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A seroprevalence study of Contagious Bovine Pleuropneumonia (CBPP) and Assessment of Risk Factors on Indigenous Afar Cattle in Selected Districts of Afar Region, Afar, Ethiopia

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ABSTRACT

Contagious Bovine Pleuropneumonia CBPP) is a transboundary and economically devastating cattle disease rampant in lowland areas where majority of the country's cattle population are reared by the pastoral production system. Influenced by pastoral production system, CBPP has continued to be a productivity impedance to pastoral area settings. Studies suggested that CBPP is being prevalent in lowlands than mid and highland agro-ecologies. No matter how CBPP is a prime constraint to cattle producers in Afar region, research outputs on CBPP are unavailable compared to highland areas in the country. Thus, the objectives of the current study were to determine serological prevalence of CBPP and evaluate associated risk factors in selected districts of the region. A cross-sectional study design was conducted on local Afar cattle aged six months and above from February 2018 to January 2019 in selected Dubti, Asaita and Chifra districts, Afar region. From each randomly selected animal, 8ml blood was drawn from the jugular vein into plain vacutainer tubes. Determined by Thrusfield formula, a total of 420 serum samples were collected. Samples were labeled, packed and transported to Samara University for separation of serum and blood and sera stored at -20C. Using c-ELISA, antibodies against *Mycoplasma mycoides subspecies mycoides small colony* (MmmSc) were detected at National Veterinary Institute (NVI), Ethiopia. Data were analyzed using Stata 14.0 software. Using descriptive statistics, prevalence and frequencies were computed. Of 420 samples tested by c-ELISA, 158 samples were found to be positive for CBPP providing an overall prevalence of 37.6% with 95% CI (32.97-42.27). Of the three risk factors (age, sex and district) assessed by Chi-square ($\chi 2$), only two (age and district) were found to be associated with CBPP ($P<0.05$). Both age and district were significantly associated with the disease by bivariate logistic regression. However, only district was found to be significantly associated with CBPP by multivariate logistic regression analysis using 95 % CI and P-value less than 5%. The study addressed the current status of CBPP in the study areas to be higher, urging prompt and coordinated intervention to be set in place.

Keywords: CBPP, Cattle, Disease, Risk factors, Seroprevalence, Mycoplasma, Bacteria, Afar region

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1. INTRODUCTION

Livestock enterprises and animal production contribute significantly to the world economy, generate household income, food security, source of energy, draft power for crop cultivation or providing services, high-quality animal proteins and vitamins (meat, milk), creating job opportunities, manure, raw materials (hides and skins), social assets, cultural and environmental values, and sustain livelihoods (Perry *et al*., 2003, Bonnet *et al*., 2011; Naqvi and Sejian, 2011; Metaferia *et al*., 2011).

Cattle are generally regarded as the most important domestic livestock species in the world (Rushton 2009). The major biological constraints contributing to low productivity of cattle include the low genetic potential of animals, poor nutrition and prevailing diseases (Belay *et al*., 2012a; Belay *et al*., 2012b). Among the prevalent cattle diseases, foot and mouth disease (FMD), contagious bovine pleuropneumonia (CBPP), lumpy skin disease, trypanosomiasis, external parasites and tick-borne diseases are main animal health problems in the animal health context.

CBPP is one of the most important transboundary cattle diseases through its clinical effects on animals and far more severe than foot and mouth disease (FMD) (Nicholas, *et al*., 2008). Currently, it is recognized as a priority transboundary disease and has thus been categorized as the only bacterial disease in the OIE list A diseases (OIE, 2000).

