

Full Length Research Paper

Seroprevalence of contagious caprine pleuropneumonia in Dire Dawa provisional administrative council, Eastern Ethiopia

Eskindir Yousuf, Achenef Melaku* and Basaznew Bogale

Faculty of Veterinary Medicine, University of Gondar, Ethiopia.

Accepted 13 August, 2017

A cross-sectional study was conducted in and around Dire Dawa Provisional Administrative Council (DDPAC) from November, 2011 to March, 2012 to determine the seroprevalence of contagious caprine pleuropneumonia (CCPP) and to assess risk factors associated with seropositivity. In this study, 244 sera were collected from goats and subjected to complement fixation test. Out of the total sera tested, 12 (4.92%) were positive for CCPP. The seroprevalence of CCPP was significantly ($P < 0.05$) higher in adult (7.38%) than in young (1.05%) goats. There was non-significant variation with regards to the risk involvement of she-goat (4.67%) and buck (5.32%) in the flock, irrespective to the low and mid agro-climatic zones. Husbandry practices were found to play a significant role on the seroprevalence of CCPP as revealed in semi-intensive (13.64%) than in extensive (4.05%) husbandry system. Moreover, higher seroprevalence in large flock established significant contagiousness than in small flock size. In conclusion, this study indicated that CCPP is still prevalent in DDPAC region of Eastern Ethiopia, which may underlines the importance of further studies and implementation of appropriate preventive and control measures.

Key words: Contagious caprine pleuropneumonia (CCPP), Dire Dawa, complement fixation test (CFT), serum, risk factors.

INTRODUCTION

In Ethiopia, the livestock sub-sector accounts for about 40% of the annual gross domestic product, 16% of the gross domestic product and generates an estimated 31% of the total agricultural employment. With the establishment of modern export abattoirs, the annual sale for goat meat has increased significantly (LHAU, 2003). However, one major constraint to export fresh goat meat from a contagious caprine pleuropneumonia (CCPP) affected country is the requirements for an international sanitary certificate at testing (OIE, 2004).

Goats are among the major economically important livestock in Ethiopia. There are about 23.33 million goats in the country (CSA, 2004). Farmers and pastoralists

depend on small ruminants for much of their livelihood often to a greater extent than cattle, because goats are generally owned by the poor sector of the community. The short generation interval coupled with high frequency of multiple births allows for rapid increase in animal numbers (Yami and Merkel, 2008).

CCPP is one of the most severe infectious diseases of goats, causing major economic losses in goat farming in Africa and Asia where it is endemic (CFSPH, 2008). Considerable losses occur frequently as a result of outbreaks. Many *Mycoplasma* species were frequently infecting goat's and sheep's lungs by inducing pleuropneumonia (Jones and Woods, 1998). CCPP is a disease which is caused by *Mycoplasma capricolum* subsp. *capripneumoniae*, which was previously known by strain name of its species, F38 (Leach et al., 1993).

In Ethiopia, CCPP was reported in most of the goat rearing areas namely Afar, Borana, Omo Valley, West

*Corresponding author. E-mail: achenefmela@yahoo.com. Tel: +251 581141240.

Gojjam, and in the lowlands of Tigray (Yigezu et al., 2004; APHRD, 2010). The information available on the current prevalence of the disease in and around Dire Dawa Provisional Administrative Council (DDPAC) was scarce and the present study recorded the prevalence of CCPP in the area and indicated some risk factors that may favour the occurrence and transmission of the disease.

MATERIALS AND METHODS

Study area

The study was conducted in DDPAC which is situated in the eastern part of Ethiopia about 515 km East of Addis Ababa. The area is located between 9°27' and 9°49' north latitude and 41°38 and 42° 19' east longitudes. The rainfall pattern of the area is characterized by short rainy season from March to May and long rainy season from July to September. The dry season extends from October to January. The mean annual rainfall in the study area varies from 550 to 850 mm. The monthly mean maximum and minimum temperature ranges from 28.19 to 34.6°C and 14.5 to 21.6°C, respectively. The area has two agro-ecological zones, the lowland (below 1500 m above sea level) and midland (1500 to 2000 m above sea level) (DDPAC-AB, 2008).

Study animals

The study was conducted on goats of local breed which were found in Dire Dawa and in eleven peasant associations. The main husbandry system includes extensive type in which animals were allowed to graze freely day time and kept in poorly constructed house at night. Some semi-intensive type of husbandry system was also practiced. In this case, animals were offered some nutritional supplement and kept usually in-door environment.

