Sero-prevalence of contagious bovine pleuropneumonia and its potential risk factors in selected sites of Western Oromia, Ethiopia

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Abstract

Contagious bovine pleuropneumonia (CBPP) is a disease of cattle caused by *Mycoplasma mycoides subsp. Mycoides* small colonies and it is one of the most important threats to cattle health and production in Ethiopia, such as at livestock farm of Bako Agricultural Research Center (BARC) an outbreak of contagious bovine pleuropneumonia occurred in May, 2011 and many animals were affected and died before the disease was identified. Therefore, this study was designed to determine the seroprevalence of contagious bovine pleuropneumonia in the selected districts of Western Oromia Zones as well as to assess the risk factors associated with the occurrence of the disease. Therefore, a cross-sectional study design was conducted from November 2013 to March 2014 in three selected districts from three Western Oromia Zones. A total of 386 sera were examined for the presence of specific antibodies of the disease by using competitive enzyme linked immunosorbent assay (cELISA). In this study, districts, peasant associations, age, sex, breed and body conditions were considered as risk factors. Thus, the overall seroprevalence of contagious bovine pleuropneumonia in this study was 28.5%. The seroprevalence of contagious bovine pleuropneumonia at districts level were 40.3%, 19.0 % and 5.7 % in Gobbu-Sayyo, Bako-Tibbe and Horro district, respectively. There was a statistically significant variation ($p < 0.05$) in prevalence of the disease among the districts. However, age, sex, breed and body condition were not significant ($p > 0.05$) with the serostatus of the animal. In conclusion, the present study indicated that the overall prevalence of CBPP in Western Oromia Zones was high, This warrants the need of the institute to follow appropriate preventive and control measures to stop further spread of the disease and appropriate controlling and prevention should be designed in general as a country level and further study should be done in the future to know the temporal pattern of the disease.

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Keywords: Seroprevalence, CBPP, Risk factors, cELISA, Western Oromia Zones, Ethiopia

Introduction

Contagious bovine pleuropneumonia (CBPP) is an infectious and contagious respiratory disease of *Bovidae* caused by *Mycoplasma mycoides* subsp. *mycoides* "small colony" (*Mmm*SC) with a major impact on livestock production and a potential for rapid spread. It is one of the most important infectious diseases of cattle in Africa (OIE, 2002). With the imminent eradication of Rinder pest, CBPP has become one of the most important cattle disease presenting significant setback to livestock development in Africa in general and Ethiopia in particular.

CBPP is endemic to parts of Africa, parts of India and China; with minor outbreaks in the Middle East. Countries free of CBPP include the US, UK, and Australia. In almost all African countries CBPP is a fortifiable disease with official controls on the import of cattle. Despite these control, there are nomadic people which move freely across borders of certain countries such as the Fulani in West Africa and the Maasai in east Africa which may have contributed to CBPP spread. Wars, famine and inadequate financing of veterinary departments have resulted in CBPP running riot in east and central Africa (Radostitis *et al.*, 2006). In World Animal Health organization, reported outbreaks of CBPP in 20 countries, with the highest number of cases in Ethiopia. Ethiopia is one of the African countries were CBPP is causing enormous economic losses through cattle morbidity and mortality. Although there is no systematic epidemiological investigation to show the distribution and impact of CBPP in the country, it is considered as the major disease of cattle in the country especially in pastoral and agro-pastoral areas (OIE, 2008).

In western Oromia of the farming communities there are different animal diseases of unknown etiologic agent which are often reported, affecting production and productivity of livestock and threatening the livelihood of small scale farmers in the area. In East Wollega and Horro Guduru zone, an assessment was made on the overall food security situation of this area. Among the main problems reported, feed shortage and massive cattle death attributable to prolonged dry season and diseases of unknown etiologic agent. The disease that caused massive cattle death at that time was tentatively

diagnosed as pasteurellosis and/or it might be other respiratory disease like CBPP (UN-OCHA, 2003).