Historically, CBPP has been known to occur in Europe since the 16th century though it gained a worldwide distribution only during the second half of the 19th century due to increased international trade in live cattle. In Africa, the disease was introduced first into South Africa in 1854 through importations of cattle from the Netherlands from where the disease spread to other African countries. CBPP has been eradicated from Australia, most parts of Europe, Asian and America) by the beginning of the 20th century through the application of restrictions to the movement of cattle and application of test and slaughter policies combined with compensation for livestock keepers (Andrews *et al*., 2004). However, CBPP is yet present in other regions of the world including Middle East, parts of Asia and until very recently, Southern Europe. Eradication policies are difficult to apply in most developing countries because of pastoralism, lack of economic resources and fragmented veterinary services (Neiman *et al*., 2009; Sacchini *et al*., 2012). The disease is endemic to parts of Africa and in almost all African countries and is a notifiable endemic disease (Radiostits *et al*. 2006) and considered to be the most damaging threat to the livestock industry in the region. The Pan African Program for the Control of Epizootics (PACE) identified CBPP as the second most important transboundary disease in Africa after Rinderpest (Tambi *et al*., 2006). Following the eradication of Rinderpest from Africa, CBPP has become the disease of prime concern in terms of epizootics affecting cattle in the continent (Amanfu, 2009).

CBPP is a highly infectious, acute, subacute or chronic septicemic cattle disease affecting lungs, pleura and occasionally joints in calves (Tambi *et al*., 2006; Radostits *et al*., 1994) caused by *Mycoplasma mycoides subspecies mycoides* small colony (OIE, 2008; Terlaak, 1992; Taylor *et al*., 1992)**.** The principal transmission route of CBPP is

through inhalation of infective droplets from active animals or carrier cases of the disease (Radiostits *et al*., 2008) and the disease is clinically characterized by anorexia, fever, weakness, emaciation, dyspnoea, polypnoea, cough and nasal discharges (OIÈ, 2002; Egwu *et al.,* 1996). Current advanced diagnostic techniques available for the diagnosis of CBPP include clinical signs, pathologic lesions (Pleurisy, lung hepatization), identification and isolation of the agent (the bacterium), immunoblotting, serology and PCR techniques (Goffe and Thiaucourt, 1998).

CBPP causes reduced productivity, disrupts local market system, international trade and commerce, exacerbate poverty, causes pain and suffering to animals, disrupts food supplies system, retards genetic improvement and inhibits sustainable investment in livestock production, increases disease control costs, reduces draft power, causes direct losses (deaths, stunting, reduced fertility, and changes in herd structure), added labour costs and profit losses due to denied access to better markets (Thornton, 2010; FAO 2009; Rushton, 2009; Tambi *et al*., 2006).

CBPP status in Ethiopia

Historically, there is no established document as to when and how the disease exactly entered Ethiopia (Amanfu, 2009). Economically viewed, CBPP is one of the most important diseases in Africa being widespread in West, Central and Eastern parts of the continent (Thomson, 2005) and the disease is endemic in Eastern Africa, including Rwanda, Burundi, Tanzania, Sudan, Ethiopia and Uganda (Lesnoff *et al*., 2002). According to OIE (2008), the highest number of outbreaks reported in 20 African countries (2006) was recorded in Ethiopia. An economic loss analysis study conducted by Tambi *et al*. (2006) in 10 African countries including, Ethiopia has estimated an annual loss of €14, 987,000 million attributed to CBPP threat.

In Ethiopia, according to reports of various outbreaks, national serosurveillance and research results from 1997 to 2010, CBPP was found to be present in almost all regional states (Tuli, 2010). CBPP has been reported in different regions of Ethiopia with an overall seroprevalence like 7.13% in Afar, 1.29% in Amhara, 12.05% in Benishangul Gumuz, 19.72% in Gambella, 5.17% in Oromia, 5.44% in Southern Nations Nationalities and People (SNNP), 0.9% in Somali, and 6.11% in Tigray in the year of 2004 (Gulima, 2011). In Ethiopia, CBPP is considered as one of the most important cattle diseases and continued to be an important impediment to livestock development in the country (Atnafie *et al*., 2015; Amanfu, 2009; Ministry of Agriculture (MOA), 2003). Studies were undertaken on CBPP so far revealing the existence of the disease in different parts of Ethiopia with prevalence ranging from 0.4% (from the bull at finishing phase for export in East Shewa zone that brought from Borena pastoral area) (Alemayehu *et al.*, 2015) to 96% in Western Gojjam (Yigezu and Roger, 1997).

