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ORIGINAL RESEARCH ARTICLE

Comparative study of *Fasciolosis* among Cattle, Sheep, and Goats in Selected Farms in Kano

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ABSTRACT

Liver flukes from the genus *Fasciola* cause the parasitic disease *fasciolosis*, one of the most serious helminth infections affecting livestock worldwide. This study aimed to conduct a comparative analysis of *fasciolosis* among cattle, sheep, and goats on selected farms in Kano State, Nigeria. A total of 387 fecal samples (129 from cattle, 129 from sheep, and 129 from goats) were collected and analyzed using standard sedimentation techniques, from March to September, 2024. The overall prevalence of *fasciolosis* was 4.13%, with species-specific prevalence rates of 3.88% in cattle, 3.10% in sheep, and 5.43% in goats. No statistically significant differences in prevalence were observed across species or locations, indicating uniform environmental and management conditions. However, despite non-significant statistics ($p>0.05$), male goats/cattle showed 3–6× higher prevalence than females. This is the first study comparing species/sex susceptibility in Kano's urban farms. The results highlight the importance of targeted control measures, particularly for goats and male animals, which are at higher risk of infection.

INTRODUCTION

Liver flukes belonging to the genus *Fasciola* are the cause of the parasitic disease *fasciolosis*. It is among the most serious helminth infections that livestock worldwide encounter. *Fasciola hepatica* and *Fasciola gigantica* are the two species that cause the sickness. These trematodes induce serious pathological damage, decreased productivity, and occasionally even death when they infect ruminants' livers and bile ducts (Mas-Coma *et al.,* 2009). *Fasciolosis* is more common in areas with favorable environmental conditions for *Lymnaea* snails, its intermediate host which facilitates the parasite's lifecycle (Malone *et al.,* 1998). *Faciolosis* is endemic in Nigeria and most of sub-Saharan Africa, becoming a major problem to livestock production, food security, and rural livelihoods (Nyindo and Lukambagire, 2015).

The lifecycle of *Fasciola* species involves intermediate hosts (freshwater snails) and definitive hosts (ruminants). The parasite's infectious stage, *metacercariae*, which encyst on vegetation in moist environments, is consumed by ruminants. Once the *metacercariae* grow into adult flukes, they cause extensive tissue damage in the liver after excysting in the duodenum and migrating through the intestinal wall (Boray, 1969). The presence of suitable habitats for *Lymnaea* snails, such as stagnant water bodies, irrigation canals, and marshy areas, is a critical factor in the transmission of *fasciolosis* (Malone *et al.,* 1998). In Kano State, the seasonal rainfall patterns and the presence of water bodies during the wet season create ideal conditions for the proliferation of these snails, thereby increasing the risk of *fasciolosis* transmission (Ogundipe *et al.,* 2019).

Cattle, sheep, and goats exhibit varying levels of susceptibility to *fasciolosis*. Cattle are generally considered more resistant to infection compared to sheep and goats, which are highly susceptible and often experience severe clinical manifestations (Boray, 1969). However, the economic impact of *fasciolosis* in cattle is significant due to their higher market value and the chronic nature of the disease, which leads to reduced weight gain, reduced production of milk and reduced fertility (Spithill *et al.,* 1999). However, sheep and goats often suffer acute infections, resulting in high mortality rates, particularly in young animals (Torgerson and Claxton, 1999). The differences in susceptibility and clinical outcomes among these species are influenced by factors such as grazing behavior, immune response, and management practices (Taira *et al.,* 2011).

Fasciolosis has been extensively studied worldwide due to its significant impact on livestock health and productivity. The disease is most common in tropical and subtropical areas because of the favorable environmental conditions that allow the parasite and its intermediate host to survive and reproduce (Mas-Coma et al., 2009). In the African sub-region, fasciolosis poses a considerable threat to

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livestock, with varying prevalence rates reported across different countries and regions. For example, studies in Ethiopia have documented prevalence rates of up to 52.6% in cattle, 48.3% in sheep, and 36.7% in goats (Yilma and Mesfin, 2000).

