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Prevalence of contagious bovine pleuropneumonia based on gross lesions in cattle at slaughter in Adamawa State, Nigeria

MI Francis[1]*, AO Oragwa[2], PI Ankeli[1,3], JW Liba[4], EF Ejeh[5], MA Raji[1,6], JA Ameh[7] & GO Egwu[7]

1. *Department of Veterinary Microbiology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria*
2. *Department of Veterinary Microbiology and Pathology, Faculty of Veterinary Medicine, University of Jos, Plateau State, Nigeria*
3. *Bacterial Vaccine Production Division, National Veterinary Research Institute, Vom, Plateau State, Nigeria*
4. *Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Nigeria*
5. *Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Nigeria*
6. *Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Ilorin, Ilorin, Nigeria*
7. *Department of Veterinary Microbiology, Faculty of Veterinary Medicine, University of Abuja, Abuja, Nigeria*

*Correspondence: Tel.: +2348067026690; E-mail: markfrancis4u@gmail.com

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Abstract

Contagious bovine pleuropneumonia is an important economic disease of cattle caused by *Mycoplasma mycoides* subspecies *mycoides* and manifested by anorexia, fever, dyspnoea, polypnoea, cough and nasal discharges. An eleven years (2006-2016) abattoir-based retrospective data were collated and analysed from Adamawa state Ministry of Livestock Production. Out of 241,700 cattle examined at post-mortem, 8,429 had CBPP-like lesions giving a prevalence of 3.49% (95% CI: 3.41-3.56). The overall prevalence for each local government area were 2.42% (95% CI: 2.35-2.49), 5.53% (95% CI: 5.30-5.74) and 8.97% (95% CI: 8.56-9.41) for Yola, Mubi and Ganye abattoirs respectively. There was significant association ($p<0.05$) between Local Government Areas and occurrence of CBPP. The annual highest prevalence of 5.75% (95% CI: 5.43-6.09) was recorded in 2010 with 1,128 cases and lowest prevalence of 2.43% (95% CI: 2.23-2.66) was recorded in 2007 with 505 cases. Based on season, highest prevalence rate of 3.85% (95% CI: 3.58-4.14) was recorded in February with 709 cases and lowest prevalence rate of 3.03% (95% CI: 2.80-3.28) was recorded in December with 605 cases. Both annual and monthly prevalence rates varied significantly ($p<0.05$). It was concluded that CBPP is endemic and widespread in Adamawa state. Hence, we recommend increased funding in the control of the disease, restriction of cattle movement and provision of cattle ranches.

Keywords: Adamawa state, Cattle, Contagious bovine pleuropneumonia, Gross lesions, Prevalence

Introduction

Contagious bovine pleuropneumonia (CBPP) an important economic disease listed by World Organisation of Animal Health, is a major militating factor affecting cattle production in terms of animal protein supply and economic value, and is widespread in the northern Nigeria (Alhaji & Babalobi, 2015). It is a highly infectious disease of cattle caused by *Mycoplasma mycoides* subspecies *mycoides* and characterized by a relatively long incubation period and a highly inconsistent clinical course (Admassu *et al*., 2015). It is manifested by anorexia, fever, dyspnoea, polypnoea, cough and

nasal discharges (Radostits *et al.,* 2007). Most infections are limited to the respiratory tract, although arthritis occurs in calves usually less than 6 months of age (Gull *et al.,* 2013). It is an economic disease and of serious concern in Africa that re-surfaced when the combined rinderpest/CBPP vaccination programs was suspended (Amanfu, 2009). Native herds can experience losses up to 80%, many cattle that survive remain chronic carriers and may suffer from persistent low-grade fever, loss of condition, respiratory signs upon exercise and might introduce the causative agent into uninfected herds (Amanfu, 2009).

