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Coprological prevalences and hepatic infestation rates of fasciolosis in cattle in 3 slaughterhouses in Mali

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Abstract

Fasciolosis is a helminthosis of the liver caused by trematodes of the genus Fasciola. It is an enzootic disease in several West African countries, it causes milk losses and significant seizures of livers in slaughterhouses.

The objective of this study is to determine the parasitic status of cattle slaughtered in slaughterhouses in relation to fasciolosis.

It was carried out in 3 slaughterhouses in Mali, namely the Frigorifique Abattoir of Bamako (AFB), the Ségou Regional Abattoir (ARS) and the Mopti Regional Abattoir (ARM). A total of 900 faecal samples were analyzed by the successive wash sedimentation technique and 900 slaughtered cattle livers were inspected for Fasciola gigantica.

When analyzing the data,the highest prevalences (feces and livers) were observed at the regional slaughterhouse of Mopti (13% and 30%), followed by the regional slaughterhouse of Ségou (11.5% and 18.5%). The lowest, at the Bamako refrigerated slaughterhouse (6.4% and 13.6%). It also emerges from the results obtained that overall the prevalences both for coprology and liver inspection, of the rainy season (11.3% and 20.3%) were higher than those of the dry season (6, 8% and 15.7%).

In relation to the sexes, the study showed that females were more parasitized than males with coprological prevalences and infestation rates of 11.7% and 20.2% respectively in females compared to 7.2% and 17 % in males.

Keywords: Fascioliasis; Cattle; Prevalence; Slaughterhouses; Mali.

1. Introduction

Mali's economy is essentially agro-sylvo-pastoral. Livestock is the main source of livelihood for more than 30% of the Malian population and contributes 15% to GDP, 24% to rural sector production, approximately 80% to the income of rural populations and nearly 20% to revenue. export [1]. The national herd is ranked first in the UEMOA region and second in the ECOWAS region. It was estimated in 2022 at 12,848,696 cattle, 21,149,809 sheep, 29,201,079 goats, 1,291,233 camels, 607,786 horses, 1,190,567 donkeys, 88,262 pigs and 54,703,373 poultry [1].

Despite the efforts made by the State and its partners, the livestock sub-sector is faced with many difficulties, including those linked to animal diseases and especially parasitosis.

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Fasciolosis is a helminthosis of the liver caused by trematodes of the Fasciola genus. It is a disease which occurs enzootically in several countries of West Africa (Benin, Ghana, Mali, Niger, Nigeria, Senegal, etc.), its prevalence by region or by season is very little known [2, 3] .

This parasitosis from a health point of view, considered the most dangerous disease of domestic ruminants in Africa, is characterized by poor general condition, pronounced weight loss, diarrhea, dehydration with sunken eyeballs and liver lesions, characterized by parenchymal hepatitis which gradually gives way to cholangitis then cirrhosis.

The economic importance of fasciolosis is very great considering the losses of milk and the seizures of parasitized livers in slaughterhouses in endemic areas. Several studies have been carried out around the world to determine the importance of liver infestation by Fasciolas sp: in Kenya, Ethiopia, Iran and Rwanda [4, 5, 6, 7]; The estimated monetary value of losses caused by liver seizures amounts to $2.6 million, with annual losses of around $0.2 to $0.3 million in Kenya. [8] and in Rwanda at 8932.40 US dollars [7].

In Mali, fascioliasis is endemic in the Niger River basin and especially the water retention areas such as lakes and rivers, which at certain times of the year constitute a real concentration point for animals. Few studies have been carried out on the problem and they date back more than thirty years [9, 10, 11].

This study aims to update data on fasciolosis in cattle by determining its prevalence in three slaughterhouses in Mali.

2. Material and method

2.1. Material

- Biological material: feces and livers taken from slaughtered cattle constitute biological materials
- Inclusion criteria:all cattle slaughtered at the slaughterhouse during the sampling period were likely to be part of the study
- Non-inclusion criteria:cattle not slaughtered during the sampling period

2.2. Methods

2.2.1. Study zone

The study took place in three (03) slaughterhouses in Mali :

Table 1 Geographic coordinates of the study sites.

