Sero-Prevalence of Brucellosis in Sheep and Goat Destined for Slaughter in Selected Export Abattoirs, Ethiopia

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Abstract: A cross sectional study was carried out from November 2011 to April 2012 in selected sheep and goat product export abattoirs, Ethiopia, to determine the sero-prevalence of small ruminant brucellosis and to assess the possible associations of different epidemiological risk factors that might contribute for the infection. A total of 1000 serum samples (388 from sheep and 612 from goats) were collected and initially screened by Rose-Bengal-Plate-Test (RBPT) and positive reactors to RBPT (n=34) were further tested by Complement Fixation Test (CFT) for confirmation. Accordingly, the overall prevalence of brucellosis in small ruminants was 2.7% (27 out of 1000). In this study there were no statistical significant variations observed between possible risk factors like species, age and origin of the animals in which the Chi-square values were $\chi^2(1)=1.99$, $\chi^2(1)=0.46$, and $\chi^2(1)=1.94$ and p-values 0.1583, 0.830 and 0.660 ($p > 0.05$) respectively, but there were statistically significant correlations between the occurrences of the disease and the body weight, $\chi^2(2)=2.075$ and $p-value = 0.000$ ($p < 0.05$) in which higher prevalence were observed in poor body conditioned than that of medium and good body conditions. The existence of positive results in those animals subjected for slaughter may lead to ban the export of live animals and raw meat and meat-products in order to prevent zoonotic hazards which indirectly lead to the reduction of over all income of the country. Therefore screening tests, awareness creation to the public and animal owners about the risk, mode of transmission and prevention of brucellosis is essential.

Key words: Brucellosis • CFT • Ethiopia • Export abattoirs • RBPT • Sheep and Goats

INTRODUCTION

Small ruminant population of Ethiopia is estimated to be nearly 23.33 million goats (70% in low land pastoral areas) and 23.62 million sheep (75% in the highlands) [1, 2]. They contribute 33% of meat 1.4% of milk requirement of the country [3].

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 household meat consumption [3].

Investment in sheep and goats can avoid losses due inflation which is common in unstable economy countries like Ethiopia by providing rapid cash turnover. Moreover, little land requirement, low cost of production and higher prolificacy made sheep and goats attractive assets for development [4, 5].

Though 1,078,000 sheep and 1,128,000 goats are used in Ethiopia for domestic consumption annually, export market is also growing in the Middle Eastern Gulf states and some African countries, reaching up to 700,000 sheep and two million goats annually [6].

In spite of the presence of huge small ruminant population, Ethiopia fails to optimally utilize the resource mainly because of animal diseases, poor feeding and managements and low genetic endowments. Among the various diseases that hamper productivity of small ruminants, brucellosis is the one that have also zoonotic importance [1, 7-9]. Therefore, the objective of this study is to determine sero-prevalence of small ruminant brucellosis and assess possible associations with epidemiological risk factors in sheep and goats subjected for slaughter at export abattoirs of the country.
MATERIAL AND METHODS

Study Area: The study was conducted in selected sheep and goat product export abattoirs that are located around central Ethiopia. Procurement of animals are from different parts of the country, both from highlands, greater than 2500 meters above sea levels (like Arsi, Asela, Balle, Debrembrihan, Dessie and its surroundings, Babille, Jima and Kemisse) and lowlands, less than 1500 meters above sea levels (like Afar, Arbaminch, Awash, Ambo, Borena, Methara Miyesso, Mojo and Negelle) [10].

The annual rain fall for these areas ranges from 500-600mm for lowland and 520-672mm for highlands and the mean minimum and maximum temperature ranges from 18 °C and 27 °C for lowland and 18.3 °C and 5.8°C for highland [10].

Study Animals: The study animals are unvaccinated male sheep and goats originated from different areas of the country and subjected for slaughter in export abattoirs. Ages of the study animals were determined based on their dental eruption patterns and categorized into two groups, young and adult. In goats young (1-3 years old) if it has up to four permanent teeth, adult (greater than 4 years) if more than four permanent teeth; in sheep young if it has three permanent teeth and adult if it has more than four permanent teeth according to Gatenby [4] and Steel [5].

Body weight classification was made as poor, medium and good according to Alemu and Merkel [6]. From the total of 1000 sera (388 sheep and 612 goats) tested, 3.4% (n=34) were positive by RBPT, however 2.7% (n=27) were confirmed positive by CFT (Table1). Based on this study sero-prevalence of brucellosis observed in sheep 3.61% (n=14) were greater than that of goats 2.12% (n=13) though the difference is not statically significant (p > 0.05). Similarly variation in age groups, young and adult, were not statistically significant (p >0.05) with relative prevalence of 2.63% (n=19) and 2.78 % (n=8) respectively. Likewise small ruminants originated from high land and low lands and slaughtered in these export abattoirs showed almost similar sero-prevalence pattern, 2.90% (n=16) and 2.45% (n=11) respectively without significant difference (p > 0.05) (Table-1).