Contagious bovine pleuropneumonia is prevalent in Africa where outbreaks of the disease has been reported from 20 countries in 2006, with the highest number of cases in Ethiopia, Angola, Cameroon and Nigeria (Nicholas *et al*., 2008). CBPP has been eradicated in Australia, Europe and America through the application of restrictions to the movement of cattle, as well as test and slaughter policies combined with compensation for livestock keepers. Such policies are difficult to apply in most African countries because of pastoralism, lack of economic resources and fragmented veterinary services (Neiman *et al*., 2009; Sacchini *et al*., 2012). CBPP is currently endemic in Nigeria with pockets of outbreaks occurring in the northern part of the country, where most of the cattle population is located. Most cattle in Nigeria are owned by nomadic Fulanis who move for long distances in search for forage, thereby enhancing the spread of the disease (Aliyu *et al*., 2000).

Mycoplasma mycoides subsp. *mycoides* (*Mmm*) is mainly transmitted from animal to animal in respiratory aerosols (OIE, 2015). This organism also occurs in saliva, urine, fetal membranes and uterine discharges. Close, repeated contact is generally thought to be necessary for transmission; however, *Mmm* might be spread over longer distances (up to 200 meters) if the climatic conditions are favourable (Tardy *et al*., 2011; Campbell, 2015). Carrier animals, including subclinically infected cattle, can retain viable organisms in encapsulated lung lesions (sequestra) for several months to two years (Tardy *et al*., 2011). These animals are thought to be capable of shedding the organisms, particularly when stressed. Transplacental transmission is also possible (Campbell, 2015).

Clinical diagnosis of CBPP is difficult as early signs may be slight or non-existent and are indistinguishable from any severe pneumonia with pleuritis (OIE, 2014). Postmortem CBPP lesions on lung tissues are often unilateral, the lungs are consolidated and typically marbled, and there is also large amount of straw coloured fluid in the thoracic cavity (Campbell, 2015). Confirmatory diagnosis of CBPP is achieved by the demonstration of typical pathology and/or the presence of *Mmm* after postmortem examination and isolation of the etiologic agent from pneumonic lesions characteristic of CBPP when combined with other diagnostic tests (Egwu *et al*., 2012).

The economic effects of CBPP can be enormous, resulting in heavy losses in cattle populations. Due to high financial and economic loss caused by the disease in endemic regions, OIE declared it as the most serious, notifiable and major transboundary animal disease (TAD) of high socio-economic impact (Wade *et al*., 2015). CBPP has been reported to have high economic impact to the livestock industry as well as national economy (Admassu *et al*., 2015). The disease has a major impact on livestock-dependent populations and can lead to reduced food supply and significant income losses because of trade restrictions (Gourgues *et al*., 2016). Egwu *et al*. (1996) reported losses in excess of 1.5 million US dollar per year of cattle from CBPP in Nigeria. Adamawa state being a CBPP endemic state in northern Nigeria witnesses outbreaks with high rate of detection of the disease at abattoirs, slaughter houses and even in the field (Francis, personal observations). It was against this background that this investigation was conducted with a view to determine the status of the disease among slaughtered cattle at different abattoirs in the state and suggest possible ways of reducing the prevalence of the disease.

Materials and Methods

Study area

Adamawa state is located in the north-eastern part of Nigeria. It lies between latitude 7° and 110°N and between Longitude 11° and 140°E. It shares interstate boundary with Taraba state in the South and West, Gombe state in its North-West and Borno state to the North. The state has an international boundary with the Cameroon Republic along its eastern side. It has a land area of about 38,741 km^2 (Adebayo, 1999). The state is divided into 21 local government areas (Figure 1) with three agro-ecological zones. Adamawa state has a tropical wet and dry climate. Dry season lasts for a minimum of five months (November-March) while the wet season spans April to October. Mean annual rainfall in the state ranges from 700 mm in the Northwest to

1600 mm in the extreme southern part of the state (Adebayo, 1999). The state has low humidity and high temperature. The climate in the area is also characterized by high evapo-transpiration especially during the dry season (Adebayo, 1999). The state has an estimated cattle population of 3.1 million (MLP, 2012) made up of White Fulani,Red Bororo, Adamawa Gudali breeds and their crosses, which constitutes 88% of cattle breeds in Nigeria (Ngere, 1983). The state is one of the producers of livestock with two (2) recognised international cattle markets at Ganye and Mubi.