Sampling frame and sample size determination

A total of 244 goats were selected by systematic random sampling method. The sample size was calculated according to Thrusfield (1995) by considering 10.88% expected prevalence (Matiasse, 2009), 95% confidence interval with a 5% desired absolute precision, thus, the calculated sample size was 149. However, additional 95 samples were included to increase the accuracy and hence a total of 244 animals were examined.

Study design and sampling

A cross-sectional study was conducted to determine prevalence of CCPP in and around DDPAC. Blood sample collections were carried out in randomly selected flock in the area. Age, sex, husbandry system, agro-climate and flock size of the area were recorded in the study during sample collection. Age of the animals was determined based on owners information and dental eruption and were categorized into two groups as age group ≤ 2 years (young), age group >2 years (adult). Goat flock sizes were categorized as ≤ 20 goats (small flock size) and >20 as large flock size.

Blood samples were collected from 244 goats by using sterile plain vacutainer tube and needles. The collected blood was allowed to stand in a slant position to clot for 2 h. At room temperature, the sample was centrifuged at 300 \cdot g for 3 min. The serum was transferred to a sterile tube with rubber stopper

and stored at a temperature below 0°C till transported to the Dire Dawa Regional Veterinary Laboratory.

Serological test

The samples were tested using complement fixation test (CFT) according to standard test procedure (OIE, 2008) at the Dire Dawa Regional Veterinary Laboratory, Ethiopia. Briefly, collected sera were de-complemented in a water-bath at 58°C for 30 min. Then, 25 μ l 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 25 μ l aliquot of antigen was added to each well with 25 μ l of complement, which was agitated and incubated for 45 min at 37°C. Finally, 25 μ l of sensitised 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 h to allow the unlysed cells to settle. More than 50% haemolysis was considered as positive (OIE, 2004).

Data analysis

The collected data was analyzed through Microsoft excel spread sheet program by using SPSS version 17 software. The seroprevalence was calculated by dividing the number of CFT positive animals by the total number of animal tested. Fisher's exact test was utilized to measure the association between risk factors confidence level was held at 95%.

RESULTS

Out of 244 collected sera subjected for CFT, 12 (4.92%) were found positive (more than 50% haemolysis). Minimum seroprevalence of 1.05% was recorded in young goats, while, significantly higher (7.38%) seroprevalence was obtained in adult goats. The prevalence of the disease in buck and goat was 4.67 and 5.32%, respectively. The CCPP was more prevalent (5.85%) in lowland areas indicating high risk factor involvement as compared to in midland agro-climatic zone (1.79%) but it was not statistically significant. On the other hand, seroprevalence of 13.64% in semi-intensive and 4.05% in extensive husbandry system had indicated the significant role of promoting in-door environment for the transmission of CCPP in the area. Moreover, seroprevalence of 7.97% was registered in large flock size group which was significantly higher than in small flock (0.94%) as shown in Table 1.

DISCUSSION

This study revealed that the prevalence of CCPP in and around DDPAC was 4.92%. This finding was higher than the previous report of Zerihun (2004) (1.8%). This variation in the prevalence of CCPP might be due to uncontrolled animal movement from areas where the disease is highly prevalent (Bekele et al., 2011). However, the prevalence of CCPP obtained in this study

Table 1. Prevalence of CCPP in relation to different risk factors.

Risk factors	Categories	No. examined	No. positive	Prevalence (%)	Fisher's exact test
Age	Adult	149	11	7.38	0.032
	Young	95	1	1.05	
Sex	Female	150	7	4.67	1.00
	Male	94	5	5.32	
Climate	Lowland	188	11	5.85	0.306
	Midland	56	1	1.79	
Husbandry	Semi-intensive	22	3	13.64	0.047
	Extensive	222	9	4.05	
Flock size	Large	138	11	7.97	0.014
	Small	106	1	0.94	

was relatively lower than the results reported by Mamo (1993) 51.5% in East Shoa, Degeffa (1993) 66.7% in Yabello, Zekarias (1995) 35% in Konso, Birhanu et al. (2009) 32.68% in Afar and Tigray, Ketema (1996) 24% in Yabello, Lema (1996) 36% in Arbaminch Zuria, Eshetu et al. (2007) 31% in Hashim Nur export abattoir, Debre zeit, Mekuria (2005) 15.5% in Hammer and Benna, Matiase (2009) 10.88% in and around Dire Dawa and Regassa et al. (2010) 22.49% in Afar region. The difference in the prevalence of the disease may due to the type of tests used to evaluate the seroprevalence, where more than two tests may be recommended to screen out the true prevalence of CCPP. The variation in the agro-ecology, husbandry systems and sampling of sick goats may also impact the seroprevalence results (Regassa et al., 2010).

