

Epidemiological Investigation of Contagious Caprine Pleuropneumonia in Afar Region, Ethiopia

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Abstract: An epidemiological survey on CCPP was undertaken to assess the distribution and prevalence of CCPP and its related risk factors in the Aba'ala district of the Afar region. The study was based on the sero-epidemiological investigation of the herd. A total of 200 serum samples was collected from goats and used to investigate for the presence of antibodies against CCPP using a complement fixation test. Out of the 200 goat sera samples tested, 61 were seropositive for CCPP, giving an overall seroprevalence of 30.5% in the study areas. There was non-significant difference ($p > 0.05$) with regard to the risk factors of sex (between female and male), age (between young and adult) and body condition score (between poor, medium and good) categories. Moreover, significant difference was observed between pastoral and agro-pastoral production system with seroprevalence of 43.9% and 27.2% respectively. From the associated risk factors herd size, herd type and husbandry systems were the significant risk factors associated with the occurrence of the disease with odds ratios of 2.73 (95% CI=1.14-6.605.82), 2.06 (95% CI=1.12-3.82) and 2.1 (95% CI=1.03-4.25) respectively. In conclusion, the CFT finding indicated that CCPP presents in the study area probably in subclinical form.

Key words: Afar • Ccpp • Districts • Sero- Epidemiology

INTRODUCTION

The small ruminant population of Ethiopia is about 25, 509, 004 sheep and 22, 786, 946 goats. Owing to their high fertility, short generation interval and adaptation even in harsh environments, sheep and intervals and adaptation even in harsh environments, sheep and goats are considered as an important asset of low-income households [1].

However, small ruminant production and productivity and producers' benefits are far below expectations due to diseases and other factors. Contagious caprine pleuropneumonia (CCPP) is one of the most severe economical important diseases of goats, causing major economic losses in goat rearing areas of Africa and Asia. Contagious caprine pleuropneumonia (CCPP) is a highly contagious, infectious fibrinous pleuropneumonia of goats caused by *Mycoplasma capricolum subsp capripneumoniae* (Mccp), characterized by fever, respiratory distress with coughing, nasal discharge, high morbidity and mortality rates [2].

The presence of CCPP in Ethiopia had been suspected since 1983 and was confirmed later in 1990 by isolation and identification of Mccp following an outbreak

of CCPP in Ogaden, Eastern Ethiopia [3]. Since then the disease has been reported from different regions of the country [4]. The disease results in severe economic losses, because CCPP occurs in the most extensive goat-rearing areas of Ethiopia namely; Afar, Borana, Omo valley, West Gojjam and in the low land of Tigray [5].

In pastoral and agro pastoral systems, livestock is a key asset, fulfilling multiple economic, social and risk management functions. Nowadays, pastoralists have been shifting raising mixed species of animals from livestock (cattle, camel, sheep and goats) to only camel and goats since they are found these animals are more adapted to the ever-changing climatic condition leading to shortage of feed and water availability [6, 7]. Hence controlling diseases like CCPP which affects the productivity of goats will play a crucial role to ensure food security in the current study area. In this regards quantification of the level of disease and knowledge of specific risk factors is a prerequisite to formulating appropriate control strategies;

However, there is limited/lack of up-to-date information on the status of CCPP and on its risk factors influencing the spread of the disease in the current study area [8- 10].

Objectives of this research were; to determine the overall prevalence of the disease in the area and to identify associated risk factors for the occurrence of the disease.

MATERIALS AND METHODS

Study Area: Aba'ala *district* (formerly called Shiket) is one of the seven *districts* in Zone Two of Afar Regional State. It is located between 13° 15' and 13° 30' North latitude and 39° 39' and 39° 53' East longitude about 55km southeast of Mekelle. It is bordered by Tigray Regional State in the west. It is one of the smallest districts in the region, with an area of about 1700 km² (i.e. less than 2% of the area of the region). The district is divided into 11 kebelles: 1= Aba'ala town (Wuhdet village); 2= Wakrigubi; 3= Irkudi; 4= Hidmo; 5= Assengola; 6= Adiharemele; 7= Undasengola; 8= Galaiso; 9= Haridan; 10= Wossema= 11. The average elevation of the area is approximately 1, 500 meters above sea level with a range of 1, 300-1, 700m. The population of Aba'ala *district* is about 37, 943. Currently, over 69% of the people in the district are pastoralists who derive their livelihood solely.