Designation	**Geographic coordinates**	
	Latitude	Longitude
Bamako Refrigerated Slaughterhouse (AFB)	2°38'32'' N	7°58'3'' W
Segou Regional Slaughterhouse (ARS):	13°27'36.2"N	6°12'57.3"W
Mopti Regional Slaughterhouse (ARM):	14°32'05.6"N	4°05'47.2"W

The choice of these 03 slaughterhouses is linked to their large slaughter capacity, to the diversity of origin of the animals slaughtered and specifically to the fact that they are located in the interior Niger delta. The interior Niger delta is considered an endemic area for fascioliasis in Mali.

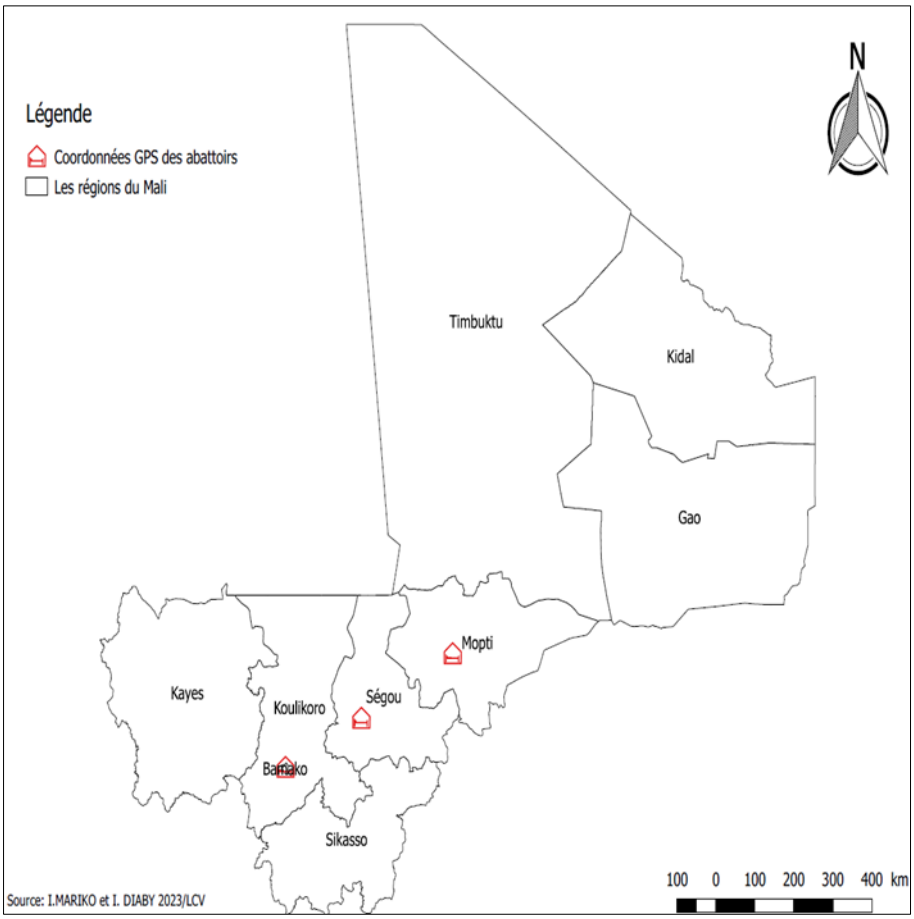

Figure 1 Map of study sites

2.2.2. Sample collection

This descriptive cross-sectional study was conducted from February to December 2021 on cattle in three (3) slaughterhouses: the Bamako Refrigerated Abattoir, the Ségou Regional Abattoir and the Mopti Regional Abattoir.

The sample size to be taken from each slaughterhouse was determined based on the average estimate of the number of cattle slaughtered per night over a year, based on slaughter records. Thus, 10% of the cattle slaughtered per night were sampled for ten (10) nights at each visit by the team.

Table 2 Number of feces and liver samples taken per season in the slaughterhouses of Bamako, Ségou and Mopti.

