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Seroprevalence and Distribution of Contagious Bovine Pleuropneumonia (CBPP) in Eastern States of Sudan

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ABSTRACT

This study was conducted to estimate the seroprevalence and geographical distribution of Contagious Bovine Pleuropneumonia (CBPP) in eastern states of Sudan, and to identify the highly risk areas within localities of Al Gedaref, Red Sea and Kassala states. During this study a total of 1960 serum samples were collected randomly from cattle in the mentioned states. The samples were tested using Competitive ELISA (c. ELISA). The highest seroprevalence was observed in Al Gedaref state (12%), followed by Kassala (6.9%) and Red Sea state (4.1%). In Al Gedaref state; Al Galabat Eastern and El Rahad localities had scored the highest seroprevalence (17.1%). In Kassala state the highest seroprevalence was observed in Naher Atbara locality. And in Red Sea State the highest seroprevalence was observed in Sawakin locality (11.4%).

INTRODUCTION

Contagious Bovine Pleuropneumonia (CBPP) is one of the most threatening transboundary cattle disease in Africa (CFSPH, 2015) ,the disease affect cattle in most countries of sub-Saharan Africa (OIE,2018; Jores *et al.*, 2013).The Pan African programme for the Control of Epizootics (PACE) identified CBPP as the second most important transboundary disease in Africa, after Rinderpest (Tambi *et al.,* 2006).The disease is caused by *Mycoplasma mycoides* subsp *mycoides* (Edward and Freundt, 1969; Amanfu, 2009).

The disease has serious socioeconomic consequences at the farmer and national level hampering the export potential, so the affect of the disease is not only due to the morbidity and mortality but also due to restrictions on cattle trade imposed by international regulations. Therefore, control of the disease is a priority in endemic areas (Radostits *et al.,* 2007).

Epidemiological studies of the disease are important to carry out an effective control of CBPP through strategic vaccination. Hence, from the outset the epidemiological assessment of CBPP should be implemented in order to envisage a rational plan for the control and eventual eradication of CBPP from Sudan.
, Figure (1)

The aim of this study to estimate the seroprevalence of CBPP in the Eastern states of Sudan within its localities in order to make strategic plans for disease eradication.

MATERIAL AND METHODS

Study area: The study covered: Al Gedaref, Red Sea and Kassala states

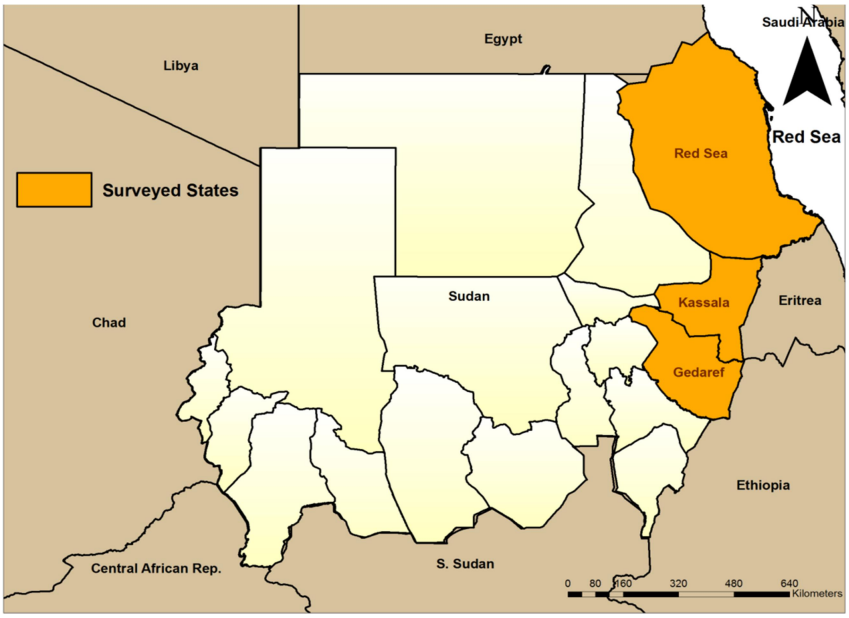

Figure 1: Study area (Red Sea, Kassala and Al Gedaref state (CVRL.Epidemiology Dep.GIS unit).

Study Design and sample size determination: A cross-sectional survey was carried out in the three mentioned states. Cattle were selected for sample collection using the simple random method. The herds; either with no vaccination history or hadn't been vaccinated in the past six months. The sample size required for the study was calculated according to the formula given by Thrusfield (2005). In Al Gedaref state the total serum samples were 770 from 10 localities. In Red Sea the total serum samples were 490 from 7 localities. In Kassala state the total samples were 700 from 8 localities.

