

Sero-Epidemiological study of small ruminant Brucellosis in and around Bahir Dar, Northwest Ethiopia

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Abstract

A cross sectional study was carried out from October 2008 to April 2009 to determine the sero-prevalence of brucellosis and assess the impact of potential risk factors in small ruminants in and around Bahir Dar, Northwest Ethiopia. The sampling method used was purposive sampling technique for the district and simple random for the study animal. A total of 500 serum samples (270 from sheep and 230 from goats) were collected from extensive management system with no history of vaccination. All serum samples were initially screened by Rose-Bengal-Plate Test (RBPT) and positive reactors to RBPT (n=6) were further tested by complement fixation test (CFT) for confirmation. Accordingly, the overall prevalence of brucellosis in small ruminants was 0.4%. Rose Bengal Plate Test detected (1.2%) of the samples as seropositive for brucellosis where 4(1.74%) were goats and 2(0.74%) were sheep. Up on further testing using CFT only 2 (0.4%) were positive which were adult goats. The seroprevalence of brucellosis was found higher in females (0.4%) than males (0%). Although seropositive animals are low in number it was found that animals > 1 year are more affected than animals < 1 year. The result of the present study revealed that the sero-prevalence of small ruminant brucellosis in the study area was very low. However, the existence of the disease in the study area has possible risk of spread in the future. Accordingly, elimination of positive sero-reactors will provide better considerable success in the control of brucellosis in these species of animals.

Key words: Brucellosis, CFT, goats, RBPT, Sheep.

Introduction

The small ruminant population of Ethiopia is estimated to be nearly 23 million goats and 23 million sheep (IBC, 2004). In the central highlands of Ethiopia where mixed crop- livestock production system is practiced, small ruminants account for 40% of cash income and 19% of the house hold meat consumption (Zelalem and Flecher, 1993). Sheep and goats are highly adaptable to broad range of environmental conditions. Moreover, low cost of production, requirement of little land and higher prolificacy made them attractive asset for development. Investment in sheep and goats avoid losses due to high inflation rates that are found in unstable economies of many underdeveloped countries like Ethiopia. This is because sheep and goats provide rapid cash turn over (Gatenby, 1991; Steel, 1996).

There is also a growing export market for sheep and goats meat in the Middle Eastern Gulf states and some African countries. At optimum offtake rates, Ethiopia can export 700,000 sheep and 2 million goats annually, and at the same time supply 1,078,000 sheep and 1,128,000 goats for the domestic market (Alemu and Markel, 2008).

In spite of the presence of huge small ruminant population, Ethiopia fails to optimally utilize this resource as a sector. This is because of small ruminant production is constrained by the compound effect of diseases, poor feeding, poor management and low genetic endowment. Among many factors that limit economic return from small ruminants, production diseases stand in the front line. One of such disease that hampers the productivity of small ruminants is Brucellosis (Ademosoum, 1994; LMA, 1995). The genus *Brucella* is now considered to contain six species: namely, *B. abortus*, *B. melitensis*, *B. suis*, *B. ovis*, *B. canis* and *B. neotomae*. *Brucella melitensis* (biovars 1, 2 or 3) is the main causative agent of caprine and ovine brucellosis and it is highly pathogenic for humans causing one of the most serious zoonoses in the world (OIE, 2000).

Despite the presence of larger population of small ruminants in different regions of Ethiopia, very limited researches have been done on small ruminant brucellosis even if it is said to be endemic in the country. Thus this experiment was conducted to determine the Sero- prevalence of small ruminant Brucellosis and assess some of the possible epidemiological risk factors that might contribute for the infection of brucellosis in small-ruminants in the study area.

Materials and methods

The study area

The study was conducted in and around Bahir Dar starting from October 2008 to April 2009. Bahir Dar is located at Northwestern part of Ethiopia, 565 km away from Addis Ababa. It is the capital city of Amhara National Regional State situated in the Southwest direction of Lake Tana.

