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ORIGINAL RESEARCH ARTICLE

The Prevalence, Economic Impact and associated risk factors of *Fascioliasis* in Ruminants Slaughtered at Mubi Slaughter Slab, Mubi-North Local Government Area of Adamawa State, Nigeria

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ABSTRACT

This research was conducted to determine the prevalence, economic impact, and associated risk factors of fascioliasis in domestic ruminants slaughtered at Mubi North slaughter slab. 300 ruminant species were examined randomly from (July – September, 2024). This was achieved through ante-mortem to determine the Body Condition Score (BCS) and post-mortem inspection to access the level of liver damage. Bile samples collected was subjected to microscopic examination to determine the prevalence. Additionally, 120 structured questionnaire was administered to livestock farmers in five different wards randomly selected to assess the risk factors influencing disease transmission and spread. The economic loss was also determined by market survey. Results reveals that 72 animals were positive with a prevalence of 24%. 42 were females and 30 were males. Across species. 25 cattle, were positive where 11(22%) were male and 14(28%) were females. While in sheep 24 animals were infected where 9(18%) were male and 15(30%) were females. In goats, 23 were positive where 10(20%) were male and 13(26%) were female respectively. Significant variation occurred across geographical origins, with Vimtim recording the highest prevalence in cattle (40%) and goats (40%). Loses due to condemned livers was approximately ₦867,000 during the study period. Risk factors analysis indicates (82.2%), graze near water bodies, (80.8%) use river/stream as their water sources. (80.8%) had snail in grazing areas. (73.9%) practiced open grazing, (84.9%) are not aware of the disease and poor deworming practices constitute about (71%). Strict surveillance, farmers' education, and veterinary services will help prevent the effect of fascioliasis in these areas.

Introduction

Fascioliasis is a globally significant parasitic disease of both public health and veterinary importance, caused primarily by *Fasciola hepatica* and *Fasciola gigantica*. These trematodes affect a wide range of domestic and wild ruminants, causing considerable economic losses through liver condemnation, reduced productivity, decreased milk yield, and increased mortality (World Health Organization [WHO], 2023). In tropical regions such as Nigeria, *F. gigantica* predominates due to ecological conditions that support the development and survival of the

intermediate snail hosts, predominantly *Lymnaea* species (Salahi-Moghaddam and Arfaa, 2022). The epidemiology of fascioliasis is influenced by several interrelated factors, including climatic patterns, grazing systems, livestock husbandry practices, and water management strategies. Seasonal flooding, poorly managed irrigation systems, and reliance on natural water bodies significantly heighten disease transmission in Sub-Saharan Africa (Nyagura *et al.,* 2023). Livestock production remains central to the livelihoods of rural communities in Nigeria, serving as a major source of income, nutrition, and socio-cultural value. However, parasitic infections such as fascioliasis substantially undermine this sector, with recent studies reporting increasing prevalence rates among ruminants in northern Nigeria (Shehu *et al.,* 2024; Yohanna *et al.,* 2023). Female animals are often more affected due to physiological stresses associated with reproduction and lactation, which compromise immunity (Che-Kamaruddin *et al*., 2024). Similarly, animals in poor body condition typically exhibit higher susceptibility, reflecting the interplay between nutrition, immunity, and disease exposure (Muluken *et al.,* 2022).

Environmental and management factors are central drivers of fascioliasis transmission. Open grazing, use of contaminated surface water, and the presence of snail-infested marshy fields have been strongly associated with elevated infection rates in various studies across Africa (Jean-Richard *et al.,* 2021). Despite these concerns, farmer awareness and access to veterinary care remain limited, contributing to persistent transmission cycles (Oluwole *et al.,* 2023). Given the absence of extensive surveillance data in Mubi North and the significance of livestock to local economies, this study assessed the prevalence, economic burden, and risk factors associated with fascioliasis in ruminants slaughtered in the area. Understanding these factors is essential for developing targeted and sustainable control strategies.

