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(RESEARCH ARTICLE)

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Prevalence of Babesia isolated from cattle from farms in the Koulikoro region (Mali)

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Abstract

This study carried out in 2023, in the Koulikoro region aimed to determine the prevalence of babesia in the Koulikoro region. 219 blood samples were taken from cattle (142 females and 77 males) and were examined for Babesia bovis. Trypanosomes were identified by microscopic examination of blood smears stained in a GIEMSA Rapide solution. 24 cattle were positive for bovine babesiosis out of a total of 219 cattle examined, i.e. a prevalence rate of 10.96%. Statistical analysis showed that the prevalence did not vary between the communes of Kaniogo and Karan (p>0.05). The prevalence rate of bovine babesiosis was 13.38% in female cattle, compared to 6.49% in males. There was no significant difference between the prevalence of male and female cattle (p>0.05). The prevalence of bovine babesiosis observed in adult cattle (14.74%) and young cattle (8.06%). The study revealed that babesia is present in the Koulikoro region livestock farms and that it constitutes a real threat to cattle in this locality.

Keywords: Babesia prevalence; Cattle; Koulikoro; Mali

1. Introduction

Recent studies conducted on ticks and tick-borne diseases in certain eco-climatic zones of Mali, including the Sahelian zone, the Sudanian zone and the Sudano-Guinean zone as well as in the Bamako District and its peri-urban area have revealed that bovine babesiosis is clearly increasing in Mali (Modibo and al. [9] As a result, this pathology constitutes a major constraint to the development of livestock farming in Mali. The Kangaba circle is located in the southwest of the Koulikoro region and is characterized by a Sudano-Guinean climate with annual rainfall ranging from 1000mm to 1200mm. It's very dense vegetation is dominated by tall and large trees that peak between 20 and 50m, DEMBELE [4]. This type of climate provides the Kangaba circle with favorable conditions for the proliferation of ticks of the Boophilus genus, which are the main vectors of bovine babesiosis. These different factors led us to initiate this study with a view to improving our knowledge of the situation of bovine babesiosis in the Koulikoro region.

2. Materials and methods

219 blood samples were collected from cattle in the communes of Kaniogo and Karan. Blood was collected from the jugular vein of the cattle using a sampling needle in vacuum-sealed ''Vaccutainer'' tubes containing the anticoagulant ''EDTA''. The site code, animal identification number and collection date were written on each tube. The tubes containing the collected blood were placed in a rack and then stored in a cooler containing ice cubes sent to the Central Veterinary Laboratory of Bamako. In the laboratory, the smears were prepared on glass slides with a margin at one end. The smears were fixed in a methanol solution for 5 minutes, then stained in a GIEMSA Rapid solution for 5 minutes. They

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were then washed under running tap water and dried. After receiving 2 or 3 drops of immersion oil, the dried smears were placed under the ''X100'' objective of the binocular electric microscope for the search for Babesia bovis and Babesia bigemina in red blood cells. The raw data were entered with Microsoft EXCEL 2010 software and analyzed with Stata version 12.1 software. The ''chi 2'' test was used to compare the different variables.

3. Results

3.1. Prevalence of *bovine Babesia*

24 cattle were positive for bovine babesiosis out of a total of 219 cattle examined, representing an overall prevalence rate of 10.96%. The analysis did not reveal any statistically significant difference (p>0.05) between the communes of Kaniogo and Karan, which obtained prevalence rates of 10.00% and 11.93%, respectively (Table 1). In the commune of Kaniogo, statistical analysis revealed a significant difference (p<0.05) between the villages of Kéniégué (19.35%), Balanzan (10.00%), Teguecoura (6.90%) and Salamalé (3.33%), (Table 1). A significant difference (p<0.05) was also revealed in the commune of Karan between the villages of Landy (17.86%), Faragué (bakarila) (15.00%), Karan (14.29), N'valila (6.67%) and Faragué (Nangala) (0.00%), (Table 1).

Table 1 Prevalence of *Babesia* by municipality

Municipality	Villages	Total	Negatve	Positive	prevalence (%)
Kaniogo	Balanzan	20	18	2	10,00
	kéniégué	31	25	6	19,35
	Salamalé	30	29	1	3,33
	Teguecoura	29	27	2	6,90
	S/total 1	110	99	11	10,00
Karan	Faragué (bakarila)	20	17	3	15,00
	Faragué (Nangala)	10	10	0	0,00
	Karan	21	18	3	14,29
	Landy	28	23	5	17,86
	N'valila	30	28	2	6,67
	S/total 2	109	96	13	11,93
Total		219	195	24	10,96

a) Analysis between communes; X-squared = 0.057614, p-value = 0.8103

b) Analysis between villages in the commune of Kaniogo; X-squared = 15.768, p-value = 0.001265

c) Analysis between villages in the commune of Karan; X-squared = 22.021, p-value = 0.0001985