In Nigeria, several studies have been done on the prevalence and impact of *fasciolosis* in different regions. A study in Ibadan reported a prevalence rate of 45.5% in cattle slaughtered at abattoirs (Ajayi *et al.,* 2018). Similarly, a study in Zaria found a prevalence rate of 38.2% in sheep and goats (Onyenwe *et al.,* 2016). Kano State is a key livestock-producing state in Nigeria, contributing greatly to the country's agricultural economy. The state's semi-arid climate, characterized by seasonal rainfall and the existence of water bodies, creates ideal conditions for the proliferation of *Lymnaea* snails, thereby facilitating the transmission of *fasciolosis* (Ogundipe *et al.,* 2019). However, while fasciolosis is documented in rural Nigeria, urban livestock systems in Kano remain unstudied despite unique management practices (e.g., confined grazing, veterinary access). Also, there is a paucity of comparative studies on cattle, sheep, and goats in the State, despite its importance as a livestock-producing area. Ogundipe et al. (2019) reported 12% prevalence in Kano's ruminants but did not compare species/sex susceptibility. Therefore, this study aims to carry out a comparative analysis of *fasciolosis* among cattle, sheep, and goats in Kano state.

MATERIALS AND METHODS

Study Area and Population

The study was carried out in Kano State, which is situated in northern Nigeria (longitude 8.5167° E, latitude 11.9964° N). With its semi-arid climate that alternates between rainy and dry seasons, Kano is a significant livestock-producing state. Usually lasting from May to October, the wet season creates ideal conditions for the growth of *Fasciola* species' intermediate host, *Lymnaea* snails. The study focused on selected livestock farms, namely, farm A, farm B and farm C. The study population consisted of cattle, sheep, and goats. A total of 387 animals (129 cattle, 129 sheep, and 129 goats) were randomly sampled from the three livestock farms. The animals were selected based on sex to ensure a representative sample. Only mature animals were included in the study to ensure that they had sufficient exposure to the parasite.

Ethical Considerations

Ethical approval for the study was obtained from the Research Ethics Committee at Northwest University, Kano. Permission was also secured from the farm owners prior to sample collection. All procedures were carried out in accordance with the guidelines for the care and use of animals in research (National Research Council, 2012).

Study Design

The cross-sectional research approach was employed in this study, integrating both field and laboratory techniques to collect and analyze data. The methodology aimed to provide a thorough comparative analysis of *fasciolosis* among cattle, sheep, and goats in Kano metropolis, Kano State, Nigeria.

Sample Size Determination

A total of 387 samples (129 each of cattle, sheep and goats) were determined using formula of Thrusfield (2018).

$$N = \frac{Z^2 pq}{d^2}$$

Where:

q = complementary probability (1-P).

n = minimum sample size.

P = Assumed prevalence (50.0%)

d = desired precision 0.05.

Z = appropriate value for the standard normal deviate set at 95% confidence interval (1.96)

Therefore,

$$N = \frac{1.96^2 \times 0.5 \times o.5}{0.05^2}$$

$$= \frac{0.9604}{0.0025}$$

$$= 384.16 = 387$$

Sample Collection

Using sterile gloves, fecal samples were collected directly from each animal's rectum and placed in sealed, labeled containers. Within four hours of collection, the samples were transported to the lab for examination. Data on animal demographics (sex and location) were recorded, along with the number of fecal samples.

Sample processing

The method of Magaji *et al.* (2014) was adopted. Two grams (2 g) of feces were collected into labeled test tubes containing 3 mL of distilled water. The fecal samples and the distilled water were strained to create a suspension. The suspension was strained through a tea strainer into a corresponding cleaned labeled Petri dish. The filtrate was poured into corresponding test tubes. The test tubes were filled with one milliliter (1 mL) of 10% formalin and allowed to stand for five minutes. After five minutes, a separate 18-gauge hypodermic needle and syringe were used to add 1 mL of diethyl ether to the test tubes. The suspension-filled test tubes were then corked, shaken to combine, and centrifuged for eight minutes at 2000 rpm. The fecal debris settled into a layer between the diethyl ether and water, while the parasite eggs and cysts settled at the bottom. A small portion of the supernatant was retained with the sediment during decantation. To check for the presence of Fasciola eggs, which are distinguished by their large size, oval shape, and yellowish-brown color, drops (1-2) of the sediment were placed on a glass slide, covered with a coverslip, and examined under a microscope at a magnification of ×100 (Urquhart et al., 1996; Magaji *et al.,* 2014).

