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Bovine Fasciolosis in Slaughtered Cattle at Akinyele, Ibadan, Nigeria

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ABSTRACT

Bovine Fasciolosis poses significant public health problems and is of great concern for all livestock farmers. Studies on bovine Fasciolosis have been carried out in different abattoirs in Nigeria. However, there is no study on bovine fasciolosis at the Akinyele Central Abattoir, Ibadan. Our study aimed to determine the prevalence of bovine Fasciolosis and associated risk factors, the most prevalent *Fasciola* spp., fluke burden and severity of liver lesions, and the correlation between fluke burden and severity of liver lesions at the Akinyele Central Abattoir, Ibadan. A total of 640 slaughtered cattle were sampled over the course of a year. During the postmortem examination, the liver was examined for the presence of flukes, which were identified at the species level. The flukes in each liver were counted, and liver lesions were classified based on severity. The prevalence of bovine Fasciolosis was 20%, with *Fasciola gigantica* (78.1%) being the most common species. Fasciolosis in the wet season (26.5%) was significantly ($P < 0.05$) more prevalent than in the dry season (8.6%). The fluke burden of 3 to 20 flukes (65.6%) was the most prevalent. Most of the livers with Fasciolosis were moderately affected (50%). There was a moderate correlation between fluke burden and the severity of the liver lesion. Bovine fasciolosis is prevalent in Akinyele Central Abattoir, Ibadan, with season being the only identified risk factor. It is recommended that regular deworming be initiated for the control and prevention of bovine Fasciolosis before and after the rainy season.

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INTRODUCTION

Bovine fasciolosis is a zoonotic and economically significant disease in cattle caused by the parasites *Fasciola hepatica* and *Fasciola gigantica.* Globally, it is regarded as one of the most crucial helminth diseases (**WHO, 2007**). Humans can accidentally become infected (**Biu *et al*., 2006**). In the tropics, bovine fasciolosis is caused most commonly by *Fasciola gigantica* and sometimes by *Fasciola hepatica* (**Nyirenda *et al*., 2019**). The distribution of *Fasciola hepatica* is cosmopolitan, mostly in temperate zones. There is an overlap of the two fasciolid species in several countries across Asia and Africa, especially in areas where the flukes and their snail intermediate host have distinct ecological demands (**Mas-Coma *et al*., 2005**).

Fasciolosis is a major concern for livestock farmers as it leads to significant public health problems. It is associated with a substantial global economic loss to the livestock industry, mainly through mortality, liver condemnation, reduced production of milk, meat, and wool, and expenditures for anthelmintics (**Köstenberger *et al*., 2017**).

According to **Animal Health Ireland (2013)**, with respect to infection level, fasciolosis can decrease meat production in beef cattle by 20%, taking 80 days post-deworming to reach meat production levels that are compatible with those of the marketplace. Also, it was shown that fasciolosis can reduce milk production in dairy cattle by 8%. The associated liver pathology is responsible for partial or complete condemnation (**Biu *et al*., 2006**; **Oladele-Bukola and Odetokun, 2014**), causing large economic losses to livestock producers and food industries worldwide.

In Nigeria, several studies have been carried out on bovine fasciolosis in different abattoirs, with a reported prevalence of 15–50% (**Jeremiah and Folorunsho, 2019; Okonkwo *et al*., 2023**). However, there is a dearth of information on bovine fasciolosis

at the Akinyele Central Abattoir, Ibadan. Coupled with the dynamic epidemiology of fasciolosis that may change with time (**Mungube *et al.*, 2006**). Hence, our study aimed to determine the following at the Akinyele Central Abattoir, Ibadan: the prevalence of bovine fasciolosis and associated risk factors, the most prevalent *Fasciola* spp., the fluke burden and severity of liver lesions, and the correlation between fluke burden and severity of liver lesions.

MATERIALS AND METHODS

Study area and sample size

The study was carried out at the Ibadan Municipal Abattoir, Akinyele Central Abattoir, Amosun, located at KM 16 on the Ibadan/Oyo motorway, Akinyele Local Government Area, Ibadan, Oyo State. The Central Abattoir is located on a grid reference at a longitude of 3.91° E and a latitude of 7.61° N, with an area coverage of 0.15 km^2.

