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Epidemiology of brucellosis, Q Fever and Rift Valley Fever at the human and livestock interface in northern Côte d'Ivoire

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ABSTRACT

Northern Côte d'Ivoire is the main livestock breeding zone and has the highest livestock cross-border movements in Côte d'Ivoire. The aim of this study was to provide updated epidemiological data on three neglected zoonotic diseases, namely brucellosis, Q Fever and Rift Valley Fever (RVF). We conducted three-stage cross-sectional cluster surveys in livestock and humans between 2012 and 2014 in a random selection of 63 villages and a sample of 633 cattle, 622 small ruminants and 88 people. We administered questionnaires to capture risk factors and performed serological tests including the Rose Bengal Plate Test (RBPT), *Brucella* spp. indirect and competitive ELISAs, *Coxiella burnetii* indirect ELISA and RVF competitive ELISA. The human seroprevalence for *Brucella* spp. was 5.3%. RBPT-positive small ruminants tested negative by the indirect ELISA. The seroprevalence of *Brucella* spp. in cattle adjusted for clustering was 4.6%. Cattle aged 5–8 years had higher odds of seropositivity (OR = 3.5) than those aged ≤4 years. The seropositivity in cattle was associated with having joint hygromas (OR = 9), sharing the pastures with small ruminants (OR = 5.8) and contact with pastoralist herds (OR = 11.3). The seroprevalence of Q Fever was 13.9% in cattle, 9.4% in sheep and 12.4% in goats. The seroprevalence of RVF was 3.9% in cattle, 2.4% in sheep and 0% in goats. Seropositive ewes had greater odds (OR = 4.7) of abortion than seronegative ones. In cattle, a shorter distance between the night pens and nearest permanent water bodies was a protective factor (OR = 0.1). The study showed that the exposure to the three zoonoses is rather low in northern Côte d'Ivoire. Within a One Health approach, cost-benefit and cost-effectiveness of control measures should be assessed for an integrated control.

1. Introduction

Zoonotic diseases arise from infections transmitted from vertebrate animals to humans or vice versa. Neglected zoonotic diseases (NZDs) are not adequately addressed by health systems nationally and internationally (WHO, 2015). Brucellosis, Q Fever and Rift Valley Fever (RVF) are NZDs that have been largely eliminated in industrialised countries, but under-diagnosed and under-reported in resource-poor countries (WHO, 2015).

Brucellosis is caused by *Brucella* spp. with *Brucella melitensis* being assigned to small ruminants and *Brucella abortus* to cattle. *Brucella suis, Brucella ovis* and *Brucella canis* are mainly associated with pigs, sheep and dog brucellosis, respectively (Seleem et al., 2010). In sub-Saharan Africa, the exposure to the disease is highest in pastoral and agro-pastoral systems where the seroprevalence in cattle is commonly greater than 5% and decreases as herd size decreases (McDermott and Arimi, 2002). A few bacteriological studies have demonstrated the existence of *B. abortus* in cattle and sheep, but evidence for *B. melitensis* in small ruminants of West Africa is unclear (Ducrotoy et al., 2014). Q Fever is caused by *Coxiella burnetii*, an obligate intracellular gram-negative bacterium (Maurin and Raoult, 1999). It has been reported all over the African continent with the highest seroprevalences occurring in sub-Sahara and in West Africa, where it induces significant production losses (Vanderburg et al., 2014). The exposure to Q Fever was also shown to be higher in pastoral systems than in other communities (Mazeri et al., 2012). RVF is caused by a *Phlebovirus* in

