

A Study on Seroprevalence and Associated Risk Factors of CCPP (Contagious Caprine pleuropneumonia) in Meinitshasha District, Benchimaji Zone, Ethiopia

Tamirat Haile, Bizuayehu Demissie and Dawit Dejene

Mizan Regional Veterinary Laboratory Center, P.O. Box: 254, Mizan-aman, Ethiopia

Abstract: CCPP (Contagious caprine pleuropneumonia) is contagious emerging as a serious threat to other countries which either never encountered with high morbidity and mortality rates. Rapid diagnosis of this devastating disease is essential for its immediate containment. The cross-sectional study was conducted in Bench maji zone Meinitshasha district in selected six peasant associations (PAs) from January-March 2018 to determine seroprevalence and risk factors of CCPP. Latex agglutination test was conducted to screen the collected serum samples. Among 384 goats which are not vaccinated against CCPP disease observed for seroprevalence 30 (7.8%) of them were positive for CCPP disease. Highest to lowest rate of prevalence in each PAs were Tuyi 12 (16.66%), Bout 11 (13.58%), Bass 2 (6.66%), Kanti 4 (5.12%), Baro 1 (1.61%) and Yirmi 0 (0%). Adult and young goats were almost equally affected with rate of 21 (7.80%) and 9 (7.82%) respectively. Clinically suspected goats were negative for the disease 0 (0%). Sex based prevalence revealed difference in the value with male sex had higher prevalent 10 (10.41%) than female sex 20 (7.8%). Small, medium and large flock size with the prevalence rate of 5 (4.34%), 10 (6.09%) and 15 (14.28%) respectively were also found. Age and flock size risk factors were closely correlated with the prevalence rate with P-value less than 0.05 while, sex, PAs had the P-value greater than 0.05. Therefore, the study result showed that CCPP prevalence was in an alarming rate and need further study in neighboring areas next.

Key words: CCPP • Goats • Meinitshasha • Prevalence • Risk Factors

INTRODUCTION

CCPP is an infectious disease which affects only goats. This disease is caused by a mycoplasma, *Mycoplasma capricolum* subsp. *Capri pneumoniae* (MccF38) [1]. CCPP is emerging as a serious threat to other countries which either never encountered this highly contagious disease or are at risk of contracting the disease because of regular trade with the affected countries or the adjacent neighborhood by geographical location [2, 3]. The incubation period generally lasts 10 days but may vary between two and 28 days. The first symptom to appear is a reluctance to walk. Fever is extreme (41°C) but the animals continue to feed and ruminate [1]. Abortions are frequent in pregnant goats. Gradually, the respiratory symptoms become prominent. Respiration is accelerated and painful and accompanied by violent coughing. In the terminal stages, the animals

are unable to move [4]. They stand with their legs wide apart, the neck is stiff and extended, saliva continuously drips from their mouth and their nose is obstructed by a mucopurulent discharges [5]. The disease is characterized by fibrinous pleuropneumonia with increased straw-colored pleural fluid [6].

The transmission is direct, by the aerogenic route, through droplets released during coughing. Indirect transmission does not seem to occur, as mycoplasmas are not very resistant and are rapidly inactivated [7]. Some animals may become latent chronic carriers and thus play an important role in the transmission of the disease [8]. Contaminated milk may be the main vector for the dissemination of the disease, by mechanical transmission from one animal to another through milking and to the kids by suckling or by inhalation of infected droplets [5]. Contagious caprine pleuropneumonia (CCPP) is a cause of major economic losses to goat production in at least 30

countries in Africa and Asia containing a total goat population of more than 300 million [9]. CCPP is a major cause of economic losses in the goat industry globally as these intracellular bacteria can infect domestic as well as wild breeds of goat [10] with 100% morbidity and 60-80% mortality rates [11, 12]. In the absence of antibiotic treatment, mortality varies between 60% and 100% [1]. Subsequently, Mccp (*Mycoplasma capricolum* subsp. *capripneumoniae*) has been isolated in other countries including Chad, Ethiopia, India, Oman, Sudan, Tunisia, Turkey and Uganda and pleuropneumonia disease indistinguishable from naturally occurring CCPP has been experimentally reproduced with Mccp by several research groups [13].

Goats are reared as the major economic income source like cash crops for the people living in the Meinitshasha district. However, the density of goats was high there was no published study report about status of CCPP disease in the district. Based on the above statement of problem the current research study was conducted in order to identify the distribution of the disease in the area.

Therefore, the objectives of the study were:

- To examine the prevalence of CCPP disease in the Meinitshasha district.
- To measure the association of the risk factors with the occurrence of the disease.