Slaughterhouses	**Dry season (April to May)**		**Rainy season (July to September)**		**Total**	
Biological materials	Feces	Livers	Feces	Livers	Feces	Livers
AFB	250	250	250	250	500	500
ARS	100	100	100	100	200	200
ARM	100	100	100	100	200	200
Total	450	450	450	450	900	900

Cattle were randomly selected and fecal and liver samples were taken from each slaughtered animal.

Feces were collected directly from the rectum of the animals (*in recto*) and placed in plastic bags. Ten (10) drops of 10% formalin were added to each fecal sample to allow their preservation until laboratory analysis.

The samples were taken in 02 passages : the first in the dry season (months of April and May) and the second in the rainy season (months of July and September).

2.2.3. Analysis of fecal samples

The successive wash sedimentation method was used for the search and identification of Fasciola gigantica eggs.

- Procedure:

- A quantity of 5g of feces was collected using a spatula.
- This quantity of feces was disintegrated and crushed in a beaker, with the addition of 10 times its volume of simple water.
- The mixture was filtered through a tea strainer (approximately 0.5 mm diameter mesh) into another beaker.
- The filtrate obtained was left to stand for 45 minutes, after which 2/3 of the supernatant was poured out.
- The same amount of simple water was added again, and the mixture was allowed to sit for an additional 45 minutes.
- This rinsing operation was repeated three (3) times in a row.
- Finally, the supernatant was poured one last time, and the remaining sediment was mixed with the little remaining supernatant, in order to obtain a homogeneous mixture.

Liver inspection

Livers taken from slaughtered cattle were inspected on site at slaughterhouses for the presence of *Fasciola gigantica.*

Procedure : it began by examining the general appearance of the liver (the dorsal and ventral or visceral sides for the presence of abscesses, nodules or others) then the liver parenchyma was incised. Manual pressure was exerted on the parenchyma to extract the large flukes (Fasciola gigantica) lodged in the bile ducts. Thus, all livers containing at least one parasite or Fasciola gigantica were considered positive.

2.2.4. Total seizure of the liver

When more than 70% of the liver parenchyma is affected by parasites. The organ is withdrawn from consumption and must be destroyed.

Partial liver seizure

When parenchyma damage by parasites is less than 60%. The affected parts are peeled and the rest is given to the butcher for consumption.

2.3. Data analysis

The data resulting from the analysis of feces and the inspection of livers in the three slaughterhouses were subjected to statistical tests (Excel Stata spreadsheet version 12 and R4.3.1) to determine the coprological prevalences and infestation rates. liver as well as the levels of significance between the different variables (slaughterhouse, sex and season). The significance threshold considered is $\alpha = 5\%$.

$$\text{liver infestation rate} = \frac{\text{number of livers inspected positive}}{\text{total livers inspected}} \text{ x } 100$$

$$\text{Coprological prevalence} = \frac{\text{number of positive fecal samples}}{\text{total fecal samples analyzed}} \text{ x } 100$$

3. Results

3.1. Fecal analysis and liver inspection

The analysis of Table 3 shows that the highest values (feces and livers) are observed at the regional slaughterhouse of Mopti (13% and 30%), followed by the regional slaughterhouse of Ségou (11.5% and 18. 5%). The lowest are observed at the Bamako refrigerated slaughterhouse (6.4% and 13.6%). The average of the three (03) slaughterhouses is 9% for feces compared to 18.3% for livers; The statistical analysis of the results shows that between the average of the

coprological prevalence and that of the liver infestation rates, that the differences between the three slaughterhouses are significant at the threshold of α = 0.05 with the value of P = 1.231e- 08.

Table 3 Comparative situation of the results of fecal analysis and liver inspection in the 03 slaughterhouses.

Slaughterhouses	Fecal analysis		Liver inspection	
	Feces collected	Prevalence (%)	Liver inspected	Infestation rate (%)
AFB	500	6.4	500	13.6
ARS	200	11.5	200	18.5
ARM	200	13	200	30
Total	900	9	900	18.3

3.2. Analysis of feces depending on the seasons

Table 4 Situation of the analysis of feces according to the seasons in the slaughterhouses of Bamako, Ségou and Mopti.