Data collection

Eleven years (2006-2016) abattoir-based data records from Ministry of Livestock Production, were collated and analysed. The important information collected includes: total number of cattle slaughtered, number examined for suspected CBPP in the abattoirs and number with CBPP lesions. The prevalence rate was calculated for the entire period. Most of the animals brought for slaughter were bought from cattle markets located close to the abattoirs. Selection on the herd basis was not possible because most of these cattle originated from nomads who were the major cattle owners in the state.

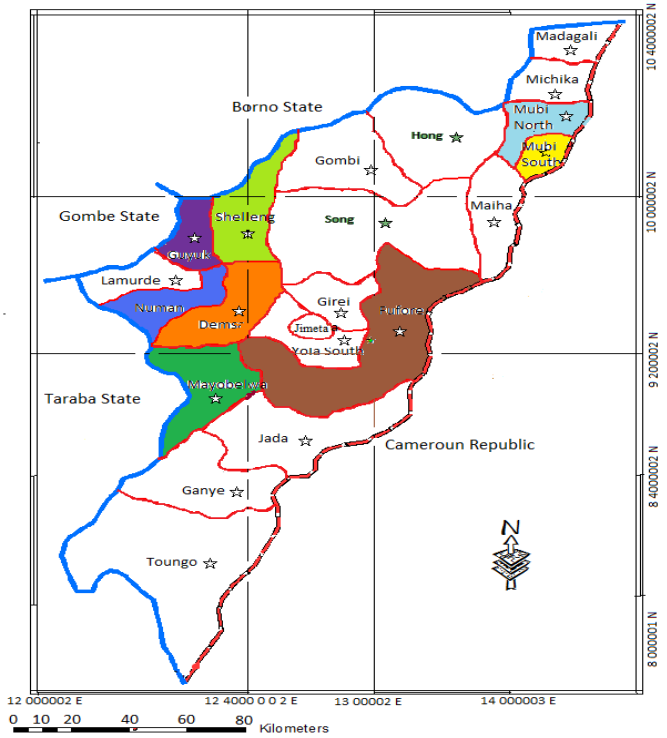

Figure 1: Map of Adamawa state showing Local Government Areas, interstate and international boundaries (MLS, 2010)

Data analysis

The prevalence was calculated as the number of cattle with suspected CBPP lesions divided by the total number of cattle slaughtered within the specified period. Simple descriptive statistics and binomial confidence interval at 95% were used and the value of $p<0.05$ was considered significant.

Results

Data collated from 2006 - 2016 (eleven years) for three local government areas of Adamawa state are shown in Table 1. A total of 241,700 cattle were examined at postmortem and 8,429 had lesions suggestive of CBPP giving a prevaence of 3.49% (95% CI: 3.41-3.56). The annual prevalence varied from 2.42% to 3.97%, whereas the overall prevalence for each of the local government area was 2.42% (95% CI: 2.35-2.49), 5.53% (95% CI: 5.30-5.74) and 8.97% (95% CI: 8.56-9.41) in Yola, Mubi and Ganye abattoirs respectively. The highest annual prevalence of 5.75% (95% CI: 5.43-6.09) was recorded in 2010 with 1,128 cases, followed by 5.40% (95% CI: 5.10-5.72) in 2011 with 1,118 cases and lowest prevalence of 2.43% (95% CI: 2.23-2.66) was recorded in 2007 with 505 cases.

Based on season (Figure 2), lesion based prevalence varies from 3.03% to 3.85%. Highest prevalence of 3.85% (95% CI: 3.58-4.14) was recorded in February with 709 cases and lowest prevalence rate of 3.03% (95% CI: 2.80-3.28) was recorded in December with 605 cases. The annual and monthly prevalence rates varied significantly ($p<0.05$).

