p = 0.02*										
Mangu	Cattle	19	2	10.53	3.99	0.14	8	42.11	4.74	0.28
	Sheep	16	4	25.00			3	18.75		
	Goats	12	0	0.00			7	58.33		
	Total	47	6	12.77			18	38.30		
t = -1.00, p = 0.28 ^{NS}										
Total	Cattle	111	7	6.31	1.57	0.46	31	27.93	2.84	0.24
	Sheep	75	5	6.67			13	17.33		
	Goats	51	0	0.00			12	23.53		
	Total	237	12	5.06			56	23.63		
t = -4.92, p = 0.04*										
Mixed infection	Cattle	111	2	1.80	-	-	0	0.00	-	-
	Sheep	75	0	0.00	-	-	0	0.00	-	-
	Goats	51	0	0.00	-	-	0	0.00	-	-

Keys: +ve = positive, CI = confidence interval, χ^2 = chi-square, * = significant, ^{NS} = not significant

Table 2: Association of Prevalence of *Fasciola* and *Dicrocoelium* Species with Sex of Cattle in Jos and Mangu Abattoirs of Plateau State, Nigeria

Abattoir	Sex	Sample size	<i>Fasciola gigantica</i>						<i>Dicrocoelium hospes</i>					
			No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value	No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value
Jos	Male	12	1	8.33	1.73	0.18-16.90	0.00	1.00	1	8.33	0.24	0.03-1.99	1.15	0.28
	Female	80	4	5.00	0.58	0.06-5.66	0.00	1.00	22	27.50	4.17	0.51-34.26	1.15	0.28
	Total	92	5	5.43	-	-	-	-	23	25.00	-	-	-	-
Mangu	Male	11	2	18.18	NA	NA	0.27	0.60	4	36.36	0.57	0.09-3.65	0.02	0.90
	Female	8	0	0.00	NA	NA	0.27	0.60	4	50.00	1.75	0.27-11.16	0.02	0.90
	Total	19	2	10.53	-	-	-	-	8	42.11	-	-	-	-
Total	Male	23	3	13.04	3.15	0.65-15.21	0.31	0.31	5	21.74	0.69	0.27-11.16	0.17	0.68
	Female	88	4	4.54	0.32	0.07-1.53	0.31	0.31	26	29.55	1.45	0.49-4.35	0.17	0.68
	Total	111	7	6.31	-	-	-	-	31	27.93	-	-	-	-

Keys: +ve = positive, CI = confidence interval, χ^2 = Chi-square, OR = Odds ratio, NA = Not applicable

Table 3: Association of Prevalence of *Fasciola* and *Dicrocoelium* Species with Sex of Sheep in Jos and Mangu Abattoirs of Plateau State, Nigeria

Abattoir	Sex	Sample size	<i>Fasciola gigantica</i>						<i>Dicrocoelium hospes</i>					
			No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value	No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value
Jos	Male	33	1	30.03	NA	NA	0.00	1.00	3	9.09	0.27	0.06-1.18	2.14	0.14
	Female	26	0	0.00	NA	NA	0.00	1.00	7	26.92	3.68	0.85-16.02	2.14	0.14
	Total	59	1	1.69	-	-	-	-	10	16.95	-	-	-	-
Mangu	Male	8	4	50.00	NA	NA	3.00	0.08	2	25.00	2.33	0.17-32.59	0.00	1.00
	Female	8	0	0.00	NA	NA	3.00	0.08	1	12.50	0.43	0.03-5.99	0.00	1.00
	Total	16	4	25.00	-	-	-	-	3	18.75	-	-	-	-
Total	Male	41	5	12.20	NA	NA	2.70	0.10	5	12.20	0.63	0.19-2.09	0.22	0.64
	Female	34	0	0.00	NA	NA	2.70	0.10	8	23.53	1.60	0.48-5.36	0.22	0.64
	Total	75	5	6.67	-	-	-	-	13	17.33	-	-	-	-

Keys: +ve = positive, CI = confidence interval, χ^2 = Chi-square OR = Odds ratio, NA = Not applicable

Table 4: Association of Prevalence of *Fasciola* and *Dicrocoelium* Species with Sex of Goats in Jos and Mangu Abattoirs of Plateau State, Nigeria

