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SEROLOGICAL SURVEY OF SWINE BRUCELLOSIS IN NORTHERN CÔTE D'IVOIRE: PRELIMINARY ASSESSMENT

Guillaume B. Gragnon[1], Benjamin K. M'Bari[2*], Azoumana Timitey[2] and Emmanuel Couacy-Hymann[1]

[1]Korhogo Regional Laboratory (LRK), National Agricultural Development Support Laboratory (LANADA), PO Box 32 Korhogo, Côte d'Ivoire.
[2] Agro-Pastoral Management Institute (IGA), Peleforo GON COULIBALY University, PO Box 1328, Korhogo, Côte d'Ivoire.

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***Corresponding author: Benjamin K. M'Bari**

Agro-Pastoral Management Institute (IGA), Peleforo GON COULIBALY University, PO Box 1328, Korhogo, Côte d'Ivoire.

ABSTRACT

A serosurvey was conducted in northern Côte d'Ivoire to determine the prevalence of pig brucellosis in 2018. For this purpose, blood was taken from peripheral veins on the ear the ear basis of 600 pigs from 6 months of age and regardless of sex. Pigs were randomly selected from 60 herds herds in four districts. The serological analysis performed was Rose Bengal Test. Brucellosis appeared to be a major problem in the study area, with an overall seroprevalence of 10.2% (61/600). Moreover brucellosis was diagnosed in all the selected localities; and only one from the 60 selected herds did not give positive results in the District of Korhogo, pigs appeared to be most exposed to brucellosis (18.2%). Sex and age did not affect the prevalence of this disease. The high seroprevalence observed shows the urgent need to sensitize pig breeders to improve the biosecurity and pig farms management techniques. In-depth studies are needed to better understand the epidemiology of porcine brucellosis in northern Côte d'Ivoire.

KEYWORDS: Brucellosis, Pigs, Seroprevalence, Northern Côte d'Ivoire.

INTRODUCTION

Brucellosis is an essentially an animals disease, especially domestic livestock with humans as an accidental host. This pathology is caused by bacterias belonging to *Brucella* group with six main "species" distinguished as *B. abortus*, *B. suis*, *B. melitensis*, *B. neotomae*, *B. ovis* and *B. canis*. The *Brucella*e are somewhat host-specific but cross-species infections occur, particulary with *B. melitensis*. Four amongst these can also cause human disease: *B. melitensis*, *B. suis*, *B. abortus* and *B. canis* (in decrease pathogenicity importance) of pathogenicity.[1]

Brucellosis can be transmitted by direct contact with recently aborted sows, by ingestion of contaminated food or exposure to a contaminated environment. However, sexual transmission is particularly important. This infection can be introduce to farms to farms through the common use of boars or the purchase of infected animals. In pigs, the initial phase following infection is often not apparent. In sexually mature animals, the infection is localized in the reproductive system and usually causes placentitis followed by abortion in the pregnant female, usually during the last third of pregnancy. In males, it is observed an in the male. Clinical signs of this disease are not pathognomonic and it diagnosis depends upon the demonstration of the presence of g. Brucella, either by isolation of the bacteria or detection of its antigens or genetic material, or by demonstration of specific antibody or cell-mediated immune responses.[1,2]

The economic importance of brucellosis is poorly perceived in in different countries. Abortions appear to be appears to be the most important negative effect of the disease on livestock, followed by stillbirth, infertility, decreased milk production and longer calving intervals. Human cases have been reported in 11 African countries as a result of the consumption of infected animal products, contact with infected animals, or placenta or abortion products *Brucella* abortion.[3,4]

In developing countries, pig farming exists everywhere, especially in the countryside, where many families have some pigs that live in freedom. In that zone, pigs mating is free and can favour the transmission of *Brucella* infection. Swine brucellosis has been reported in several parts of the world. Pig brucellosis seroprevalence found in Brazil was 0.34%,[5] while the positivity of this

infection were 6.7% in Bangladesh[6], 4.5% in Ethiopia[7] and 0.6% in Nigeria[8,9]

In Côte d'Ivoire, pork production is strongly dominated by traditional pigs with a high proportion of local breeds and low genetic performance. The traditional pig herd was estimated in 2007 at 476,700 heads against 11,000 heads for the modern type.[10] Several investigations have examined Brucellosis in cattle and small ruminants.[11,12,13] and in humans.[13] However, information on brucellosis in pigs, due to *B. suis*, is very limited.