At livestock farm of Bako Agricultural Research Center, an outbreak of respiratory disease of cattle occurred in May, 2011, where significant proportion of animals were affected before the disease is diagnosed as CBPP (NAHDIC, 2011) which is un published by National Animal Health Diagnostic and Investigation Center (NAHDIC) with collaboration of Bako Agricultural Research Center. As a result, the center was decided not to distribute cross breed heifers or any cattle from the center for farmers until the problem is addressed and further CBPP surveillance is conducted to know the presence and distribution of the disease in the area. So far there was no systematic study conducted to look into the status of this economically important disease in the area. Hence, the objectives of this study were to identify the seroprevalence and the associated risk factors of CBPP in the study area.

Materials and Methods

Description of the study area

The study was carried out in three selected zones (Western Shoa, Horro-Guduru Wollegga and Eastern Wollegga) and from each zone only one district was selected (Bako Tibbe, Gobbu Sayyo, Horro). Bako Tibbe district is located in western part of Ethiopia at 238 km from Addis Ababa. The district has an altitude ranging from 1300-2998 meter above sea level and the average annual temperature ranging from13.7 ^{o}C to 27.8^{o}C. The livestock population of the area is (Cattle 137 343, Sheep 12 502, Goat 24 212, Horse 5685, Mule, 1023, Donkey 8415 (BTWOARD, 2012). Gobbu Sayyo district is located 281 km west of Addis Ababa at an altitude 1650 meter above sea level. The temperature of the area ranges from 13.6 ^{0}C to 28.8 ^{0}C. This district has 226 791 of Cattle, 5 334 of Sheep, 9 253 of Goat, 72 of Horses, 601 of Mules, 3 300 of Donkeys (GSWOARD, 2011). Horro Guduru district is located in Horro Guduru wollegga zones to the west of Addis Ababa on 314 km, with altitude of 2430 meter above sea level. The temperature of the area ranges from 10.78 ^{0}C to 22.32 ^{0}C. The livestock populations in the district were 362,507 cattle, 118,389 sheep, 29,214 Goats, 85,557 Poultry, 38,523 horses, 4,007 Mules and 18,545 donkeys as reported by (HWRDO, 2009).

Study animals

The study animals include all cattle populations which were kept under extensive and intensive husbandry systems. Cattle above six month old age both cross and local bred of cattle and those with no history of vaccination before one year back were used.

Study design

A cross-sectional survey was carried out in three zones of the Western Oromia Regional State namely, Horro Guduru wollegga, Eastern Wollegga and Western Shoa. From each zone only one district was selected purposively based on nearby of Bako Agricultural Research Center research farm (Bako Tibbe, Gobbu Sayyo, Horro) and finally from each district two peasant associations (PA's) were purposively selected based on the district livestock population, nearby Bako Agricultural Research Center and disease prevalence of the area. For example, from BakoTibbe district (Sadanqixxe and DembiDima), from GobbuSayyo district (Ongobbo and Kejo) from Horro district (Gitilo and Lakku) and BARC research farm was also included.

Sampling frame and sample size determination

The sampling frame consisted of a list of districts and associated cattle population and a total of 386 samples were selected based on district livestock populations and PAs size of the district such as Bako Tibbe (100), Gobbu Sayyo (216), Horro (70). The population in each village could not be obtained except the list of the villages. The sampling methods were purposive sampling based on CBPP status namely, outbreak area, suspected area, and free area. Since the approximate prevalence of the disease in the region was not known, 50% expected prevalence and a 5% absolute level of precision was considered to calculate the number of animals to be sampled (Thrusfield, 1995). However, a totally of 386 sero-samples were collected from the three districts.

Sample collection

Animals were restrained by owners and 10 ml of blood sample were collected from the jugular vein using vacutainer tubes. The samples were kept under the shade in a slant position for twenty four hours. The sera sample were transferred to serum tubes, labeled with a code and kept at - 20 ^{0}C until they

were tested. Corresponding to each sample code, the age, breed, body condition, site and sex of every animal's information were collected and registered on a separate case book. Therefore, in this study, districts, PAs, age, sex, breed, body condition were considered as risk factors.

Laboratory test

A total of 386 serum samples were collected from the study areas (Horo Guduru Wollega, West Showa, East Wollega Zones and Bako Agricultural Research Center farm) and were submitted to National Animal Health Diagnostic and Investigation Center (NAHDIC), Sebeta and sera were examined for the presence of specific antibodies against *Mycoplasma mycoides* sub species *mycoides* small colony type by using competitive enzyme linked immunosorbentasssay (cELISA).