Serum sample collection: The blood samples were taken from jugular vein. These were immediately placed into an ice bath slanted and transported to the laboratory. The sera were later transferred into tubes and centrifuged at 3000 rpm for 20 min and then decanted into cryovials, which were identified before storage at −20 °C until analyzed

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Serological analysis: The serological analysis was performed by IDEXX Competitive -ELISA kit –France

Principle of c ELISA test and Method: Sera samples were mixed with specific monoclonal antibody (*Mab 117-5*) in a dilution plate and were incubated with gentle agitation at 37°C for one hour, and then it was transferred into the *Mmm* coated microplate. After washing, anti-mouse IgG serum conjugated-horse radish perioxidase (HRP) was added. After series of washings the HRP substrate (TMB) was added forming a blue compound that was turned yellow when the reaction stopped. The plates were read by the c-ELISA reader at 450 nm MAb and negative controls exhibit a darker color while strong positive serum controls are very pale. The cut-off point has been set at 50%.The cut off point was calculated using a monoclonal control (Cm).

RESULTS

Prevalence of CBPP in Eastern states of Sudan: During this study a total of 1960 serum samples were collected and tested using c.ELISA. The distribution of samples collection and prevalence of CBPP within the localities is presented in Table (1), Table (2) Table (3). The highest prevalence of the infection was observed in Al Gedaref state (12%), then Kassala state (6.9%) and lastly, Red sea state (4.1%), Figure (2).

Table.(1) The seroprevelance of CBPP in Al Gedaref state using c.ELISA test (55 herds)

Locality	Sample size	Positive samples	Prevalence%
Al fashga	70	8	11.4
Al Gedaref city	70	7	10
Al Galabat Eastern	70	12	17.1
Al gurisha	70	7	10
Basonda	70	10	14.3
Albutana	70	7	10
AlGedaref (wasat) Rural	70	9	12.9
El lfao	70	3	4.3
Al Mafaza	70	9	12.9
El Rahad	70	12	17.1
Total	**770**	**92**	**12**

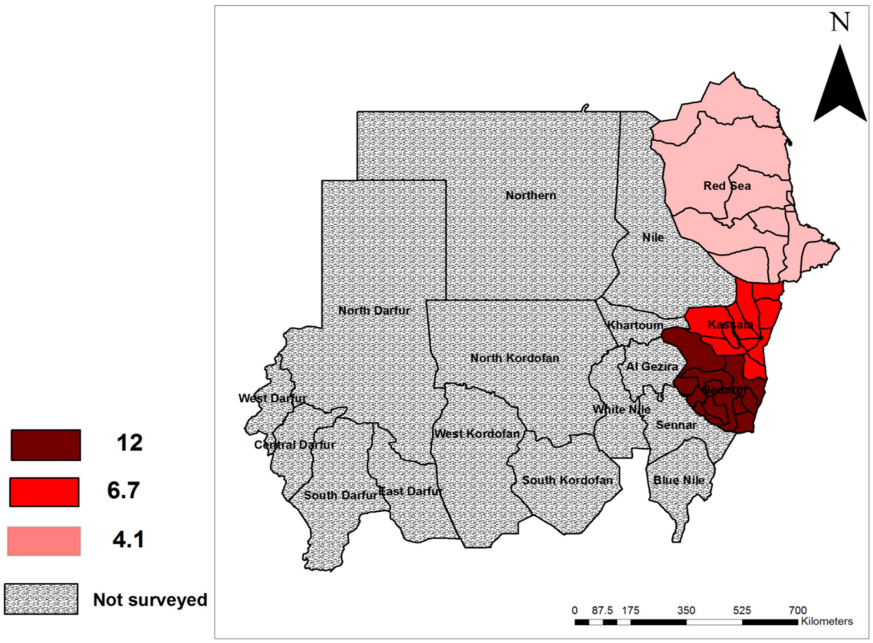

Figure 2: Seroprevalence of CBPP in Eastern states of Sudan using c.ELISA test (CVRL.Epidemiology Dep..GIS unit)

As shown in Table 1, 10 localities in Al Gedaref state were tested. The highest seroprevalence was in Al Rahad and Al Galabat Eastern (17.1%), followed by Basonda (14.3%). The least prevalence was in El fao locality (4.3%). The same data is shown in Figure (3), which demonstrated by colors .The distribution of the disease was mentioned in the map´s key.