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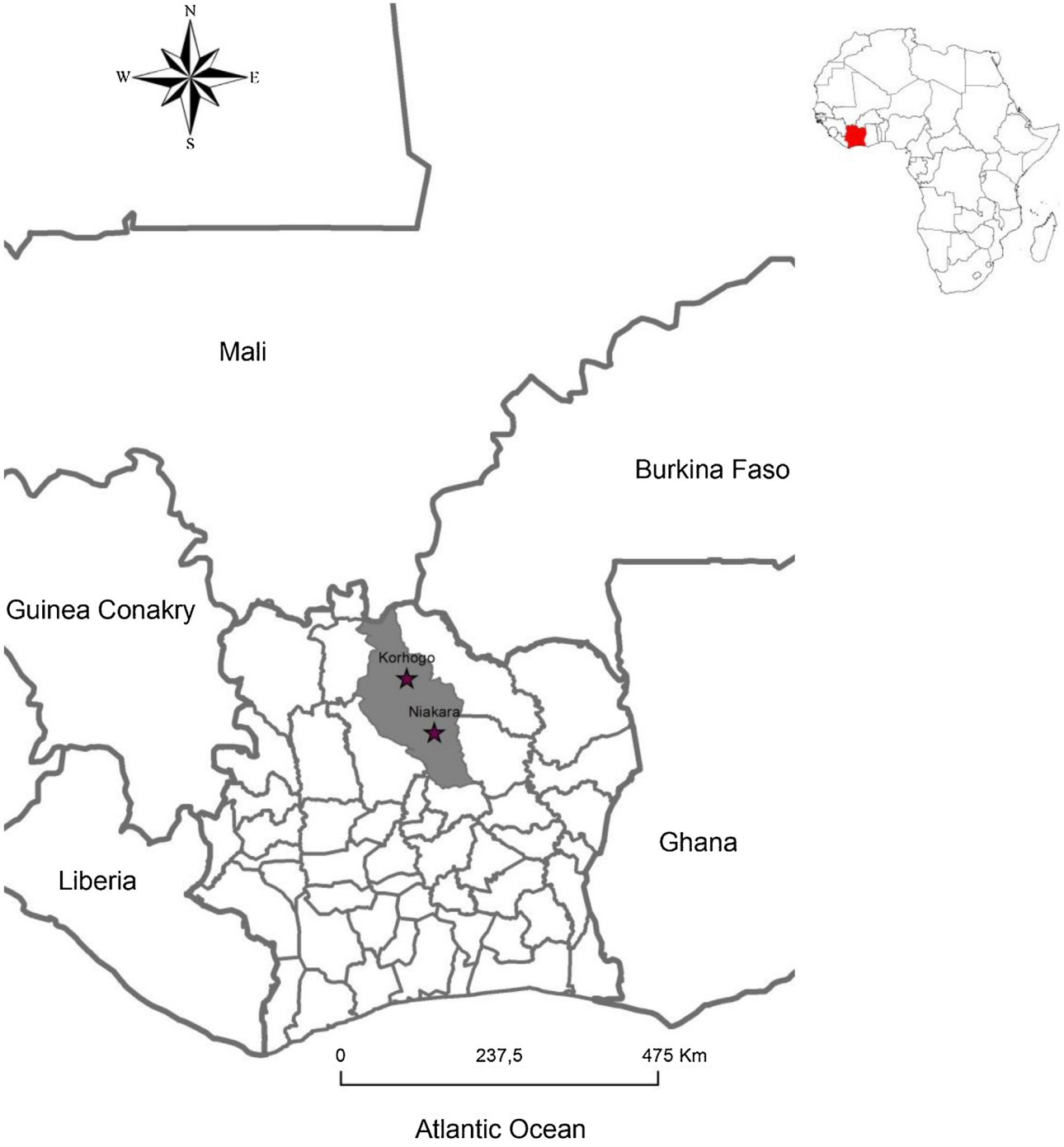

Fig. 1. Map of the study sites (shaded are the region of Korhogo and the department of Niakara). The neighbouring countries of Côte d'Ivoire in West Africa are Mali, Burkina Faso, Ghana, Liberia and Guinea Conakry.

the family of *Bunyaviridae* (Daubney et al., 1931). The disease is widespread in sub-Saharan Africa and in Egypt, from where several outbreaks have been reported (Caminade et al., 2014; El Mamy et al., 2011; WHO, 2007; Abd el-Rahim et al., 1999). Mosquitoes of the genera *Aedes* and *Culex* uptake RVF virus by biting infected vertebrate animals and further transmit it transovarially and infect livestock and humans (Diallo et al., 2000; Fontenille et al., 1995; Meegan and Bailey, 1988). In contrast to East and South Africa, where epidemic outbreaks are observed after heavy rainfalls and flooding, in West Africa outbreaks can occur during years of rainfall deficit (Caminade et al., 2014; Fontenille et al., 1998). The three NZDs are transmitted to humans through the consumption of uncooked dairy products, contact with infected animals and contaminated carcasses or abortion materials. Additionally, humans and animals can be infected with *C. burnetii* through aerosols and ticks (Vanderburg et al., 2014; Franco et al., 2007). The most common symptoms of the three zoonoses in livestock are abortions and weak new-borns; whilst in humans, nonspecific febrile diseases, headache, musculo-skeletal pains, malaise and body wasting are found (Vanderburg et al., 2014; Dean et al., 2012; WHO, 2007). Test and slaughter are a suitable control approach in countries with animal tracking systems and low prevalences, but are not feasible in resource-poor countries due to the mobile pastoral systems and lack of proper compensation of herders. In endemic areas, control