CBPP in arid and semi-arid areas: The case of Afar region

Influenced by mobile pastoralism, CBPP is one of the most dominant diseases in arid and semi-arid areas in eastern, northeastern and southeastern parts of Ethiopia (Tegegne *et al*., 2009). As studies suggest, CBPP is a great plague and continued to devastate cattle on which many people are dependent in lowland areas (Ministry of Agriculture (MOA), 2003). The persistence of CBPP in pastoral areas could be

attributed to migratory lifestyle of pastoralists leading in turn for uncontrolled movement of cattle with continuous mixing at grazing fields, watering points and difficulty in accessing vaccination services (Amanfu, 2009). A regional survey reported by Gulima (2011) indicated the prevalence of CBPP to be 7.13% in the Afar region.

By implication, CBPP remained to be a major threat to the country as 40% of livestock populations are kept under the pastoral lowland production systems (CSA, 2011). Furthermore, a significantly higher seroprevalence was found in animals in lowland areas than highland and mid highland agroecologies (Mamo, 2016). CBPP is reported to be a major constraint to cattle production in arid and semi-arid pastoral areas (Kairu-Wanyoike *et al*., 2013), affecting livelihoods of many more thousand households. Furthermore, studies suggested that CBPP is prevalent in lowland areas than mid and highland agroecologies. No matter how CBPP is a prime constraint to cattle producers in Afar region in general and stated study districts in particular, research outputs on CBPP are unavailable in Afar region as compared to highland areas of Ethiopia. Therefore, the objectives of the current study were to determine prevalence of CBPP in selected districts in the region and evaluate risk factors associated with the disease.

2. MATERIALS AND METHODS

2.1 Study areas

The study was conducted from February 2018 to January 2019 in three selected districts of Afar region, namely Dubti, Asaita and Chifra where the entire study districts are situated in Zone one of the region. Afar region is one of the nine federal states of Ethiopia located in the northeastern part of the country. The region is geographically located between 39º34’ and 42º28’ East Longitude and 8º49’and 14º30’North Latitude. The region comprises 5 administrative zones, 32 districts and 331 kebeles, 28 towns, and 401 rural and urban kebeles (CSA, 2008).

2.2 Study design

A cross-sectional study design was applied to determine the prevalence of CBPP and associated risk factors over the selected study sites.

2.3 Study population

All indigenous Afar cattle aged 6months and above reared by pastorals and agropastoral in the selected sites were used for the study.

2.4 Sampling technique and sample size determination

Both randomized and purposive sampling techniques were applied for the selection of study animals (cattle) and study areas. While study zone, districts and kebeles were chosen purposively, households and study units/individual cattle were selected using a simple random sampling technique. As no previous study conducted on CBPP in cattle found in the selected areas, the present study has considered 50% expected prevalence, 95% confidence level and 5% absolute precision or marginal error. Based on these variables, the total number of animals to be included in the study got determined using the Thrusfield (2007) formula.

$$n = \frac{1.96^2 \times P_{exp} \times (1-P_{exp})}{d^2}$$

Where n= required sample size, d= desired absolute precision, P_{exp}= expected prevalence (50%).

Based on the formula, the total sample size was computed to be 384 cattle to be selected of the three districts. To minimize chance and increase precision of the outcome, the total number of study animals was increased to 420. Proportionally, a total of 128, 130, and 162 were collected from Asaita, Dubti and Chifra districts, respectively mainly based on density of cattle population and accessibility of kebeles in the study districts. Based on age animals were grouped into three categories namely (1) young (1 to 2 years), (2) adult (3 to 8 years), and (3) old (>8 years) according to Gatenby (1991) and Abera *et al*. (2010).

2.5 Methodology

A total of 420 sera samples each amounting to 8-10 ml of whole blood was collected from the jugular vein of cattle into disposable plain vacutainer tubes using 21 Gauge needle. Just following collection, blood sample containing vacutainer tubes were labeled and transported to the laboratory and kept overnight at room temperature to allow the blood clot. Correspondingly, each sample was identified along with age, study district and sex. Coded sera were transferred to cryogenic vials and stored in -20°C refrigerator at Samara University Veterinary Medicine Microbiology Laboratory to the time of transportation to National Veterinary Institute (NVI) for sera analysis.

