PREVALENCE AND ASSOCIATED RISK FACTORS FOR CONTAGIOUS BOVINE PLEURO PNEUMONIA (CBPP) IN MANA SIBU DISTRICT, ETHIOPIA

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ABSTRACT
Contagious Bovine Pleuro Pneumonia (CBPP) has become the most important cattle disease that hinders livestock development in Ethiopia. It is a disease of cattle caused by Mycoplasma mycoides subspecies mycoides small colonies (MmmSC) and one of the most important threats to cattle health with high morbidity and mortality. Therefore, cross-sectional study was conducted to determine the seroprevalence of CBPP and to assess the risk factors associated with the occurrence of the disease in Mana Sibu district of West Wollega zone Western Oromia from January 2020 to June 2020. A total of 389 sera were examined for the presence of specific antibodies of the disease by using competitive enzyme linked immunosorbent assay (cELISA). In this study, peasant associations, age, sex, herd size and market history were considered as risk factors. Thus, the overall seroprevalence of CBPP in this study was 13.90%. The seroprevalence of CBPP at peasant association level were 14.30%, 4.10%, 5.20% and 32.0 % in Wama Tobera, Wanasha, Mukerba and Gunfi peasant associations, respectively. There was a statistically significant variation ($p \leq 0.05$) in prevalence of the disease among the peasant associations, herd size and market history. However, age and sex were not significant ($p > 0.05$) with the serostatus of the animal. In conclusion, the overall prevalence of CBPP in West Wollega Zone, Mana Sibu district was 13.90% so, due to the behavior of the diseases since it is significant at herd level, which warrants the government 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.

Keywords: *CBPP; Seroprevalence; Risk factors; cELISA; cross-sectional; W/wollega; Ethiopia*

INTRODUCTION

Contagious bovine pleuro pneumonia (CBPP) is becoming a big problem in cattle production in western Ethiopia. CBPP is an infectious and contagious respiratory disease of *Bovidae* caused by Mycoplasma mycoides subsp. mycoides "small colony" (MmmSC) and endemic to parts of Africa, parts of India and China; with minor outbreaks in the Middle East (OIE, 2011). The disease is an immediate threat to livestock producers in the endemic regions of Africa, its implications in animal health is important in other geographical areas as well. Yearly losses directly or indirectly due to CBPP in Africa are estimated to be around two billion US dollars (FOA-OIE, 2003). Next to the eradication of rinderpest, CBPP is a prime concern in African continent (Amanfu *et al*., 1998).

In almost all African countries CBPP is a fortifiable disease with official controls on the import of cattle. In World Animal Health organization, reported outbreaks of CBPP occur in 20 countries, with the highest number of cases in Ethiopia. Ethiopia is one of the African countries where 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).

Contagious Bovine Pleuropneumonia remains the most important infectious disease of cattle in Ethiopia. It is one of the major threats in Ethiopia hindering and challenging the livestock production system (Alemayehu *et al*., 2014; Dele *et al*., 2014). In Ethiopia, various surveys have been carried out to estimate the prevalence of CBPP on livestock in different regions by various investigators. In Mana Sibu district where mixed farming is the mainstay of the communities, cases of animal diseases of unknown etiology were often reported. These diseases directly affect livestock production and productivity, consequently threatening the livelihood of small-scale farmers in the area. No previous investigation has been carried out to determine the prevalence of CBPP in this district. Even though cases and outbreaks reports had been coming to Bedelle Regional Veterinary Laboratory Center through West Wollega Zone Livestock resource and development Agency Office from Mana Sibu District, due to lack of kits this disease didn't systematically studied and information is so far scanty on the overall status of the disease and possible risk factors associated with it. Therefore, the present study was aimed to estimate the sero-prevalence of CBPP among cattle in Mana Sibu district and to identify possible major associated risk factors for the occurrence of the disease.

