

Prevalence and Distribution of Tick-Borne Hemoparasites in Cattle from the Noun and Ndé Divisions of the West Region, Cameroon

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Abstract

Background and Objective: Tick-borne hemoparasitic illnesses pose a serious threat to the well-being and productivity of cattle. This study aimed to investigate the prevalence of tick-borne hemoparasites in Cameroon, with a specific focus on the Noun and Nde Divisions of the West Region. **Methodology:** A total of 423 cattle from 10 villages in both divisions were included in the study. Blood smears were prepared and subjected to microscopic screening for *Babesia* and *Anaplasma* parasites. **Results:** The prevalence of *Anaplasma* was found to be 23.4%, while *Babesia* exhibited a seroprevalence of 17.3%. Samples from *Institute of Agricultural Research for Development* (IRAD) and Koupa Ngangnou demonstrated significantly higher prevalence rates, potentially influenced by climate variations affecting tick populations. Additionally, 17.3% of the animals exhibited low hematocrit levels, indicative of anemia. No significant associations were observed between the presence of hemoparasite infection and cattle characteristics. **Conclusion:** This study provides fundamental data on the extensive distribution and impact of tick-borne hemoparasites in a significant cattle-producing region of Cameroon.

Keywords

Tick-Borne, Hemoparasites, Cattle, Prevalence, Cameroon

1. Introduction

Hemoparasites are parasites that reside in the bloodstream of their hosts. Hemoparasitic diseases are widely distributed around the world. This is due to the global distribution of their vectors, specially the ticks which are the main vector of hemoparasitic diseases. The most important tick-borne hemoparasites are *Babesia*, *Theileria* and *Anaplasma* [1]. Since ticks can carry more than one pathogen, animals can be affected with multiple pathogens at the same time [2]. The tick-borne hemoparasites have a significant economic impact on livestock, affecting 80% of bovine population. Infections can be fatal to farm animals, but they are also known to induce anorexia, anemia, and sterility, with a great impact on livestock industry. They are also responsible for food insecurity, particularly in livestock-dependent communities in Sub-Saharan Africa [3] [4]. On the other hand, these hemoparasites may be responsible for the production of toxins in animals, which can be passed on to humans through the consumption of infected animals, leading to health problems. This poses a real problem for the concept of one health system.

Bovine tick-borne hemoparasitic diseases are common in Sub-Saharan Africa [5] [6]. The recent introduction of the *Rhipicephalus microplus* (cattle tick) into Cameroon, exacerbates the problem of tick-borne hemoparasites. This bovine tick is the most important parasite and disease vector of livestock in the world [7]. In addition, this tick appears to be more resistant to the various mite treatments available [8] [9]. Ngnindji-Youdje *et al.* (2022) showed that ticks harbor a wide variety of hemoparasites in Western Highlands of Cameroon, known to be one of the three major agroecological livestock production zones in Cameroon. On the other hand, tick-borne hemoparasite diseases are less investigated than other vector-borne diseases in this zone [10]. In the West Region, the main bovine farms are located in the Noun, Menoua and Nde Divisions. Previous studies in the West Region assessing the prevalence of tick-borne hemoparasites in bovine were in Menoua Division [10]. To the best of our knowledge, no study has examined the prevalence of tick-borne hemoparasites in bovine in the Noun and Ndé divisions. Epidemiological data are still needed to control these diseases in localities with high livestock production. The aim of this study was to evaluate the prevalence of tick-borne hemoparasites in cattle in Noun and Ndé Division (West Region of Cameroon).

2. Methodology

2.1. Study Site

Cameroon is known throughout the continent for its agropastoral potential. One of the regions that better characterizes this description is the West region. It is subdivided into eight divisions, including Ndé and Noun. The Ndé division consists of 14 villages. Two of them are known for cattle breeding, Bangangté and Bangoua. This division is located between 5°0'0" and 5°20'0" North; 10°20'00" and 10°50'00" East and the estimated population is 304,800. The division covers

an area of 7687 km² (**Figure 1**) and most of the land is hilly savanna with wooded valleys. Most of Noun's inhabitants are small-scale farmers and cattle-herding. The climate is unimodal with one long rainy season from April to November, and a dry season from December to March. The samples collected in this study were from two villages of the Ndé division, Bangoua and Bangangté and eight villages of the Noun division, Kouffen, Koupa Matapit, Koupa Ngangnou, Koutomloun, Machimbaim, Mambouo and Samboure. Information gathered in the field were recorded in two sheets. The first records were the observations made on the animals studied. This included the number of the animal per herd, gender, age, number of samples collected and the date of collection.