3.2. Prévalence de *Babesia* par espèce

03 cattle were positive for bovine babesiosis with Babesia bovis out of a total of 24 cattle positive for bovine babesiosis, i.e. an overall prevalence rate of 16.67%. In addition, 21 cattle were positive for Babesia bigemina out of a total of 24 cattle positive for bovine babesiosis, i.e. an overall prevalence rate of 83.33%. Statistical analysis revealed a significant difference between Babesia bigemina and Babesia bovis. (Table 2). In the commune of Kaniogo, statistical analysis revealed a significant difference (p<0.05) between the parasite species Babesia bigemina (81.82%) Babesia bovis (18.18%). The analysis also revealed a significant difference (p<0.05) Babesia bigemina (92.30%) Babesia bovis (7.69%) in Karan commune, (Table 2)

Table 2 Prevalence of *Babesia* par species

Municipality	Villages	Total	*Babesia bovis*		*Babesia bigemina*	
			Number	Prevalence (%)	Number	Prevalence (%)
Kaniogo	Balanzan	2	0	0,00	2	100,00
	kéniégué	6	1	16,67	5	83,33
	Salamalé	1	0	0,00	1	100,00
	Teguecoura	2	1	50,00	1	50,00
	S/total 1	11	2	18,18	9	81,82
Karan	Faragué (bakarila)	3	0	0,00	3	100,00
	Faragué (Nangala)	0	0	0	0	0
	Karan	3	0	0,00	3	100,00
	Landy	5	1	20,00	4	80,00
	N'valila	2	0	0,00	2	100,00
	S/total 2	13	1	7,69	12	92,30
Total		24	3	16,67	21	83,33

a) Global analysis by species of Babesia; X-squared = 24.083, p-value = 9.226e-07

b) Analysis by species of Babesia in the commune of Kaniogo; X-squared = 6.5455, p-value = 0.01052

c) Analysis by species of Babesia in the commune of Karan; X-squared = 141.13, p-value < 2.2e-16

3.3. Prevalence of *bovine Babesia* according to the sex of cattle

The prevalence of *bovine Babesia* was 13.38% in female cattle, compared to 6.49% in males. There was no significant difference between male and female cattle by chi2 test, ($p>0.05$) (Table 3).

Table 3 Prevalence of *bovine Babesia* according to the sex of cattle

Sex bovin	Negative	Positive	Total	Prevalence (%)
Female	123	19	142	13,38
Male	72	5	77	6,49
Total	195	24	219	10,96

X-squared = 1.7722, p-value = 0.1831

3.4. Prevalence of *bovine Babesia* by sex according to Babesia species

21 male and female cattle were infected with Babesia bigemina, while 03 male and female cattle were infected with Babesia bovis. A significant difference ($p<0.05$) was revealed between the overall prevalence rates of Babesia bigemina (87.5%) and Babesia bovis (12.5%), (Table 4). Out of a total of 19 female cattle positive for bovine babesiosis, 16 individuals were infected with Babesia bigemina and 3 others with Babesia bovis. Statistical analysis revealed a significant difference ($p<0.05$) between female cattle infected with Babesia bigemina (84.21%) and those infected with Babesia bovis (15.78%), (Table 4). Statistical analysis also revealed a significant difference ($p<0.05$) between male cattle infected with Babesia bigemina (100%) and those infected with Babesia bovis (0.00%), (Table 4).

Table 4 Prevalence of *Babesia* by sex

Sex bovin	Positive	Babesia bigemina		Babesia bovis	
		Number	Prevalence (%)	Number	Prevalence (%)
Female	19	16	84,21	3	15,78
Male	5	5	100	0	0
Total	24	21	87,5	3	12,5

a) Between females; X-squared = 15.158, p-value = 9.888e-05

b) Between males; X-squared = 6.4, p-value = 0.01141

c) Between males and females; X-squared = 24.083, p-value = 9.226e-07

3.5. Prevalence of *bovine Babesia* according to the age of cattle

Statistical analysis did not reveal any significant difference ($p > 0.05$) between the prevalence rates of bovine babesiosis observed in adult cattle (14.74%) and young cattle (8.06%), (Table 5).