MATERIALS AND METHODS

Description of the study area

The study was conducted from January 2020 to April 2020 in Mana Sibu district West Wollega Zone, Oromia regional state of Ethiopia. Mana Sibu district is bounded on the south by Jarso district, on the north by the Benishangul-Gumuz Region, on the south by Begi district and on the south west by Nejo district. Mend is the district town which is found at 586 km on the West direction from Addis Ababa, capital city of Ethiopia. The climatic condition of the area is highland (0%), midland (70%) and lowland (30%) with average temperature 25^0C. The farming system practiced in the area is the mixed type with crop and livestock productions. The livestock population in the Mana Sibu district:- include Cattle; 378,980 Sheep; 30,463 Goat; 53,623 Equine; 42,490 and poultry; 465,928 (West Wollega Zone Livestock resource and development Agency Office, 2020).The estimated total population of Mana Sibu district was 182,336; with 89,661 and 92,675 are men and women respectively (CSA, 2007). West Wollega zone is near to Southern and Northern Sudan(Figure 1).

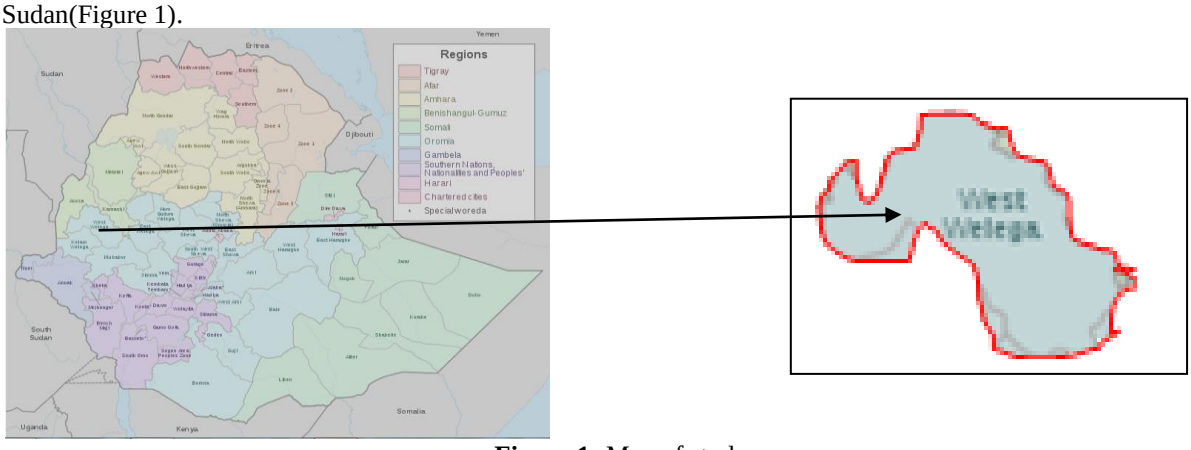

Figure 1: Map of study area

Source (M/Sibu District Livestock resource and development Agency Office, 2020)

Study Animals

The study animals include all cattle populations of four randomly selected peasant associations which were kept under extensive husbandry systems. Cattle above two years old age of local cattle and those with no history of vaccination before one year back were used.

Target Population

The target population included all cattle populations of Mana Sibu district and West Wollega zone which were kept under extensive husbandry systems.

Study design

A cross-sectional active surveillance was carried out in purposively selected Mana Sibu district based on history of previous suspected out breaks reports. Peasant associations (PA's) were randomly selected. Peasant associations randomly selected were Wama Tobera, Wanasha, Mukerba and Gunfi.

Sampling and sample size determination.

A total of 389 samples were selected from Cattle above one year old age of local cattle and those with no history of vaccination before one year back were used.

The sampling methods in randomly selected Peasant associations were done by using simple random sampling after having lists of farmers (households) from peasant associations' administrations. So, 98, 97, 97 and 97 serum samples were taken from Wama Tobera, Wanasha, Mukerba and Gunfi peasant associations respectively from appropriate animals.