The study animals were 640 adult slaughtered cattle, comprising the following breeds: White Fulani, Sokoto Gudali, Red Bororo, and Kuri. Samples were taken over a period of a year (February 2022–February 2023). Animals were purchased from smallholder farms around Ibadan and Iseyin; the Guinea savannah, Sahel, and sub-arid climatic zones of northern Nigeria; and border countries such as Niger, Chad, and Mali **(Jeremiah and Banwo, 2019).** They are conveyed to the aforementioned abattoir and adjacent market for slaughtering, rearing, or sales purposes.

Post-mortem inspection and risk factor assessment

Information regarding sex, breed, and season was recorded. The sex was classified into male and female; the season was classified into dry (December–March) and wet (April–November) seasons; and the breed of cattle (*Bos indicus*) encountered during the study included White Fulani, Sokoto Gudali, Red Bororo, and Kuri.

The liver was inspected for fasciola by making a lengthwise incision on the ventral side of the liver, such that the bile duct was cut open. The forceps were used to pick up the exposed worms in the bile duct and the gall bladder. The flukes gotten from each cattle liver were kept in labelled containers and taken to the parasitology laboratory for identification and preservation, as described by **Yesmirach and Mekonnen (2012).**

Fasciola flukes recovered from the sampled animal were examined macroscopically and microscopically and classified as adult *F. gigantica*, *F. hepatica*, and unidentified flukes (very small immature flukes that are difficult to categorise macroscopically) on the basis of size and shape (**Soulsby, 1982**). Fluke burden was classified into 3 categories: (1) fluke count of 3 to 20; (2) fluke count of 21 to 40; and (3) fluke count of 41 to 60. Categorization of the affected livers based on the severity of the lesion was carried out based on the approach of **Ogunrinade and Adegoke (1982)**. Severely affected were defined by more than 50% liver lesions with cirrhotic outline and atrophy; moderately affected were defined by less than 50% liver lesions with cirrhotic outline and atrophy; and lightly affected were defined by liver lesions with no cirrhotic outline and atrophy.

Data analysis

The data were summarised in tables using descriptive statistics in frequency and percentage. A Chi-square ($\chi 2$) test was used to test for an association between the prevalence of fasciolosis and the categorical variables (breed, sex, and season). Confidence intervals (CI) of 95% were calculated **(Akpan *et al.*, 2023).**

A Spearman rank correlation was used to test for a relationship between fluke burden and the severity of liver lesions. The Spearman's rank correlation coefficient result was interpreted as follows: Values from 0.90 to 1.00 (- 0.90 to - 1.00) indicated very high positive (negative) correlation, 0.70 to 0.90 (- 0.70 to - 0.90) high positive (negative), 0.50 to 0.70 (- 0.50 to - 0.70) moderate positive (negative), 0.30 to 0.50 (- 0.30 to - 0.50) low positive (negative), and 0.00 to 0.30 (- 0.00 to - 0.30) negligible correlation. Values of $P < 0.05$ were considered significant. The Statistical Package for Social Sciences (SPSS®, version 26) was used for the analysis.

RESULTS

Prevalence of fasciolosis

Out of the 640 cattle slaughtered, the prevalence of fasciolosis was 20% (128/640; 95% CI: 17.0%–23.1%) (Table 1).

Table 1: Prevalence of fasciolosis

Fasciolosis	No. of samples	Prevalence (%)	95% CI
Positive	128	20	17.0% - 23.1%
Negative	512	80	76.9% - 83.0%
Total	640	100	100% - 100%

Summary of *Fasciola* spp. Identified

In terms of the *Fasciola spp.* identified in the liver of cattle with fasciolosis, *Fasciola gigantica* (Fig.1) was 78.1%, *Fasciola hepatica* (Fig. 2) was 6.3%, mixed infection of both *Fasciola gigantica* and *Fasciola hepatica* was 6.3%, and unidentified fluke was 9.4% (Table 2).