2.6 Competitive Enzyme Linked Immunosorbent Assay (c-ELISA)

As recommended by OIE for CBPP test, c-ELISA technique was applied at National Veterinary Institute (NVI) serology laboratory, based on the manufacturer's instruction (CIRAD-EMVT, France) (Amanfu et *al*., 2000). In principle, c-ELISA test is based on a monoclonal anti-MmmSC antibody named Mab 177/5 (OIE, 2014). Technically, using microplates precoated with MmmSC purified lysate, test samples were premixed with the specific monoclonal antibody Mab117/5 in a separate plate and the mix was transferred to the precoated microplate with MmmSC antigen. Any MmmSC specific antibodies present in the sample will form an immune complex with MmmSC antigen coated on the microplate competing with Mab117/5 for the specific epitope. Following washing of unbounded material, an anti-mouse antibody-enzyme conjugate was added. In the presence of an immune complex between MmmSC antigen and antibodies from the sample, Mab117/5 cannot bind to its specific epitope and the conjugate is blocked from binding to Mab117/5. On the other hand, in the absence of MmmSC antibodies in the test sample, Mab117/5 can bind to its specific epitope and the conjugate is free to bind to Mab 117/5. The unbound conjugate was washed away and the enzyme substrate, Tetra methyl Benzedrine (TMB) was added. In the presence of the enzyme, the substrate is oxidized and leading to the development of blue color but yellow color will develop after adding the stop solution. Subsequent color development was inversely proportional to the amount of anti-MmmSC antibodies in the test sample. Eventually, optical density (OD) of individual reaction was measured at 450 nm using

a plate reader and samples having OD values greater 50 or more were considered positive.

3. Data management and analysis

Data were coded and fed into Microsoft Excel for further statistical analysis. Applying Stata version 14.0, (StataCorp, Texas, USA, 2015) descriptive statistics were computed to calculate the overall prevalence of CBPP and related figures associated with risk factors. Association between risk factors and disease positivity was assessed using Chi-square ($\chi 2$). Bivariate logistic regression was computed to estimate the magnitude of association between risk factors and the disease. Risk factors having significant association with the disease were further analyzed by multivariate logistic regression analysis using 95% confidence level (CI) and P-value less than 0.05.

3.1 Descriptive statistics

Descriptive statistics were employed to calculate the proportion of risk factors (season, sex, age and district) to test result as summarized in Table 1. The total collected sera were tested using c-ELISA. Accordingly, the total number of positive samples for each variable category with its respective percentage has been computed and summarized in Table 1.

Table 1: Summary of descriptive statistics

Variable		Samples tested	cELISA test result		Percentage (%)
			Negative(n)	Positive (n)	
Sex					
	Female	**377**	**234**	**143**	34.0
	Male	**43**	**28**	**15**	3.6
District					
	Dubti	130	89	41	9.8
	Asaita	128	59	69	16.4
	Chifra	162	114	48	11.4
Age					
	Young	48	29	19	4.5
	Adult	249	170	79	18.8
	Old	123	63	60	14.3

Of all serum samples tested (n=420) by c-ELISA in search of *Mycoplasma mycoides subspecies mycoides* small *colony type* (MmmSc) specific antibody, 158 serum samples were found to possess MmmSc specific antibody. Hence, the overall seroprevalence of CBPP over the three study districts was computed to be 37.6% with 95% CI (32.97-42.27).