Since the approximate prevalence of the disease in the west Wollega zone was not known, 50% expected prevalence and a 5% absolute level of precision was considered to calculate the number of animals to be sampled was 384 Thrustfield (1995). However, a totally 389 serum samples were collected from Mana Sibu district of four peasant association.

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 -20^0C until they were tested. Corresponding to each sample code, the peasant associations, age, sex, market history, herd size of every animal's information were collected and registered on a separate case book. Therefore, in this study peasant associations, age, sex, market history and herd size were considered as risk factors.

Laboratory test

A total of 389 serum samples was collected from the study areas and was submitted to Bedelle Regional Veterinary Laboratory Center. Sera were examined for the presence of specific antibodies against *Mycoplasma mycoides* sub species *mycoides* small colony type by using competitive enzyme linked immunosorbent assay (cELISA).

Data analysis

The collected data were stored in Microsoft office excel 2007 spreadsheet. Statistical analyses were performed using SPSS version 21 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 pleuro pneumonia (CBPP) using c-ELISA

The overall seroprevalence of CBPP in the study area was 13.90%. The highest CBPP seroprevalence (32%) was observed in Gunfi peasant association while the lowest seroprevalence (4.10%) was recorded in Wanasha peasant association. There was a statistically significant variation (P-value = 0.000) in CBPP seroprevalence among the four peasant association(Table 1).

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.434[a]	3	.000
Likelihood Ratio	38.721	3	.000
N of Valid Cases	389		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.47.

Table1: Relation of CBPP Result * Pissant Association

			Pissant Association				Total
			Wama Tobera	Wanasha	Mukerba	Gunfi	
CBPP Result	Negative	Count	84	93	92	66	335
		% within CBPP Result	25.1%	27.8%	27.5%	19.7%	100.0%
		% within Pissant Association	85.7%	95.9%	94.8%	68.0%	86.1%
		% of Total	21.6%	23.9%	23.7%	17.0%	86.1%
	1	Count	14	4	5	31	54
		% within CBPP Result	25.9%	7.4%	9.3%	57.4%	100.0%
		% within Pissant Association	14.3%	4.1%	5.2%	32.0%	13.9%
		% of Total	3.6%	1.0%	1.3%	8.0%	13.9%
Total		Count	98	97	97	97	389
		% within CBPP Result	25.2%	24.9%	24.9%	24.9%	100.0%
		% within Pissant Association	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	25.2%	24.9%	24.9%	24.9%	100.0%

Market history is another very important risk factor since the disease is highly contagious with higher CBPP seroprevalence (24.4%) was observed in cattle bought from market or local area while in born cattle seroprevalence(9.3%) which was a statistically significant variation (P-value = 0.000) between cattle born and bought from market(Table 2).

Table2: Relation of CBPP Result * market history

			Market History		Total
			Born	Bought	
CBPP Result	Negative	Count	245	90	335
		% within CBPP Result	73.1%	26.9%	100.0%
		% within Market History	90.7%	75.6%	86.1%
		% of Total	63.0%	23.1%	86.1%
	1	Count	25	29	54
		% within CBPP Result	46.3%	53.7%	100.0%
		% within Market History	9.3%	24.4%	13.9%
		% of Total	6.4%	7.5%	13.9%
Total		Count	270	119	389
		% within CBPP Result	69.4%	30.6%	100.0%
		% within Market History	100.0%	100.0%	100.0%
		% of Total	69.4%	30.6%	100.0%

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.775[a]	1	.000
Continuity Correction[b]	14.537	1	.000
Likelihood Ratio	14.637	1	.000
Fisher's Exact Test			
N of Valid Cases	389		

The other considered risk factor was herd size of farmers (1-5), (6-10) and above 10 with 6.7%, 13.8% and 20.2% respectively. CBPP seroprevalence with statistically significant variation (P-value = 0.026) of different herd size (Table 3).