The minimum and maximum altitude of this town ranges from 1810 to 1850 meter above sea level. The minimum and maximum temperature of the town ranges from 10 to 38 °C. The area receives mean annual rainfall of 750 mm. The area is marked by two distinct climatic seasons namely; the dry season extending from December to May; and the wet season which extends from June to September. The livelihood of major section of the population in the area depends on crop-livestock mixed farming.

Study animals

The study animals were indigenous breeds of sheep and goats kept under extensive management system. The sampling included all sheep and goats above 6 months of age with no history of previous vaccination against brucellosis.

Sampling method and survey design

The sampling method used was purposive for the district and simple random sampling technique for study animal. The study design was cross-sectional. As there was no study conducted in small ruminant brucellosis in the study area 50% expected prevalence was considered in sample size determination. The other determinants considered in sample size determination are 95% confidence interval and 5% desired absolute precision.

$$\text{Hence, } N = \frac{(Z_x)^2 P_{\text{exp}} (1-P_{\text{exp}})}{D^2}$$

Where, N= the required sample size

P_{exp} = the expected prevalence rate (50%)

Z_x = the value of the required confidence interval (1.96)

D = desired absolute precision (5%)

$$\text{Hence, } N = \frac{(1.96)^2 0.5 (1-0.5)}{(0.05)^2} = 384 \text{ heads of sheep and goat were the actual sample size.}$$

However, to increase the precision of the survey, the sample size was increased to 500 (270 sheep and 230 goats).

Data collection

Relevant data of the study animals was recorded along side with blood specimens collection. The individual animal details such as the name of the animal, sex, age, flock size and source of animals were registered. Further more, history of abortion and placenta retention were recorded.

Blood sample collection

About 10 ml of blood was collected from the Jugular vein of each sheep and goats using plain vacutaioner tubes and needles. The blood was allowed to clot for 1-2 hours at room temperature, stored horizontally overnight at 4°C, and then the serum was separated from the clot by centrifugation at 2000-3000 rpm for 10-15 minutes. Then the separated serum was labeled and kept under refrigeration (-20°C) until tested.

Laboratory procedure /serological tests

Rose Bengal plate test (RBPT)

The Rose Bengal plate test (PBPT) was used as a screening test for the serum samples collected for the presence of *Brucella* agglutinins. The test was conducted as per the procedure recommended by Alton *et al.* (1975) and Nilsen and Dunkan (1990). This test was carried out at Bahir Dar regional veterinary laboratory.

Complement fixation test (CFT)

All sera which tested positive by the RBPT were retested using CFT for further confirmation. Standard B. abortus antigen for CFT was used to detect the presence of anti-brucella antibodies in the sera. A hemolytic reaction of 25% at a dilution of 1:5 was considered the minimum positive threshold (Dohoo *et al*, 1986). The Complement Fixation Test (CFT) was done at the National Animal Health Diagnostic and Investigation Center (NAHDIC).

Interpretation: Serum with strong reaction, more than 75% fixation of complement (3+) at a dilution of 1: 5 and at least 50% fixation of complement (2%) at a dilution of 1:10 and at dilution of 1:20 were classified as positive (Alton *et al.*, 1975; OIE, 2004).

Data analysis

Data was stored in the Microsoft excel spread sheet program and analyzed using STATA version 8.0 software. The seroprevalence was calculated by dividing the number of CFT positive animals by the total number of animal tested.

Results

The results of the study are summarized in Tables 1 and 2 below. Of a total of 500 serum sample tested (270 sheep and 230 goats), six (1.2%) tested positive for brucellosis infection by the RBPT and only two (0.4%) of the six were found positive for CFT (Table 2).

Table 1. Seroprevalence of small ruminant brucellosis according to species of animals in and around Bahir Dar.