Slaughterhouses	Dry season		Rainy season		Average (P value = 0.02)	
	Feces	Prevalence (%)	Feces	Prevalence (%)	Feces	Prevalence (%)
AFB	250	3.2	250	9.6	500	6.4
ARS	100	10	100	13	200	11.5
ARM	100	12	100	14	200	13
Total	450	6.8	450	11.3	900	9

Table 4 shows that the highest rates are observed at the Mopti regional slaughterhouse regardless of the season; the lowest values are observed at the Bamako refrigerated slaughterhouse.

Considering the values obtained in the three slaughterhouses and the averages, we see that the coprological prevalences of the rainy season (11.3%) are higher than those of the dry season (6.8%) with a significant difference between the two seasons and the value of P = 0.02.

3.3. Analysis of feces according to gender

Table 5 Situation of the analysis of faeces according to gender in the slaughterhouses of Bamako, Ségou and Mopti.

Slaughterhouses	Female		Male		Average (P = 0.03)	
	feces	Prevalence (%)	feces	Prevalence (%)	feces	Prevalence (%)
AFB	135	8.8	365	5.4	500	6.4
ARS	153	11.7	47	10.6	200	11.5
ARM	83	15.6	117	11.1	200	13
Total	371	11.6	529	7.2	900	9

Overall, females have higher coprological prevalence than males, the average of the three slaughterhouses is 11.6% for females compared to 7.2% for males and the differences are significant at the threshold of α = 0.05 (P = 0.03). By slaughterhouse, the highest prevalences among females and males are observed at the regional slaughterhouse of Mopti (15.6% and 11.1%) while the lowest values are observed at the refrigerated slaughterhouse of Bamako (8.8% and 5.4%).

3.4. Inspection of livers according to the seasons :

Table 6 Situation of livers inspected according to the seasons in the slaughterhouses of Bamako, Ségou and Mopti

Slaughterhouses	Dry season		Rainy season		Average (P = 0.05)	
	livers inspected	Infestation rate(%)	livers inspected	Infestation rate(%)	livers inspected	Infestation rate (%)
AFB	250	12	250	15.2	500	13.6
ARS	100	14	100	23	200	18.5
ARM	100	27	100	33	200	30
Total	450	15.7	450	20.8	900	18.3

In the three slaughterhouses, the liver infestation rates observed in the rainy season are higher than those in the dry season and the differences are significant with a value of P = 0.05. The Mopti regional slaughterhouse has the highest rates (33% and 27%). While the lowest rates are observed at the Bamako refrigerated slaughterhouse (15.2% and 12%). The average of the three slaughterhouses varies from 20.8% to 15.7%.

3.5. Liver inspection according to gender

Table 7 Situation of inspected livers according to gender in the slaughterhouses of Bamako, Ségou and Mopti.

Slaughterhouses	Female		Male		Average (P value = 0.25)	
	livers inspected	Infestation rate(%)	livers inspected	Infestation rate(%)	livers inspected	Infestation rate(%)
AFB	135	16.3	365	12.6	500	13.6
ARS	153	19	47	17	200	18.5
ARM	83	29	117	31	200	30
Total	371	20.2	529	17	900	18.3

By considering the liver infestation in relation to sex in the three slaughterhouses, we see that apart from the regional slaughterhouse of Mopti (may be due to the number of males slaughtered compared to females), that the females present higher rates than males; the average of the three (03) slaughterhouses is 20.2% for females compared to 17% for males, however the differences between the sexes are not significant at the threshold of $\alpha = 0.05$ with the value of P = 0 .25. By slaughterhouse, the highest rates among both females and males are observed at the regional slaughterhouse of Mopti (31% and 29%); while the lowest are observed at the refrigerated slaughterhouse in Bamako (16.3% and 12.6%).

3.6. Inspection of livers in slaughterhouses based on seizure types

The results of the inspection of the livers of cattle in the (03) three slaughterhouses gave two situations : healthy livers (absence of parasite) and infested livers (presence of at least 01 Fasciola gigantica in the bile ducts).