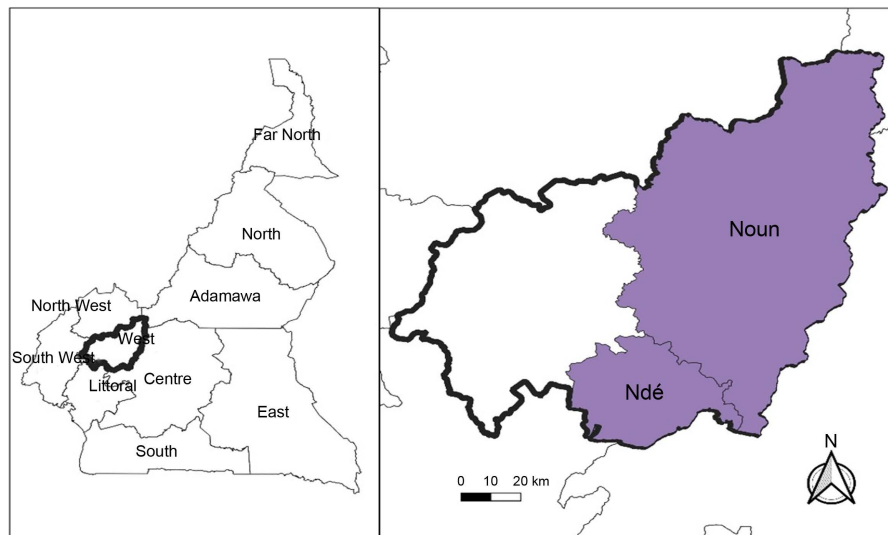


Figure 1. Localization of Noun and Ndé.

2.2. Ethical Consideration

Ethical clearance No: BTC-JIRB2021-005 was issued by the Joint Institutional Review Board for Animal and Humans Bioethics (JIRBAHB) of the CRFD-SVSE to conduct the project.

2.3. Method

2.3.1. Blood Sample Collection from Cattle

In each herd, ten animals were randomly selected. The general characteristics of selected animals were noted, namely age, gender, color of the coat and breed. Five milliliters (ml) of blood were collected through puncture of the jugular vein according to good veterinary practices [11]. The blood samples were carried in an icebox with ice packs to the district hospital of Fouban or the *Université des Montagnes* for temporal conservation. Serum was separated from whole blood by centrifugation at 3000 g, 4°C and stored at -20°C.

2.3.2. Blood Sampling and Identification of Hemoparasites

Each animal was identified by breed and gender prior to blood sampling. Approximately 3 to 5 milliliters of blood were collected from each animal at the

jugular vein in vacutainer tubes containing EDTA (ethylene diamine tetra acetic acid). EDTA is used as an anticoagulant, particularly in blood tubes, as it captures the calcium ions required for coagulation to take place. The blood collected was stored in a cooler containing sealed containers of liquid nitrogen. Once at the IRAD (*Institut de Recherche Agricole pour le Développement*) laboratory in Bangangté, in the hours following collection, the blood plasma was transferred from tubes to heparinized hematocrit microtubes, then centrifuged at a speed of 3500 rpm. The hematocrit of each animal was recorded on a hematocrit reader.

2.3.3. Staining Smears

A drop of blood was taken with a pipette and placed on one end of the slide. Another slide was used to spread the drop. The spread was then dried and stained with May Grünwald-Giemsa. After placing the slide (unfixed smear) on the support of the staining tray, the smear was covered with a few ml of May Grünwald reagent. Then left for 3 minutes (add the stain more if necessary on the slide if it's dry). Without discarding the dye, 1 ml of buffered water was added to the slide. After one minute, the dye was discarded and the slide with buffered water was rinsed. The slide was then covered with a few ml of Giemsa solution diluted 1:10 in buffered water (1 part Giemsa + 9 parts buffered water). After 10 minutes, the slide was rinsed, drained and dried [4].

2.3.5. Microscopic Examination of Smears

The stained smear was placed under the $\times 100$ immersion objective. The smear was checked for areas where the leukocytes and red blood cells were evenly distributed and clearly distinguishable.

2.4. Statistical Analysis

Quantitative variables were presented in percentage and qualitative variables were presented in frequency. The statistical analysis was performed using SPSS version 25.0 for Windows. The Chi² square test was used to assess the association of frequencies and p values < 0.05 were considered statistically significant.

3. Results

3.1. Animals' Characteristics

Table 1 shows the general characteristics of the animals in the study. The study was carried out on 423 animals. Animals aged between 2 and 4 years were the most represented (49.2%). As for the sex of the animals, they were predominantly female (63.1%). The white Fulani (Akou) breed was the most represented (32.2%).

3.2. Prevalence of Hemoparasites

Table 2 presents the prevalence of haemoparasites. *Anaplasma* were the most frequent haemoparasites with prevalence of 23.4%, while we noted a prevalence of 17.3% for *Babesia*. 17.3% of animals had a hematocrit count under 24.

