Goats play a significant role in the socio-economy of Ethiopia because of their better adaptation to unfavorable arid environment and their suitability for resource poor farmers. Diseases affecting goats such as *Peste des petits ruminants* (PPR), contagious caprine pleuropneumonia (CCPP), *pasteurellosis*, and *pox* cause substantial losses through high morbidity and mortality. *Contagious caprine pleuropneumonia* (CCPP) which is caused by *Mycoplasma capricolum subsp. capripneumoniae* (Mccp) is a rampant and highly contagious animal disease with potential of rapid spread irrespective of national borders. The exact picture, dynamics and distribution of CCPP in areas bordering Tigray and Afar regions is not well documented. Hence, a cross sectional study was conducted to determine the seroprevalence of the disease in goats in three districts namely Kafta Humera and Alamata (Tigray) and Aba-'ala (Afar) and to check the potential of sheep in maintaining the disease. Proportions and chi-square test statistics were used to analyze the data. The tested serum samples were collected from 863 goats and 137 sheep; 282 (32.68%) and 25 (18.25%) were positive for antibodies of *Mycoplasma capricolum subsp. capripneumoniae* (Mccp) respectively using Complement Fixation Test (CFT). The sero-prevalence was higher in Alamata 123 (43.93%) followed by Aba-'ala 136 (38.64%) and Humera 23 (9.96%) and the variation was statistically significant (X²=76.00, P<0.0001). However, there was no statistically significant difference in the seroprevalence of CCPP in goats in both sexes (X²=3.619, P=0.0571) and age (X²=0.990, P=0.6095) groups. The finding of high seroprevalence of CCPP in sheep (18.25%) could indicate that sheep are potential carriers of Mccp, hence sheep could be considered as one potential reservoirs of Mccp infection warranting that control and prevention strategies such as vaccination in goats should include sheep as well.

**INTRODUCTION**

Goats being an important component of livestock sub-sector play a significant role in the socio-economy of the developing countries because of their better adaptation to the unfavorable arid environment and suitability for resource poor farmers [3]. *Peste des petits ruminants* (PPR), contagious caprine pleuropneumonia (CCPP), *pasteurellosis*, *sheep and goat pox* diseases cause substantial losses through high morbidity and mortality [21]. CCPP is defined as an infectious disease which clinically affects only goats [17] and it is one of those rampant and highly contagious animal diseases with potential of rapid spread irrespective of national borders [4]. *Mycoplasma capricolum subsp. capripneumoniae* (Mccp) is the causal agent of CCPP. Mccp originally known as the F38 biotype was first isolated in the Sudan, Tunisia, Oman, Turkey, Chad, Uganda, Ethiopia, Niger, Tanzania and the United Arab Emirates. CCPP was first reported in the mainland of Europe in 2004, when out breaks were confirmed in Thrace, Turkey, with losses of up to 25% of kids and adults in some herds [14]. Several tests may be used for serological diagnosis such as complement fixation test (CFT), passive haemagglutination test [13], latex agglutination (Robust test) [18] and indirect ELISA [24]. CFT remains the most widely used serological test for CCPP and it has been found to be more specific though less sensitive than the indirect haemagglutination test. Moreover; it is the official test recommended for international trade [14]. The exact picture, dynamics and distribution of CCPP in areas bordering Tigray and Afar regions is not well documented. Hence, the objectives of this study were to assess seroprevalence of CCPP in Alamata, Humera (Tigray) and Ab-'Ala (Afar) and to evaluate the presence of Mccp antibodies in sheep.