Materials and Methods

The Study Area

The research was conducted at Mubi North slaughter slab and its environs. Mubi North is situated between Mubi South and Hong Local Government area of Adamawa State (North Eastern Nigeria). The abattoir is owned by the Adamawa state Government, and managed by the Ministry of Livestock and Nomadic Resettlement. The abattoir is the major source of meat for the people of Mubi and it located at latitude 9^{o} 14'N of the Equator and longitude 12^{o} 14'E of the Greenwich Meridian. The annual rainfall ranges between 700mm and 1600mm which starts in May and ends in October. The wettest months are from July to September and dry season commences fully in November and ends in April. The relative humidity ranges between 20-30% and the mean monthly temperature ranges between 26 ^{o}C to 39 ^{o}C. It is located in the Sub-Sudan and Northern Guinea Savannah Zone (Adebayo *et al.,* 2020).

Experimental Animal

Various species, of ruminants from both sex were selected randomly from the lairage and tagged before slaughter. The species of ruminants sleeted were cattle, sheep and goat, which were all indigenous breeds. The sexes of the cattle, sheep and goats were identified by examining the perineal region for the presence of penis, testicles or the udder

Study Design

The research was conducted between the months July – September, 2024. The slaughter slab was visited twice a week for 12 weeks and total of 300 ruminants comprising of cattle sheep and goat, 50 animals from each sex were examined. Ante-mortem and post-mortem inspection was carried out to determine the level of liver damage and heavy parasitic

infection. Bile sample was also collected for laboratory analysis. On the sport assessment was also done at each visit to ascertain certain risk factors associated with other practices at slaughter slab. Questionnaires were distributed in five different wards (Bahuli, Vimtim, Bestso, Mijilu and Muchalla) randomly selected in Mubi North to determine the risk factors associated with the transmission and spread of ruminant fascioliasis. Market survey was also conducted to determine the cost of liver per kilogram for all ruminant species to help ascertain economic loss during the period of research.

Sample collection and laboratory analysis

Post-mortem inspection was conducted by palpation and incision to determine the presence of liver fluke and to access the state of liver damage. At the same period, 2 ml of bile sample was collected from the gall bladder of each of the slaughtered animal using a 5ml sterile syringe. The bile sample was poured into a labelled test tube and then placed in a test tube rack which was then transported to the Zoology laboratory of Adamawa State University, Mubi for parasitological examination. 1 ml of 10% formalin was added into the bile sample and allowed to stand for 5 min. Also, the samples were subjected to concentration by sedimentation using diethyl-ether and formaldehyde. 1 ml diethyl-ether was added into the test tube after 5 min. the content in the test tube was then corked and shaken for the solution to mix. The solutions were then centrifuged at 2000 rpm for 10 min and the eggs of *Fasciola* settled at bottom of the tube, while diethyl-ether with some fats suspended as supernatant. The supernatant was decanted and the sediment left in the test tube. One to two drops of the sediment was then placed on a glass slide, covered with a slip and viewed under microscope using 100× magnifications, these was performed as described by (Cheesbrough, 1999). Sample were considered positive if a *Fasciola* egg with the correct morphology of ellipsoidal and operculated structure is observed (Valero *et al.,* 2009). This procedure was done after each visit to the slaughter slab.

Ante-mortem and Post-mortem examination

Ante-mortem examination conducted at the lairage before slaughter to determine body condition score (BCS) of all ruminants, the risk factors, sex of animal and origin. The BCS was estimated based on a 5-point scoring system. The assessment classes used were very thin (score 1), thin (score 2), moderate (score 3), fat (score 4), and very fat (score 5) as described by (Wildman *et al*., 1982).