Table 2: Overall prevalence of CBPP by cELISA

Samples tested	Negative Samples	Positive Samples	Prevalence (%)	95% Confidence Interval (%)
420	262	158	37.62	32.97 - 42.27

Association and bivariate logistic regression analysis

The association between the disease and risk factors **(**age, sex and district**)** was computed by Chi-Square (χ^2). As a result, only two risk factors (age, P<0.05:0.036) and district, P<0.05:0.000) were found associated with CBPP occurrence. However, sex has no significant association with CBPP occurrence (P>0.05: 0.696). Further, using 95% CI and P<0.05, bivariate logistic regression analysis was computed for age and district to estimate the magnitude of association (Crude Odds Ratio=COR) with the disease (Table 3).

Multivariate logistic regression analysis

Independently analyzed by binary logistic regression, age and district were found associated significantly with the disease. To compute the real significant contribution of associated risk factors without compounding effect, multivariate logistic regression analysis was computed with 95% CI and P<0.05 and only district has been associated significantly (P<0.05:0.000) with the disease but age has no significant impact on CBPP occurrence among the different age groups. Taking Dubti district as the reference category, those cattle found in Asaita district were 2.54 times more likely at risk of acquiring CBPP as compared to those animals found in Dubti district.

Table 3: Bivariate and multivariate logistic regression analyses

Variable	cELISA test result		Binary logistic regression analysis		Multivariate logistic regression analysis	
	Negative	**Positive**	**COR(95%CI)**	**P-value**	**AOR (95%CI)**	**P-value**
Age						
Young	**29**	**19**	**0.6878 (0.349-1.355)**	0.280	0.923(0.429 - 1.981)	**0.837**
Adult	**170**	**79**	**0.488(0.313 -0.759)**	0.001	0.607(0.362-1.0173)	**0.058**
Old	**63**	**60**	**1**		**1**	**0**
District						
Dubti	**89**	**41**	**1**		**1**	**0**
Asaita	**59**	**69**	**2.537 (1.528-4.217)**	0.000	2.509 (1.505- 4.185)	**0.000**
Chifra	**114**	**48**	**0.9139(0.554-1.508)**	0.725	1.089 (0.619-1.913)	**0.768**

Based on the magnitude of the current overall prevalence observed (37.6%), over the three selected Afar districts, CBPP could be considered as a prime concern for cattle health and productivity in the particular study districts as well in Afar region. It could also be inferred that CBPP is more prevalent in Asaita district (16.4%) as compared to Dubti (9.8%) and Chifra (11.4%) districts.

In Ethiopia, the prevalence of CBPP varies from the lowest prevalence of 0.4% reported by Alemayehu *et al*., 2014 in Borena Zone, Ermiyas *et al*., 2014 in Export quarantine centre of Adama by Dele *et al*. (2014) in Export quarantine centre of Adama to the highest CBPP prevalence in Ethiopia (96%) reported by Yigezu and Roger (1997) from Western Gojam.

The prevalence of CBPP among African countries also varies. The prevalence of CBPP in 10 African countries included: 8.1% in Sudan (McDermott *et al.*, 1987), 0.29% in Nigeria (Aliyu, *et al.*, 2000), 2.8% in Kenya (Wanyoike, 1999), 4% in Ethiopia (Fikru,

2001), 2.9% in Burkina Faso (Kane, 2002), 5.4% in Mauritania (Kane, 2002), 8.1% in Mali (Sery *et al*., 2014), 21.05% in Guinea (Soromou *et al*., 2014), 66% in the Gambia (Mbengue *et al*., 2013) and 0.43% in Senegal (Mbengue *et al*., 2013). According to reports, the highest CBPP prevalence (96%) was recorded in Ethiopia followed by Gambia (66%) and thirdly Mali (21.05%).

Similarly, the magnitude of CBPP prevalence has been so variable in different parts of Ethiopia. According to reports of various outbreaks, national serological surveillance and research results from 1997 to 2010, CBPP has been confirmed to be present in almost all regional states of Ethiopia (Tuli, 2010).