Indeed, Côte d'Ivoire is one of the West African countries that reported porcine brucellosis between 1996 and 2000.[14] However, no serological studies on porcine brucellosis have yet been conducted in Côte d'Ivoire.

This study was conducted following reports of abortions and early returns in heat by breeders. Therefore the objective of this survey was to describe the status of brucellosis in domestic pigs in northern Côte d'Ivoire using Rose Bengal Test.

MATERIALS AND METHODS

Description of study area and animals

The Department of Korhogo is located between 8°26 and 10°18 North latitude, and 5°17 and 6°19 West longitudes, in northern Côte d'Ivoire (figure 1). It is bordered to the north by the Department of Tengrela and the Republic of Mali, to the East by the Departments of Sinematiali and Niakara, to the South by the Department of Mankono and to the West by the Department of Boundiali.

The Department of Korhogo covers a total land area of 13,400 km². The climate is Sudano- Guinean. It is characterized by an alternation of two seasons. The dry season that runs from November to April is very marked by the harmattan between December and January and by heat spikes in March and April. The rainy season extends from May to October with maximum rainfall in July and August. The average annual rainfall is between 1,200 mm and 1,400 mm. The average temperature is 26.5° C for a maximum temperature of 38° C, with low temperatures reaching 21° to 14°C from December to February. The maximum humidity is 83.1 %.[15]

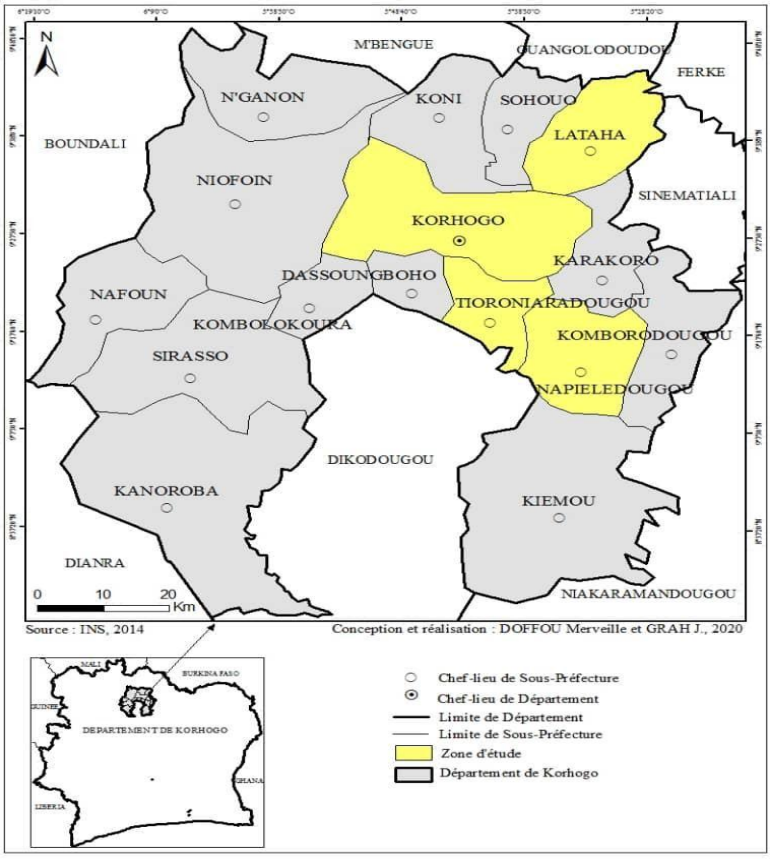

Figure 1: Study area.

The study was conducted in the Department of Korhogo. Eleven villages in four sub- prefectures (Korhogo, Napié, Tioro and Lataha) were randomly selected. However, the majority of pigs considered for this study were from the Sub-prefectures of Korhogo which had the largest pig population compared to the other sub-prefectures of this study.