**MATERIALS AND METHODS**

Randomly selected goats (n=863) and sheep (n=137) with no history of vaccination for CCPP were used as a source of serum samples regardless of age, sex or status of health [23] and were grouped in to three age categories using dental formula [7]. 5-7 ml of blood was collected directly from jugular vein of each animal using sterile plain vacutainer tubes and needles [9] and was allowed to stand in slant position for 2-6 hours at room temperature until sufficient amount of clot is formed [2]. Then the samples were put at +4oc in the refrigerator till serum was extracted. Serum was then separated in to cryovials. All the samples were labeled (date, age, sex)
and stored temporarily at -20°C. Transportation to the referral laboratory National Veterinary Institute (NVI) was made using an ice box. The serum samples were examined for the presence of specific antibodies against *M. capricolum subsp. capripneumoniae* by using complement fixation test (CFT) in NVI. The test was under taken according to the standard operating procedures of [15]. The sera were tested at dilutions rates of 1/10, 1/20, 1/40 and 1/80. Data entry and analysis was made through JMP 5 statistical software. Proportions were used to calculate the prevalence of CCPP while X2 test was used to assess the status of the disease with age, sex and area. Results were reported as statistically significant if *P*-value was less than 0.05.

**RESULTS**

A total of 863 goats sera collected from the three study sites were tested and 282 (32.68%) was found to be positive for the presence of antibodies of *Mycoplasma capricolum* subsp. *capripneumoniae* considering at 1:20 dilutions and above as positive. The seroprevalence was higher in Alamata 123 (43.93%) followed by Aba’alla 136 (38.64%) and Humera 23 (9.96%) with significant statistical difference (X^2^= 76.00, P<0.0001) (Table 1). However, there was no significant statistical difference (X^2^= 1.806, P= 0.1790) in seroprevalence of CCPP between the two neighboring districts; Alamata 123 (43.93%) and Aba’alla 136 (38.64%). 74 (30.96%),105 (32.01%) and 103 (34.8%) of the goats with age between 6 months to 1 year ,1 to two years and greater than two years respectively were positive and there was no significant statistical variation (X^2^=0.990, P=0.6095) among the three age groups (Table 2). Contingency analysis of the sero prevalence of CCPP with respect to sex in goats also showed no significant statistical difference (X^2^= 3.619, P= 0.0571) between male 37.84 % (84/222) and female 30.89% (198/641) (Table 3). 137 sheep’s sera collected from the three woredas were tested for *Mccp* antibodies and 25 (18.25%) became positive and there was significant statistical variation (X^2^= 8.188, P=0.0042) in comparison to the prevalence in goats. The statistical analysis of the seroprevalence in sheep among the three districts indicated that there was a significant variation (X^2^=32.585, P< 0.0001) except between Alamata and Aba’alla (X^2^= 0.227, P=0.6337).

**Table 1:** Sero-prevalence of CCPP by study sites and species

<table>
<thead>
<tr>
<th></th>
<th>Goats</th>
<th>Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Positive (%)</td>
<td>No. Negative (%)</td>
</tr>
<tr>
<td>Alamata</td>
<td>123 (43.93)</td>
<td>157 (56.07)</td>
</tr>
<tr>
<td>Aba’alla</td>
<td>136 (38.64)</td>
<td>216 (61.36)</td>
</tr>
<tr>
<td>Humera</td>
<td>23 (9.96)</td>
<td>208 (90.04)</td>
</tr>
</tbody>
</table>

1 X^2^ = 76.000, DF = 2, P<0.0001 (significant for goat among the three sites)
1 X^2^ = 32.585, DF = 2, P<0.0001 (significant for sheep among the three sites)
* X^2^ = 8.188, DF = 2, P=0.0042 (significant between sheep and goat)

**Table 2:** Prevalence of CCPP in different age groups of goats

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. of Positive (%)</th>
<th>No. of Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 month – 1 year</td>
<td>74 (30.96)</td>
<td>165 (69.04)</td>
</tr>
<tr>
<td>1-2 years</td>
<td>105 (32.01)</td>
<td>223 (67.99)</td>
</tr>
<tr>
<td>Above 2 years</td>
<td>103 (34.80)</td>
<td>193 (65.20)</td>
</tr>
</tbody>
</table>

X^2^ = 0.990, DF = 2, P = 0.6095 (not significant)

**Table 3:** Prevalence of CCPP in goats with respect to sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>No. of Positive (%)</th>
<th>No. of Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>198 (30.89)</td>
<td>443 (69.11)</td>
</tr>
<tr>
<td>Male</td>
<td>84 (37.84)</td>
<td>138 (62.16)</td>
</tr>
</tbody>
</table>