Table 3: Relation of CBPP Result * Herd Size

			Herd Size			Total
			1-5	6-10	>10	
CBPP Result	Negative	Count	83	169	83	335
		% within CBPP Result	24.8%	50.4%	24.8%	100.0%
		% within Herd Size	93.3%	86.2%	79.8%	86.1%
		% of Total	21.3%	43.4%	21.3%	86.1%
	1	Count	6	27	21	54
		% within CBPP Result	11.1%	50.0%	38.9%	100.0%
		% within Herd Size	6.7%	13.8%	20.2%	13.9%

Total	% of Total	1.5%	6.9%	5.4%	13.9%
	Count	89	196	104	389
	% within CBPP Result	22.9%	50.4%	26.7%	100.0%
	% within Herd Size	100.0%	100.0%	100.0%	100.0%
	% of Total	22.9%	50.4%	26.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.262[a]	2	.026
Likelihood Ratio	7.663	2	.022
N of Valid Cases	389		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.35.

Table-4: Summary relation of peasant association, herd size and market history with finding of the study.

Risk factors		CBPP C.ELISA Result		Chi-square (X^2) Value	P-Value
		Negative	Positive		
Peasant association	W/Tobera	84(85.7%)	14(14.3%)	40.434[a]	0.000
	Wanasha	93(95.9%)	4(4.1%)		
	Mukerba	92(94.8%)	5(5.2%)		
	Gunfi	66(68.0%)	31(32.0%)		
Total		335(86.1%)	54(13.9%)		
Herd Size	1-5	83(24.8%)	6(6.7%)	7.267[a]	0.026
	6-10	169(50.4%)	27(13.8%)		
	>10	83(24.8%)	21(20.2%)		
Total		335(86.1%)	54(13.9%)		
Market History	Born	245(90.7%)	25(9.3%)	15.775[a]	0.000
	Bought	90(75.6%)	29(24.4%)		
Total		335(86.1%)	54(13.9%)		

The CBPP prevalence increase with age of cattle however, the association was statistically not significant (P-value > 0.05) (Table 5).

Table-5: Association of the age and sex with result of the study.

Risk factors		CBPP C.ELISA Result		Chi-square (X^2) Value	P-Value
		Negative	Positive		
Age	2-5	206(88.4%)	27(11.6%)	2.760[a]	0.252
	6-10	126(82.9%)	26(17.1%)		
	>10	3(75%)	1(25%)		
Total		335(86.1%)	54(13.9%)		
Sex	Male	117(82.4%)	25(17.6%)	2.594[a]	0.107
	Female	218(88.3%)	29(11.7%)		
Total		335(86.1%)	54(13.9%)		

The prevalence of CBPP in Male (17.6%) is slightly greater than Female (11.7%) however, it was statistically not significant (P-value > 0.05) (Table 5).

DISCUSSION

The current 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 389 serum samples were tested from the two districts of West Wollega zone of western Oromia Regional state and the overall seroprevalence of CBPP in the study areas was 13.9 %. The finding is almost in agreement with the work of Mamo *et al.* (2018), Schnier *et al.* (2006*)* and Tadesse (1998) who reported seroprevalence of 8.1 % in Gimbo District, Southwest Ethiopia, 9.7 % in south western Kenya and 9.1 % in Northwest Ethiopia, respectively. The overall seroprevalence of CBPP in the present study is lower than the findings of Matua-Alumira *et al.* (2006), Gelgelo *et al.* (2017), Wendimu (1996) and Adugna (2017) reported seroprevalence 16 % in Kajiado District Kenya, 25.3% in Sidama Zone, Southern Ethiopia, 56% in North Omo and 28.5% in Bodji district of Western Wollega. However, the overall sero-prevalence of CBPP in the current study is higher than that of Kebede *et al.* (2017) who reported seroprevalence of 6.9% in selected districts of East Wollega Zone. The highest herd sero-prevalence was observed in Mieso district (100 %). 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%) Tadesse (1998). The

variation in the prevalence of CBPP reported from different parts of Ethiopia in particular and other countries in general could be due to difference in agro-ecological system, animal management, production system, population density, livestock movement and the types of tests used to evaluate the seroprevalence.