Compared to the current finding over the study districts (37.6%), other studies have reported lower CBPP prevalence: 5.1%. by Roger and Yigezu (1995) in North Omo,5.1% by Issa (2004) from Borena pastoral areas reported, a 10.3% by Mekonnen (2004) in Somali region, 4% by Kassaye and Molla (2012) during a period of 2010-2011 from export quarantine centers in and around Adama, 8.7% by Gedlu (2004) in Bishoftu, 9.4% by Ahmed (2004) in Borena zone and 9.5% by Kassaye and Molla (2013) on Adam export quarantine center, 10% by Molla and Delil (2014) from Dasench district of South Omo, 11.0% by Teshale et *al*. (2015) from Southern Tigray, 10.3% by Gizaw (2016) from Shinille zone of the Somali region, 28.5% by Daniel *et al*. (2016) from Western Oromia, 31.8% by Tolesa *et al*. (2105) from Amaro district, SNNP, 28% by Regassa (2001) from Bodji district of Western Wollega, 32.5 by Desta (1998) from Western Ethiopia, 9.1% by Gashaw (1998) from Northwest Ethiopia, 7.8% by Biruhtesfa *et al*. (2015) on Abattoirs at Bishoftu and Export Oriented Feedlots Around Adam, and 8.1% by Mamo (2016) from Gimbo district, SNNP.

However, the current finding was found to be in a close agreement with other reports including Gedlu (2004) who reported 39% prevalence from Somali Regional State. Similarly, the current report has agreed with the report of Desta (1998) who reported 32.5% in Western Ethiopia.

However, just based on magnitude, the current finding was lower some other prevalence reports: From Western Gojam and Awi Zone, Gashaw (1998) has reported 66.3%) in Banja district, 41.7% in Dangila district and 33.3% in Denbecha district. Similarly, Dejene (1996) has reported 56% CBPP prevalence in North Omo, Desta (1998) has reported a prevalence of 48% in Ilu Ababor and Wollega (Western Ethiopia), Roger and Yigezu (1995) reported 46% CBPP prevalence in Konso of SNNP, Yigezu and Roger (1997) reported 74 % CBPP prevalence in Borena Zone and finally 75% prevalence of CBPP in Western Wollega zone.

As indicated by different scholars, the prevalence of CBPP varies in Ethiopia as well as the across the African continent in general. The variation of findings on CBPP seroprevalence in different parts of Ethiopia could be due to variation in the temporal and spatial distribution of disease agroecological system, animal management (husbandry practices), biological or breed difference, communal grazing areas, production system, cattle population density, herd size, number of examined animals, livestock movement and sensitivity of serological tests used to evaluate seroprevalence (Daniel *et al*., 2016; OIE, 2014; Ebisa *et al*., 2015).

In the current study, district, age and sex were considered as risk factors. Accordingly, their association and strength of association with the disease were statistically evaluated. Based on the computations found, district was found to have a statistically significant association (P=0.000, χ^2 = 20.924) with the disease. Similarly, the age of animals was also significantly associated (P=0.006, χ^2 = 100.292) with disease seropositivity. On the other hand, sex (P=0.696, χ^2 = 0.153) had no significant association with the disease.

The current study has revealed the seroprevalence of CBPP at districts to be 9.8%, 16.4% and 11.4% for Dubti, Asaita and Chifra, respectively, indicating differences with statistically significant variation (P<= 0.05; 0.000) in the prevalence of antibodies among the districts. Other studies have reported similar findings (Tesfaye,2016); Tadese,2014; Daniel *et al*.,2016). The significant variation among study districts might be attributed to the presence of large number of livestock population within the districts, the presence of communal grazing and watering areas, degree of confinement/crowding, husbandry practices, agroecological difference and degree of cattle movements (OIE, 2014).

Referring to Gatenby (1991) and Abera *et al*. (2010), the age of study animals was divided into three groups: Young, Adult and Old. The current study has indicated infection rates of 4.5%, 18.8%, and 14.3% for young, adult and old age groups, respectively. Unlike sex, age had statistically significant association (P=0.006, $\chi 2$ = 100.292) with CBPP occurrence. However, multivariate logistic regression analysis showed that the significant association of age with the disease found by bivariate logistic regression analysis was found to be nonsignificant (**Table 3**) implying that age has real no contribution to CBPP occurrence and rather was confounded.