Data Analysis

The Statistical Package for the Social Sciences (SPSS) version 25 was used to evaluate the data after it was entered into Microsoft Excel. The prevalence of *fasciolosis* in cattle, sheep, and goats was compiled using descriptive statistics. Chi-square tests were used to assess the relationship between fasciolosis prevalence, sex, and location of the animals.

RESULTS AND DISCUSSION

387 fecal samples from 129 cattle, 129 sheep, and 129 goats in Kano Metropolis were collected and examined. 4.13% was the overall prevalence for all species (16/387). Five (5) of the 129 cattle analyzed had *fasciolosis*, yielding a 3.88% prevalence rate. Four (4) of the 129 sheep that were inspected had the infection, resulting in a 3.10% prevalence rate. The highest prevalence percentage was seen in goats, where 7 out of 129 animals were affected, yielding a 5.43% prevalence. However, to ascertain whether the prevalence rates of the three animal species differ significantly from one another, a chi-square test was used. The prevalence of *fasciolosis* in cattle, sheep, and goats does not differ statistically significantly, as indicated by the computed chi-square value (0.8798) being less than the critical value (5.99).

Table 1: Prevalence of *Fasciolosis* among Cattle Sheep and Goats

Animal	No. examined	No. infected	Prevalence
Cattle	129	5	3.88%
Sheep	129	4	3.10%
Goats	129	7	5.43%
Total	387	16	4.13%

The prevalence of *fasciolosis* in cattle was consistent across all three locations, with a prevalence rate of approximately 4.65% at farm A and 4.63% at both farm B and farm C. In the case of sheep, at farm A and B, the prevalence was 4.63%, but no infections were found at farm C. However, Goats at farm A had a prevalence of 4.63%, while those at farm B and farm C had a lower prevalence of 2.33%. Chi-square tests were performed to assess if there are significant differences in prevalence by location for each species. The results showed that there are no statistically significant differences in the prevalence of *fasciolosis* among locations for cattle ($\chi^2 = 0$), sheep ($\chi^2 = 2.007$) or goats ($\chi^2 = 0.501$), which are all less than the critical value (5.99).

Table 2: Prevalence of *Fasciolosis* by Location

Animal	Location	Number Examined	Number Infected	Prevalence (%) (95% CI)
Cattle	Farm A	43	2	4.65% (0.6–15.5%)
	Farm B	43	2	4.63% (0.6–15.5%)
	Farm C	43	2	4.63% (0.6–15.5%)
Sheep	Farm A	43	2	4.63% (0.6–15.5%)
	Farm B	43	0	0.00% (0.0–8.2%)
	Farm C	43	2	4.63% (0.6–15.5%)
Goats	Farm A	43	2	4.63% (0.6–15.5%)
	Farm B	43	1	2.33% (0.1–12.1%)
	Farm C	43	1	2.33% (0.1–12.1%)

Male cattle had a significantly higher prevalence of *fasciolosis* (6.25%) compared to females (1.54%). However, the prevalence was similar between male (3.13%) and female (3.08%) sheep, while male goats had a much higher prevalence (9.38%) compared to females (1.54%). Chi-square tests were conducted to determine if there are significant differences in prevalence by sex for each species. While the observed differences, especially in goats (3.487) and cattle (1.849), are relatively higher, the calculated chi-square values did not reach statistical significance as they are all less than the critical value (3.84).