RESULT

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Though body weight score of an animal is affected by multiple factors and is usually the outcome of the diseases, assessment in this study to see its association with the risk of exposure to brucellosis, showed clearly higher sero-prevalence, 100.00% (n=5) in poor body conditioned and only 1.50% (n=14) in good body conditioned animals with statistically significant values (p<0.05) (Table-2).
Table 1: Prevalence of small ruminant brucellosis based on species, age and origin of animals.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Sample tested</th>
<th>RBPT positive</th>
<th>x², p-value</th>
<th>CFT positive</th>
<th>x², p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caprine</td>
<td>612</td>
<td>17(2.78%)</td>
<td>x²(1) = 1.859, p=0.173</td>
<td>13(2.12%)</td>
<td>x²(1) = 1.99, p=0.1583</td>
</tr>
<tr>
<td>Ovine</td>
<td>388</td>
<td>17(4.38%)</td>
<td></td>
<td>14(3.61%)</td>
<td></td>
</tr>
<tr>
<td>Sub Total</td>
<td>1000</td>
<td>34(3.4%)</td>
<td></td>
<td>27(2.7%)</td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>722</td>
<td>27(3.74%)</td>
<td></td>
<td>32(2.12%)</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>278</td>
<td>9(3.24%)</td>
<td></td>
<td>8(2.78%)</td>
<td></td>
</tr>
<tr>
<td>Sub Total</td>
<td>1000</td>
<td>34(3.4%)</td>
<td></td>
<td>27(2.7%)</td>
<td></td>
</tr>
<tr>
<td>High land</td>
<td>551</td>
<td>20(3.63%)</td>
<td></td>
<td>16(2.90%)</td>
<td></td>
</tr>
<tr>
<td>Low land</td>
<td>449</td>
<td>14(3.12%)</td>
<td></td>
<td>11(2.45%)</td>
<td></td>
</tr>
<tr>
<td>Sub Total</td>
<td>1000</td>
<td>34(3.4%)</td>
<td></td>
<td>27(2.7%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Relative sero-prevalence of brucellosis in relation to body conditions out of 1000 male small ruminants subjected for slaughter in selected export abattoirs, Ethiopia.

<table>
<thead>
<tr>
<th>Body condition</th>
<th>Sample tested</th>
<th>RBPT positive</th>
<th>x², p-value</th>
<th>CFT positive</th>
<th>x², p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>5</td>
<td>5(100.00%)</td>
<td>x²(2) = 1.610, p=0.000</td>
<td>5(100.00%)</td>
<td>x²(2) = 2.075, p=0.000</td>
</tr>
<tr>
<td>Medium</td>
<td>66</td>
<td>8(12.12%)</td>
<td></td>
<td>8(12.12%)</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>929</td>
<td>21(2.26%)</td>
<td></td>
<td>14(1.51%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td>34(3.4%)</td>
<td></td>
<td>27(2.7%)</td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION**

Abattoir provide information on the epidemiology of diseases on livestock to know to what extent the general public is exposed to certain zoonotic disease and estimate the financial losses incurred through condemnation of affected organs and carcasses [17,18]. According to this study the overall CFT confirmed sero-prevalence of male sheep and goat brucellosis is 2.7% with relatively higher prevalence rate in sheep (3.61%) than in goats (2.12%). Though goats are more susceptibility to *Brucella* infection than sheep and sheep are not excreting the organism for longer period of time unlike goats [19, 20] the prevalence of sheep can be higher when they are exposed to infected cattle [21].

The result of this study showed lower prevalence than previous studies done on both sexes in Afar region i.e. 14.6% in sheep, 16.2% in goats as per the report of Ashenafi *et al.*[12] and 16% in goats by Yebeltal [22], but it was relatively higher than that of Somali region, sheep (1.6%) and goats (1.7%) as per Yibeltal [22], as well as Central highlands of Ethiopia, 1.5% in sheep and 1.3% in goats as per the report of Tekeleye and Kasali [23]. The difference in the prevalence of brucellosis between the current and the previous studies might be due to the difference in geographical location sampled animals hence abattoirs purchase from both highlands and lowlands of various regions. This study is in line with the study done by Dinka and Regassa [24] who reported higher prevalence in pastoral area (lowland) (15.2 %) than agro- pastoralists (mid land area) (4.1%).

The 2.7% sero-prevalence of this study appears generally to be low when compared with most previous reports may be because infected male animals are usually observed to be non reactors to the serological test due to low antibody titers [25] and because serological testes under estimate brucellosis in males due to the colonization of the bacteria in the testes and reticulo-endothelial system [26].

In this study there were no statistical significant variations observed between brucellosis sero-prevalence and expected risk factors like species, age and origin of the animals (p > 0.05). Similar study conducted by Yohannes *et al.* [27] showed no statistically significant variation among different age groups. But prevalence varies significantly (p < 0.05) with body weights in which higher prevalence were observed in poor body conditioned than that of medium and good body conditions. This variation may be due to the possible associations of higher prevalence brucellosis occurrence in the presence of various infectious diseases that can lead to the reduction of body weight, such as tuberculosis [28].
CONCLUSIONS

In most developing countries, brucellosis is still an endemic disease in human and animals, so in order to control and eradicate the disease, it is very important to establish appropriate serological methods and perform screening tests [29].

The sero-prevalence carried out in this study and the studies conducted so far in Ethiopia indicate that, brucellosis as one of the important diseases in sheep and goats raising districts. Even though no statically significant difference recorded in the prevalence rates with above mentioned risk factors, except body condition, sheep had higher prevalence rates than goats which may be associated with brucellosis of cattle that may expose sheep to higher prevalence while grazing contaminated pasture.

Though the causative agent, *Brucella* is not resistant to mild unfavorable environmental conditions and may die at lower pH of meat and positive sero-prevalence doesn't mean that the agent is present in the animal, the existence of positive results in those animals subjected for slaughter may lead to ban of the export meat and meat-products to avoid zoonotic risks. Therefore it is strongly recommended to perform screening tests on sheep and goats that are supplied to abattoirs before slaughtering process, improve awareness of animal owner's about the risk of brucellosis and its mode of transmission to control the dissemination of the disease.

ACKNOWLEDGEMENTS

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REFERENCES