MATERIALS AND METHODS

Study Area: The study was conducted in Bench maji zone Meinitshasha district in selected six peasant associations covering an area of 277100 km². The distance from zonal town Miza-aman was 120 km. The district bordered with Decha district from Kafa zone, Meinitgoldia, Bero and South bench districts from Benchimaji zone. The land use of the district was 43400 km² for cultivation, 60007 km² bushes, 53202.5km² forests, 4093.5 km² permanent crops and 70560 km² for grazing. The total populations of animals were; cow (321645), ox (214430), sheep (84384), goat (158173), horse (119), donkey (418), mule (66) and poultry (81205) [14].

Study Population and Sample Size: The study was conducted on goats of local breed with main husbandry system includes extensive type in which animals were allowed to graze freely day time in the grazing land and kept in poorly constructed house at night. The sample size was calculated according to Thrusfield [15] by

considering 50% expected prevalence due to absence of published documents and 95% confidence interval with a 5% desired absolute precision, thus, the calculated sample size was 384.

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

where,

P exp= expected prevalence;

D = absolute precision;

N = sample size.

Therefore, the estimated sample size was 384 animals.

Study Design: A cross sectional study was conducted in Meinitshasha district of Bench maji zone in south Nations Nationality and Peoples Regional State from January-March 2018 to determine sero-prevalence and risk factors of CCPP. PAs were selected purposively based on bordering with neighboring districts and availability of high population of goats in order to evaluate the distribution of the disease in the district. Risk factors like age, sex, health status and flock size were considered for the prevalence study. The flock size classification was conducted by sorting the three categories with small size (1-5 goats), medium (6-10 goats) and large flock size (Above 10 goats) depending on the goats population of the owners brought to sample collection area during sample collection time.

Sample Collection and Serological Test: Blood samples were collected from 384 goats using sterile plain vacutainer tubes and needles for testing by latex agglutination test which is highly sensitive than other tests [16]. The collected blood was allowed to stand in a slant position to clot for 2-6 hrs at room temperature, centrifuged at 1500 rpm for 3 minutes. The serum was transferred to a sterile tube with rubber stopper and stored at a temperature below 0°C till transported to the Mizan regional veterinary laboratory center. Sera were tested for presence of anti Mccp antibodies using the latex agglutination test (Capri LAT) in Mizan regional veterinary diagnostic laboratory center, following recommendations of the manufacturer. The latex agglutination test which detects serum antibodies in CCPP infected goats using whole blood or undiluted serum with a prompt result [17]. Briefly, 20µl serum was placed into a black reaction slide and the same amount of latex reagent (Containing latex beads coated with capsular polysaccharide of Mccp) was added next to the serum and

mixed with wooden stick (Tooth picks) and rocked side to side for 3 minutes while examining for agglutination. The presence of agglutination was observed within 3 minutes the sample was considered positive for Mccp while no agglutination was considered as negative.

Data Analysis and Management: Appropriate data were collected in data collection sheet prepared. The collected hard copy data was coded in to Microsoft excel spread sheet soft copy and analyzed through STATA version 13 in order to tabulate the prevalence rate, Chi-square and P-value (For correlation of possible risk factors with positivity of the sample). The sero-prevalence was calculated by dividing the number of latex agglutination test positive animals for CCPP disease to the total number of tested animal. The associations of the individual risk factors with outcome of interest were analyzed using P-value with confidence level held at 95%.

RESULTS

Among 384 goats which were not vaccinated against CCPP disease observed for seroprevalence 30 (7.8%) of them were positive for CCPP disease.

Highest to lowest rate of prevalence in each PAs were Tuyi 12 (16.66%), Bout 11 (13.58%), Bass 2 (6.66%), Kanti 4 (5.12%), Baro 1 (1.61%) and Yirini 0 (0%). Adult and young goats were almost equally affected with rate of 21 (7.80%) and 9 (7.82%) respectively. Sex based prevalence revealed difference in the value with male sex had higher prevalent 10 (10.41%) than female sex 20 (7.8%). Depending on the goat flock size; small, medium and large flock size with the prevalence rate of 5 (4.34%), 10 (6.09%) and 15 (14.28%) respectively were also found. Age and flock size risk factors were closely correlated with the prevalence rate with P-value less than 0.05 while, others had the P-value greater than 0.05.

DISCUSION

The overall prevalence revealed in this study was 30 (7.8%) out of 384 observed goats. The study was less than the report of Kibrom *et al.* [18] 78.5% in selected districts of South Omo zone, Mohamed *et al.* [19] 109 (32.63%) in selected districts of Jigjiga Zone, Tesfaye *et al.* [20] 119 (13.2%) in Borana and Guji lowlands. While the result was greater than the report of Yousuf *et al.* [21] 12 (4.92%) in Dire Dawa provisional