Data analysis

The collected data were stored in Microsoft office excel 2007 spreadsheet. Statistical analyses were performed using SPSS version 20 software. The overall sero-prevalence of CBPP was determined using descriptive statistics. Sero-prevalence was calculated by dividing the number of positive test results by the total number of animals tested. Chi-square test was used to determine association between explanatory variables and the serostatus of the animals. In all analyses confidence level of 95% and p–value of 0.05 was used for statistical test of significance.

Results

Prevalence of contagious bovine pleuropneumonia (CBPP) using c-ELISA

The overall seroprevalence of CBPP in the study area was 28.5 %. The highest CBPP seroprevalence (40.3%) was observed in Gobbu Sayyo district of Eastern Wollegga Zones while the lowest seroprevalence (5.7%) was recorded in Horro district of Horro Guduru Wollegga Zone. There was a statistically significant variation ($p < 0.05$, $\chi 2 = 64.13$) in CBPP seroprevalence among the three districts (Table 1).

Table 1: Individual animal level seroprevalence of CBPP in Western part of Oromia, Ethiopia

District	Number of animals tested	Number of positive	% positive sample	95 % CI	X^2 (P- value)
Bako-Tibbe	100	19	19	11.8 – 28.06	64.13(0.001)
Horro	70	4	5.7	1.5 – 14.00	
Gobbu-Sayyo	216	87	40.3	33.6 – 47.1	
Total	386	110	28.5	24.04 – 33.2	

Among, the seven sampled villages the prevalence was the highest (58.8%) in Kejo of Gobbu Sayyoo district and the lowest prevalence (4.8 %) was recorded in lakku of Horro district. There was a statistically significant variation ($p < 0.05, \chi 2 = 73.73$) in CBPP seroprevalence among the seven villages (Table 2).

Table 2: Animal level seroprevalence of CBPP in the sampled villages of the three districts

Site (Villages)	Number of tested	Number of positive	%positive sample	95 % CI	X^2 (P- value)
Ongobbo	67	27	40.2	28.4 – 52.99	
Kejo	51	30	58.8	44.1 – 72.4	
BARC farm	98	30	30.6	21.6 – 40.7	
Gitilo	29	2	6.8	0.84 – 22.7	73.73 (0.001)
Lakku	41	2	4.8	0.59 – 16.5	
Sadan Qixxe	52	5	9.6	3.1 – 21.02	
Dembi Dima	48	14	29.01	16.9 – 44.06	
Total	386	110	28.4	24.04 – 33.2	

Host related potential risk factors like sex, age, breed and body condition of the animals were assessed with CBPP sero status of the animal show ever, none of these factors significantly explain ($p > 0.05$) the occurrence of CBPP.

Table 3: Seroprevalence of CBPP against various host demographics

Variables	Number of tested	Number of positive	% positive sample	95 % CI	X^2 (P- value)
Sex					
Male	142	44	30.9	23.5– 9.2	0.683(0.407)
Female	244	66	27.04	21.5- 3.08	
Age					
Young	133	34	25.5	18.3– 33.8	0.857(0.409)
Adult	253	76	30.3	24.4– 36.0	
Breed					
Local	343	94	27.4	22.7– 32.4	1.802(0.209)
Cross	43	16	37.2	22.9– 53.2	
Body condition					
Poor	113	26	23.00	15.6– 31.8	4.384(0.114)
Good	91	33	36.2	26.4– 7.00	
Medium	182	51	28.02	21.6– 35.1	
Total	386	110	28.4	24.04-3.28	

Discussion

The result of the present study indicated that CBPP was found to be one of the major cattle health problems in Western Oromia Region. In this investigation a total of 386 serum samples were tested from the three zones of western Oromia Regional state and the overall seroprevalence of CBPP in the study areas was 28.5 % (CI= 24.04 –33.2) (Table 1). The finding was similar result to the work of Fayisa Ragassa (2001) which reported seroprevalence of 28%, in Bodji district of Western Wollegga and in addition, the finding of this result somewhat related to the report of Desta Bakele (1997) which was reported a seroprevalence of 32.5% in Western Ethiopia. The overall seroprevalence of CBPP in the present study was lower than the findings of Gedlu Mokonnen (2004) who reported seroprevalnce of 39% in Somali Regional state and Dejene Wendimu (1996) who reported a seropositivity of 56% in North Omo.