Infested livers gave rise to 02 types of seizures: partial and total seizure.

The livers which have been subject to partial seizure are those lightly infested by parasites, the organ is peeled (sanitized) of the affected parts and the rest is given to the slaughtering butcher.

Livers subject to total seizure are those whose organ is completely infested by parasites with damage to the liver tissue. In these cases, the organ is seized, removed and destined for destruction.

The situation of seizures made during the two visits and in the three slaughterhouses is given in table 8.

Table 8 Results according to seizure types in the three (03) slaughterhouses

Slaughterhouses	Number of livers inspected	Partial seizures	Total seizures	Total
AFB	500	58	10	68
ARS	200	29	8	37
ARM	200	51	9	60
Total	900	138	27	165

The analysis of Table 8 shows that out of a number n = 900 livers inspected, 165 livers were found to be affected by fasciolosis, representing an infestation rate of 18.3%. The largest number of seizures was made at the refrigerated slaughterhouse of Bamako (the number of livers seized is 68 out of n = 500) and the smallest number at the regional slaughterhouse of Ségou (the number of livers seized is 37 with n = 200). Of the 165 livers seized in the three slaughterhouses, 83.6% were partial seizures compared to 16.4% cases of total seizure. It is important to emphasize that the majority of partial seizures were made during the dry season and most cases of total seizures were made during the rainy season.

4. Discussion

On the analysis of feces, our results are close to those obtained in a study carried out in the Niger River valley in Benin [2] with a coprological prevalence of 7.5%; slightly higher than the 4.9% obtained in Ethiopia [5] and much lower than the 48.9% in Zambia [12] and 54.3% obtained in Nigeria [13].

In Mali in relation to the inspection of livers, our figures are close to those obtained in a study [9], which found, depending on the agro-climatic regions of the country, an infestation rate of 50% with n= 436 cattle in the Sahelian region, 12% with n=169 cattle in the Sudanian region and 7% with n=87 cattle in the sub-desert region.

In other countries, researchers found similar results of 14%, 15%, 20.14% in Ethiopia [5], Nigeria [15] and Iran [6] respectively; values higher than our results and which vary from 45.5% in Ivory Coast [16] to 53.9% in Zambia [12].

We can also say that the transmission of the disease has a seasonal character which can be explained by the fact that the months of April and May (end of the hot dry season) are considered periods of heavy infestation of animals by metacercariae (resistant and infective form of the parasite) especially at water points where high concentrations of animals are observed on these sites due to the lean period. The months of October and November (end of the rainy season) are also periods of heavy fecal excretion which can lead to a massive expulsion of parasite eggs into the wild by parasitized animals. This seasonal variability in transmission has been highlighted by studies carried out in Mali [10] and Zimbabwe [14].

Compared to the sexes, we found that females are more parasitized than males with a significant difference between the sexes (P = 0.03); the same observations were made in Iran [6] with a prevalence of 22.28% in females compared to 9.09% in males, in Rwanda [7] with a liver infestation rate of 14.6% in males. females compared to 11.1% among males. This demonstrates that sex can be considered a risk factor in the transmission of fasciolosis.

As for the seizures of livers in the 03 slaughterhouses, the total of livers inspected is n=900 out of which 165 livers were positive for fasciolosis, representing an infestation rate of 18.3%. Partial seizures constituted 83.6% of cases (i.e. a number of 138/165 livers seized) compared to 16.4% for total seizures (i.e. a number of 29/165 livers seized). It appears that the majority of total seizures were made during the rainy season (19/27 cases), this shows that the transmission of the disease occurs 2 or 3 months before the rainy season because the prepatent period of the parasite varies from 9 at 12 weeks.

5. Conclusion

This study carried out on fasciolosis in 03 slaughterhouses in Mali, made it possible to know the health status of slaughtered cattle in relation to this disease, to confirm that sex and season constitute risk factors in the transmission of fasciolosis and also to determine infestation levels of livers infested with Fasciola gigantica.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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