The pork industry in Côte d'Ivoire consists of traditional and modern breeding. The share of traditional pig

farming in the country's meat production is 23%. In this type of breeding, the breeds are very heterogeneous and the genetic potential is low. In addition to traditional livestock farming, modern pig farms have been developed around large consumer centres, especially towns, with modern individual units.[16]

In the department of Korhogo, the pig population consists of local hogs, small size and black dress. Pig farming remains dominated by traditional and family production. Pork production is low specialized and typically extensive.[17]

The semi-intensive system is also encountered but on the periphery of agglomerations. In this system, animals are reared in enclosures with food provided by the breeders.[18]

Study design and sample size

A cross-sectional study design on the prevalence of brucellosis in pig farms in the different localities in northern Côte d'Ivoire was conducted from October to March 2018. The farms selected were those with at least five pigs up to 6 months old and regardless of sex. In the Department of Korhogo, four sub-prefectures (Korhogo, Lataha, Tioro and Napié) were chosen randomly.

Since no previous study had been carried out on brucellosis in pigs in Côte d'Ivoire and not knowing the size of the pig population in the study area, the sample size of this survey was calculated based on the following formula proposed by Ancelle.[19]

$$n = P(1-P)Z^2 / i^2$$

With n: sample size
P: expected prevalence i: absolute precision
Z: confidence interval
In the case of our study, we hypothesized that the expected prevalence was (P) = 50%, (i) = 4%, (Z) = 1.96. Thus n = 600 animals were retained to be sampled. Samples distribution is shown on table 1.

Collection of blood samples

Blood samples were taken by venipuncture from the ear vein in vacutainer tubes without anticoagulant and transported to Animal Biology, Production and Health Laboratory, Agropastoral Management Institute, Peleforo GON Coulibaly University, Korhogo, Côte d'Ivoire. After centrifugation at 3000 rpm for 10 minutes, serum was collected from each blood sample, transferred to a sterilized labelled Eppendorf tube and conserved at -20° C until analysed.

Serological tests

Brucella antigen was obtained from IDvet, 310 rue Louis Pasteur 34790 Grabels, FRANCE. Rose Bengal Plates Test (RBPT) was performed according to World Organisation for Animal Health (OIE) standard procedures.[20] Sera with strong agglutination were considered as positive for brucellosis. Accordingly, the formation of distinct pink granules (agglutination) was recorded as positive, while the absence of agglutination was recorded as negative.

Data management and analysis Data analysis

The socio-economic characteristics of the farmers and production systems were analysed using descriptive statistics such as percentages. A chi-square test was used to determine the significance of association between the different percentages. The proportion of pigs positive for brucellosis was compared by age category, sex and location using a chi-square test. All analyses were performed using the XLSTAT (2019.3.2) at a 5% probability level.

RESULTS

A total of 600 serum samples were collected from four selected sub-prefectures (Korhogo, Lataha, Napié and Tioro). Out of which 10.2% (61 /600) were found to be seropositive for anti-*Brucella* antibodies. The distribution of *Brucella spp* in the four districts showed that the highest seroprevalence was in the Korhogo (18.2 %) and Napié (12 %) sub-prefectures, and the lowest prevalence was observed in the Lataha (2.8%) and Tioro (5.5%) ones (Table 1).The brucellosis prevalence varied from a sub-prefecture to another with a high statistical significance (***p=0.000***). Brucellosis prevalence in male (12.1%) seemed to be higher than female (8.4%) one's but that difference was not statistically significant ($p>0.05$). In this study young animals (6 to 11 months old) and eldest pigs group (>11 months old) had respectively a brucellosis seroprevalence of 10.7% and 10 %. The statistical comparison of the positivity rate shown no significant difference ($p>0.05$) between those age groups (Table 2).

Table 1: Sampled animals distribution by location, sex and age groups.

Risk Factors			Sub-prefectures			Department of Korhogo
		Korhogo	Lataha	Tioro	Napié	
Sex	Female	78	108	29	75	290
	Male	103	71	61	75	310
Age group	6-11 months	64	56	28	47	195
	> 11 months	117	123	62	103	405
	Total	**181**	**179**	**90**	**150**	**600**

Table 2: Seroprevalence of porcine brucellosis in relation to sampled locations, pig's sex and age groups.

