

Small Ruminant Brucellosis and Awareness of Pastoralists Community about Zoonotic Importance of the Disease in Yabello districts of Borena Zone Oromia Regional State, Southern Ethiopia



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Abstract

Brucellosis is zoonotic disease affecting the wellbeing of human and animals mainly in developing countries. Small ruminants are important domestic animals highly adaptable to broad range of environmental conditions and income source for poor households. Cross sectional study was carried out on a total of 283 (99 sheep and 184 goat) from October 2016 and April 2017 to estimate sero prevalence of small ruminant brucellosis. In addition, structured questionnaire was also administered to 126 respondents of 10 PA's to assess community awareness about zoonotic importance of diseases. The overall sero prevalence of brucellosis in small ruminant was 23 (8.1%) (95%CI: 5.2, 11.9) byc-ELISA. The individual species sero-prevalence of Brucellosis was 9.2 (95%CI: 5.5, 14.4) and 6.1(95%CI: 2.3, 12.7) in goat and sheep respectively. Among 126, 112(88.9) of community have no knowledge about zoonotic importance of Brucellosis and ways of transmission of disease where as 14(11.1%) of them have awareness about a disease. Consequently, they handle all aborted fetus; support their animal during parturition by bare hand without any protective clothing, consume raw milk and animal blood. This suggests high risk of human brucellosis in the study area. In addition, physicians have no awareness about the disease they don't consider Brucellosis while treating patient submitted to health post with suggestive clinical sign Brucellosis. Therefore, integrated human and veterinary doctors' disease control strategy should be developed and applied to control disease both in human and animals.

Keywords: Borena; Brucellosis; Pastoralist; Public awareness; Small ruminant

Introduction

Small ruminants are important domestic animals highly adaptable to broad range of environmental conditions. In addition, base for livelihood of poor family members in tropical livestock production systems in Africa [1]. Goats and sheep in Africa, accounts about 21% of the global small ruminant population. Small ruminants fulfil a number of economic and social functions. According to statistics from the Central Statistical Agency [2], Ethiopia has over 18 million head of sheep and 24 million goats. Twenty-five percent of the sheep and 73% of the national goat population inhabit the lowlands mostly pastoral areas [3]. However, different disease affecting the production and productivity of small ruminant in the area due to management problems and poor animal disease control strategies.

Different livestock diseases can affect production and productivity of livestock in African including Ethiopia. The disease could be Viral, Bacterial or Parasitic disease. *Brucellosis* is a highly contagious bacterial disease of animal which has zoonotic importance, causing significant reproductive losses in animals. Members of the genus *Brucella* are Gram-negative, facultative intracellular pathogens that may affect a wide range of mammals including humans, cattle, sheep, goats, pigs, rodents, and marine mammals [4]. It is endemic disease in African countries among ruminants and humans [5]. Brucellosis in livestock and humans is still common in the Middle East, Asia, Africa, South and Central America, the Mediterranean Basin and the Caribbean. *Brucella melitensis* particularly common in the Mediterranean basin and it has also been reported from Africa, India and Mexico [6]. The disease has worldwide distribution

and importance affecting number of animal species. Species of *Brucella* are obligate parasites, requiring an animal host for maintenance [7]. Infection occurs through inhalation or ingestion of organisms. High numbers of the organism are shed in urine, milk, vaginal discharge, semen and through discharges of birth of infected animals.

Caprine and ovine brucellosis, caused by the zoonotic bacterium *Brucella melitensis*, is an economically important cause of abortion in small ruminants [8,9]. Brucellosis in small ruminants is mainly caused by *Brucella melitensis* (*B. melitensis*) and *B. ovis* sporadic case by *B. abortus*. This disease is mainly characterized by abortion with the development of yellowish, sticky layers on the placenta in females. In male animals, it causes orchitis and epididymitis, as well as inflammation of the joints and bursa. The consequences of brucellosis in small ruminants are: infertility, a high mortality rate in lambs and kids, mastitis, reduced milk production. According to OIE it affects about half million people acquire Brucellosis annually in the globe [10], it is a zoonotic disease and represents one of the most common public health problems worldwide [11]. However, it is neglected diseases so far in developing countries. It widely spread in many developing countries and poorly diagnosed in both human and animals due to poor health facilities, diagnostic facilities and limited awareness of the disease among medical practitioners [12]. Its diagnosis is complicated by the fact that it shares symptoms with malaria, a common cause of fever and a leading cause of morbidity and mortality in Sub-Saharan Africa, especially in children under 5 years [13]. Sharing of clinical features with malaria and other febrile conditions can likely lead to misdiagnosis and mismanagement of cases and hence perpetuating human vulnerabilities [14,15]. Therefore, the objective of this study:

- 1) To estimate sero- prevalence of small ruminant brucellosis in study area,
- 2) To assess risk factor associated with disease in human and small ruminants in study area and
- 3) To assess community awareness about zoonotic importance of disease in the area.