From livestock and livestock products. The remaining 31% are agro-pastoralists who practice cultivation and trading alongside livestock rearing. The livestock population of the *district* is estimated at 156, 538 with a composition of 21, 834 camels, 29, 605 cattle and 4, 441 donkeys [11].

Study Population: Study population constitutes a total of 208 goats that were randomly selected.

Study Design and Sampling

Study Design: A cross-sectional serological survey with a multi stage simple random sampling method was employed in Aba'ala districts of Afar region. Peasant associations (PAs) were selected purposively based on previous history of the disease, husbandry system and ease of accesses with the help of district's agricultural office and then villages were selected by purposive sampling on the basis of prior information on the problem and accessibility in collaboration with the respective district animal health workers. Finally the required sample was collected proportionally from each village.

Sample Size and Sample Collection: The sample size was determined by using technique as recommended by Thrusfield [12] at 95% confidence interval and at an expected prevalence of 38.64% and thus the desired sample size was $n = 189$. In order to increase the accuracy

of the study results, it was increased by 10% hence a total of 208 goats were sampled. The blood sample was collected directly from the jugular vein using a plain vacutainer tube. The collected blood sample was allowed to stay at room temperature for 24 hours and the serum was harvested using cryovials and labeled and stored at -20°C in the refrigerator until it was tested. Information like herd size and type, age, sex, body condition score, husbandry system and history of vaccination were recorded during sample collection [13].

Serological Examination: The samples were tested using complement fixation test (CFT) according to standard test procedure at National Veterinary Institute, Debreziet, Ethiopia. Briefly, collected sera were decomplexed in a water-bath at 58°C for 30 min. Then, 25µl of veronal buffer was dispensed to each well of a U-bottomed micro-plate and 1/5 diluted sera were added to first column and diluted serially in two-fold dilutions (1/10, 1/20, 1/160). A 25µl aliquot of antigen was added to each well with 25µl of complement, which was agitated and incubated for 45 min at 37°C. Finally, 25µl of sensitized sheep red blood cells (RBC + haemolysin) was added, mixed well and incubated at 37°C for 45 min and kept at 4°C for 1 hour to allow the unlysed cells to settle. More than 50% haemolysis was considered as positive [14].

Data Analysis: The association of the potential risk factors with the occurrence of the disease was analyzed using Pearson's Chi-square using STATA software. The strength of association between the risk factors and the occurrence of the disease was assessed using Odds Ratio (OR) at the 95% confidence level using univariate regression. The significant risk factors were further subjected to multivariable stepwise logistic regression analysis to determine the major risk factor.

RESULT

In this study, a total of 200 goat's sera were collected and all samples were subjected to CFT of which 61 goats were found positive indicating overall sero-prevalence of 30.5% (Table 1).

The overall of seroprevalence based on the assumed risk factors was given in the Table 2. Accordingly, seroprevalence observed in female was 32.6%, while it was 27.1% in male. The seroprevalence between the two sexes was not statistically significant ($p > 0.05$). The seroprevalence of CCPP was found to be higher in young 34.7% and relatively lower in adult 26.9%, however there was no significant difference ($p > 0.05$) between them.

Table 1: Overall sero-prevalence CCPP

Total animals examined	No of positive	Sero-prevalence (%)
200	61	30.5

Table 2: Univariate logistic regression analysis of risk factors vs CCPP prevalence

Risk factors	Sample tested	No. of positive (%)	χ^2	P-value	OR (95% CI)	P-value
Sex						
Female	129	42(32.6)	0.63	0.43	1.30 (0.68-2.46)	0.429
Male	70	19 (27.1)			1	
Age						
Young	95	33(34.7)	1.43	0.23	1.45 (0.79-2.65)	0.23
Adult	104	28(26.9)			1	
Body condition score						
Poor	43	18(41.9)	4.06	0.13	2.23 (1.02-4.91)	0.046
Medium	74	23(31.1)			1.40 (0.69-2.83)	0.35
Good	82	20(24.4)			1	0.136
Herd size						
Small	40	9(22.5)	9.46	0.009	1	
Medium	89	21(23.6)			1.06 (0.44-2.59)	0.89
Large	70	31(44.3)			2.74 (1.14-6.60)	0.025
Herd type						
Single	103	24(23.3)	5.43	0.02	1	
Mixed	96	37(38.5)			2.06 (1.12-3.82)	0.021
Production system						
Agro-pastoral	41	18(27.2)	4.26	0.039	1	
Pastoral	158	43(43.9)			2.09 (1.03-4.25)	0.41

Similarly, sero-prevalence of 41.9%, 31.1% and 24.4% were recorded in poor, medium and good body condition categories respectively without statistical significance ($p>0.05$).