Abattoir	Sex	Sample size	<i>Fasciola gigantica</i>						<i>Dicrocoelium hospes</i>					
			No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value	No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value
Jos	Male	15	0	0.00	NA	NA	NA	NA	0	0.00	NA	NA	2.28	0.13
	Female	24	0	0.00	NA	NA	NA	NA	5	21.74	NA	NA	2.28	0.13
	Total	39	0	0.00	-	-	-	-	5	12.82	-	-	-	-
Mangu	Male	3	0	0.00	NA	NA	NA	NA	1	33.33	0.25	0.02-4.00	0.11	0.74
	Female	9	0	0.00	NA	NA	NA	NA	6	66.67	4.00	0.25-63.95	0.11	0.74
	Total	12	0	0.00	-	-	-	-	7	58.33	-	-	-	-
Total	Male	18	0	0.00	NA	NA	NA	NA	1	5.56	0.12	0.01-1.00	3.57	0.060
	Female	33	0	0.00	NA	NA	NA	NA	11	33.33	8.50	1.00-72.45	3.57	0.060
	Total	51	0	0.00	-	-	-	-	12	23.53	-	-	-	-

Keys: +ve = positive, CI = confidence interval, χ^2 = Chi-square OR = Odds ratio, NA = Not applicable

Association of prevalence of the liver flukes infection with ruminant species

Association of prevalence of *Fasciola* and *Dicrocoelium* species infections with the ruminant species studied, irrespective of abattoir locations, showed that fascioliasis was associated with cattle (OR=1.63) and sheep (OR=1.58), but the associations were not significant ($p>0.05$). For dicrocoeliasis, prevalence was associated only with cattle (OR=1.56) but, similarly, the association was not significant ($p>0.05$) as shown in Table 5.

Association of prevalence of the liver flukes infection in each ruminant with abattoir locations

Analysis for associations in the prevalence of infections with abattoir locations for each ruminant revealed that infections with both flukes in cattle, sheep and goats were all associated with Mangu abattoir. However, the association was significant for fascioliasis infection in sheep (OR=19.33, $p=0.005$) and for dicrocoeliasis in goats (OR=9.52, $p=0.004$) as shown in Table 6.

Table 5: Association of Prevalence of *Fasciola* and *Dicrocoelium* Species with Ruminant Species in Plateau State, Nigeria

Ruminant	Sample size	<i>Fasciola gigantica</i>						<i>Dicrocoelium hospes</i>					
		No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value	No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value
Cattle	111	7	6.31	1.63	0.50-5.29	0.27	0.60	31	27.93	1.56	0.86-2.86	1.71	0.19
Sheep	75	5	6.67	1.58	0.48-5.16	0.20	0.65	13	17.28	0.58	0.29-1.16	1.93	0.17
Goats	51	0	0.00	NA	NA	2.25	0.13	12	22.58	0.99	0.48-2.06	0.00	1.00
Total	237	-	-	-	-	-	-	-	-	-	-	-	-

Keys: +ve = positive, CI = confidence interval, χ^2 = chi-square OR = Odds ratio, NA = Not applicable

Table 6: Association of Prevalence of *Fasciola* and *Dicrocoelium* Species Infections in Ruminant Species with Abattoir Locations in Plateau State, Nigeria

Ruminant	Abattoir	Sample Size	<i>Fasciola gigantica</i>						<i>Dicrocoelium hospes</i>					
			No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value	No. +ve	Prev. (%)	OR	95% CI	χ^2	P-value
Cattle	Jos	111	5	4.50	0.49	0.09-2.73	0.10	0.75	23	20.72	0.46	0.16-1.28	1.52	0.16
	Mangu	19	2	10.53	2.05	0.37-11.43	0.10	0.75	8	42.11	2.18	0.75-6.13	1.52	0.16
	Total	130	7	5.38	-	-	-	-	31	23.85	-	-	-	-
Sheep	Jos	59	1	1.69	0.05	0.01-0.50	7.56	0.005	10	16.95	0.88	0.21-3.69	0.00	1.00
	Mangu	16	4	25.00	19.33	1.98-188.6	7.56	0.005*	3	18.75	1.13	0.27-4.71	0.00	1.00
	Total	75	5	6.67	-	-	-	-	13	17.33	-	-	-	-
Goats	Jos	39	0	0.00	NA	NA	NA	NA	5	12.82	0.11	0.02-0.46	8.19	0.004
	Mangu	12	0	0.00	NA	NA	NA	NA	7	58.33	9.52	2.16-41-93	8.19	0.004*
	Total	51	0	0.00	-	-	-	-	12	23.53	-	-	-	-