Table 1. Characteristics of animals.

		Size	Percentages (%)
Age group	[2 - 4]	209	49.2
	<2	80	18.9
	>4	134	31.7
Gender	Female	267	63.1
	Male	156	35.9
Breed	Akou	136	32.2
	Djafou	113	26.7
	Goudali	99	23.4
	Oudalet	75	17.7
	Total	423	100

Table 2. Prevalence of hemoparasites.

		Size	Prevalences (%)
Hematocrit Ranges	<24	73	17.3
	>24	350	82.7
<i>Babesia</i>	Négatif	350	82.7
	Positif	73	17.3
<i>Anaplasma</i>	Négatif	324	76.6
	Positif	99	23.4
	Total	423	100

3.3. Animal Characteristics According to the Tick-Borne Hemoparasite Infections

Table 3 indicates the characteristics of the study animals according to the tick-borne hemoparasites infection. There was no significant difference for age, gender, breed and coat color for animals with a hematocrit of less than 24, or for those positive for *Babesia* and *Anaplasma*. However, there was a significant difference among villages for cattle with a hematocrit of less than 24 ($p < 0.000$), as well as for those positive for *Babesia* ($p < 0.001$) and *Anaplasma* ($p < 0.000$). IRAD 1, Tchoundjin 2 and IRAD 2 were the villages with the highest frequency of animals with a hematocrit under 24, with 50%, 50% and 40%, respectively. IRAD 1, Koupa Ngangnou and Kouffen were the villages, which had the highest prevalence of *Babesia*, with 50%, 30.40% and 27.50%, respectively. IRAD 4, Koupa Ngangnou and Machimbaim were the villages which had the highest prevalence of *Anaplasma*, with 40%, 39.24% and 32.50%, respectively.

Table 3. Animal characteristics according to the tick-borne hemoparasites infection.

		Hematocrit < 24		<i>Babesia</i> (+)		<i>Anaplasma</i> (+)	
		n (%)	p-value	n (%)	p-value	n (%)	p-value
Age range (years)	<2	11 (15.94%)	0.613	10 (12.50%)	0.132	17 (21.25%)	0.848
	[2 - 4]	39 (18.66%)		33 (15.78%)		51 (24.40%)	
	>4	23 (20.72%)		30 (22.39%)		31 (23.13%)	
Gender	Female	40 (14.98%)	0.069	47 (17.60%)	0.458	65 (14.34%)	0.313
	Male	33 (21.15%)		26 (16.67%)		34 (21.79%)	
Coat color	White-Brown	17 (17.89%)	0.067	15 (15.79%)	0.159	19 (20.00%)	0.329
	White	6 (08.45%)		14 (19.72%)		24 (33.80%)	
	White-Black	5 (12.50%)		9 (22.50%)		10 (25.00%)	
	Brown	40 (20.83%)		31 (16.15%)		39 (20.31%)	
	Black	5 (20.83%)		3 (12.50%)		7 (29.16%)	
	Black-Brown	0 (00.00%)		1 (100%)		0 (00.00%)	
Breed	Akou	16 (11.76%)	0.232	27 (19.85%)	0.551	41 (30.15%)	0.102
	Djafou	23 (20.35%)		31 (27.43%)		23 (20.35%)	
	Goudali	19 (19.19%)		13 (13.13%)		17 (17.17%)	
	Oudalet	15 (20.00%)		12 (16.00%)		18 (24.00%)	
Villages	Bangoua	2 (12.50%)	0.000	1 (06.25%)	0.001	3 (18.75%)	0.000
	IRAD 2	4 (40.00%)		1 (10.00%)		3 (30.00%)	
	IRAD 3	0 (00.00%)		3 (20.00%)		2 (13.33%)	
	IRAD 4	1 (20.00%)		1 (20.00%)		2 (40.00%)	
	IRAD1	5 (50.00%)		5 (50.00%)		3 (30.00%)	
	Kouffen	8 (20.00%)		11 (27.50%)		14 (35.00%)	
	Koupa Matapit	21 (26.58%)		6 (15.00%)		4 (10.00%)	
	Koupa Ngangnou	0 (00.00%)		24 (30.38%)		31 (39.24%)	
	Koutomloum	0 (00.00%)		8 (20.51%)		11 (28.20%)	
	Machimbaim	16 (40.00%)		7 (17.50%)		13 (32.50%)	
	Mambouo	9 (22.50%)		2 (05.00%)		5 (12.50%)	
	Onaref	0 (00.00%)		0 (00.00%)		0 (00.00%)	
	Samboure	0 (00.00%)		2 (06.06%)		4 (12.12%)	
Tchoundjin	2 (07.41%)	1 (03.70%)	1 (03.70%)				
Tchoundjin 2	5 (50.00%)	1 (10.00%)	3 (30.00%)				

4. Discussion

Bovine tick-borne hemoparasitic illnesses are not only a huge threat to bovine and human health, but they also pose a serious economic threat to Cameroon's bovine industry. One approach of combatting these diseases is to establish prevalence data in order to better understand the burden and design disease-specific control measures. The purpose of this study was to determine the prevalence of tick-borne hemoparasites in cattle in the Noun and Nde Divisions in Cameroon's West Region.