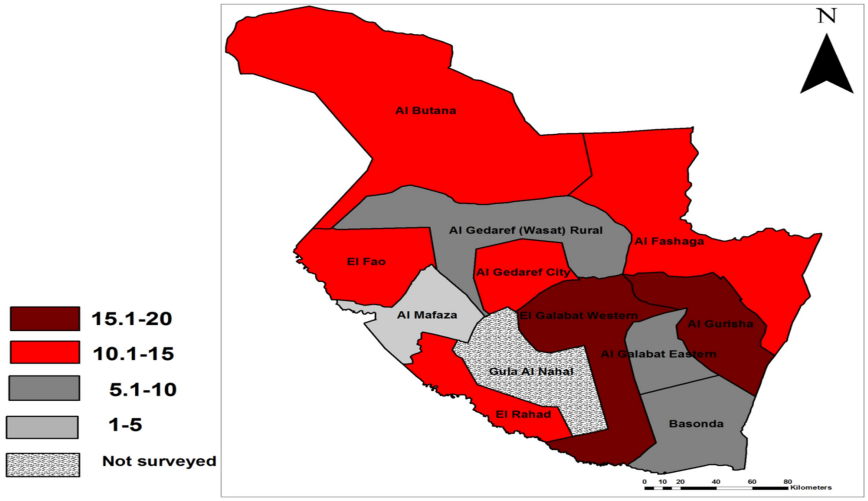

Figure 3: Distribution and seroprevalence of CBPP within Al Gedaref localities

In Red sea state, **7** localities were tested (Table 2) The highest seroprevalence was in Sawakin locality (11.4%), followed by Dordeb (8.6%). No CBPP antibodies have been detected in Agig and Al Gonnob and Awlieb localities. The same data is presented in Figure (4).

Table (2) The seroprevelance of CBPP in Red Sea state using c.ELISA test (35 herds):

Locality	Sample size	Positive samples	Prevalence%
Dordeb	70	6	8.6
Haiya	70	2	2.9
Sinkat	70	2	2.9
Agig	70	-	0
Sawakin	70	8	11.4
Port Sudan	70	2	2.9
Al Gonnob and Awlieb	70	-	0
Total	**490**	**20**	**4.1**

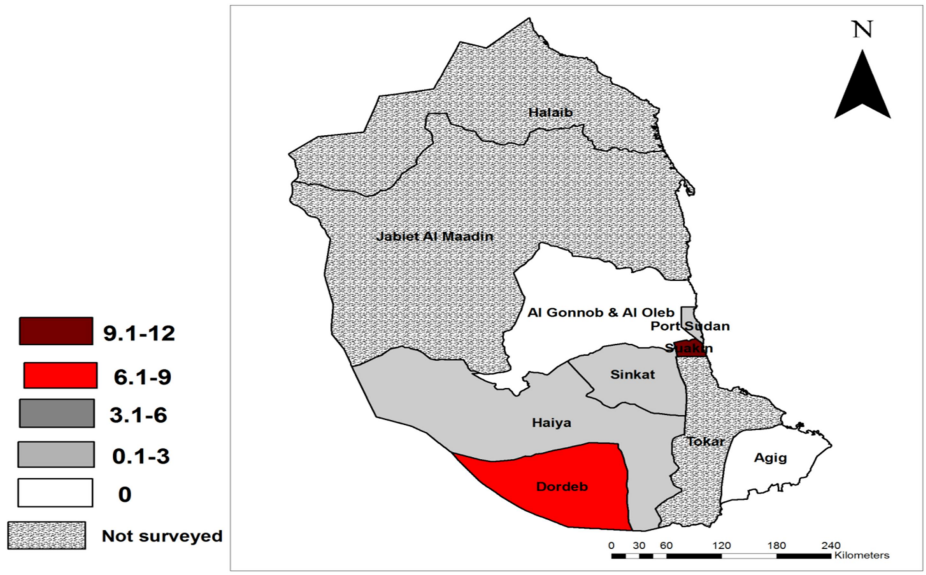

Figure 4: Distribution and seroprevalence of CBPP within Red Sea localities

Tables (3) showed the distribution of the disease in Kassala state, 8 localities were tested. The highest seroprevalence was in Naher Atbara locality (17.1%) followed by Wad Al Helew locality (15.7%). No CBPP antibodies have been detected in Telkuk locality. The same data is shown in Figure (5).