Table 2: Summary of *Fasciola* spp. identified

Fasciola spp.	No. of liver infected	Percentage (%)
Fasciola gigantica	100	78.1
Fasciola hepatica	8	6.3
Mixed	8	6.3
Unidentified	12	9.4
Total	128	100

Fig. 1: *Fasciola Gigantica*

Fig. 2: *Fasciola hepatica*

Sex, breed, and season as risk factors

Regarding sex prevalence, the prevalence of fasciolosis in male cattle was 15.2% (20/132), and the prevalence of fasciolosis in female cattle was 21.3% (108/508). There was no significant association between the prevalence of fasciolosis and sex (X^2 (1) = 2.443, P > 0.05). In terms of breed prevalence, the prevalence of fasciolosis in White Fulani was 20.9% (96/460), the prevalence of fasciolosis in Sokoto Gudali was 23.8% (20/84), the prevalence of fasciolosis in Red Bororo was 13.6% (12/88), and none of the Kuri breeds had fasciolosis (0/8). There was no significant association between the prevalence of fasciolosis and breed (X^2 (3) = 5.207, P > 0.05). Concerning seasonal prevalence, the prevalence of fasciolosis in the wet season was 26.5% (108/408), and the prevalence of fasciolosis in the dry season was 8.6% (20/232). There was a significant association between the prevalence of fasciolosis and the season (X^2 (1) = 29.452, P < 0.05) (Table 3).

Table 3: Prevalence of bovine fasciolosis based on sex, breed, and season as risk factors

Variable		No. of cattle sampled	No. of cattle with fasciolosis	Prevalence (%)	X^2 value	df	P value
Sex							
	Male	132	20	15.2	2.443	1	0.118
	Female	508	108	21.3			
Breed							
	White Fulani	460	96	20.9	5.207	3	0.157
	Sokoto Gudali	84	20	23.8			
	Red Bororo	88	12	13.6			
	Kuri	8	0	0			
Season							
	Wet (April – November)	408	108	26.5	29.452	1	< 0.001*
	Dry (December – March)	232	20	8.6			

Fluke burden

Eighty-four (65.6%) of the livers with fasciolosis had a fluke burden of 3 to 20 flukes, 32 (25%) of the livers with fasciolosis had a fluke burden of 21 to 40 flukes, and 12 (9.4%) of the livers with fasciolosis had a fluke burden of 41 to 60 flukes (Table 4).

Table 4: Summary of Fasciola fluke count interval in the representative livers

Fluke burden	No. of liver	Percentage (%)
3-20 flukes	84	65.6
21-40 flukes	32	25
41-60 flukes	12	9.4
Total	128	100

Severity of liver lesions

Fifty-two (40.6%) of the liver samples with fasciolosis were lightly affected (Fig.3), 64 (50%) were moderately affected, and 12 (9.4%) were severely affected (Fig. 4; Table 5).

Table 5: Summary of severity of liver lesions

Severity of Liver lesions	No. of Liver	Percentage (%)
Lightly affected	52	40.6
Moderately affected	64	50
Severely affected	12	9.4
Total	128	100

Fig. 3: lightly affected liver lesions with no cirrhotic outline

Fig. 4: Severely affected liver were defined by more than 50% liver lesions with cirrhotic outline (yellow arrows)

Correlation between fluke burden and severity of liver lesions

Spearman's rank correlation of fluke burden and severity of liver lesions was found to be moderately positive and statistically significant ($r = 0.666$, $p < 0.01$) (Table 6).

Table 6: Correlation coefficients for Fasciola fluke burden and severity of liver lesions

	Fluke burden	Severity of Liver lesions
Fluke burden		0.666*
Severity of Liver lesions	0.666*	

* = Statistically significant ($p < 0.01$)

DISCUSSION

The abattoir is a vital link in the farm-to-fork journey of beef, as it's where food animals are processed. Hence, the abattoir can provide information on animal disease epidemiology. Results from this study constitute the first report on the prevalence of fasciolosis in slaughtered cattle at the Akinyele Central Abattoir, Ibadan. In the present study, we reported an overall prevalence of 20%. The reason for the high prevalence of bovine fasciolosis could be due to insufficient knowledge and poor management practices in preventing it, along with the inappropriate use of fasciolicides, including the wrong choice of anthelmintic and dosing. The prevalence of bovine fasciolosis varies in Nigeria (**Ekwunife and Eneanya, 2006; Raji *et al*., 2010; Alawa *et al*., 2011; Jeremiah and Folorunsho, 2019; Okonkwo *et al*., 2023**) and different other countries (**Pfukenyi and Mukaratirwa, 2004; Yusuf *et al*., 2016)** from as low as 10.5% to as high as 68%. Climatic conditions, stocking density, and intermediate hosts' availability may explain the varied prevalence (**Adedokun *et al*., 2008**).