Risk Factors	Number of sampled animals	Number of Positive animals	Prevalence	X^2	p
Herds Localities					
Korhogo	181	33	18.2		
Lataha	179	5	2.8	26,194	0.000
Tioro	90	5	5.5		
Napié	150	18	12		
Sex					
Male	310	26	8.4	2,224	136
Female	290	35	12.1		
Age group					
6-11 months	196	21	10.7	0.027	0.869
>11 months	404	40	10		

DISCUSSION

This study revealed pigs exposition to brucellosis in northern Côte d'Ivoire with a global seroprevalence of 10.2%. The sensitivity of Rose Bengal Test (RBT) is over 99%, but it can give false positive reactions with sera from pigs infected with *Y. enterocolitica* which are frequently harbored in pigs.[1,21,22] These results must therefore be confirmed by other tests.[21,23] However, our work highlights the existence of porcine brucellosis in the study area because RBT is the recommended rapid screening test for brucellosis.[1,24]

The overall prevalence of porcine brucellosis recorded during this study is 10.2%. This result differs from the infection rate of 30.60% observed in pig farms in north-central Nigeria.[25]

However, the seroprevalence recorded in our study area is higher than that of 0% recorded in Ibadan in southwestern Nigeria, 0.6% in southeastern Nigeria, 4.5% in central Ethiopia and 6.7% in Bangladesh.[6,7,8,9,26]

The differences observed in pig's brucellosis seroprevalences may be due to the breeding system, the herds concentration, the geographic location or to the type of diagnostic test used as reported by some authors.[27] In this study, pigs sampled came from traditional farms. In the traditional system, animals are kept in confinement during the growing season and allowed to wander during the dry season.[28,29] In our study area, pigs are reared in free- range system for 7 to 8 months a year. At that period, theirs are left to their own devices for their food and their reproduction is uncontrolled in 87.50% of cases.[30] This type of breeding requires free natural copulation, generally early,[31] and promotes contact between animals and the spread of diseases,[32] (Wyckoff et al., 2009). According to the WHO,[1] porcine brucellosis is transmitted during mating, by direct contact with recently aborted sows, by ingestion of contaminated feed or by exposure to a contaminated environment. These exposure factors could explain the fact that brucellosis was identified in all the sub- prefectures sampled in this study.

Twenty six out of 310 males tested (8.4%) and 35 out of 290 females tested (12.1%) were positive for RBT, but no statistical significant association ($p>0.05$) between presence of Brucellosis and sex of the sampled pigs have been observed. Those observations confirm and works made in Nigeria and in Nepal respectively.[25,30]

At the concern of age groups, young pigs seroprevalence (10.7%) and eldest one (10%) hadn't shown significant difference ($p>0.05$). That result contrast with findings made in southeastern Nigeria.[7] Differences observed between those works can be explain by the fact that investigations conducted in Nigeria have been made on pigs coming from modern farms including large commercial and small scale. Indeed, in traditional pig farms of northern Côte d'Ivoire, animals are grouped without sex and physiological stage distinction and left to themselves for their food. Under these conditions, the risks of exposure to contaminated food resources or uncontrolled mating are also important for all subjects.

With regard to the breeding area, porcine brucellosis prevalence was higher in the Korhogo administrative districts (18.2%) and Napié (12%) than those of Tioro (5.5%) and Lataha (2.8%). These differences could be explained by the fact that Korhogo sub-prefecture's constitutes the largest market for pork consumption in this study area. This zone is the main convergence site of live or slaughtered pigs produced in its neighboring sub-prefectures. As a result, many breeders resort to these introductions for the renewal of some important part of their breeding stock. It is the same to a lesser degree for Napié area. On the other hand, the low seroprevalence recorded in the Lataha sub-prefecture could be due to the fact that in this area, pig farms are being restocked after being severely affected by African swine fever. As a result, the mixing of animals from different farms is less there than in the sub-prefectures of Korhogo and Napié.

CONCLUSION

The high seroprevalence of brucellosis shows that farmers in the study area are less aware of the importance of good agricultural management in the form of improved sanitation, good nutrition and biosecurity as

strategies for fighting diseases. Given the zoonotic nature and economic importance for the swine production of this disease, further research is needed to elucidate the importance of brucellosis for animal and human health in the study area. Further research is needed to study its economic importance in swine production and to identify *Brucella spp.* types and biotypes affecting pigs as well as risk factors for brucellosis.

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