Two tick-borne hemoparasites were identified in animals from the different localities of the 2 divisions: *Anaplasma* and *Babesia* with prevalences of 23.4% and 17.3%, respectively. In the North-Cameroon, Abanda *et al.* (2019) found a prevalence of 76.1% for *Theileria/Babesia* spp., and 17.9% for *Anaplasma/Ehrlichia* spp. Another research group in West Cameroon found prevalences of 20.52% for *Babesia bovis*, 9.39% for *Babesia bigemina* and 9.83% for *Anaplasma centrale* [10]. Our results are similar to those of Rahali *et al.* (2014) in Morocco, who found prevalences of 20.5% and 13.6% for *Anaplasma* and *Babesia* species in bovines, respectively. These prevalences can be explained by vector tick dispersal, bovine abundance and migration, and the resistances of parasite and ticks to available treatments [5] [12] [13]. Another explanation is that once infected, an animal is a chronic carrier for the rest of its life, and vector ticks merely ensure virus dissemination across herds. Pathogen transfer also occurs through various stasis of the same vector throughout its life cycle, who's completion dependent on the blood meal consumed at each standstill. These ticks become infected and disseminate infections within herds as a result of the ingestion [14] [15].

Tick-borne hemoparasites disease is associated with low hematocrit which it's anemia's characteristic [16]. We evaluated the hematocrit of the animals. We found that 17.3% of the animals had a hematocrit under 24. In fact, once the animals are infected, hemoparasites attach to the red blood cell membrane and penetrate these cells. Then, hemoparasites multiply and lyse red blood cell. The consequence is the disintegration of red blood cells. The new hemoparasites penetrate fresh erythrocytes in the bloodstream, continuing the parasite's vast growth, red blood cell lysis and consequently to low hematocrit [17].

Subsequently, we evaluated the animal characteristics according to the tick-borne hemoparasites infection in bovines. There were no significant differences for age, gender, breed and coat color for animals with a hematocrit of less than 24, or for those positive for *Babesia* and *Anaplasma*. Rahali *et al.* (2014) already shown a low influence of breed and gender on hemoparasites infection in bovine in Morocco; however, they found a significant influence of breed [18]. Abanda *et al.* (2019) also showed the influence of age, but also sex and breed on hemoparasites infection in bovine in North-Region of Cameroon. We only noted a significant influence of the village on tick-borne hemoparasites infection in bovine. These findings could be explained by differences in environmental cir-

cumstances, particularly climate, between the different villages. Abdullah *et al.* (2019) previously demonstrated the effect of climatic changes on parasite infections in cattle. The length of the tick's life cycle, as well as its capacity to oviposit and hatch, are all affected by temperature. Temperature and humidity, for example, have been found to influence tick abundance, host availability, survival, and disease transmission [19] [20]. The study highlights the significant impact of tick-borne hemoparasites on cattle health in the Noun and Nde Divisions of Cameroon. The prevalence of *Anaplasma* and *Babesia* was found to be 23.4% and 17.3%, respectively. These infections are associated with low hematocrit levels, indicative of anemia, which affects 17.3% of the cattle. Anemia due to hemoparasitic infections can lead to reduced productivity, weight loss, and increased susceptibility to other diseases. The findings underscore the economic threat these diseases pose to the cattle industry in Cameroon, as well as the need for effective control measures, such as improved acaricide use and better awareness among cattle rearers about the role of ticks in disease transmission. The study also emphasizes the influence of environmental factors, particularly climate, on the prevalence of these infections.

5. Conclusions

This study provides baseline data on the widespread distribution and effect of tick-borne hemoparasites in this significant Cameroonian cattle-producing region.

Cattle in Noun and Nde are infested by two species of parasites: *Anaplasma* 23.4%, and *Babesia* 17.3% transmitted by ticks. There were no significant connections found between hemoparasite infection status and host characteristics. The inaccessibility of acaricides, the absence of pastures during the dry season, the ignorance of cattle farmers about the role of ticks in the transmission of hemoparasites, the absence of support for farmers (training and awareness sessions) by the veterinary services constitute the main risk factors predisposing cattle to hemoparasites in this study area.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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