Materials and Methods

Description of the study area

The study was conducted in Yabello districts of Borena zone of Oromia Regional State, southern Ethiopia. The capital of the zone, Yabello is 575KM far from capital city Addis Ababa to south direction. The altitude ranges between 943 and 2,400 meters above sea level with average annual rain fall of 400 to 1100mm exhibiting a bimodal rainfall (long and short rainy seasons). The long rainy season extends from March to May whereas the short rainy season occurs from mid-September to the mid November. The annual temperature varies between 19-42 °C. The pastoralists usually move with their animals depending on the availability of forage and water (BZPDO, 2014) (Figure 1).

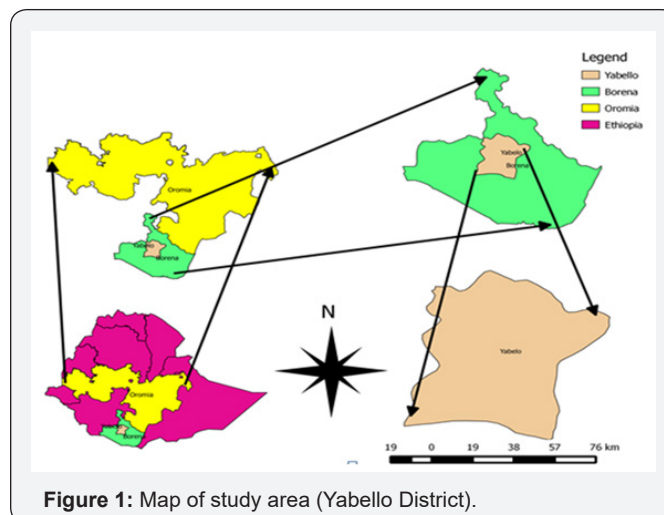


Figure 1: Map of study area (Yabello District).

Milk is the main source of food in addition to being the source of income particularly during the rainy season when it is produced sufficiently. Borena zone has about 1, 844, 027 cattle, 1, 299, 451 Goat, 664, 307 sheep, 216, 131 Camels, 414, 021 poultry, 114, 952 Donkey, 2, 624 Horse and 20, 807 Mules (BZPDO, 2014).

Study Design and Population

Study design

Cross sectional study was carried out on 283 small ruminants (184 goat and 99 sheep) in Yabello districts from October 2016 to April 2017. Study ten (10) Pastoralist Association (PA) was purposively selected based on small ruminant population. Age determination and history for presence or absence of reproductive problems were obtained from the owners and the animal attendants.

Questionnaire survey

A questionnaire survey was administered to 120 animal owners/attendant respondents whose animals were included in the study with the help of local language (Afaan Oromo). And questioner also administered to 6 human health personnel. The information gathered relates to animal risk factors like history of abortion, contact with other ruminants, rearing experience and pastoralists awareness about brucellosis and its zoonotic importance was also assessed.

Study Population

Small ruminant (Caprine and Ovine)

The study animals were goats and sheep which managed under pastoral production system. The study was conducted in Yabello districts. The PA's was selected purposively depending on small ruminant population. The sample was collected randomly from 20 herds in 10 Peasant Association (PA) of the districts. The herd size was determined by number of sheep and goat. The flock was group into three groups as Large, medium and small. Large sized flock was flocks with shoat number greater than

(>) 30; medium flock size were number of shoat greater than ten(10) and less than 30; and small herd size were herds with animal number less than or equal to(≤) 10 based on community herd level grouping.

Sample size

The previous prevalence of sheep and goat brucellosis in study area was 1.17 and 1.88 respectively [16]. Therefore using the formula

$$n = \frac{1.96^2 X P_{exp} (1 - P_{exp})}{dx^2}$$

Where: n = the required sample size

P_{exp} = expected prevalence/previous prevalence

d= desired absolute precision

When this calculated by absolute precision at 95% confidence level, the sample size calculated will be 17 and 28 for sheep and goat respectively according to the formula of sample size determination in random sampling for infinite population [17]. Meanwhile, sample size obtained using the formula was too small; sample size increased to 99 and 184 for sheep and Goats respectively for the study.

Type of Sample and Sampling Procedure

Serum sample

From all small ruminant in the district of study area serum was collected randomly from jugular vein using disposable needles and plan vacutainer tubes aseptically. About 8 ml of blood sample was collected and allowed to clot at room temperature. Finally serum was separated from clotted blood by decanting to plastic criovials. Serum labeled properly and stored at -20 °C for serological test.

