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Full Length Research Paper

Seroprevalence of caprine brucellosis and associated risk factors in South Omo Zone of Southern Ethiopia

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A cross - sectional study was conducted in Hammer and Dasenech Districts of South Omo Zone to determine seroprevalence of caprine brucellosis and its potential risk factors. Simple random sampling method was used to select 384 adult goats with no previous history of vaccination against brucellosis in the two districts. Modified Rose Bengal Plate Test (mRBPT) and complement fixation test (CFT) were used as screening and confirmatory tests, respectively. The results revealed that 16 goats (4.2%) were found seropositive for caprine brucellosis by mRBPT test and CFT. Seroprevalence of caprine brucellosis was not significantly affected by sex, age and flock size while it was significantly associated with abortion rate and parity number. In conclusion, the results of the present study showed that brucellosis is prevalent at a low rate in South Omo Zone and appropriate control measures should be employed to prevent the spread of the infection to other animals.

Key words: Caprine brucellosis, seroprevalence, South Omo Zone, Southern Ethiopia.

INTRODUCTION

Ethiopia hosts large number of small ruminants distributed in various agro-ecologies. The small ruminants' population in the country is estimated to be 24 million heads of sheep and 23 million heads of goats. Most of the populations of goat in Ethiopia are raised under pastoral conditions. South Omo Zone is one of the pastoral areas in Ethiopia, where goat rearing is a common practice (CSA, 2009).

Small ruminants and their products are important export commodity significantly contributing to the national economy. Moreover, they support the livelihood of millions of pastoral people as sources of food (milk and meat), fiber (wool and skins), cash and a form of savings. Their adaptability to a broad range of environments, short generation cycles and high reproductive rates that lead to high production efficiency made small ruminants production an attractive enterprise in pastoral production systems (PFE, 2004; CSA, 2004). Brucellosis in small ruminants is a serious disease primarily in goats which is caused by *Brucella melitensis* and occurs worldwide. *B. melitensis* is Gram-negative rod, non-motile, non-spore forming and partially acid-fast organism (OIE, 2000).

In Ethiopia, few works have been done on the epidemiology of brucellosis in goats (Tekelye and Kasali, 1990; Yibeltal, 2005; Teshale et al., 2006; Ashenafi et al., 2007). However, the distribution of the disease in the pastoral production system has not been well studied particularly in South Omo Zone (Dasenech and Hammer). Therefore, the objectives of this study was to study the seroprevalence of caprine brucellosis and its associated risk factors in selected areas of South Omo Zone.

MATERIALS AND METHODS

Study area and livestock population

The study area is located at 750 km south of Addis Ababa. The altitude is about 400 m above sea level. The average annual temperature ranges between 18 to 32°C and the average annual rainfall is about 390 mm. In the study area, rain is erratic and usually bimodal occurring from September to November and from March to May (CSA, 2004). The major livestock production system in the Zone is pastoral comprising more than 43.7% (n= 1157201) of regional goat population (CSA, 2004).

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Study design

A cross-sectional study was conducted in selected areas of South Omo Zone to determine the seroprevalence of caprine brucellosis from October 2008 to March 2009. Serum sample were collected from local breed of goats that were above 6 months of age and information on different risk factors such as age, sex, parity, abortion, flock size, district and peasant association was obtained by structured questionnaires.

Sample size and sampling methodology

The sample size was calculated using the formula recommended by Thrusfield (2005) for simple random sampling. The sample size was determined by using 95% confidence interval level with expected prevalence 50% of caprine brucellosis and with desired absolute precision of 5%. Simple random sampling method was used to select the study animals. Accordingly, 384 goats were considered for this study from Hammer and Dasenech Districts of South Omo Zone. The two districts were purposively selected and three Pas from each district were randomly selected.

Sample collection

About 10 ml of blood sample was collected from each animal in plain vacutainer tube. The blood was allowed to stand overnight at room temperature tilted horizontally. The serum was decanted into single sterile cryogenic vial, labeled, and transported in cold chain to the laboratory where Modified Rose Bengal Plate Test (mRBPT) and complement fixation test (CFT) was conducted. Separated sera were stored at -20°C until tested by mRBPT and CFT. The mRBPT was performed at Soddo Veterinary Diagnostic Laboratory, Ethiopia whereas the CFT was at National Animal Health Diagnostic and Investigation Center, Sebeta, Ethiopia.

