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DEMONSTRATION OF THE CIRCULATION OF *COXIELLA BURNETII* (Q FEVER AGENT) IN CATTLE IN KINDIA AND IN GUINEE FORESTIERE

Alpha Arsida Barry*[1], Lansana II Soumah[2], Ouo-Ouo Balamou[3] and Ibrahima Sory Sow[4]

[1]Laboratory Techniques Department, Biology Laboratory Techniques Program, Mamou Higher Institute of Technology (IST-M), Guinea.

[2,3,4]Laboratory of Bacteriology, Institute for Research in Applied Biology of Guinea (IRBAG) and Center for Research in Epidemiology, Microbiology and Care (CREMS), Guinea.

***Corresponding Author: Alpha Arsida Barry**

Laboratory Techniques Department, Biology Laboratory Techniques Program, Mamou Higher Institute of Technology (IST-M), Guinea.

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ABSTRACT

Q fever or Query Fever (fever to be elucidated) is a zoonosis described for the first time by Derrick in 1935 among employees of a slaughterhouse in Brisbane (Queensland, Australia). The study is justified by the fact that Q fever exists in Guinea but it is little studied and unknown to populations outside certain circles such as veterinary services and biomedical research centers. The objective of the study is to estimate the incidence of Q fever in cattle in four prefectures of Guinea (Kindia, Kissidougou, Guéckédou and N'Zérékoré). The analysis of 786 bovine blood samples detected 385 samples positive for C. burnetii, the prefectures of Guinée Forestière (Kissidougou, Guéckédou and N'Zérékoré) were the areas where the detection of C. burnetii DNA was the highest with a total of 347 positive cases, i.e. a prevalence of 44.15%. In the Kindia area in Lower Guinea, 38 positive cases were detected, i.e. a prevalence of 4.83% and the whole corresponded to a total prevalence of 48.98%. The detection of C. burnetii DNA in the cattle subjected to this study confirms the circulation of C. burnetii in the areas investigated (Kindia and Guinée Forestière). Indeed, this disease would hinder the economic profitability of livestock and threaten public health in Guinea.

KEYWORDS: Q fever, Coxiella burnetii, circulation, bovine, and detection.

1. INTRODUCTION

The infectious disease called Q fever is transmitted from animals to humans.[1] It is caused by a microbe called Coxiella burnetii, which can survive for months or even years in dust or soil. Some animals such as cattle, sheep and goats can carry this responsible microbe in the tissues of their reproductive system: the uterus, the placenta and the fluids produced during parturition.[2]

Infected animals also shed the microbe in their milk and feces. Humans become infected by inhaling airborne infectious particles (aerosols) and contaminated dust from animals or animal products.[3]

More than 400 cases of Q fever were observed in the Canton of Valais in Switzerland in 1983 following transhumance (seasonal movement of a herd in order to reach an area where it can feed; return of this herd to the place from which he was gone) about 900 sheep; 12 flocks of sheep returning from the mountains crossed the villages by truck and disseminated C. burnetii there.[4]

In France in the department of Maine-et-Loire in 2009, 50 cases of Q fever occurred in a building combining a cattle slaughterhouse and a meat processing plant. The source of these cases has been identified as a bag of fetal calf blood that allegedly ruptured in the transport truck. The bacterium would have spread in the establishment by the misting caused by the pressure washing of the soil and the contaminated equipment. The only country for which the incidence of Q fever is well known is Cyprus, which has developed an epidemic-surveillance system for the disease throughout the country.[5]

Fifty-one (51) seroprevalence studies of Q fever in humans and animals were performed between 1965 and 2012. They were conducted in 15 countries, mainly in the regions of North Africa, West Africa and of central Africa. Seroprevalence studies most often revealed infection by C. burnetii ≤ 13% in cattle and 11 to 33% in small ruminants, whereas human seroprevalence was generally < 8%. In studies of human populations, Q fever was responsible for 2 to 9% of hospitalizations for febrile illness and 3% of cases of endocarditis. Coxiella burnetii therefore represents an underestimated risk to human and animal health in Africa.[6,7]

In Guinea, the study carried out by Siba Kalivogui et al carried out in 1986, indicates a low prevalence of Coexilla burnetii and that carried out by Abdoulaye Ahmat Nassour et al in 2020 in the Prefecture of Kindia, carried out at the Guineo-Russian laboratory of the IRBAG showed the existence of Coxiella burnetii in humans (6.5%), in reservoir animals (10%) and vector ticks (42.12%). Finally, the study conducted by Fatoumata Dramé et al in 2021 on the circulation of Coxiella burnetii in Guinée Forestière showed its presence in all the places investigated both in humans (1.61%) and in cattle (77.11%) and in ticks (76.29 %).[8]

The general objective of this research is to highlight the circulation of Coxiella burnetii (Q fever agent) in cattle in the prefectures of Kindia, Kissidougou, Guéckédou and N'Zérékoré in Guinea.