In this study, the prevalence of the disease was significantly higher in adult than young animals. Significant variation among age groups was also reported by Eshete (2006) and Bekele et al. (2011). APHRD (2010) stated that age is an important factor and all ages can be affected. Seropositivity may be high in adult but mortality is higher in young animals than in adults (Radostits et al., 2007).

On the other hand, significant difference was not recorded between sex groups in this study. This finding was in line with the reports of Bekele et al. (2011). This might be related to equal susceptibility of both sexes for the disease (APHRD, 2010). The disease was significantly higher in semi-intensive than in extensive husbandry system which agrees with work of Degeffa (1993). In endemic areas, transmission of the disease among animals is high when animals are in close contact (Gelagay et al., 2007; Radostits et al., 2007). Significant difference was not observed between lowland and midland climatic zones. This might be due to uncontrolled animal movement between two areas for marketing, watering and grazing. In contrary to this, APHRD (2010)

stated that the disease is more prevalent in arid and semi-arid lowland of the country.

The result obtained in this study showed that flock size was an important factor in the epidemiology of the diseases, which was also reported by Bekele et al. (2011). This is attributed to the fact that as flock size increase, the chance of contact between animals increase which enhance chance of acquiring the infection. Being a contagious infection, the chances of spread of CCPP was maximum in large flock where the husbandry practices were not efficiently available and the individual animal care was not appropriately possible.

From this study, it is possible to conclude that CCPP in DDPAC is still prevalent which may be a potential risk for future outbreaks since among the reactors, there may be apparently healthy goats. Age, flock size and husbandry system may also be considered as risk factors for the occurrence of CCPP in goats. Further epidemiological studies are needed. In line with this, the control and preventive strategies should be designed and implemented.

REFERENCES

- APHRD (2010). Animal and Plant Health Regulatory Directorate, Ministry of Agriculture: Status of Major Animal Diseases in Ethiopia. Version 1, Addis Ababa, Ethiopia.
- Bekele T, Asfaw Y, Berhe G, Abebe G (2011). Seroprevalence of contagious caprine pleuropneumonia in Borana and Guji lowlands, Southern Ethiopia. *Ethiop. Vet. J.* 15(2):69-76.
- Birhanu H, Lisanework E, Wubishet M, Mekonnen H (2009). Seroprevalence of contagious caprine pleuropneumonia in Kefta Humera, Alamata (Tigray) and Aba-ala (Afar), Northern Ethiopia. *Trop. Anim. Health Prod.* 41:803-806.
- CFSPH (2008). The center for food security and public health. Iowa State University, College of Veterinary Medicine. Contagious Caprine Pleuropneumonia. Animal Disease Fact-sheets. (Available at: - http://www.iwis.org/advances/disease_factsheets/contagious_caprine_pleuropneumonia.pdf)
- CSA (2004). Central Statistical Agency. Federal Democratic Republic of