Post mortem parasite count provides a more precise assessment of parasite burden than parasite egg count. It is used for the detection and identification of the adult and immature forms of parasites (Kusumarini *et al.,* 2020)

Determination of associated risk factors

During the period of this research (July – September, 2024), interview was conducted by administering structured questionnaires to certain household, farms, and nomadic rearing cattle, sheep and goats in and around Mubi North Local Government area of Adamawa State. This was done to determining the type of animal husbandry practiced by these families, and individuals, including source of fodder, source of water, feeding system, their Knowledge on the disease, veterinary care and anthelmintic commonly used to treat their ruminants. Other practices at the slaughter slab was also examined

Statistical analysis

Descriptive statistics was used to analyse the data collected from the slaughter slab, laboratory and those obtained from the questionnaires. The percentage prevalence of the disease was determine based on sex, species and body condition score.

Results

Prevalence of Fascioliasis in ruminants based on body condition score, sex and origin

A total of 300 ruminants comprising of cattle, sheep, and goats were examined for fascioliasis, with each species represented by 100 animals. The prevalence of infection varied across sex, body condition score (BCS), and origin. Across all species, females generally had higher infection rates than their male counterparts. In cattle, the prevalence was 28.0 and 22.0% in females and males, respectively. For sheep, prevalence was 30.0 and 18.0%, while for goats, the values were 26.0 and 20.0% for females and males, respectively. Body condition score had a noticeable impact on the status of infection: very thin animals had the highest prevalence across species (33.0–33.3%). Thin animals showed moderate prevalence across species, reaching 25.0% for cattle and goats and 50.0% for sheep. Lower prevalence was recorded in animals with medium BCSs (20.7–22.4%), while fat animals showed slightly higher rates (22.7–27.3%). In all animal species, the prevalence range for very fat individuals ranged between 20.0 and 30.0%. Prevalence also differed significantly by geographical origin. The highest rate of infection in cattle was in animals from Vimtim (40.0%), followed by "Others" (Cameroon and Chad; 30.0%), while Mijilu had the lowest prevalence (10.0%). The highest prevalence in sheep was seen in animals from Mijilu (35.3%) and Muchalla (33.3%), while the lowest was recorded in Vimtim (16.7%). Similarly, goats from Vimtim recorded the highest prevalence (40.0%), followed by Bahuli (31.8%). The lowest prevalence was seen in goats from Betso and those from Cameroon and Chad with 15.4 and 15.0%, respectively.

The economic impact of fasciolisis in Mubi during the period of study

Table 2 shows the economic impact of liver infections due to Fascioliasis in cattle, sheep, and goats slaughtered at Mubi during the study period. The loss was calculated based on the number of infected livers, estimated weight of damaged liver, and the market price per kilogram for liver in each species. 300 liver were examined where 72 were infected with *fasciola* at different degree.

A total of 25 cattle livers were condemned due to infection. Out of these, male cattle contributed 11 livers, amounting to 35.2 kg and an estimated economic loss of ₦167,200. The 14 infected livers from female cattle weighed 44.8 kg, leading to a higher loss of ₦212,800. Altogether, liver condemnation in cattle resulted in a financial loss of ₦380,000. In sheep, 24 livers were found to be infected. Male sheep accounted for 22.5 kg of the condemned liver, valued at ₦101,200, while female sheep contributed 57.5 kg, resulting in a loss of ₦258,750. Overall, liver condemnation in sheep led to an economic loss of ₦359,950. For goats, 23 infected livers were recorded. Male goats contributed 8.5 kg of condemned liver, equivalent to ₦56,100, whereas female goats accounted for 10.9 kg, valued at ₦71,940. In total, losses from goat liver condemnation amounted to ₦128,040.