Laboratory Techniques

Serological examination

All the sera samples were initially screened by Rose Bengal plate test (RBPT) for the presence of Brucella antibodies using RBPT antigen in Yabello Regional Veterinary Laboratory. Finally, samples test by c-ELISA in National Animal Health Diagnostic and Investigation Center (NAHDIC).

Data Management and Analysis

Data about community awareness on brucellosis; way of consumption of animal product, presence and absence of undulant fever, joint problem and other complications recorded. Additionally, abortion history, lactation age, retained placenta in ewes, still birth, other suggestive clinical sign of brucellosis was assessed using structured questionnaire from animal owner/ attendants. All recorded data while collecting blood sample were stored in the Microsoft excel spread sheet program and analyzed by using Stata 11 the p value used to determine the significance of different risk factors with sero-positivity and, 95% confidence interval (CI) at 5% cut-off value were set for significance.

Result

Laboratory Result

Out of 283 (184 Caprine and 99 Ovine) serum sample collected from small ruminant serially tested by RBPT and c-ELISA; 24 (8.5%) and 23(8.1%) were positive for Rose Bengal Plate test (RBPT) and Competitive Enzyme Linked Immuno Sorbent Assay(c-ELISA) respectively. The overall Prevalence of small ruminant brucellosis in study area was 8.1%(95%CI: 5.2, 11.9). The individual species sero prevalence of brucellosis was 9.2(95%CI: 5.5, 14.4) and 6(95%CI: 2.3, 12.7) in goats and sheep respectively (Table 1). Highest prevalence of brucellosis recorded in goat 9.2(95%CI: 5.5, 14.4) than in sheep. High estsero positivity recorded in herds with more number of shoat in the herds with prevalence 17.3(95%CI: 9.8, 28.5).

Table 1: Species based sero prevalence of Brucellosis in small ruminants.

Species	No tested	No of positive animals (Prevalence)						95 % CI
		RBPT			c-ELISA			
		Negative	positive	%	Negative	positive	%	
Caprine	184	166	18	9.8	167	17	9.2	5.5, 14.4
Ovine	99	93	6	6.1	93	6	6.1	2.3, 12.7
Total	283	259	24	8.5	260	23	8.1	5.2, 11.9

Statistically significant variation between herd size in small ruminant in study area with chi-square 13.85 and p value of 0.001 recorded. The highest prevalence recorded in herd with large number of shoat in order by medium size herd with prevalence of 7.9(95%CI: 3.3, 13.02) in small ruminant. Furthermore, there

was also statistically significant difference between ewes with retained fetal membrane, still birth; and ewes with no retained fetal membrane and still birth with p value less than (p value< 0.05) (Table 2).

Table 2: Prevalence of small ruminant brucellosis in association to different risk factors.

Factors	N	Prevalence (%)			x ²	P-Value
		RBPT	c-ELISA	95%CI		
Retained Fetal Membrane						
Yes	9	3(40.0)	3(33.3)	4.2, 10.6	14.1	0.004
No	262	19(7.3)	18(6.9)	4.1, 10.1		
Abortion history						
Yes	29	2(6.9)	1(3.4)	0.1, 17.8	0.8	0.35
No	242	20(8.7)	20(8.3)	5.1, 12.2		
Still Birth						
Yes	3	2(66.7)	1(3.4)	9.4, 99.2	14.7	0
No	268	19(7.1)	20(8.3)	4.3, 10.8		
Age						
Adult	272	24(8.8)	23(8.1)	5.4, 12.4	1.01	0.31
Young	11	0	0	0.2, 41.3		
Sex						
Female	271	22(8.1)	21(7.7)	4.8, 11.6	1.22	0.26
Male	12	2(16.7)	2(16.7)	2.1, 48.4		
Herd size						
Large	75	13(17.3)	13(17.3)	9.8, 28.5		
Medium	127	10(7.9)	9(7.1)	3.3, 13.02	13.85	0.001
Small	81	1(1.2)	1(1.2)	0.03, 6.7		

Questioners Result

The questioner was administered to a total 120 pastoralist within 10 peasant association (PA) 20 Olla of three districts and 6 human health personnel. The questioner result showed that, assumed risk factors associated with brucellosis in the area. These were handling aborted fetus and aborted materials (Placenta) by bare hand; of drinking of raw milk and blood. Because, 120(95.3%) pastoralists drink raw milk and 114(90.5%) handle aborted fetus by bare hand which may main way of acquiring the disease. From house hold members responsible person in caring small ruminant are children and females, when children come

across aborted shoat while keeping them, they handle by bare hand. Children and female are most risk group in house hold in acquiring brucellosis from small ruminants. Community animal Health workers (CAHWs) and human health professionals working in health post have awareness about the disease in study area. Though, they know about the disease, they didn't consider *brucellosis* while diagnosing patients with suggestive clinical sign of disease. This could be due to lack of diagnostic equipment and kits, less attention given to the disease and absence of coordination between human and animal professional on zoonotic disease in sharing information for effective control and prevention (Table 3 & Figure 2).

