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THE SERO-PREVALENCE AND SEASONALITY OF CONTAGIOUS BOVINE PLEUROPNEUMONIA IN NOMADIC PASTORAL CATTLE HERDS OF NIGER STATE, NIGERIA

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Abstract

A cross-sectional study was conducted in the three agro-ecological zones of Niger State, Nigeria between December 2012 and August 2013 to determine the prevalence, distribution and seasonality of contagious bovine pleuropneumonia in the state. A total of 765 sera were collected from cattle in 125 nomadic herds, and were tested using competitive Enzyme Linked Immunosorbent Assay. Participatory epidemiology survey was conducted to obtained information on the seasonal occurrence of the disease. The true prevalence at the cattle-level was 16.2% (124/765; 95% CI: 13.7, 19.0) with Kontagora Agro-zone having the highest sero-prevalence (25.3%; 95% CI: 20.2, 30.1) amongst the zones. The herd-level true sero-prevalence was 47.2% (59/125; 95% CI: 38.2, 56.3) with the same Kontagora Agro-zone having the highest sero-prevalence of 72.5% (95% CI: 56.1, 85.4) among the zones. The Kontagora Agro-zone shared border with the Republic of Benin and some international stocks routes across it significantly (p<0.000000279) had higher sero-prevalence than other zones. The nomadic pastoralists' concordance on the most season of occurrence of CBPP is early dry season (October to December) and the agreement was very strong (Kendall's Coefficient of Concordance W=0.8719) and statistically significant (P<0.01). The study showed the usefulness of population-based serological survey in detecting active infection in populations which, until now, may be considered to be free of disease by experts' opinions. The study highlighted the benefits of conducting serological and participatory epidemiology surveys simultaneously, to ascertain the infection status of animals. These findings should be considered for strengthening active surveillance and control of CBPP in Nigeria.

Introduction

Contagious Bovine Pleuropneumonia (CBPP) is an infectious and contagious respiratory disease of cattle cause by *Mycoplasma mycoides* spp. *mycoides* small colony (*Mmm*SC) and characterized by anorexia, fever, dyspnoea, cough and nasal discharges (Enyaru *et al.*, 2012). It is a disease of high economic importance making it a serious threat and obstacle to livestock production and development in Sub-Saharan Africa, some Asian countries, and still occurring in some European

(*Mmm*SC) Antibody Test Kit (CIRAD/ IDEXX Laboratories™) was used according to the manufacturer's instructions.

Participatory rural appraisal (PRA) tools of key informants, seasonal calendar, check-list, semi-structure interviews, probing, transect and triangulation were used to obtain qualitative information and semi-quantitative variables on the seasonal occurrence of the disease. *Hausa* was the local language generally understood in the state and was therefore used as medium for communication during the participatory appraisal exercises.

Data analysis

The Open Source Epidemiologic Statistics for Public Health (OpenEpi) version 2.3 was used to compute the proportions at 95% confidence level. Descriptive statistics of mean, tables, and rates were used to present the results. Sero-prevalence was calculated using methods described by Thrusfield (2009). Pearson's Chi-square tests were used to detect significant differences in the sero-positivity between herds and also between animals in the zones.

Kendall*W* statistic, a non-parametric statistic (Legendre, 2010) was used to assess the level of agreement (concordance) among the key informants on the seasonal occurrence of CBPP in the state. W values vary from 0 to 1: the higher the value, the higher the level of agreements between the key informants at 95% confidence levels and $P<0.05$ indicates statistical significance of the agreement level. $W = 0$, means there was no agreement while $W = 1$, means there was perfect agreement. However, an online program, KendallW_Pgm.php (www.StasToDo.com), was used to compute the concordance among the key informants and other participants.

Results

Cattle-level CBPP sero-prevalence in nomadic herds

The cattle-level sero-prevalence was 16.2% (124/765; 95% CI: 13.7, 19.0). Kontagora Agro-ecological zone had the highest cattle-level sero-prevalence (25.3%; 95% CI: 20.2, 31.0) and Minna Agro-ecological zone had the least sero-prevalence (6.2%; 95% CI: 3.8, 9.5). The prevalence of *Mmm*SC antibodies varied significantly ($\div^2 = 28.3$; $p< 0.000000722$) between agro-ecological zones (table I).

Herd-level CBPP sero-prevalence in nomadic herds

The herd-level sero-prevalence was 47.2% (59/125; 95% CI: 38.2, 56.3). Konragora Agro-ecological zone had the highest sero-prevalence (72.5%; 95% CI: 56.1, 85.4) and Minna Agro-ecological zone had the least sero-prevalence (15.67%; 95% CI: 6.5, 29.5). The prevalence of *Mmm*SC antibodies varied significantly ($\div^2 = 30.1$; $p<0.000000279$) between agro-ecological zones (table II).

Seasonality of CBPP

Nomadic pastoralists named four seasons for the occurrence of CBPP, which are early dry season known in local Hausa language as *kaka* (October to

December), late dry season (*Rani*) (January to March), early rainy season (*Bazara*) (April to June), and late rainy season (*Damina*) (July to September). The nomadic pastoralists have indicated that though contagious bovine pleuropneumonia (*Ciwon-huhu or Huttu)* occurs in all seasons, highest occurrence was in the early dry season with mean seasonal score of 7.6 and least at late rainy season with mean seasonal score of 2.3 (fig. 1). The concordance on the most period of occurrence of CBPP was early dry season. The agreement was very strong (W = 0.8719) and statistically significant (P < 0.01).