Table 5 Prevalence of *Babésia* according to the age of cattle

Age	Negative	Positive	Total	Prevalence (%)
Adult	81	14	95	14,74
Young	114	10	124	8,06
Total	195	24	219	10,96

X-squared = 1.818, df = 1, p-value = 0.1776

3.6. Prevalence of Babesia bigemina and Babesia bovis by age

In adult cattle, the analysis of the results showed a significant difference ($p < 0.05$) between the prevalence rates of Babesia bigemina (85.71%^) and Babesia bovis (14.29%), (Table 6). In young cattle, there was a statistically significant difference between the prevalence rates of Babesia bigemina (90.00%^) and Babesia bovis (10.00%), (Table 6). In young and adult cattle, the analysis of the results showed a significant difference ($p < 0.05$) between the prevalence rates of Babesia bigemina (87.50%^) and Babesia bovis (12.50%), (Table 6).

Table 6 Prevalence by Babesia species

Age	Positive	Babesia bigemina		Babesia bovis	
		Number	Prevalence (%)	Number	Prevalence (%)
Adult	14	12	85,71	2	14,29
Young	10	9	90,00	1	10,00
Total	24	21	87,50	3	12,50

a) Between adults; X-squared = 11.571, p-value = 0.0006697

b) Between juveniles; X-squared = 9.8, p-value = 0.001745

c) Between adults and juveniles; X-squared = 27.086, p-value = 5.649e-06

4. Discussion

The prevalence of bovine babesiosis in the entire study area was 10.96%. This low may be due to the regular treatment of cattle with acaricides and babesicides. Our results are similar to those obtained by Abdela[1] who 11.7%). They differ from those obtained by Namomsa et al.[6] (5.2%), Hamsho and al.[8], (16.9%), Warsame and al.[15] (21%), Fethu et al.[5] (23%), Haben and al.[7] (21.7%), Bihonegn and al.[3] (1.5%) and by Modibo et al.[9,10] (15.86%). Two Babesia

species (2.2% Babesia bovis and 9.8% B. bigemina) overall prevalence of 11.7% babesiosis. The communes of Kaniogo (10.00%) and Karan (11.93%), recorded similar prevalence rates. This is explained by the fact that these two localities belong to the same eco-climatic zone. These results may be due to the good conduct of breeders in these communes in terms of treating animals against animal diseases. Our results are similar to those of Hamsho et al.[8] in the localities of Fulotole (9.4%) and Hatuse (13.6%) and also of Fethu et al.[5]. They differ from those of Kulcha (18.2%) and Billa kebele (27.85%). The study revealed that Babesia bigemina (83.33%) has a higher prevalence rate than Babesia bovis (16.67%). This may be explained by the abundance of Babesia bigemina vectors compared to Babesia bovis. In fact, the presence of the main vector of Babesia bovis (Boophilus microplus) has not yet been reported in the Kangaba circle. Similar results were obtained by Haben and al.[7] who obtained a prevalence rate of Babesia bigemina (15.53%) higher than the prevalence rate of Babesia bovis (6.17%). Our results are different from those obtained by Nawolo and al [14], which is (45.83%) of Babesia bovis and (13.61%) Babesia bigemina. Statistical analysis did not reveal any significant difference ($p>0.05$) between the prevalence rates of bovine babesiosis in male (6.49%) and female (13.38%) cattle. However, the prevalence rates of bovine babesiosis were higher in female cattle than in male cattle. This could be due to the fact that female cattle are slightly more susceptible to babesiosis than males. Similar results were obtained by Hamsho and al.[8] who also observed higher prevalence rates of bovine babesiosis in female cattle (17.5%) than in male cattle (16.3%). Our results are different from the prevalence rates of bovine babesiosis observed by Namomsa and al. (2023) in male (6.00%) and female (4.9%) cattle. Our results are also different from the prevalence rates obtained by Alemayehu and al.[2] in female (16.6%) and male (10.5%) cattle. Male and female cattle infected with Babesia bigemina (87.5%) are more numerous than male and female cattle infected with Babesia bovis (12.5%). This can be explained by the abundance of Babesia bigemina vectors compared to Babesia bovis as well as the absence in the Kangaba circle of Boophilus microplus, the main vector of Babesia bovis. Statistical analysis did not reveal any significant difference ($p>0.05$) between the prevalence rates of bovine babesiosis observed in adult cattle (14.74%) and young cattle (8.06%), However, the prevalence rates of bovine babesiosis observed in adult cattle are higher than in young cattle. Similar results were obtained by Alemayehu and al. [2] with a higher prevalence rate of bovine babesiosis in adult cattle (12.4%) than in young cattle (10.00%). In young and adult cattle, the analysis of the results showed a significant difference ($p<0.05$) between the prevalence rates of Babesia bigemina (87.50%^) and Babesia bovis (12.50%), This can be explained by the absence of Boophilus microplus (main vector of Babesia bigemina) as well as the abundance of other vectors of Babesia bigemina abundance compared to Babesia bovis.

5. Conclusion

This study shows that Babesia is present in the Koulikoro region and that it constitutes a real threat to cattle in this locality.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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