Table 3: Associated risk factor of brucellosis in human and community awareness.

Know about Brucellosis	Number of Respondents (%)
Yes	14(11.1%)
No	112(88.9)
Use protective while supporting animals during parturition	
Yes	10(7.9%)
No	116(92.1)
Consume raw Animal products (Milk, Blood or Meat)	
Yes	120(95.3%)
No	6(4.7%)
Handle aborted fetus and retained placenta by bare hand	
Yes	114(90.5)
No	12(9.5)



Figure 2: Pastoralist while supporting sheep during parturition by bare hand.

Discussion

Ethiopia is one of the developing countries in Africa and holds the 1st spot in the rankings of livestock number in the continent. There is a huge population of livestock and a very high portion of the human population live in rural areas, investigating the status of brucellosis both in livestock and humans is of principal importance to protect public and animal health. Small ruminants are main source of income for poor communities in developing countries. The community daily life and livelihood is dependent on animal and animal products which allow easy transmission of zoonotic disease from animal to human. Brucellosis is one of a disease which can affect health of human who has close contact with animal and feeding habit of raw animal products. As in other developing countries, brucellosis has not been brought under control in Ethiopian livestock, which might be due to trans-boundary animal movement, information gap about disease both in human and animal health professionals, absence of strategic plan to prevent/control brucellosis in animal and human, lack of awareness of the disease among pastoralists, farmers, and the general public Boukary et al. [18]. The current study indicated serological evidence of brucellosis in small ruminant, information gap on existence of disease both in human and animal health professionals; and lack of community awareness about zoonotic importance of the disease.

This study showed that the overall sero-prevalence of small-ruminant brucellosis in Borena zone Oromia regional state, Ethiopia was 8.1% out of which 9.2% and 6.1% in goat and sheep respectively. This finding considerably higher than study conducted by Goloet al. [16] in Borena zone, Oromia region with prevalence of 1.17 and 1.88%, in sheep and goat respectively; and study conducted by Sintayehuet al. [19] with prevalence 3.3% small ruminant *brucellosis*. This difference between two study conducted in the same area may be explained as the variation in serological test used. The higher sero positivity was recorded in goat than sheep this is in agreement with study conducted by Goloet al. [16], Tsehayet al. [20], Bezabih & Bulto

[21] and Wedajo et al. [22].

As this study showed, pastoralists recognize abortion in their animals but have no awareness about zoonotic importance of the disease. They consume raw milk and animal blood, handle aborted fetus with bare hand without any protective clothing. Due to this there is high risk of human brucellosis in the area this is in agreement with study conducted by Habtamu et al. [9]. Additionally, certain pastoralists complain suggestive clinical sign of Brucellosis like undulant fever, joint problems and back pain this also in agreement with study conducted by Bekele et al. [23]. Pastoralist's daily life is linked with livestock production and their close contact with animal and animal product is obvious. This permits spread of zoonotic diseases that are communicable from animal to human. Animals unavoidably contaminate their environment during abortion or calving with discharges which might be the source of infection to other animals while humans are often infected through contact with the infected animals, aborted materials and vaginal discharges [24].

In this study, statistically significance difference ($P=0.004$) was recorded with high sero-prevalence of brucellosis in small ruminants (ewes) having history of retained fetal membrane than those without these problem. However, there were no statistically differences between ewes with abortion history and with no problem of abortion. This could due to unknown cause abortion outbreak in 2015/2016 in study area. Generally, disease prevalence in combination with lack of community awareness about zoonotic importance of the disease and close contact of pastoralists with animals will create high risk of human brucellosis specially, in children and females who are responsible for caring small ruminants [25-27].

Conclusion

The study revealed that brucellosis is prevalent and well-established infection among goats and sheep in the study area. Sero-prevalence of brucellosis was higher in goats than sheep; and animals within dense and large herd size. It could be concluded that the positive animal can be a potential risk for both animals and humans in the area. In addition, communities in study area had no awareness about zoonotic importance of the disease. This could increase risk of human brucellosis. Despite, high risk of human brucellosis exists; physicians are not considering brucellosis while diagnosing patients with suggestive clinical sign of brucellosis. Therefore, we recommend that

- 1) National brucellosis control and prevention strategy should be developed and applied,
- 2) Community should be educated about zoonotic importance of the disease and
- 3) Human and animal health professionals; have to work together on zoonotic disease; like brucellosis for successful prevention and control of the disease both in human and animals.

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