2. MATERIALS AND METHODS

2.1 Presentation of the study area

The study area of this research work was the prefecture of Kindia in Lower Guinea and three prefectures of Guinée Forestière (Kissidougou, Guéckédou and N'Zérékoré) which are part of the important agro-pastoral areas of Guinea.

The prefecture of Kindia has an area of 9115 km2. It has a population of 438,315 inhabitants, including 226,300 women. The main activities are trade, agriculture and livestock. The density is 52 inhabitants per km2 unequally distributed between ten (10) decentralized communities and one (01) urban municipality which includes thirty-three (33) districts. With a growth rate of 34%. Its climate is of the humid tropical type, characterized by the alternation of two seasons of variable duration, a dry season from November to April and a rainy season with abundant rainfall from May to October with an average rainfall of 2500 mm of water per year. With temperatures ranging from 25°C to 39°C.[9]

The prefectures of Kissidougou, Guéckédou and N'Zérékoré are the three largest prefectures in the Forest region. This region is located in the south-east of Guinea and covers an area of 49,500 km², or 20% of the national territory. Its population is 1.1 million. Its density is estimated at 22 inhabitants per km². Its relief in plateau. It has seven (7) prefectures: Beyla, Guéckédou, Kissidougou, Lola, Macenta, N'Zérékoré and Yomou. Its climate is of the humid subequatorial type characterized by the alternation of two seasons, a rainy season from March to November and a dry season from December to February. In August and September, the monthly rainfall can reach 300 to 400 mm³ with relatively high intensities. Average temperatures are lowered by altitude and vary between 17°C and 22°C.[10,11]

The Institute for Research in Applied Biology of Guinea and the laboratory of the Center for Research in Epidemiology, Microbiology and Care served as a framework for the realization of this study.

2.2 Work equipment

2.2.1 Animals

The cattle of all ages and of the Djallonké, Peul and mixed race breeds from different crosses were the subject of blood samples.

2.2.2 Sampling equipment

The sampling material consists of: biological material (bovine blood); work protection or safety equipment (personal protective equipment); blood collection equipment (gloves, hemolysis tubes, sterile syringes, 70% alcohol, cotton, tourniquet and swabs), ice and dry ice.

2.3 Methods

2.3.1 Sampling

Blood samples were taken from 786 cattle of all ages. During the period October 2017 and October 2020, for each sample, information relating to breed, sex and locality was noted. The identified animals were examined (thermometry, search for other clinical signs such as throwing up, coughing, salivation), blood was taken from the jugular vein using a dry vacutainer tube.[12] The tubes were put in a cooler containing ice packs to maintain the temperature at +4°C and transported to the Institute for Research in Applied Biology in Guinea.

The serum was collected after centrifugation which was 3000 revolutions per second for 10 minutes, then stored at -80°C and then analyzed in the laboratory of the Center for Research in Epidemiology, Microbiology and Care (CREMS).

2.3.2 Laboratory diagnosis

The indirect Enzyme Linked Immunosorbent Assay (ELISAi) test was used, it is considered to be very sensitive and very specific. The analysis of all the sera collected was carried out using the ELISA kit named "ID Screen Q Fever Indirect Multi-Species, ID Vet, Montpellier, France" and made it possible to search for anti-Coxiella burnetii antibodies in the sera. by plate micro-method according to the manufacturer's recommendations. This method made it possible to detect type G immunoglobulins (IgG) anti-Coxiella burnetii.[13,14]

2.3.3 Statistical analysis

IBM SPSS Statistics version 20 software was used for statistical analysis. Logistic regression was used for data analysis. Differences were considered significant when $p \leq 0.05$. The factors taken into account to verify the link with the disease were the species, the sex, the age, the rank of the litter, the absence of quarantine and the abandonment of the abortions and placentas in nature.[15]

3. RESULTS AND DISCUSSIONS

3.1 Results

The results obtained during this research are shown in the tables below. These results relate to the distribution of positive cases by sampling area and the distribution of detections of C. burnetii DNA by sex.

3.1.1 Breakdown of positive cases by sampling area

The distribution of positive cases by cattle sampling area is given in Table 1.

Table 1: Distribution of positive cases for Coxiella burnetii according to origin in the sampling areas.