Table 1: Prevalence of CCPP

Result	Frequency	Percent
Positive	30	7.8
Negative	354	92.2
Total	384	100.0

Table 2: Prevalence of the disease in different risk factors

Risk factors		Positive	Percent	Total	χ^2	P-value
PAs	Baro	1	1.61	62	20.8919	0.001
	Yirini	0	0	61		
	Bass	2	6.66	30		
	Tuyi	12	16.66	72		
	Bout	11	13.58	81		
	Kanti	4	5.12	78		
	Total	30	7.8	384		
Age	Adult	21	7.80	269	0.0000	0.995
	Young	9	7.82	115		
	Total	30	7.8	384		
Sex	Male	10	10.41	96	1.2053	0.272
	Female	20	6.94	288		
	Total	30	7.8	384		
Flock size	Small	5	4.34	115	8.6954	0.013
	Medium	10	6.09	164		
	Large	15	14.28	105		
	Total	30	7.8	384		
Health status	Healthy	30	7.81	382	0.1704	0.680
	Sick	0	0	2		
	Total	30	7.8	384		

administrative council, the report of Abera *et al.* [22] 282 (32.68%) in Tigray and Afar. In India, some reports of prevalence from different states reflect a range of CCPP prevalence from 5% [23] to 64% [24]. Factors affecting receptivity of the agent might be like bad climatic conditions, lack of vaccination against the disease, overpopulation or other infectious predisposing factors. The severity of the disease depend on the following factors: these are, the proportion of immune animals, as an animal which has survived a previous infection is thought to be protected. Poor climatic conditions, such as large temperature difference between day and night or an abrupt change of climate, especially during the period between the dry and rainy seasons and stress due to nutritional deprivation or movement over long distances.

Age based prevalence result had no significant difference with the rate of adult 21 (7.80%) young 9 (7.82%). This report had variation from the report of Thiaucourt and Bolske [1] with adult 11 (7.38%) and young 1 (1.05%). The different authors have indicated that as the goats gets older; they are more susceptible to infection, they also tend to be infected repeatedly. The equal prevalence rate of young and adult goats in this study might be due to variation in the sample size.

The prevalence regarding sex were 10 (10.41%) and 20 (6.94%) in male and female goats respectively. This study was agree with the report of Mohamed *et al.* [19] both in male 36 (29.20%) and female 73 (33.03%) in selected districts of Jigjiga Zone, the report of Abera *et al.* [22] male 84 (37.84%) and female 198 (30.89%) Tigray and Afar; the report of Suryawanshi *et al.* [25] recorded higher prevalence of CCPP in males (35.71%) than in females (17.14%). While, the result was in contrary with the report of Yousuf *et al.* [21] with female 7 (4.67%) and male 5 (5.32%) in Dire Dawa provisional administrative council; the report of Bekele *et al.* [26] who recorded 14% seroprevalence in females and 11.6% in males. All goats can be affected equally whatever their sex but the chance of acquiring the disease is higher in males than females. In area of pastoralists type of farming males and females browse together without restriction of contact between males and females so that, adult male can contact with many females for mating and this might increase the chance of acquiring the disease.

Prevalence depending flock size revealed that small flock size 5 (4.34%), medium flock size 10 (6.09%) and large flock size 15 (14.28%). This result was in agreement with the report of Tesfaye *et al.* [20] in in Borana and Guji lowlands increasing the rate from small, medium and large flock size with small flock size 18 (9.6%), Medium flock size 71 (12.0%) and large flock size 30 (25.0%).The result

reported by Yousuf *et al.* [21] in Dire Dawa provisional administrative council. With small flock size 1(0.94%) and large flock size 11 (7.97%). In large flock size the contact between each other is greater and the probability of the disease transmission is higher than in small flock size population. So that, when the carrier goat was present in the flock, it might be the source for other goats and made the disease more prevalent than small and medium sized flock. Among all goats clinically healthy 30 (7.81%) were positive while clinically sick 0 (0%) were not positive for CCPP. This could be clinically suspected goats were not related with CCPP disease but, for other respiratory disease.

CONCLUSION AND RECOMMENDATIONS

In Ethiopia, goats play a unique role in the livelihood of pastoral communities, especially for women, as they provide milk and are a source of income for the family to cover school fees for children and other family expenses. Meinitshasha district is semi-pastoralists district and had high density of goat. The study result revealed that CCPP were found to be the one of goats prevalent disease in the area. However the prevalence was lower as compared to many other research results reported in different areas. Factors like contagious character, absence of vaccination in the area and type of farming will increase the prevalence of disease and make the CCPP more endemic in the future. As a whole, this study will give a clue for future detail investigation in the areas.

Therefore, based on the above conclusion following recommendations were forwarded:

- However, implementation is even more difficult in herds which have frequent contacts with other animals sanitary prophylaxis may be the sole measure that can prevent a herd from being infected by the disease.
- Some antibiotics, such as tetracyclines, fluoroquinolones (e.g., danofloxacin) and the macrolide family, can be effective if given early. Complete elimination of mycoplasmas is reported to be rare and treated animals may be potential carriers. The degree of risk from treated animals spreading *M. Capri pneumoniae* is still uncertain.
- Outbreaks can be eradicated with quarantines, movement controls, slaughter of infected and exposed animals and cleaning and disinfection of the premises.
- Reductions in animal density to decrease contact between animals is also important.

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