Animal species	Number of sera tested	RBPT positive	CFT positive
Caprine	230	4 (1.74%)	2(0.86%)
Ovine	270	2 (0.74%)	0
Total	500	6(1.2%)	2(0.4%)

Discussion

This study demonstrated that the overall sero prevalence of small- ruminant brucellosis in and around Bahir Dar to be 1.2% by the RBPT and 0.4% by CFT. Almost half of the sera which tested positive for anti *Brucella* antibodies by RBPT, tested negative by CFT. This could be due to cross-reactions between *Brucella* and other bacteria which share similar epitopes.

Table 2. Seroprevalence of small ruminant brucellosis according to sex and age in and around Bahir Dar.

Risk factor	Number of animals tested	RBPT positive	CFT positive
<i>Caprine</i>			
Male	48	1(2.08%)	0
Female	182	3(1.64%)	2(1.09%)
<i>Ovine</i>			
Male	60	0	0
Female	210	2(0.95%)	0
<i>Total</i>	500	6(1.2%)	2(0.4%)
<i>Age</i>			
Young (< 1 year)	104	1(0.96%)	0
Adult (> 1 year)	396	5(1.26%)	2(1.50%)
<i>Total</i>	500	6(1.2%)	2(0.4%)

This prevalence is lower than prevalences recorded in previous studies carried out in different parts of the country; 4.8% in Afar Ashenafi *et al* (2007); 9.7% in Afar and Somali Teshale *et al.* (2007); 1.5% in sheep and 1.3% in goats in central highlands of Ethiopia Tekeleye and Kassali(1990); 16% in Afar region Yibeltal (2005); 3.37%, 0.11%, 3.94% and 0.49% from Afar Region, Somali Region, Borena Zone and South Omo Zone respectively Melesse *et al.* (2006). The difference in the prevalence of brucellosis between the current and previous studies might be attributed to the differences in geographical location, sample size and management systems. In Afar and Somali Region, large numbers of different species of animals are raised on communal pastures under limited watering areas, where as the livestock management in the Northwestern Ethiopia is characterized by mixed farming, in which fewer animals are raised separately.

According to the present study, from a total of 500 sera tested, only two goats were sero positive for CFT while no sero-positive sheep were detected. This finding is in agreement with the reports of Omer *et al.* (2000); Radostits *et al.* (2007), and Yibeltal (2005) which

indicated that goats are at higher risk of acquiring *Brucella* infection than sheep. This may be due to greater susceptibility of goats to *Brucella* infection. It could also be partly due to the fact that goats excrete the organism for a long period of time, unlike sheep.

All seroreactors were adult female goats while no sero-positive young goat was found. It has been reported that brucellosis is essentially a disease of sexually matured animals Quinn *et al.* (1999); Radostits *et al.* (2000). This may result from the fact that sex hormones and erythritol, which stimulate the growth and multiplication of *Brucella*, tend to increase in concentration with age and sexual maturity (Radostitis *et al.*, 2007).

The present study showed, CFT positive sera were found only in female goats; the absence of male seroreactor animals in this study could probably be due to the small number of males (N = 108) tested as compared to the larger number of females (n = 392). It has also been reported that males are usually resistant than female animals to *Brucella* infection (Radostitis *et al.*, 1994). Hirsh and Zee (1999) have reported that male animals are less susceptible to infection, due to the absence of erythritol. Moreover, it has been reported that the serological response of male animals to *Brucella* infection is limited and testes of infected male animals were usually observed to be non reactors or showed low antibody titers (Crawford *et al.*, 1990).

Conclusions

The result of the present study showed that the sero prevalence of small ruminant brucellosis in the study area was very low. However, the existence of the disease in the study area has possible risk of spread in the future. Accordingly, elimination of positive reactors will provide better considerable success in the control of brucellosis in these species of animals. Based on the above conclusion the following recommendations are forwarded:

- Detailed studies should be done to have a clear picture on the prevalence of brucellosis in small ruminants in the region.

- The role of different epidemiological factors such as species, age, sex, and other possible risk factors in the prevalence of the disease should clearly be established in order to understand their effect in the control of the disease in the future.

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