However, the overall sero-prevalence of CBPP in the current study was higher than that of Ahmed Ibrahim (2004), Schnier *et al.* (2006), Gashaw Tadese (1998), Matua Alumira *et al.* (2006) and Dawit Kassaye *et al.* (2013) who

reported seroprevalence of 9.4 % in Borena, 9.7 % in south western Kenya, 9.1 % in Northwest Ethiopia, 16 % in Kajiado District Kenya and 4 % in and around Adama, respectively. Similar suggestion was also given in the study of Somale region, the highest herd sero-prevalence was observed in Mieso district (100 %) followed by Qabribeyah (75 %) and in Afdem (71.4%) (Gedlu Mokonnen, 2004). In Western Gojam and Awi zone the highest sero-prevalence was also observed in Banja district (66.3 %) followed by Dangila (41.7%) and Denbecha (33.3%) (Gashaw Tadese, 1998). The variation in the prevalence of CBPP reported from different part of Ethiopia in particular and other countries in general could be due to difference in agro-ecological system, animal management, production system, population density and the types of tests used to evaluate the seroprevalence.

In the present study seroprevalences recorded among the districts ware highly different from each other such as (40.27 %) in Gobbu Sayyo district, (19%) in Bako Tibbe (19 %) district and (5.7 %) in Horro district. The result of this study revealed that there is higher statistically significant difference of prevalence was recorded in Gobbu Sayyo district ($P < 0.05$) (Table 1). This could be related due to different reasons such as the presence of large number of livestock population within the district, the presence of communal grazing and watering areas and also found nearest to BARC research farm were the outbreak of the disease occurred previously. Therefore, animals of this area were having higher probability of contact with each other as well as with the infected animals and easily exposed to different diseases.

In the present study there was a slightly prevalence difference among the sex. However, there was no statically significant difference with sex ($p > 0.05$). This result was contradicted with Schnier (2006) who reported statically significant difference among sex. The prevalence of 25.5% and 30.3% were recorded in young and adult age categories, respectively. In age categories the seroprevlence was no statistical significant difference ($p > 0.05$) between young and adult. This result is in agreement with the previous report by Emanuel (2013) and Matua Alumira*et al.* (2006) in which sero-positive in adults would be higher as compared to the young. So that low prevalence of infection in young was due to the decreased contact between the other animal because young animal don't move long distance as well as it may be due to c-ELISA test because the present study used only c-ELISA test to categorize the cattle as CBPP seropositive and negative. It is well understood that c-ELISA is more sensitive

in detecting cattle with chronic stage than any other test and it is more prone to miss individual animals at the early stage of infection or young animals (Muuka *et al.,* 2011; Schubert *et al.,* 2011). However, this result contradicted with the report of Masiga *et al.* (1995) who reported that young animals were susceptible to articular forms of CBPP than adult cattle.

In the present study there was no significance difference among body condition ($p > 0.05$) in the sero-status of the animals. This result in lines with the report of of Biruhtesfa Atnafie *et al.* (2015), in Bishoftu abattoir and export oriented feedlots around Adama town. In the present study there was no significance difference among breed of animals. This could be due to un proportional sample size (small number of cross bred) or the intensive management system of cross bred animals cause decreases the chance of exposure to diseases than that of local bred cattle which are usually kept in extensive management systems.

Conclusion

In general, the present study indicated that the overall prevalence of CBPP in Western Oromia Zones was high and confirmed that CBPP is one of the major threats to cattle production in western part of the country in particular and the whole country in general. Therefore, the institute follows appropriate prevention and control measures of the disease like short term intervention such as isolation of infected animals and strict vaccination with treatment of symptomatic animals must be started to stop further spread of the disease in the area. Both the federal and regional government of the country have to be emphasasised in controlling and prevention of this economically devastating disease and further continuous study should be done in the future in order to identify the temporal pattern of the disease in the country.

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