Serological examination

The sample collected from field was screened using mRBPT. The positive sample was subjected to CFT (Bercovich et al., 1998).

Screening test by mRBPT

The sample collected from field was screened using mRBPT. To improve the sensitivity of the mRBPT, simple modification, increasing the volume sera to be tested has been recommended and used in this study. It is the use of serum of 75 and 25 µl of antigen and named mRBPT. In the screening, mRBPT was used, that 75 µl of serum and 25 µl of antigen on white enamel plate and mixed thoroughly with the applicator stick. It was shacked and waits for four minutes and any agglutination reaction was graded as positive.

Confirmatory test by CFT

Golden standard confirmatory test commonly used was CFT (OIE, 2004). The complement is fixed in the presence of antigen-antibody complex. This reaction is detected by the addition of sensitized SRBC (haemolysin and sheep red blood cells complex) used as an indicator system. The presence of immune complex is revealed by the absence of haemolysis (positive reaction). The absence of immune complex is revealed by haemolysis (negative reaction).

The test procedure has many steps. First a known antigen is incubated with test and control sera to allow the formation of immune complexes. A well-defined amount of complement is added to the CFT. Only in positive reaction, when specific antibodies and antigen meet, there is no formation of immune complexes and hence, no consumption of complement. All these reactions are invisible. In the second reaction step, blood cells and their specific antibodies are added and from by complexes. In the positive case, no complement will be left over to cause hemolysis. In the negative case, the complement added in the first reaction step is still present will cause visible hemolysis after addition of the hemolytic systems (OIE, 2004).

Data analysis

Data from the laboratory results was stored in Microsoft Excel spread sheet program. Analysis for *Brucella* seroprevalence was carried out using STATA 8.0. The individual animal prevalence was calculated by dividing the number of mRBPT and CFT reactors by the total number of serum samples tested. The association between each risk factor and the outcome variable was assed using Fisher's exact and chi-square. For all analyses, a p-value of less than 0.05 was taken as statistically significant.

RESULTS

Overall seroprevalence

Out of 384 tested animals; 20 (5.2%) of them were found positive for mRBPT. Up on further testing the mRBPT positive sera by CFT, 16 (4.2%) were found seropositive. Thus, overall number of seropositive goats in selected areas of South Omo Zone was 16 (4.2%) after mRBPT and CFT. There was no statistically significant difference in seroprevalence between the two districts and among the Pas ($p>0.05$) (Table 1).

Potential risk factors

In this study, the seroprevalence of brucellosis in female and male goats was 5.2% (n=12) and 2.59% (n=4) (Table 3). However, this difference in seroprevalence was not statistically significant ($p>0.05$). The seroprevalence was also higher in adult goats (9.1%) than young ones (4.0%) and in goats in larger flocks (4.7) than in smaller flocks (3.8%), although the differences were not statistically significant ($p>0.05$) (Table 2). Parity status and abortion had positive association with the seroprevalence of caprine brucellosis, which statistically significant ($p<0.05$) (Table 3).

DISCUSSION

The result obtained from the present study showed an overall individual prevalence of 4.2%. The prevalence of brucellosis in goats observed in the current study is fairly in agreement with previous studies in Morocco (4.1%) (Benkirane, 2006), and Eritrea (3.8%) (Omer et al., 2000). However, it is higher than the 1.3% prevalence

Table 1. Seroprevalence of caprine brucellosis in the study areas by district and peasant association.

Variables	No tested	CFT positive- prevalence (%)	95% CI	χ^2	P- value
District					
Hammer	174	7 (4.0)	1.96-8.1		
Dasenech	210	9 (4.3)	2.3-7.95	0.02	0.9
Peasa					
Dimeka	50	5 (10)	4.4-21.4		
Umbulle	5	0	-		
Geshe	74	2 (2.7)	0.7-9.3	0.2*	0.2
Lobot	74	2 (2.7)	0.7-9.3		
Nikya	54	2 (3.7)	1.0-12.5		
Trongole	82	5 (6.1)	2.6-13.5		

*Fisher's exact.

