A Sero-Prevalence Study of Contagious Bovine Pleuropneumonia (CBPP) in Bale Zone, Ethiopia

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Abstract: Contagious bovine pleuropneumonia (CBPP) remains a huge threat to cattle production in sub-Saharan African countries. CBPP is considered to be among the most important cattle diseases that hinder livestock development in Ethiopia. A cross-sectional study design was conducted during April 2013 in order to assess the prevalence of CBPP in the lowlands and the adjacent midland areas of Bale Zone, Oromia National Regional State. The study was focused on animals which were comprised of indigenous Zebu cattle of all sex above six months age. The animals were selected based on simple random sampling method. A total of 502 sera samples were collected from the jugular vein of each animal and all samples were screened by the method of Complement Fixation Test (CFT) for CBPP antibodies in Asella Regional Veterinary Laboratory. The screened sera were further subjected to the competitive ELISA (c-ELISA) at National Animal Disease Investigation center (NADHIC) in Ethiopia in order to detect the specific antibodies to Mycoplasma mycoides subspecies mycoides Small Colony (MmmSC). The results of this study indicated that, the overall sero-prevalence of CBPP was n= 7(1.39%). The sero-prevalence of CBPP in lowland and midland of the study area accounts 1.58% and 1.26% respectively. CBPP is an endemic disease in many parts of the country, mainly in pastoralist areas. The strict movement controls and stamping out strategies are found to be not affordable and difficult to implement in the country. The mechanisms in which to regulate the cattle movement, implementation of vaccination campaigns, effective surveillance and reporting need to be designed. Strong policies and strategies need to be adopted by the concerned bodies and legislative organs at regional, national and continental levels.

Key words: Bovine · Complement Fixation Test · Contagious bovine pleuropneumonia · Sero-prevalence · Competitive – enzyme-linked immunosorbent assay · Ethiopia

INTRODUCTION

CBPP is a highly infectious acute, sub acute and chronic disease of cattle caused by Mycoplasma mycoides subsp. mycoides Small Colony (Mmm SC); it is one of the diseases recognized by OIE that needs to be controlled or eradicated through a national surveillance protocol [1]. The disease is highly infectious and contagious with high mortality and morbidity rates, which could lead to very serious economic losses. CBPP is a respiratory disease associated with pneumonia and sero-fibrinous pleurisy. It is transmitted by direct close contact between animals excreting droplets by coughing. In the humid regions of Europe transmission may be facilitated by favorable winds over distances of a few kilometers [2]. The disease may have a long incubation period estimated in months, and that it may occur in a sub-acute form in approximately 20% of infected animals. These facts increase the danger of spreading the disease.

CBPP was eliminated from most part of the world during the first half of the twentieth century, at a time when no antibiotics or vaccines were available. It is currently important in many parts of Africa and gained a wider extension in Africa since 1990s. In 2015, CBPP was considered to be present in all countries south of the Sahara. The persistence of CBPP in sub-Saharan Africa seems to be associated also with a wide range of factors, including the lack of regional control policies, inadequate vaccination campaigns, and the lack of effective surveillance and reporting, as well as insufficient government resources allocated to CBPP control [3].
Several studies had been conducted in different parts of the country by [4-7]. All Authors revealed that endemicity of CBPP in Ethiopia. The epidemiological situations of CBPP disease in Ethiopia have been reported by various investigators and it was thought to be a problem of lowland pastoral areas with their adjacent midlands or highlands. The disease is usually spread by the movements of animals across the international boundaries with high morbidity and mortality, particularly in severe outbreaks [8, 9]. Based on data generated through reports submitted to AU-IBAR monthly by African Union member states, CBPP is endemic in most pastoral areas of West, Central and East Africa, with at least 24 countries (45%) regularly reporting outbreaks every year for the last 10 years. The reported fatality rates range between 17 and 20%. The disease spread during the past decade, particularly towards Eastern and Southern Africa and it has become a major constraint to these countries. It has severe impacts on cattle production and productivity (e.g. mortality, loss of milk, weight and draught power) as well as on food security and people’s livelihoods [10]. Therefore, awareness of the distribution of this disease in the area is found to be very important.