In the current study, the prevalence of CBPP in young animals was lower than both adult and old animals. In adult animals, the prevalence was observed to be higher than young animals. The higher prevalence in adults would be attributed to the fact that young animals do not move far away from houses; therefore, there is less chance to come into contact with infected animals. Besides, Masiga, Domenech and Windsor (1995) reported that young animals are more susceptible to acute forms of CBPP than adult cattle and thus acutely infected young animals may die of CBPP and not be available for testing. The current finding agrees with reports of Bashiruddin *et al.* (2005) who reported that with age infection resistance could also vary. According to Bashiruddin *et al*. (2005) animals, less than 3 years of age are less resistant to CBPP by experimental studies. In two separate experiments, it was shown that cattle over 3 years of age were more resistant to CBPP infection than younger animals. Besides, the present result was also in close agreement with previous study reported by Swai *et al*. (2013) and Matua-Alumira *et al*. (2006) who reported that seropositivity in adults was a bit higher than that in young animals. However, the study made by Kassaye and Molla (2012) and Andrew *et al*. (2004) contradicted with Bashiruddin *et al*. (2005) in which both described as calves were less positive to CBPP seroprevalence.

The lower prevalence of CBPP in older cattle as compared to adults would probably be associated with decreased immunity and resistance of older animals. Conversely,

the prevalence of CBPP in older cattle was higher as compared to young animals. This finding agrees with the claim that CBPP is a disease of older animals (Andrews *et al*. 2004). This might be attributed to long time exposure and life span of the older animals than the younger ones and the persistency of sequestrum for a long period of time in CBPP recovered animals.

In the current study, infection rate by sex was computed to be 3.6% and 34.0% for male and female respectively. However, there was no statistically significant difference with sex (P=0.696, χ^2 = 0.153). No matter how there was no statistically significant difference ($p > 0.05$), the higher prevalence of CBPP in female cattle agrees with Schnier *et al*. (2006) who reported a significantly higher prevalence in female animals. Similarly, the current finding agrees with the report of Tesfaye (2016). Similarly, Teshale *et al*. (2015) has also reported a difference in the prevalence of CBPP between male and female. The variation in the prevalence between male and female animals could be due to sampling error or the nonproportionality of samples collected, level of stress and degree of contact with young susceptible young/calves. However, the insignificant ($P<0.05$) difference of seroprevalence between sex may be due to similar exposure of animals to the disease since the disease is contagious that all animals in the herd can be affected and that a single diseased animal can serve as a continuous source of infection to the herd. The disease is mainly transmitted from animal to animal in aerosols. This organism occurs in saliva, urine, fetal membranes and uterine discharges (Radostits *et al*., 2008). This could play a great role in the uniformity of infection in both sexes.

4. CONCLUSION AND RECOMMENDATION

The current study has provided founding evidence against CBPP in Afar region. The overall magnitude of seroprevalence of the disease over the three selected districts suggested higher prevalence indicating higher level of economic challenge posed on cattle owners'. Furthermore, the study has identified contributory risk factors for disease occurrence. Of the three risk factors evaluated, age and study sites (districts) have indicated to have a significant association with seropositivity of the disease. In conclusion, the study findings strongly urge a prompted and coordinated intervention to be taken forward.

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6. Appendix

LIST OF ABBREVIATIONS

CBPP	Contagious Bovine Pleuropneumonia
c-ELISA	Competitive Enzyme Linked Immunosorbent Assay
CIRAD-EMVT	Centre de cooperation Internationale en recherche agronomique pour le développement- Département élevage et médecine vétérinaire
CSA	Central Statistical Agency
FAO	Food and Agricultural Organization
FMD	Foot and Mouth Disease
MmmSc	Mycoplasma mycoides subspecies mycoides Small Colony type
NGOs	Nongovernmental Organizations
NVI	National Veterinary Institute
OIE	Office of International Des Epizootics
PCR	Polymerase Chain reaction
PFE	Pastoralist Forum Ethiopia
SNNP	Sothern Nations and Nationalities People
SPSS	Statistical Package for Social Science