Fasciola gigantica was the dominant fluke species (78.1%) in the present study. This agrees with the work of **Nyirenda *et al*. (2019)** that bovine fasciolosis in Africa is mostly caused by *Fasciola gigantica* and scarcely by *Fasciola hepatica*, whereas in America, Oceania, and Europe, only *F. hepatica* is concerned (**Mas-Coma *et al*., 2005**). The relatively small proportion of mixed infection in both species (6.3%) is consistent with the report of **Ahmad *et al*. (2020)**. With the exception of other large freshwater snails like Radix spp. and *Indoplanorbis spp.*, which are only associated with *F. gigantica* to date, both species share the intermediate host *Lymnaea* spp. The liver of the same animal may have mixed infections if ecological conditions favour the replication of both snail species and cattle from different grazing areas.

This study shows that there is no significant association ($P > 0.05$) between sex and fasciolosis. The prevalence of fasciolosis in cows was significantly higher than in bulls, according to **Van Veen (1997).** This was attributed to the hormone-controlled relaxation of immunity during pregnancy and lactation in female animals. However, in our study, the slaughtered cows sampled were neither pregnant nor lactating.

Differences in genetics and physiological adaptations could explain the influence of breed. However, the different indigenous breeds sampled had no significant influence on the susceptibilities of cattle to Fasciola infections in this study. The White Fulani breed was the most encountered cattle breed during the course of the study, as it is the dominant breed of cattle in the agropastoral herd in Nigeria **(Olafadehan and Adewumi, 2010).**

In the present study, there was a significant association between the season and fasciolosis. The significantly higher prevalence of fasciolosis in the wet season (26.5%) as compared to the dry season (8.6%) could be because rainfall periods favour the growth, transmission, and development of parasitic life cycle stages and maximal growth of snails, and humidity (90%) caused by ample provision of water facilitates embryonation, the emergence of miracidium from eggs due to increased activity of cilia, and the liberation of cercariae from snails **(Andrews, 1999)**. This is in agreement with several other studies **(Eguale *et al*., 2007; Njoku-Tony, 2011).**

Regarding fluke burden, 65.6% of the livers with fasciolosis had a fluke burden of 3 to 20 flukes, 25% of the livers with fasciolosis had a fluke burden of 21 to 40 flukes, and 9.4% of the livers with fasciolosis had a fluke burden of 41 to 60 flukes. According to **Soulsby (1982),** the presence of more than 50 flukes per liver is indicative of high pathogenicity. This implies a high pathogenicity of flukes in the livers, with a fluke burden of 41 to 60 flukes (9.4%) in the present study. This is also supported by 9.4% of severely affected livers. The moderately and severely affected liver lesions caused by fasciolosis in the present study are responsible for considerable economic loss due to the condemnation of the affected livers.

The moderately positive and statistically significant correlation between fluke burden and the severity of liver lesions observed in the present study may be a direct consequence of the pathogenesis of fasciolosis. Also, according to **Marcos *et al*., (2007),** the number of adult *Fasciola spp.* increases the likelihood of developing liver fibrosis.

CONCLUSION

Bovine fasciolosis is prevalent in Akinyele Central Abattoir, Ibadan, with the season being the only identified risk factor. *Fasciola gigantica* was the most prevalent Fasciola species. Fluke burdens of 3 to 20 flukes and moderately affected liver lesions were the most prevalent. Fluke burden and severity of liver lesions moderately correlate. It is recommended that regular deworming be initiated for the control and prevention of bovine fasciolosis before and after the rainy season.

Conflict of interests

The authors declare no potential conflict of interest.

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