Hence, the objective of this study was to determine the epidemiological distribution of CBPP among the cattle population in pastoral and mixed crop and Livestock farming areas of the study area.

MATERIALS AND METHODS

Study Area and Study Population: The study area was in five peasant associations (PAs) of Saweyina and Ginir districts, which is found in the Bale administrative zone of Oromia National Regional State.

The Seweyna pastoral livelihood zone includes 20 PAs. It is bordering the lowland areas of Somali region in the east and south east, east Harergae in the east and the highland of Bale in the North West. The livelihood is purely dependent on livestock rearing with some practice of farming activity. The topography of the area is 60% plain, 13% sloppy and 12% gorge. Altitude ranges from 500 to 900 meters above sea level. In most part of the livelihood zone, soils are primarily composed of fertile clay soil. In terms of natural resource, the area is rich in salt and gums. Vegetation coverage is mainly bush and shrubs with forest and grassland covering the livelihood zone.
The livelihood zone is characterized by low precipitation and high temperature. Annual temperature ranges from 26 degree centigrade during the cool season to 40 degree centigrade during the hot season. There are two rainy seasons, with mean annual rainfall ranging from 500 to 700 ml/year. Major livestock species as sources of food and income for the pastoral livelihood in the area are shoats, camel and cattle. The livestock market is far from most of the livelihood population and this has forced the pastoralist to travel long distance to sell their livestock to the market. The livestock market is found in Oda (Ginner district). Livestock mainly shoats and cattle are also traded in the terminal markets of Modjo and Addis Ababa areas. There is also some informal trade of cattle to East Harergae and Somali regions which is not common and reliable trade route. Ginir district is found at 060 81’ 348’ North, 0780 58’30’ East and at an elevation of 1954 masl. Sedentary mixed crop- livestock farming is the main economic activity in this area. The study animal included indigenous zebu cattle of all sex, above six months of age, reared under the extensive management systems in the study areas. The animals were selected on the basis of the simple random sampling method and the Peasant Associations (PA’s) were selected based on accessibility, the size of animal populations and willingness of the owners.

**Study Design, Sample Size and Sample Size Determination:** A Cross-sectional study design was used during January 2013 in order to investigate the sero-prevalence of CBPP. The average expected prevalence of the CBPP in lowlands of the study area was 9% (Asella Regional Veterinary Laboratory, 2004 unpublished). The average expected prevalence rate in the highlands of Bale zone was assumed to be 50% within 95% Confidence Intervals (CI) at ± 5%. The formula used to calculate sample size (n) will be according to [11]. Hence the total sample size for both areas, n = 502.

**Blood Serum Collection:** Animals were restrained by owners and 10 ml of blood sample were collected from the jugular vein using vacutainer tubes. The samples were kept under the shade in a slant position for four hours and centrifuged. The sera sample was transferred to cryogenic vials, labeled and kept and kept at - 20 °C until brought to the laboratory for analysis. Corresponding to each sample, the age and sex of every animal and geo reference information was collected and registered on a separate questionnaire.

**Complement Fixation Test (CFT):** The Complement Fixation Test (CFT) for CBPP was conducted in Asella Regional Veterinary Laboratory according to the manufacturer’s operating procedures [12]. CFT has been used for CBPP eradication campaigns in many countries. The CIRAD CFT [13], was conducted according to the manufacturer’s instructions. The kit included all reagents except veronal buffer, sheep red blood cells and negative control serum (purchased from Virion-Serion). The incubation time for antigen binding at 37°C was 30 min. All sera used were inactivated at 56°C for 30 min and diluted in the range of 1:5 to 1:2560. The highest dilutions of sera producing 100% hemolysis inhibition of sheep red blood cells was taken as end points of dilutions to be examined, and CFT titers were given as reciprocals of these dilutions. CFT readings were scored according the [13], i.e. positive in the case of 100% inhibition of hemolysis at a serum dilution of 1:10 or greater; ambiguous at 25, 50 or 75% inhibition at 1:10 serum dilution, and negative with absent hemolysis or hemolysis at 1:5 serum dilution.