In the current study seroprevalence recorded among the peasant associations were different from each other 14.3%, 4.1%, 5.2 and 32% in Wama Tobera, Wanasha, Mukerba and Gunfi respectively. The result of this study revealed that there is higher statistically significant difference of prevalence recorded in all peasant associations ($P < 0.05$) (Table 1). The result of this study revealed that there is higher statistically significant difference of prevalence is recorded in all peasant associations ($P < 0.05$, $X^2=7.262^a$) (Table 1). This could be related due to different reasons such as the presence of large number of livestock population within the peasant associations, source of cattle, the presence of communal grazing and watering areas.

In this study there was a slightly prevalence difference among the sex 17.6% and 11.7% male and female respectively. However, there was no statically significant difference with sex ($p > 0.05$, 0.107, $X^2 = 2.594^a$). This result is contrary to Schnier *et al.* (2006*)* who reported statically significant difference among sex. The prevalence of 11.6%, 17.1% and 25% were recorded in animals' age category of 2-5 years, 6-10 years, and > 10 years respectively. This result is in agreement with the previous report by Emanuel *et al*. (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 animals because young animals 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 is contrary to the report of Masiga *et al*. (1996) who reported that young animals were susceptible to articular forms of CBPP than adult cattle.
In the study there was significant difference among the market history of born (9.3%) and bought (24.4%) which was statistically significant with market history ($p < 0.05$, 0.000, $X^2 = 15.775^a$). The small sero-prevalence in born animals than bought was due the high contact time among diseased herd than those bought due to the diseases behavior.
In this study there was significant difference among herd size of house hold 1-5, 6-10 and >10 with 6.7%, 13.8% and 20.2% sero-prevalence respectively ($p < 0.05$, 0.000, $X^2=40.434^a$) due to transmission behavior of the disease in agreement with Tesfaye (2016). This result is not in agreement with the report of Biruhtesfa *et al*. (2015) in Bishoftu abattoir and export oriented feedlots around Adama town in which there were no difference among herd size.

CONCLUSIONS AND RECOMMENDATION

The impact that contagious bovine pleuropneumonia (CBPP) can impart in an economy of a given country is so vast and tremendous that it is not advisable to overlook like any of the ordinary routine disease of livestock that can be easily removed by treatment or self cure. In Ethiopia where great majority of cattle management and the production fashion was not technically and scientifically supported; and of either semi-intensive or completely extensive that enhance close or repeated contact of cattle, the propagation of CBPP is so simple and the output is very worsening. In general, the present study indicated that the overall prevalence of CBPP is 13.9% in Mana Sibu district, West Wollega zone of Western Oromia Regional State. It was confirmed that CBPP is one of the major threats to cattle production in western part of the Oromia in particular and the whole country.Generally, based on magnitude of prevalence, different risk factors and behavior of its transmission the following recommendations are forwarded:

- ▶Mass blanket vaccination supported by regular diagnosis, isolation of animals, stamping out of outbreaks.
- ▶ Endorsing of intensive sero-surveillance in different agro-ecological zones.
- ▶ Frequent training of veterinarians about diagnostic techniques.
- ▶Avoiding of re-introduction, close or frequent contact of cattle from neighboring countries or herds suspected of CBPP.
- ▶ Awareness creation among society about control and prevention of CBPP.
- ▶ Producing marketing standards for livestock and livestock products for small holder farmers which do have paramount importance for generation of income to support livelihood of individual thereby increase participation of small holders in the disease controlling process.

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