Sampling area	Sampling	Positive cases	Frequency (%)
Kindia			
Madina-Oula	60	12	3,57
Kolentin	57	5	1,48
Gomba	61	7	2,08
Konkouré	61	8	2,38
Danmakaniya	49	4	1,19
Friguiabhé	48	2	0,59
Total	336	38	11,29
Forest Guinea			
Bola	92	73	16,22
Sinko	114	85	18,88
Foumbadou	83	63	14,00
Gueassou	24	20	4,44
Lainè	61	49	10,88
Lola	42	30	6,6
Koropara	34	27	6,00
Total	450	347	77,11

The results of this table show that in the areas investigated (Kindia and Guinée Forestière), there is indeed a circulation of Coxiella burnetii with different local proportions:

- In the Kindia area, Madina-Oula had the highest percentage with 12 positive cases corresponding to 3.57% in the area;
- In Forest Guinea, Sinko kept the highest score with 85 positive cases corresponding to 18.88% in the area.

3.1.2 Breakdown of cases of detection of C. burnetii DNA by sampling area

The distribution of cases of DNA detection of C. burnetii according to the sampling area is given in Table 2.

Table 2: Distribution of cases of detection of C. burnetii DNA according to the sampling area.

Sampling area	Sampling	Positive cases	Frequency (%)
Kindia	336	38	4,83
Guinée Forestière	450	347	44,15
Total	786	385	48,98

In this table we see that Forest Guinea represented the area where the detection of C. burnetii DNA in cattle was the highest with 347 positive cases detected corresponding to a prevalence of 44.15%. The Kindia area followed with 38 positive cases detected resulting in a prevalence of 4.83%. All the areas investigated showed a total prevalence of 48.98%.

3.1.3 Breakdown of C. burnetii DNA detection results by gender

The distribution of C. burnetii DNA detection results by gender is given in Table 3

Table 3: Distribution of C. burnetii DNA detection results by gender.

Gender	Serum collected	Positive cases	Frequency (%)	$IC_{95\%}$
Femelles	568	276	35,11	32,69 - 37,53
Mâles	218	109	13,87	12,94 - 14,80
Total	786	385	48,98	45,63 - 52,33

By observing the results of this table, we see that the detection of C. burnetii DNA was higher in females with 35.11%. In males the detection of C. burnetii DNA was 13.87%.

This percentage difference could be explained by the constraints due to their sex (receptivity). Indeed, the females give birth and nurse the young. This function linked to their sex makes them and their young attractive to infestation by ticks which are generally located around the udders.

3.2 Talks

The results of this study showed that Forest Guinea was the area where the detection of C. burnetii DNA was the highest in cattle with 347 positive cases for a prevalence of 44.15%. In the Kindia area, 38 positive cases were detected for a prevalence of 4.83%.

Analyzes of 786 bovine blood samples detected 385 positive cases for C. burnetii for all the areas investigated, corresponding to a prevalence of 48.98%.

The work of Fatoumata Dramé et al. (2021) on the examination of 450 bovine serum samples from Guinée Forestière, produced 347 detections of C. burnetii DNA, i.e. a prevalence of 77.11%.[8] This rate is much higher than that of the present study corresponding to 48.98% for all of our investigated areas.

The work of Abdoulaye Ahmat Nassour et al in 2020, on the analysis of 336 bovine blood samples in 2020 in the prefecture of Kindia produced 38 detections of C. burnetii DNA corresponding to a prevalence of 9.81%.[16] This rate is much lower than that of the present work corresponding to 48.98% for all the areas investigated.

In the United States, R.D. Fournier et al (Sidibé. S. S et al. 2013) also obtained a seroprevalence of 3.4% in cattle in 2003, this rate is much lower than that of the present study (48, 98%).[17]

Similarly, the studies carried out in Algeria and Tunisia respectively by Abdelhadi, F et al. and Elandalousi et al in 2015 produced respectively (24% and 16%) prevalence of C. burnetii in their study populations.[18] These rates remain lower than those of the present study in the areas investigated, i.e. Kindia and Guinée Forestière.

3. CONCLUSION

The analysis of 786 bovine blood samples detected 385 positive samples for C. burnetii, Forest Guinea was the area where the detection of DNA of C. burnetii was the highest with 347 positive cases for a prevalence of 44 .15%. In the Kindia area, 38 positives cases were detected for a prevalence of 4.83% and the whole corresponded to a total prevalence of 48.98%.

According to sex, it is found that the detection of C. burnetii DNA was higher in females 35.11%. On the other hand, in males, this detection was 13.87%.

The results of the places investigated in the two study areas (Kindia and Guinée Forestière) showed that Coxiella burnetii circulates in all these areas with different local proportions:

- In the Kindia area, Madina-Oula was the most affected place with 12 positive cases corresponding to 3.57% in the area;
- In Forest Guinea, Sinko was the most affected place with 85 positive cases corresponding to 18.88% in the area.

The detection of C. burnetii DNA in cattle and in ticks submitted to this study confirms the circulation of C. burnetii in the investigated areas of (Kindia and Guinée Forestière). This demonstrates that Q fever has a significant role in the development of febrile illnesses that are rampant in these two agro-pastoral areas of Guinea.

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