Keys: +ve = positive, CI = confidence interval, χ^2 = chi-square OR = Odds ratio, NA = Not applicable * = significant association

DISCUSSION

The overall prevalence of 6.31% and 27.93% for *Fasciola* and *Dicrocoelium* species, respectively, observed in cattle indicated that cattle were more susceptible to infection with *Dicrocoelium* than *Fasciola*. This might be related to the availability of the intermediate snail host species in the study area, which, if infected, release cercariae that encyst as metacercariae on vegetation (*Fasciola*) or as slime balls that are eaten by ants, a second intermediate host and encyst as metacercariae (*Dicrocoelium*) that crawl on vegetation and are eaten by ruminants. This is consistent with the reports of Iyaji *et al.* (2018) and Adamu *et al.* (2025), although they reported higher prevalences in Ayingba, Kogi State and Jos North, respectively, than in this study. Dada and Jegede (2019) in Akure, Ondo State, Yaro *et al.* (2022) in Akwa Ibom State and Siama *et al.* (2025) in North Cameroon reported higher prevalence of *Fasciola* than *Dicrocoelium* in cattle, indicating that the prevalence of these trematodes increases with an increase in temperature, humidity and precipitation as one moves from north to south in Nigeria. However, there is a contrasting scenario in the study conducted by Ulayi *et al.* 2007 and Ieren *et al.* (2016) in Zaria, where both reported higher prevalences of 37.1 % and 36.22 % in respectively, compared to the current study, though in similar geographical areas. This difference could be attributed to the difference in altitude between these locations in terms of temperature, rainfall and humidity.

Whereas male cattle had a higher prevalence of *Fasciola* infection, female cattle had a higher prevalence of *Dicrocoelium* infection in the study area. Although these differences were not significant, the seeming differential in affinity to sex needs to be verified because it may serve as a guide to selective treatment in the control of liver flukes in cattle in the study area. This was corroborated with the work of Adamu *et al.* (2025) in Jos. Other workers reported higher prevalences of *Fasciola* infection in female cattle for studies that were conducted in states other than Plateau such as Ulayi *et al.* (2007) and Ieren *et al.* (2016) in Zaria, Kaduna State; Ogbaje *et al.* (2024) in Abuja; Shinggu *et al.* (2019) in Wukari, Taraba State; Dada and Jegede (2019) in Akure, Ondo State; Yaro *et al.* (2022) in Akwa Ibom State; Siama *et al.* (2025) in North Cameroon. The prevalence of *Dicrocoelium* species was, however, consistently higher and associated with female cattle, sheep and goats than the males, although not significantly. This might be a unique situation on the Plateau compared

to elsewhere in Nigeria, presenting a situation for a selective control strategy based on the sex of ruminants.

Association of prevalence of these liver flukes with ruminant species was established with cattle (OR=1.63) and sheep (OR=1.58) for fascioliasis and with only cattle (OR=1.56) for dicrocoeliasis, indicating that cattle and sheep are more exposed to infection with *Fasciola* and cattle only are more exposed to infection with *Dicrocoelium* species in Plateau State than goats and sheep, respectively. Goats are apparently more resistant to fascioliasis than cattle and sheep in Plateau State.

Prevalence of fascioliasis and dicrocoeliasis was associated with Mangu abattoir, which was significant for fascioliasis in sheep (OR=19.33, $p=0.005$), and for dicrocoeliasis in goats (OR=9.52, $p=0.004$), indicating that exposure of ruminants to infection is enhanced by their being in Mangu as a location. This implies that ruminants in Mangu should be subjected to routine, selective targeted treatment against liver flukes in addition to identifying the environmental conditions unique to Mangu that enhance infection with these liver flukes in ruminants.

CONCLUSION

The prevalence of *Fasciola* infection is higher in male ruminants than females, while that of *Dicrocoelium* is higher in female ruminants than males in the study area. Since fascioliasis is treated with triclabendazole and dicrocoeliasis with praziquantel, selective treatment of ruminants against these flukes can be done based on sex. The prevalence of infection with both flukes in ruminants is higher in Mangu than in Jos metropolis. This implies that there are hotspots for liver fluke infections in Plateau State which can be identified if more locations in the state are screened for ruminant liver fluke infections. Hotspots so identified can be targeted for treatment against ruminant liver fluke infections. This is a cost-effective control measure that will reduce ruminant liver fluke infections in Plateau State.

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