Table 1: Prevalence of ruminant fascioliasis based on body condition score, sex and origin

Categories		Cattle			Sheep			Goat		
	Variables	No. Exam.	+ve	Prev.(%)	No. Exam	+ve	Prev.(%)	No. Exam.	+ve	Prev.(%)
Sex	Male	50	11	22.0	50	9	18.0	50	10	20.0
	Female	50	14	28.0	50	15	30.0	50	13	26.0
BCS	Very thin	6	2	33.0	6	2	33.3	6	2	33.0
	Thin	4	1	25.0	4	2	50.0	4	1	25.0
	Moderate	58	13	22.4	58	13	22.4	58	12	20.7
	Fat	22	6	27.3	22	5	22.7	22	6	27.3
	Very fat	10	3	30.0	10	2	20.0	10	2	20.0
Origin	Bahuli	20	3	15.0	20	4	20.0	22	7	31.8
	Mijilu (Gaja)	10	1	10.0	17	6	35.3	23	4	17.4
	Betso	8	2	25.0	8	2	25.0	13	2	15.4
	Muchalla	12	3	25.0	12	4	33.3	12	3	25.0
	Vimtim	10	4	40.0	18	3	16.7	10	4	40.0
	Others (Cameroon & Chad)	40	12	30.0	25	5	20.0	20	3	15.0

BCS = Body condition score

Table 2: Total estimated loss during the period of study from infected liver of cattle sheep and goats

Species		Number of liver examined	No. of infected liver	Total weight of infected liver (kg)	Estimated loss = Total weight (kg) x ₦ current price
Cattle	(Male)	50	11	3.2 kg/ liver x 11	35.2 x ₦4,750 = ₦ 167,200
	(Female)	50	14	3.2 kg x 14	44.8 x ₦4,750 = ₦ 212,800
Sheep	(Male)	50	9	1.5–2.0 x 9	22.5 x ₦4,500 = ₦ 101,200
	(Female)	50	15	1.5–2.0 x 15	57.5 x ₦4,500 = ₦ 258,750
Goat	(Male)	50	10	1.0–1.5 /liver x 10	8.5 x ₦6,600 = ₦ 56,100
	(Female)	50	13	1.1-1.5 x 13	10.9 x ₦6,600 = ₦ 71, 940
Total		300	72		**Aprox**. ₦ 867

Assessment of risk factors in ruminant fasciolosis in Mubi North LGA

A total of 120 structured questionnaires were distributed to livestock farmers across various communities in Mubi North Local Government Area, Adamawa State. Out of these, 73 duly completed questionnaires were retrieved and analysed. The responses provided insights into several management and environmental factors that may predispose ruminants to fasciolosis within the study area. Table 3 summarizes the distribution of key risk factors, while the narrative below highlights the major findings. The origin of animals appeared to influence the likelihood of fasciolosis occurrence. Animals sourced from local farms recorded the highest prevalence (79%), suggesting greater exposure to contaminated pastures or suboptimal management practices. Pastoral herding communities accounted for 19.1% of cases, while animals from government-owned farms showed the lowest prevalence (2.7%), likely due to better supervision and health management protocols. Grazing close to water sources was strongly associated with increased infection risk. Farmers who allowed their livestock to graze near water bodies reported an 82.2% prevalence, compared to only 17.8% among those who avoided such areas. This trend aligns with the well-established role of aquatic environments in supporting the intermediate snail hosts responsible for *Fasciola* transmission. The type of water source used in livestock husbandry also contributed to disease exposure. Animals watered from rivers or streams exhibited the highest prevalence (80.8%), reflecting the potential contamination of these natural sources. Lower prevalence rates were observed among those using wells (19.2%) and boreholes (4.1%), while no cases were reported for animals accessing piped water, indicating its relative safety. A substantial proportion of respondents (80.8%) confirmed the presence of snails around their grazing fields. This finding underscores the suitability of the environment for the survival of *Lymnaeid* snails, which play a critical role in the life cycle of *Fasciola* spp. Only 19.2% reported no snail presence, reflecting their reduced exposure due to farming practices or locality. The feeding system adopted by farmers had a marked effect on risk levels. Open grazing accounted for 73.9% of reported cases, indicating high vulnerability due to unrestricted access to potentially contaminated pastures and water. In contrast, stall-fed (13.6%) and semi-intensive systems (12.3%) showed significantly lower prevalence, likely due to improved control over feed and water sources. Farmer awareness regarding fasciolosis was generally low. A large majority (84.9%) had no prior knowledge of the disease, while only 15.1% demonstrated some understanding. This low level of awareness likely contributes to inadequate preventive practices and poor recognition of early disease sign**.** Access to veterinary intervention was limited among respondents. Only 27.4% reported regular access to veterinary services, while 63.1% had no access at all. An additional 9.6% indicated occasional access. This lack of veterinary support hampers early diagnosis and effective control efforts. Most farmers (71%) reported not using anthelmintic which significantly increases the risk of parasite build-up and ongoing transmission. Only 29% indicated routine use of anthelmintic in their herds. Among those who deworm their animals, practices were largely inconsistent. A notable 71% reported not deworming at all, while 13.6% dewormed irregularly. Annual deworming was recorded by 9.6% of respondents, and only 2.7% each practiced quarterly or biannual deworming. No respondents reported monthly deworming, reflecting a general lack of structured parasite-control programs.