The sero-prevalence of 22.5%, 23.6% and 44.3% was observed in small, medium and large herd size categories respectively. The difference in sero-prevalence among the three herd size categories was significant ($p<0.05$). Large herd size category has shown significantly different ($p<0.05$) seroprevalence as compared to the small herd size category. The odds of the disease in large herd size category was 2.74 (95% CI=1.14-6.60) times more likely to occur as compared to in the small herd size. Moreover, sero-prevalence of 23.3% and 38.5% was observed in single and mixed (goat and sheep) herd type respectively. The difference in sero-prevalence among the two categories was significant ($p<0.05$). Mixed herd type has shown significant difference ($p<0.05$) seroprevalence as compared to single herd type. The likelihood of the disease in mixed herd type was 2.06 (95% CI=1.12-3.82) times more likely to occur as compared to single herd type. Furthermore, seroprevalence of 27.2% and 43.9% was observed in agro-pastoral and pastoral husbandry system respectively. The difference in seroprevalence in agro-pastoral and pastoral husbandry system was significant ($p<0.05$). Pastoral husbandry system has

shown significant difference ($p<0.05$) seroprevalence as compared to agro-pastoral husbandry system. The likelihood of the disease in pastoral husbandry system was 2.09 (95% CI=1.03-4.25) times more likely to occur as compared to agro-pastoral production system.

DISCUSSION

The overall seroprevalence of CCPP in the study area was 30.5%. This finding was relatively lower than the previous report of Hadush [13]. (38.64%) in the study area. The finding in the present study is about similar to Eshete [5] 31% in Hashim Nur export abattoir, Debre zeit. However it was relatively lower than the results reported by Mamo [14] 51.5% in East Shoa, Degeffa [15] 66.7% in Yabello and 35% in Konso, Zekarias [16] 36% in Arbaminch Zuria, Lema [17] and higher than the results reported by Ketema [18] 24% in Yabello, Mekuria and Asmare [9] 15.5% in Matiase [19] 10.88% in and around Dire Dawa, 22.49% in Afar region, Bereket [8] 13.2% in Borana and Guji lowland and Zekarias [16] 4.92% in Dire Dawa Provisional Administrative Council. The difference in the prevalence of the disease might be due to the type of tests used, the variation in the agro-ecology and husbandry systems and sampling of goats [20].

In this study significant difference is not observed between sex categories. This finding is in line with the reports of Eshete [5], Eskindir [6], Bereket [8], Mekuria and Asmare [9] and Hadush [13] in studies conducted in different parts of Ethiopia. This might be related to equal susceptibility of both sexes for the disease. Similarly there was no observed significant difference between young and adult age categories which agrees with the works of Hadush [13], Eshetu [21] and Gizawu [22].

On the other hand the result obtained in this study showed that the difference in seroprevalence among the various herd size categories was significant ($p < 0.05$) which was also reported by Bereket [9]. This was attributed to the fact that as herd size increase, the chance of contact between animals increase which enhances the chance of acquiring the infection. Being a contagious infection, the chances of spread of CCPP was high in a large herd, where the husbandry practices were not efficiently available and the individual animal care was not appropriately possible [20].

The difference in sero-prevalence among single and mixed herd type was found to be significant ($p < 0.05$). This might be due to the role of the sheep as reservoirs of Mccp organisms and in the dissemination of CCPP to the highly susceptible goats which has also been explained by Laikemariam [7]. Moreover there was a significant difference between pastoral and agro-pastoral husbandry system with a high probability to be seropositive for CCPP in pastoral areas. This might be due to owning of large herd size with mobile husbandry system and insufficient access to the veterinary service in pastoral areas relative to agro-pastoral husbandry system. Using multivariate logistic regression analysis it was observed that herd size, herd type and production system were the major risk factors associated with the occurrence of CCPP in this study [19].

CONCLUSION AND RECOMMENDATIONS

In this sero-epidemiological investigation the overall seroprevalence of 30.5% of CCPP was observed in the study area even though there was no history of disease outbreak and vaccination. This prevalence may be a potential risk for future outbreaks of the disease in the area. The outcome of the present findings also indicated that herd size, herd type and husbandry system were found as significant risk factors for the occurrence of disease in goats. In conclusion, the CFT finding indicated that CCPP presents in the study area probably in subclinical form.

In line with the above conclusion the following recommendations are forwarded:

- Appropriate control and preventive measures should be designed and implemented
- Awareness creation to the herdsman regarding associated risk factors.

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