Discussion

Detection of CBPP based on gross lesion among slaughtered cattle is one of the cheap, easy and practical methods for initial monitoring of disease in abattoir as pathological lesions are distinctive and pathognomonic, even though there are far more sensitive methods for diagnosis of CBPP (OIE, 2014). Microbiological, serological and molecular methods are the reliable diagnostic methods but are time consuming, expensive and required expert skills, constant power supply and special equipment; these methods of diagnosis are necessary before confirmation of an outbreak (OIE, 2014). The time consuming nature of microbiological isolation of the causative agent of CBPP from clinical sites and inability of most developing countries like Nigeria to employ test and slaughter policy, has led to the use

Table 1: Annual prevalence of CBPP-like lesions among cattle at slaughter in selected abattoirs in Adamawa state (2006-2016)

LGA	Variables	Year											All years	
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total ($x10^3$)	Prevalence (95% CI)
Ganye	No. slaughtered ($x10^3$)	1.58	1.24	1.73	1.62	1.94	2.38	1.32	1.80	2.07	2.43	2.18	20.30	8.97 (8.56-9.41)
	No. with lesions ($x10^3$)	0.15	0.11	0.11	0.24	0.19	0.22	0.13	0.11	0.18	0.22	0.17		
	Prevalence(%)	9.29	8.94	6.07	14.80	9.69	9.26	9.98	5.88	8.88	8.86	7.92		
Mubi	No. slaughtered ($x10^3$)	3.82	3.55	4.81	4.35	4.08	3.99	4.07	4.68	1.65	0.83	4.48	40.28	5.53 (5.30-5.74)
	No. with lesions ($x10^3$)	0.21	0.20	0.28	0.23	0.21	0.20	0.21	0.26	0.10	0.05	0.30		
	Prevalence(%)	5.37	5.49	5.78	5.29	5.13	4.99	5.09	5.65	5.94	5.42	6.63		
Yola	No. slaughtered ($x10^3$)	18.51	15.99	16.86	16.49	13.59	14.35	12.95	16.41	18.07	19,.25	18.65	181.12	2.42 (2.35-2.49)
	No. with lesions ($x10^3$)	27.7	19.9	29.1	29.8	73.1	69.9	37.7	25.5	41.7	46.8	36.9		
	Prevalence(%)	1.50	1.24	1.73	1.81	5.38	4.87	2.91	1.55	2.31	2.43	1.98		
All LGAs	No. slaughtered ($x10^3$)	23.91	20.75	23.40	22.45	19.61	20.71	18.34	22.88	21.79	22.51	25.32	241.70	3.49 (3.41-3.56)
	No. with lesions (x10)	0.63	0.51	0.67	0.77	1.13	1.12	0.72	0.63	0.70	0.73	0.84		
	Prevalence(%)	2.63	2.43	2.88	3.42	5.75	5.40	3.91	2.73	3.21	3.23	3.31		
	95% CI	(2.43-2.84)	(2.23-2.66)	(2.67-3.11)	(3.19-3.67)	(5.43-6.09)	(5.10-5.72)	(3.63-4.20)	(2.53-2.95)	(2.95-3.45)	(2.10-3.48)	(3.10-3.54)		

No = number; LGA = Local Government Area; p=0.001

of post-mortem examination as well as other affordable diagnostic tests for CBPP surveillance (Danbirni *et al*., 2010; Egwu *et al*., 2012). From the available reports, a lesion-based prevalence study in Adamawa state was conducted by Aliyu *et al*. (2000), which as at present do not give a true picture of the disease because the study was carried out more than a decade ago.

The present study established a prevalence rate of 3.49%. This finding is higher than previous reports; 0.29% (Aliyu *et al*., 2000) for 1988-1997 for five northern states; 0.13% (Adamu & Aliyu, 2006) for 1988-1997 for Borno state; 0.01% was reported in Zaria, Kaduna state (Alawa *et al*., 2011) and 2.60% (Gumel *et al*., 2015) for dry season abattoir prevalence in Jigawa state, all in northern Nigeria. The higher prevalence observed in this study may indicate the endemic nature of the disease, increased and unrestricted cattle movement, porous nature of borders among other factors. The finding of this study is lower than the reports of Wade *et al*. (2015) who reported gross lesion prevalence of 29.7% in Cameroun. Although CBPP has been reported to be endemic in Cameroun (Yaya *et al*., 2008), this may likely serve as a source of infection to states in Nigeria that share international boundary.