Table 3: Assessment of risk factors in ruminant fasciolosis in Mubi North LGA of Adamawa State

Risk factors	Categories	Response	Prev. (%)
Source	Local farms	57	79
	Pastoral herding community	14	19.1
	Government owned farms	2	2.7
Do your animals graze near water bodies (e.g., rivers, lakes, ponds, swamps)?	Yes	60	82.2
	No	13	17.8
Source of water	Well	14	19.2
	Borehole	3	4.1
	River/stream	9	80.8
	Piped water	0	0
Are there snails around the grazing area?	Yes	59	80.8
	No	14	19.2
What feeding system do you practice	Stall feeding (indoors)	10	13.6
	Grazing (open)	54	73.9
	Semi intensive	9	12.3
Do you have any knowledge on the disease (Fascioliasis)	Yes	11	15.1
	No	62	84.9
Do you have access	Yes	20	27.4
Veterinary care	No	46	63.1
	Sometimes	7	9.6
Anthelmintic use for treatment	Yes	21	29
	No	52	71
Intervals of deworming	Monthly	0	0
	Quarterly	2	2.7
	Biannually	2	2.7
	Annually	7	9.6
	Irregularly	10	13.6
	Not at all	52	71

Discussion

The findings from this research provides an insight into the prevalence of fascioliasis in cattle, sheep and goat based on sex, body condition score (BCS), and origin. Female cattle had a higher prevalence (28%) compared to males (22%), which may be due to longer exposure times to infection risk factors, as females are often retained longer for reproduction. This aligns with findings by (Ardo *et al.,* 2014), who reported similar trends in Adamawa State, suggesting sex-based differences in susceptibility or exposure duration.

The body condition score reveals that cattle with very thin body condition accounted for the highest prevalence (33.3%), followed by very fat (30%) and fat (27%). Interestingly, the moderate and thin categories had relatively low prevalence rates (22.4% and 25%, respectively). This may seem counterintuitive, as fascioliasis is often associated with weight loss. However, early or moderate infections might not yet have severely impacted the

host's condition, while emaciated cattle may suffer from other underlying conditions or chronic fascioliasis. The lower prevalence of fascioliasis observed in cattle with poor body condition scores (thin and moderate) may not necessarily indicate reduced susceptibility but rather a reflection of their lower representation in the slaughter population.. This trend aligns with reports by (Pfukenyi *et al.,* 2006), who emphasized that sampling bias could affect prevalence estimates. Additionally, Fasciola infections may not always manifest clinically in moderate or fat animals, especially in early stages, as noted by (Chanie, 2012) Thus, higher prevalence in better-conditioned animals may be due to greater sample sizes and subclinical infections going undetected in emaciated animals. Regarding origin, the highest prevalence (40%) was found in cattle sourced Vimtim. Followed by Cameroon and Chad (30%), while Muchalla and Betso also showed notable rates (25% and 25%, respectively), suggesting local foci of infection possibly due to favourable snail habitats. This finding agrees with (Aliyu *et al.*, 2020), who highlighted the role of waterlogged grazing fields and poor veterinary control in sustaining fascioliasis in North-Eastern Nigeria.