- Ethiopia. Agricultural Sample Survey 2004/2005; Reports on Livestock and Livestock Characteristics. Stat. Bull. 446:39.
- DDPAC-AB (2008). Dire Daw a Provisional Administrative Council Agricultural Bureau, Annual report. Dire Daw a, Ethiopia. p. 16.
- Degeffa T (1993). Tradition management practice and major diseases of goats in southern range lands of Borana administrative region. In: Abstracts of DVM Thesis (1985-2005). Faculty of Veterinary Medicine, Addis Ababa University, August, 2005. Debrezeit, Ethiopia. pp. 154-475.
- Eshete G (2006). Serological and Participatory Epidemiological Survey of Contagious Caprine Pleuropneumonia in Afar Pastoral areas of North East Ethiopia. In: Abstracts of MSc Theses (1998-2006). Faculty of Veterinary Medicine, Addis Ababa University, Debre-zeit, Ethiopia.
- Eshetu L, Yigezu L, Asfaw Y. 2007. A study on Contagious Caprine Pleuropneumonia (CCPP) in goats at an export oriented abattoir, Debre zeit, Ethiopia. Trop. Anim. Health Prod. 39:427-432.
- Gelagay A, Teshale S, Amsalu W, Esayas G (2007). Prevalence of contagious caprine pleuropneumonia in the Borana pastoral areas of Ethiopia. Small Rum. Res. 70:131-135.
- Jones GE, Wood AR (1998). Microbiological and serological studies on caprine pneumonia in Oman. Res. Vet. Sci. 44:125-131.
- Ketema D (1996). Serological and Microbiological studies on Major Respiratory Mycoplasmoses of Goats in Yabello (Range land of Borana, Ethiopia). In Abstracts of DVM Thesis (1985-2005). Faculty of Veterinary Medicine, Addis Ababa University. Debre-zet, Ethiopia. pp.154-475.
- Leach RH, Erno H, Macowan KJ (1993). Proposal for designation of F38-type caprine mycoplasmas as *Mycoplasma capricolum* subsp. *capripneumoniae* subsp. nov. and consequent obligatory relegation of strains currently classified as *M. capricolum* (Tully, Barile, Edward, Theodore, and Ernø 1974) to an additional new subspecies, *M. capricolum* subsp. *capricolum* subsp. nov. Int. J. Syst. Bacteriol. 43(3):603-605.
- Lema M (1996). Contagious caprine pleuropneumonia (CCPP) study on Economic significance and vaccine Trials (Ethiopia). In: Abstracts of DVM Thesis (1985-2005) Faculty of Veterinary Medicine, Addis Ababa University, Debre-zeit, Ethiopia pp. 154-475.
- LHAU (2003). Generic HACCP model for abattoir (sheep, goats and cattle), Livestock Marketing Authority, Ministry of Health, Ministry of Agriculture and United Nations. Addis Ababa, Ethiopia.
- Mamo G (1993). Preliminary study of contagious caprine pleuropneumonia (CCPP) in selected shoa. In: Abstracts of DVM Thesis (1985-2005). Faculty of Veterinary Medicine, Addis Ababa University, Debrezeit, Ethiopia. pp. 154-475.
- Matiase B (2009). Seroprevalence of Contagious Caprine Pleuropneumonia (CCPP) in and around Dire Daw a Administrative Region. In: Abstracts of DVM Thesis. Faculty of Veterinary Medicine, Jimma University, Jimma, Ethiopia.
- Mekuria S (2005). Epidemiological survey of contagious caprine pleuropneumonia in South Omo and Gamogoffa zones of SNNP Regional state, Ethiopia. In: Abstracts of MSc Thesis (1998-2005). Faculty of Veterinary Medicine, Addis Ababa University, Debre-zeit, Ethiopia.
- OIE (2008). World organization for animal health: Terrestrial Manual, Contagious Caprine Pleuropneumonia, Chapter 2.7.6. pp. 1000-1013.
- OIE (2004). World organization for animal health: Contagious caprine pleuropneumonia. In: Manual Standards Diagnostic Tests Vaccines 2000:503-514.
- Radostits OM, Blood DC, Cray CC (2007). Veterinary Medicine: A textbook of the disease of cattle, sheep, goats, pigs and horses. 8th eds, Baillier Tindall. London, pp. 1214.
- Thrusfield M (1995). Veterinary Epidemiology. 2nd ed., Blackwell science Ltd. Edinburgh pp. 178-179.
- Yami A, Merkel RC (2008). Sheep and Goat Production Handbook of Ethiopia. Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). pp. 2-3.
- Yigezu L, Tariku S, Ayelet G, Roger F (2004). Respiratory Mycoplasmaosis of Small ruminant's. Ethiop. Vet. J. 8(2):67-74.
- Zekarias B (1995). Contagious caprine pleura pneumonia: prevalence in Konso, southern Ethiopia and a study on the effects of antibiotic Treatment. In: Abstracts of DVM Thesis (1985-2005), Faculty of Veterinary Medicine, Addis Ababa University. Debre-zeit Ethiopia. pp. 154-475.
- Zerihun Z (2004). Epidemiological and sero-surveillance of contagious caprine pleura pneumonia (CCPP) in and Around Dire Daw a Administrative Region. Eastern Ethiopia. In: Abstracts of DVM Thesis (1990-2005). DVM Thesis (1990-2005). Faculty of Veterinary Medicine, Addis Ababa University, Debre-zeit, Ethiopia, pp. 154-475.