X^2^ = 3.619 DF = 1, P= 0.0571 (not significant)

**DISCUSSION**

Based on the antibody titre 1:20 taken as positive threshold, the 32.68% (282/863) seropositivity of goats for CCPP antibodies was comparable with the reports made by [5] 29.08% in selected districts of Afar, [19] 29% in Wololo and North Shoa using CFT. Similarly 31% prevalence had been reported by [2] in an export abattoir from goats that had been collected from Afar, Borena, Bale and Jinka using CFT. Higher proportions of sero-prevalence were observed in other studies underwent in different times and areas in the country; a prevalence of 51.5% using CFT [6], 50 % using CFT [11], 53 % using B-ELISA [16] in east Shoa, Melkasedi (Hararge) and Gewane (Afar) respectively. This variation may be due to the situation of the disease during the time of sampling in the study areas. A relatively lower sero-prevalence of 16.5% using CFT [20], 1.3% using C-ELISA [1] and 0.56% using B-ELISA [25] in south Omo and Gamogofa, Diredawa and eastern Ethiopia respectively had been reported. The difference may be as a result of the temporal and spatial factors associated with sampling, the situation of the disease during the time of sampling and the variation in the specificity and sensitivity of the different serological tests employed. The prevalence of the disease has been evaluated between the three different study sites, Alamata (43.93%), Humera (9.96%) and Aba’Ala (38.64%), by using contingency analysis (chi-square) and the results...
revealed (P<0.0001) a highly significant statistical difference (Table 1) which is in agreement with [5, 20, 1] that reported the significant difference in the distribution of the disease among the different agro ecological zones. The prevalence of the disease in goats between Alamata (43.93%) and Ab-‘Ala (38.64%) was not statically significant (X^2= 1.806, P= 0.1790). This may be associated with the non restricted animal movement between the two neighboring districts of Afar and Tigray region and the highly contagious nature of \textit{Mccp} infection. The occurrence of the disease across age and sex factors showed that there was no significant statistical difference among the three age categories and between male and female goats (Table 2 and 3). This result was compatible with the similar observations made by [5, 20] in studies conducted in different parts of Ethiopia. It has also been reported that CCPP is highly contagious and fatal to susceptible goats irrespective of age and sex by [15].

These might also indicate that the humeral immunity to \textit{Mccp} infection is not age and sex dependent. Sheep being reared together with goats in the study areas, they were included in the investigation to weigh up their role in the dissemination of CCPP to goats, which has been described by [15] that goats are the only species to be clinically affected by \textit{Mccp} infection. A prevalence rate of 18.25% was observed in sheep in the present study. This is a relatively higher result obtained as compared to sero-prevalence report of 5% and 7% using B-ELISA by [12,22] respectively. The higher value might be associated with the higher sensitivity of CFT in contrast to B-ELISA [19]. The result clearly illustrates that sheep can act as reservoirs of \textit{Mccp} organisms and can play a tremendous role in the dissemination of CCPP to the highly susceptible goats which has also been explained by [10, 8] by isolating \textit{Mccp} organisms from apparently healthy sheep.

**CONCLUSION**

Although there were no official reports of outbreak and clinical cases of CCPP during the study period in the study areas, the CFT sero-surveillance had shown that CCPP exists at least in sub clinical level warranting the need for regular vaccination programs. More over; though the exact role of sheep in the epidemiology CCPP was not established, it can be concluded that sheep can have the infection with detectable antibody response. Thus, an over all epidemiological study of CCPP in goats and the role of sheep in maintaining and dissemination of CCPP need to be further studied to design best control strategies. Lastly, rapid, inexpensive, easily applicable diagnostic tests for primary screening of CCPP in field (for example, latex agglutination or capsular polysaccharide antigen antibody) should be developed adequately and be easily accessible as part of surveillance and control program in regional laboratories.
REFERENCES