Notably, female sheep exhibited a higher prevalence (62.5%) compared to males (37.5%). This aligns with findings from Bauchi State, Nigeria, where female sheep showed higher infection rates, possibly due to physiological stressors like pregnancy and lactation that may compromise immunity (Aliyu *et al,*. 2018). Analysing BCS, sheep with thin condition had the highest prevalence (50%), while moderate, very thin, fat, and very fat categories each showed a prevalence of 22, 33, 22.7 and 20% respectively. This pattern suggests that sheep in thin condition might be more susceptible, potentially due to factors like grazing behaviour or immune status which aligns with a study in Ethiopia where higher fascioliasis prevalence in sheep with poor body condition was reported emphasizing the role of nutrition and health status in susceptibility (Alemu and Chala, 2018)

Regarding origin, sheep from Mijilu (Gaja) had the highest prevalence (35%), followed by Muchalla (33.3%). Those from Chad and Cameroon had (20%) while Buhuli, Betso and Digil had (20, 25 and 16.7%) respectively. Variations in prevalence based on origin could be attributed to differences in environmental conditions, grazing practices, and management systems. This aligns with a study in Sokoto, Nigeria, which highlighted the influence of local environmental factors on fascioliasis prevalence in small ruminants (Shehu *et al.,* 2024). These findings underscore the multifactorial nature of fascioliasis prevalence, influenced by sex, body condition, and origin.

Findings also higher prevalence in female goats (26%) compared to males (20%). Goats with very thin BCS exhibit the highest prevalence (33.3%), while those classified as very fat and moderate show significantly lower prevalence rates (20% and 20.7%) respectively. Regarding origin, goats from Vimtim had the highest prevalence (40%), followed by Bahuli at (31.8 %). These findings align with previous studies in Nigeria and other African regions. For instance, a study in Bauchi State reported a higher prevalence of fascioliasis in female goats (42.6%) compared to males (30.4%) (Aliyu *et al.,* 2018). The association between BCS and fascioliasis prevalence has also been documented, with very thin BCS animals showing higher infection rates (Yadav *et al.,* 2015) this may be due to the fact that goats with very thin BCS are more suceptable increasing their exposure to infective stages of *Fasciola* species. Geographical variations in prevalence, as observed in the table, have been attributed to differences in environmental conditions and

grazing practices. A study in the Lake Chad area found that goats grazing near water bodies had higher infection rates (Jean-Richard, 2021) Similarly, regional differences in prevalence have been reported in Bauchi State, with certain areas exhibiting higher rates due to favourable conditions for the intermediate host snails (Aliyu *et al,*. 2018).

Conclusion

This research demonstrates that fascioliasis remains a significant parasitic challenge among ruminants in Mubi North, with notable prevalence across cattle, sheep, and goats. Infection patterns were influenced by sex, body condition score, and geographical origin, with females and very thin animals exhibiting higher prevalence rates. Economic analysis showed substantial financial losses due to liver condemnation, amounting to approximately ₦867,000 during the study period. Risk factor assessment highlighted critical contributors to disease transmission, including grazing near water bodies, presence of snails in grazing areas, reliance on natural water sources, low farmer awareness, poor access to veterinary services, and inconsistent anthelmintic use. These findings underscore the multifactorial nature of fascioliasis epidemiology and emphasize the need for integrated control strategies. Strengthening veterinary extension services, improving farmers' knowledge, and implementing targeted parasite management programs are crucial steps toward reducing the disease burden and improving livestock productivity in the region.

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