**Competitive ELISA (c-ELISA):** The samples were subjected to CBPP competitive enzyme-linked immunosorosent assay (c-ELISA) kit to detect the specific antibodies to *Mycoplasma mycoides* subspecies mycoides Small Colony (MmmSC). Competitive ELISA is an OIE prescribed test and can be used for official CBPP testing [14]. This test is based on a monoclonal anti MmmSC antibody, named Mab117/5. Its specificity was estimated at around 99.7%. The test was undertaken by National Animal Disease and Health investigation Center (NADHIC).

**Data Analysis:** The data was stored using excel spread sheet and analyzed by using descriptive statistics. The prevalence rate was determined by dividing the number of c-ELISA positive animals by the total number of animals tested. The Chi-square test was used to determine the association between the agro-ecologies. In all analyses confidence level of 95% and p-value of 0.05 was used for statistical tests of significance.

**RESULTS AND DISCUSSIONS**

The overall sero-prevalence of CBPP in the study area was 1.4%. The sero-prevalence of CBPP in the lowland and midland areas than accounted 2/126 (1.58%) and 5/394 (1.26%) respectively. The differences
between the two agro-ecologies were not significantly associated (P >0.05) and also there was an association between the districts (x² = 1.51). The result of this study is in agreement with other studies conducted during the 1970s, which revealed, that the seroprevalence of 0% and 1.78% in the Southern and Eastern lowlands of Ethiopia, respectively [9]. The seroprevalence of CBPP in the county had been reported also within the range of 17% to 45%.by [15, 16, 17, 18, 19]. In areas classified as an endemic, relatively low rate (4%) of prevalence was reported in eastern Ethiopia and 2.8% in Kenya by [20].

CBPP had been eradicated from the U.S.A, Australia and most European countries through implementation of animal movement control. In most continents, control strategies are based on the early detection of outbreaks, control of animal movements and a stamping-out policy. In Africa control of the disease is based on vaccination campaigns using attenuated MmmSC strains such as T1/44 or T1SR.

The major obstacles to the control and eradication of the disease are: Difficulty in controlling the movements of cattle, complications of applying quarantine and slaughter policies. The indiscriminate movement of cattle by cattle traders accelerates the spread of disease. It has been suggested that pastoralism are major means of transmission of the disease from one area to another. Control and eradication are applied to the individual herd and to the area with the goal of eradication in the country.

CONCLUSIONS AND RECOMMENDATIONS

Contagious bovine pleuropneumonia (CBPP) is a highly contagious disease that affects cattle throughout most of sub-Saharan Africa, where it consistently ranks as one of the most serious livestock diseases. CBPP directly impacts economies through cattle mortality and morbidity: up to 60% of infected animals die in naive herds, lactation yields of infected cows are reduced by up to 90%, infected animals grow more slowly and produce less meat, and infected draught oxen have a reduced capacity to work. CBPP is also a barrier to trade and reduces the value of livestock and the income of value chain stakeholders in many African countries. Current control measures, like diagnostic tests and vaccines, are suboptimal in controlling CBPP in most of sub-Saharan Africa [21].

CBPP had been recognized in Ethiopia for many years. The result of this study also revealed that the disease is endemic in the study area. Animals kept in these areas are always at the risk of contracting CBPP disease because of their uncontrolled movement and migration in search for water and grazing. Control of this disease in countries that have achieved eradication relied on the combined use of animal movement controls and slaughter of affected animals, possibly combined with vaccination and surveillance.

In Sub-Saharan African countries the difficulty in controlling cattle movement has been identified as one of the major reasons for the spread of CBPP [22]. The same fact has a similarity in Ethiopian condition. Slaughtering policy of CBPP affected and in contact animals is found to be a challenging task for the country. The mechanisms in which to regulate the cattle movement, implementation of vaccination, effective surveillance and strong reporting systems need to be designed. Cleaning and disinfection of the premises is also very important. Strong policies and strategies need to be adopted by the concerned bodies, legislative organs at regional, national and continental levels.

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