Table 3: Prevalence of *Fasciolosis* by Sex

Animal	Sex	Number examined	Number infected	Prevalence
Cattle	Male	64	4	6.25%
	Female	65	1	1.54%
Sheep	Male	64	2	3.13%
	Female	65	2	3.08%
Goats	Male	64	6	9.38%
	Female	65	1	1.54%

Discussion

The prevalence rates of *fasciolosis* among cattle, sheep and goats observed in this study are lower than those reported in other parts of Nigeria and sub-Saharan Africa. Maikaje *et al.* (2010) found the prevalence of 4.2% in cattle and 5.1% in goats in Plateau State, Nigeria, while Keyyu *et al.* (2006) documented higher rates in Tanzania, with 7.8% in goats, 4.5% in cattle, and 5.2% in sheep. The lower prevalence in Kano Metropolis could be due to differences in environmental conditions, grazing and management operations, or the efficacy of anthelmintic treatments. For example, the semi-arid climate of Kano may limit the proliferation of the snail intermediate host, thereby reducing the risk of transmission. Additionally, the study area's urban setting may result in more controlled grazing practices compared to rural areas, where animals are often allowed to roam freely.

The slightly higher prevalence in goats (5.43%) compared to cattle and sheep conforms to results of previous studies, like that of Nyirenda *et al.* (2019) in Zambia, and Tariq *et al.* (2008) in Pakistan. This trend can be explained by grazing behavior of goats, which tend to graze closer to the ground and are more likely to ingest *metacercariae*, the infective stage of *Fasciola* species. Furthermore, goats are often managed less intensively than cattle and sheep, particularly in extensive farming systems, which may increase their exposure to contaminated environments.

The study found non-significant differences in *fasciolosis* prevalence across all three locations (Farm A, Farm B and Farm C), for cattle, sheep, or goats. This shows that environmental conditions conducive to the survival of the intermediate host snails are relatively uniform across the study area. However, the absence of infections in sheep at farm B may be due to differences in grazing patterns or the absence of suitable habitats for snails in that location. Similarly, the lower prevalence in goats at farm B and farm C compared to farm A could be due to variations in grazing management or environmental factors, such as soil moisture and vegetation cover, which influence the distribution of snails.

These findings differ from studies conducted in other areas, where significant variations in prevalence have been linked to environmental factors such as altitude, rainfall, and water availability. For example, Mas-Coma *et al.* (2005) reported that the prevalence of *fasciolosis* is higher at areas with abundant water bodies and high rainfall, which creates an ideal environment that favours the survival of the snail intermediate host. The absence of such variations in Kano Metropolis may be due to the relatively small geographic area covered by the study or the homogeneity of environmental conditions across the sampled locations.

The study also found sex-based differences in *fasciolosis* prevalence, especially among cattle and goats, consistent with Iboyi *et al.,* 2017, who found (45.0%) in males and (40.5%) in female cattle in Minna, North central Nigeria. Male cattle showed a high prevalence rate (6.25%) compared to females (1.54%), which may be attributed to their use for draught purposes. Male cattle are often required to graze in swampy or marshy areas, where the risk of *Fasciola* infection is higher due to the presence of intermediate host snails. However, female cattle are typically kept closer to home and may have limited access to contaminated grazing areas. This finding is consistent with studies such as Tariq *et al.* (2008), who reported a higher prevalence in male cattle due to their grazing behavior.

Similarly, male goats had a much higher prevalence (9.38%) compared to females (1.54%). This disparity may be due to the roaming behavior of male goats, which are often allowed to graze freely in search of food, increasing their exposure to contaminated environments. Female goats, on the other hand, are often kept for milk production and are managed more intensively, reducing their risk of infection. Although the chi-square tests did not reach statistical significance, likely due to the small sample size, these trends align with findings from other studies, such as Phiri *et al.* (2007), who also reported higher prevalence in male goats in Zambia.

The use of sedimentation in this study limited species-level identification of Fasciola. While it enabled egg detection, molecular methods such as PCR-RFLP (Marcilla et al., 2002) are needed to distinguish *F. hepatica* from *F. gigantica*. Future work should incorporate these techniques for improved epidemiological resolution

CONCLUSION/RECOMMENDATIONS

From the results of the research, it can be concluded that there is low *faciolosis* prevalence among cattle, sheep, and goats in the studied farms at Kano state, with goats showing the highest susceptibility. Therefore, Male goats and cattle should be Prioritized in deworming programs during wet seasons. Anthelmintic efficacy should also be monitored given emerging resistance in Nigerian trematodes (Ajayi et al., 2018).

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