Discussion

The 16.2% sero-prevalence of CBPP obtained in this survey was more than the earlier 8.7% sero-prevalence obtained from similar investigation in small pastoral cattle camps in the state (Alhaji, 2011), but less than 32% sero-prevalence in a CBPP surveillance in Nigeria (Aliyu *et al.*, 2003) while Matua-Alumira *et al.*, (2006) and 22.0% sero-prevalence in transhumant cattle production systems in Kajiado District, Kenya.

The increased prevalence in the present study showed that CBPP is fast spreading in the state, which may likely be due to nomadic pastoral practices of the herders that exacerbate spread of this disease (Masiga and Domanech, 2004). This present high prevalence may also be due to many factors that include: poor vaccine cold-chain maintenance, irregular annual vaccination campaign, absence of movement controls, lack of stamping-out policy, inadequate stock routes, porous border with neighboring countries such as Republic of Benin, and very little government budgetary allocations to animal health sub-sector amongst others.

The high prevalence of the disease in Kontagora and Bida Agro-ecological zones may not be unconnected with the fact that the zones have high concentrations of nomadic cattle, many stock routes for the transits of nomadic cattle on seasonal movements from far north of Nigeria to the southern parts and high close contacts of cattle at grazing and watering points. Further, the zone has common border with the Republic of Benin in its west that is very porous. The high sero-prevalence obtained from this study may be attributed to the extensive management system practice by the pastoralists. This is in consonants with the observations of Windsor and Wood (1998) that prevalence of CBPP varies according to the cattle production system and higher in extensive cattle production systems such as in the nomadic pastoral system.

In this study, participatory epidemiology (PE) provides opportunity for gathering intelligence information on the seasonal occurrence of CBPP. The outcomes were interesting and highlighted the importance of participatory epidemiology. However, findings of this study revealed that occurrence of CBPP (*ciwon-huhu* or *huttu*) is more in early dry season (*kaka*) and late dry season (*rani*) than in the

Table I. Cattle-level CBPP sero-prevalence in nomadic herds from three agro-ecological zones of Niger State, Nigeria

Agro-ecological zone	No. of cattle sampled	No. positive	No. negative	Sero-prevalence (%)	95% CI
Bida	245	45	200	18.4	13.2-22.9
Minna	275	17	258	6.2	3.8-9.5
Kontagora	245	62	183	25.3	20.2-30.0
Total	765	124	641	16.2	13.7-19.0

CI=Confidence interval

Table II. Herd-level CBPP sero-prevalence in nomadic herds from three agro-ecological zones of Niger State, Nigeria

Agro-ecological zone	No. of cattle sampled	No. positive	No. negative	Sero-prevalence (%)	95% CI
Bida	40	23	17	57.5	41.9-72.0
Minna	45	7	38	15.6	7.1-28.4
Kontagora	40	29	11	72.5	57.2-84.6
Total	125	59	66	47.2	38.3-56.3

CI=Confidence interval

Table III. Seasonal calendar of CBPP in nomadic pastoral communities of Niger State, Nigeria

Pastoral communities	Early rainy season (*Bazard*)	Late rainy season (*Damina*)	Early dry season (*Kaka*)	Late dry season (*Rani*)
Lapai	4	1	10	5
Eyagi	2	0	8	10
Lemu	5	3	6	5
Paiko	6	3	6	5
Kuta	5	2	8	5
Bosso	4	3	8	5
Wushishi	5	3	7	5
Borgu	5	3	7	5
Bobi GR	4	2	8	6

GR=Grazing reserve, the figures represent the number of pebbles and the scores. In italics are the Hausa names for the seasons.

rainy seasons (*bazara* and *damina*). This is in agreement with the observations of Nwanta and Umoh (1992) that more cases of CBPP occur in the dry season when infected cattle come in contact with susceptible ones as they converge at rivers and drinking pools, while Egwu *et al.* (1996) and Adamu and Aliyu (2006) expressed contrary views. They reported more occurrences in the rainy season which may be associated with high stocking and hurdling in groups because of increased crop farming with little spaces for grazing at this season. This is also in contrast with reports from Jie and Dimka communities that, though *louko* (CBPP) occurs in both seasons, severe cases occur in the rainy season due to high contacts with other herds due to very little available grazing lands (AU-IBAR, 2002).

The present study has shown that cELISA can detect specific antibodies to CBPP even in apparently healthy cattle and participatory epidemiology approach can be used as diagnostic method to assess seasonal occurrence of the disease. The combination of the two investigative tools can improve the detection of burden of this disease as corroborated by the findings of previous workers (Nicholas *et al.*, 1996). Furthermore, there is need to apply participatory rural appraisal tools during CBPP surveillance, backed up with a reliable serological tests such as cELISA, if effective control of CBPP is to be achieved. This position is in support of a recent report on a need to use combine tools for better monitoring and detection of this disease in Nigeria (Danbirni *et al.*, 2010). The significant difference in the occurrence of the disease across the agro-ecological zones may indicate that risk factors for its occurrence vary from one zone to another in the state.

In conclusion, this study has shown that pastoralists possess existing veterinary knowledge about CBPP as demonstrated by strong agreements among the key informants. Therefore, there is need to combine the two investigative approaches to search for CBPP during its active surveillance for better and more reliable information on the prevalence of CBPP in Nigeria. These findings should be considered for strengthening surveillance and control of CBPP in Nigeria.

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