Table 2. Seroprevalence of caprine brucellosis in the study areas by sex, age and flock size**.**

Variables	Category	No tested	CFT positive-prevalence(%)	95% CI	χ^2	P- value
Sex	Male	154	4 (2.6)	1.0-6.5	1.58*	0.3
	Female	230	12 (5.2)	3.0-8.9		
Age	Young	373	15 (4.0)	2.4-6.5	0.8*	0.5
	Adult	11	1 (9.1)	1.6-37.7		
Flock size	< 150	23	9 (3.9)	2.0-7.2	0.15	0.7
	> 150	150	7 (4.7)	2.3-9.3		

* Fisher's exact.

Table 3. Seroprevalence of caprine brucellosis in the study areas by parity and abortion status.

Variables	Category	No tested	CFT positive- prevalence (%)	95% CI	P- value
Parity	Nullyparous	104	0 (0)	-	0.035*
	Monoparous	51	1 (1.96)	0.4-10.3	
	Pluriparous	75	11 (14.67	8.4-24.4	
Abortion	No abortion	78	4(5.13)	2.0-12.5	0.00*
	One abortion	50	6 (12)	5.6-23.8	
	> one abortion	102	2 (1.96)	0.5-6.9	

*Fisher's exact.

recorded by Mengistu (2007) and Tekelye and Kasali (1990) in different areas in Ethiopia and 1.9% recent report by Bekele et al. (2011) from Jijiga, Eastern Ethiopia. The result of the present study is lower than that of Teshale et al. (2006) who reported prevalence of 16.55 % in Afar Region in Ethiopia. These differences could be mainly due to variation in agro-ecological location, management and production systems.

In this study smaller reactors recorded in males than females. Some studies reported that serological response of male animals is limited and thus infected animals are usually observed to be non-reactors or show low antibody titer (FAO/WHO, 1989). Furthermore, male animals are known to be less susceptible to *Brucella* infection due to the less amount of carbon 4-sugar erythritol (Hirsh and Zee, 1999).

The present study also revealed that there was no statistically significant difference among age groups,

although higher prevalence was found in the adult age group. However, it has been reported that brucellosis is essentially a disease of sexually mature animals (Quinn et al., 2004) due to the influence of sex hormones and erythritol on the pathogenesis of brucellosis (Radostits et al., 2000). On the other hand, younger animals tend to be more resistant to infection and frequently clear the established infections, although latent infection could occur.

It has also been found out in this study that flock size did not have statistically significant effect. This might be due to the fact that animals in the study area use common grazing and watering areas that could create the chance for transmission of brucella among different flocks of goat. The statistically significant association between seroprevalence of caprine brucellosis and occurrence rate of abortion and parity number could be explained by the fact that abortions and prolonged kidding interval (parity) are typical out-puts of brucellosis (Radostits et al., 2000; Swell and Brocklesby, 2002). On the other hand, this could be due to the fact that the greater the number of parturitions the higher would be the exposure risk in the herd. After abortion uterine infection persists for up to 5 months and in the udder the bacteria persists for years (Radostits et al., 2000). The lack of significant in seroprevalence of caprine brucellosis among districts and peasant association could be due to the similarity in the agro-ecological conditions and livestock management systems in the areas.

Conclusions

The present study showed that caprine brucellosis is prevalent at a low rate among goat populations in South Omo Zone and abortion and parity have significant association with brucella seropositivity. This emphases impacts of caprine brucellosis and the need to control and prevent the disease in the area through isolation of aborted animals and proper disposal of aborted fetuses and fetal membranes, preferably, by incineration, the isolation of kidding animals' in separate kidding pens. Strict movement control of animal from one area to another in order to prevent the spread and transmission of the disease from infected goats to the non-infected ones, proper hygienic practices and good husbandry management should be exercised and these could in many situations minimize the spread of disease in the flock.

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