Table (3): The seroprevelance of CBPP in Kassala state using c.ELISA test (25 herds)

Locality	**Sample size**	**Positive samples**	**Prevalence%**
Halfa Elgadieda	70	2	2.9
Naher Atbara	70	12	17.1
Khashm Ghirba	70	7	10
Westren Kassala	140	3	2.1
Wad Al Helew	70	11	15.7
Aroma	70	6	8.9
Telkuk	70	1	0
Rural Kassala	140	6	4.3
Total	**700**	**48**	**6.9**

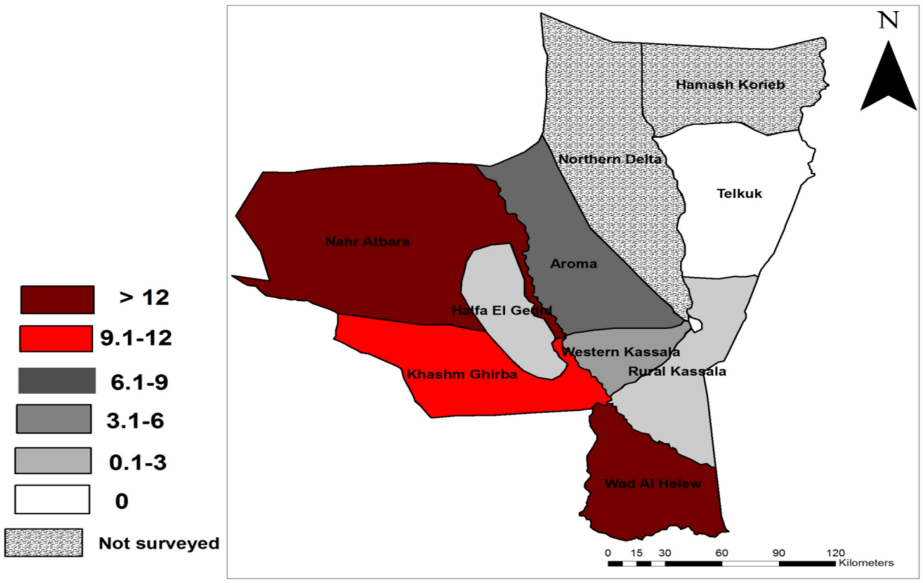

Figure 5: Distribution and seroprevalence of CBPP within Kassala localities

DISCUSSION

CBPP is one of the major infectious diseases which affecting cattle in Africa. This situation necessitates continuous surveillance and data collection in Sudan to eliminate quickly positive reactors and hence, restriction disease spreading. Based on this study using serological and epidemiological methods, CBPP was found to be an important cattle health problem in the eastern states of Sudan. From economic standpoint, should also be free from CBPP because it is considered as an export channel, the largest market of animals.

A total of 1960 serum samples were tested using c.ELISA. In accordance with other studies, none of the present serological tests was capable of detecting all CBPP infected animals (Evelyn Schubert *et.al*, 2011).

The c-ELISA has advantages in terms of ease of testing and standardization of results. It has 99.9% specificity (Amanfu *et al.,* 1998, OIE, 2018) and 63.8% sensitivity levels (Le Goff and Thiaucourt, 1998).

The overall CBPP seroprevalence observed in this study was 12.2% in Al Gedaref, 6.7% in Kassala and 4.1% in Red sea states. During the year of surveillance the herds have no vaccination history so the seropositive animals are just due to infection.

In Al Gedaref state the seroprevelance is very high in the southern parts and that may due to its location at Ethiopian border, which is classified as endemic and epidemic areas as Gedlu, (2004), Nejash and Nesradin (2017) mentioned. Also Tambi and Maina, (2004) and Kassaye and Molla, (2013);stated that the country experiences the largest number of cattle deaths, and reduction in cattle products under both endemic and epidemic conditions compared to the other African countries, due probably to its large cattle population. Generally countries in East Africa reported 66% of the total outbreaks (58% in Ethiopia and Tanzania, and 8%

in other countries in the region) (Tambi *et al.,* 2006; Alemayehu *et al*., 2014).

Kassala state has borders with Al Gedaref state and Eretria and that exposed it for disease transmission during animal movement between states and neighboring countries, the highest prevalence is found in southern parts (Wad Al Helew locality) which has border with Al Gedaref state.

Red sea state to some extend has low seroprevelance compared with the two above states, this is due to the poor vegetation area reflected on few animal population .In Swakin we found the seroprevelance is high, Swakin is a port in which the animals gather for exportation and that may gave chance of disease transmission.

The distribution of the disease was increasing during decades and hazard of the disease must be under focused Thus, it requires great attention both at production area and the quarantine stations. As its occurrence may cause restriction on the trade of animals and animal products internationally, this is affecting the export earnings of the country.

CONCLUSION AND RECOMMENDATIONS

The situation of CBPP in eastern states of Sudan has been investigated. Some strategies should be implemented to control the disease:

-Vaccination with treatment,

- Cattle movement control through,

- Creating awareness about the disease to the communities.

Great attention is required both at production area and quarantine stations because the occurrence of the disease may cause restriction on the trade of animals and animal products internationally, which is affecting the export earnings of the country.

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