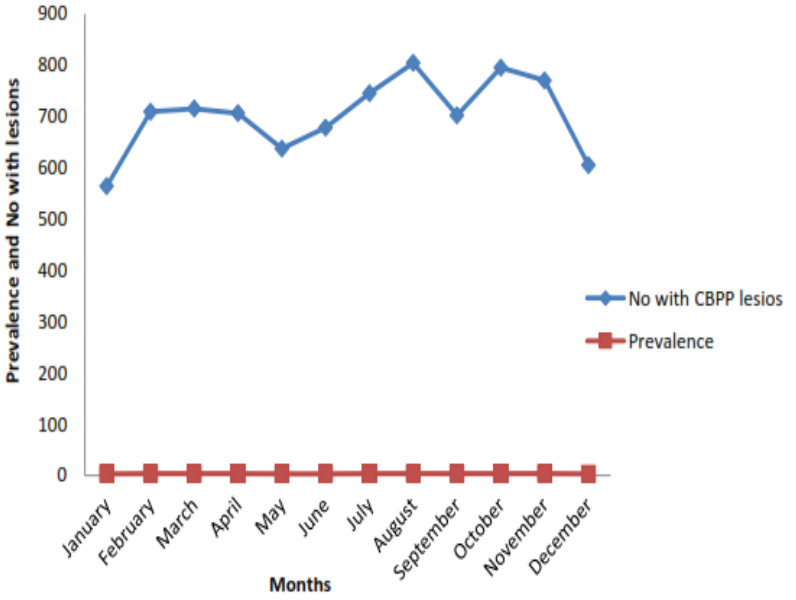

Figure 2: Monthly prevalence of CBPP-like lesions among cattle at slaughter in Adamawa state (2006-2016)

Prevalence of CBPP lesions was higher in Ganye and Mubi as compared to Yola. This is most likely because the two local government areas share an interstate and international boundary in addition to having an international cattle market each. During market days, cattle are pooled from neighbouring LGAs, states and the border country, and this may lead to introduction of CBPP into the area. This corroborates with the previous findings (Egwu *et al*., 1996; Aliyu *et al*., 2000).

In comparison to other months, low prevalence rates were recorded in December and January. The finding of this study suggests that CBPP is prevalent in all months of the year in Adamawa state irrespective of the season. This contradicts the findings of Alhaji & Babalobi, (2015) and Gumel *et al*. (2015) who reported higher prevalence during dry season; and also Adamu & Aliyu, (2006) who reported higher prevalence in rainy season. The persistence of CBPP throughout the year is a pointer that much needs to be done about the disease in this part of the country. The increased prevalence of CBPP in Adamawa state may also be connected to increased public, communal and civil unrest so prominent in the Northeastern Nigeria where nomadic herdsmen migrate with their animals from one area to another coupled with fragmented veterinary services (Aliyu *et al*., 2000). This may lead to introduction of apparently healthy carrier cattle from infected area or herds to another leading to outbreak of CBPP (Egwu *et al*., 2012).

The findings in this study strengthen previous reports from some African countries which showed the prevalence of CBPP lesions in cattle. In Cameroun, Wade *et al*. (2015) reported 29.7%, 1.6% and 3.4% using gross lesions, isolation and polymerase chain reaction respectively. In Tanzania, Swai *et al*. (2013) reported a CBPP prevalence of 0.91%. Prevalence of 3.60% was reported in Zambia (Phiri, 2006).

The prevalence of CBPP based on gross lesions does not give a true picture of the disease as compared to culture and molecular diagnosis. This is because many other diseases are responsible for gross pathological lesions on lung tissues. There was a report where the causative agent was isolated from apparently normal lung tissues (Wade *et al*., 2015). It is pertinent to note that true reasonable CBPP prevalence value would involve isolation and molecular identification of the organism from

suspected tissues; this tool was not employed in this study. Therefore, our findings are likely to be at variance with true prevalence and should be interpreted with caution. The number of suspected CBPP lesions detected in this study might have been higher, but due to debilitating state of our abattoirs and slaughter slabs, inadequate personnel and reporting system in the study area, most chronically infected animals are slaughtered outside the designated abattoirs as earlier reported (Adamu & Aliyu, 2006).

From the findings we conclude that CBPP is endemic in Adamawa state and widespread irrespective of the season. The high prevalence of CBPP in the study area indicates that surveillance and control measures by stakeholders were insufficient. Therefore, we recommend that government should increase funding in the control of the disease, restrict cattle movement and provide cattle ranches.

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