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Research Article

Brucellosis in Borena Cattle: - Seroprevalence and Awareness of the Pastoral Community in Yabello Ethiopia

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Abstract

The study was cross-sectional and the objectives of the study were: estimation of prevalence of bovine brucellosis, assessment of risk factors and assessment of knowledge of pastoralist about the disease and its risk factors in Borana cattle at Dida Tuyura ranch and its surrounding. The study animals were selected by multi-stage sampling. Blood was collected from selected animals and serum was extracted. The Sera samples were screened using the rose Bengal plate (RBPT) test and those which tested positive were further tested using Complement fixation test (CFT) for confirmation. Sixteen (16) cattle out of 661 (2.4%; 95 5 CI: 1.39, 3.9) tested using RBPT were found to be positive. However, only 5 animals were found positive with CFT in animal sampled from Dida Tuyura Ranch yielding a prevalence of 1.47% (95% CI: 0.48, 3.41). from Six animals which gave positive reaction to RBPT from pastoralists' herd in the vicinity of the ranch only two gave positive reaction to CFT yielding a prevalence of 0.62% (95% CI: 0.162, 4.73). Taken together the seroprevalence of bovine brucellosis as revealed by CFT 1.1% (95% CI: 0.43, 2.17). Univariable logistic regression analysis showed that previous history of abortion and retained fetal membranes were significantly associated with seropositivity to brucellosis ($P<0.05$) whereas sex, age, parity, body condition and PAs were not associated with infection with Brucella ($P>0.05$). In the multivariable analysis, only abortion (OR=13.46, $p<0.05$)) remained to be independently associated with brucellosis seropositivity whereas other not. The results of questionnaire survey revealed that the majority of the pastoralists or cattle attendants do not have sufficient knowledge about brucellosis and are at risk of acquiring the infection. Therefore, educating the pastoralists about the disease through extension service on the handling of aborted fetuses and assistance of delivery is important.

Keywords: Bovine Brucellosis; Knowledge of Pastoralists; Seroprevalence; Borana; Ethiopia

Introduction

Cattle are an important component of the livestock sector and are mainly kept in different agro ecological zones of Ethiopia. They provide various benefits particularly to smallholder farmers and the country as a whole. The current report of the Central Statistical Agency (CSA) Ethiopia hosts over 50 million heads of cattle. They are important collaterals and insurance in case of crop failures. Besides, they are important source of cash and high-quality proteins to the rural people [1,2].

The level of product obtained from cattle at present is suboptimal in all regions and production systems of the country. In the first place, the national cattle productivity is one of the lowest in Africa. Secondly, the contribution of cattle to the national economy does not commensurate with its size. All together, level of foreign currency obtained from international marketing of cattle and cattle products is much lower than would be expected, given the size of the cattle population [3]. This suboptimal productivity of Ethiopian cattle is due to several technical and non-technical factors. Infectious diseases are among the

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technical factors impairing cattle production. Brucellosis is one of these infectious diseases of live stock and human in Africa and other parts of the developing world. Its importance is emanated from its wide spread distribution and impact on multiple animal species, such as cattle, sheep, goat, pig and human beings [4,5].

In cattle Brucellosis is primarily a reproductive disease characterized by abortion late in pregnancy, frequently followed by fetal membrane retention and endometritis which may be the cause of infertility in subsequent pregnancies [6]. The serological differences are related to the amounts of A and M antigens that a *Brucella* strain possesses. There are about nine biotypes being recognized and a number of strain variants. About 85-89 % of the infection are from biotype1 [7]. *Brucella abortus* affects many animal species on every continent and has zoonotic and economic importance, as well as a public health hazard [8].

Bovine brucellosis is widespread throughout the world except for a number of countries (Japan, Canada, USA) where eradication has been successful [9]. It is an economically important disease of livestock causing reproductive wastage through infertility, delayed heat, loss of calves, reduced meat and milk production, culling and economic losses from international trade bans [10]. Many countries have made considerable effort with their eradication programs and some have eradicated the disease [11]. Most European countries are free of Bovine Brucellosis [12].

Brucellosis is of major public health importance in most developing countries, which have no national brucellosis control and eradication program [6]. In addition, the policy of many developing countries, importing exotic, high production animals, without having the required veterinary infrastructure and appropriate level of development of socio-economic situations of the animal holders aggravates the situation [13]. In most developing countries, resource is short falling to control brucellosis. Although, information on the prevalence of brucellosis is inadequate, there are indications of a very high incidence in many areas, particularly in the tropical countries where the loss in milk and animal protein that accompanies this disease is least affordable. The prevalence of infection varies considerably between herds, areas, management and countries [9].

In Ethiopia, information on economic and zoonotic importance of brucellosis is not well established quantitatively as well as qualitatively as compared to the degree of the risks of the disease expected due to high animal population of the country and the greater tendency of private as well as government farms to expand high producing exotic dairy farms to satisfy the ever-increasing milk demand of the urban population [14].

However, the existence of bovine brucellosis in state dairy and privately owned dairy farms, different ranches and research institutions is reported. The first report was given in 1970 by the veterinary section of the US Navy Medical Research Unit which shows that the overall prevalence of bovine brucellosis was 11.7% out of 1328 bovines tested for brucellosis in different regions of the country [14]. Though the team had reported that it had conducted the test in all domestic animals, they have reported bovines as the only species to give positive reaction for the test. According to their study, the result of the test in different regions of Ethiopia was 2 % (1:43) for Eritrea, 8 % (24:293) for Harar, 5% (2:40) for Illuababor, 7 % (10:141) Kaffa, 8 % (28:349) for Shoa, 21 % (90:418) for Sidamo and 2 % (1:40) for Wallo [14]. According to a recent Studies, prevalence rate as low as 0.2% is reported in Jimma [15] and 1.66 was reported in Sidama Zone [16].

The evidences of *Brucella* infections in Ethiopian cattle have been serologically demonstrated by different authors [17, 18, 19]. A relatively high seroprevalence of brucellosis (above 10%) has been reported from smallholder dairy farms in central Ethiopia [20]. While most of the studies suggested a low seroprevalence (below 5%) in cattle under crop-livestock mixed farming [21, 22, 23]. There is a scarcity of published literature on the status of cattle brucellosis in pastoral areas of the country where large population of cattle are reared. So far, a study carried out in east Showa zone of Ethiopia showed a relatively higher seroprevalence in pastoral than agropastoral system [24].

The limited studies (the surveys) so far conducted on brucellosis are not sufficient to show the exact national picture and significance except highlighting the existence of the disease in very limited areas of the country which were selected not based on strategic national disease survey approach but on personal preference and motives of the investigators or researchers. Moreover, most of the studies so far conducted were based on serological diagnostic technique; most of which were not according to OIE recommendation for international trade for their sensitivity and specificity. The overall infection risk is also influenced by the pattern of *Brucella* spp. present; as *B.melitensis* often represents a more serious public health hazard than *B. abortus* [25].

To date, the occurrence of brucellosis has not been investigated in different livestock species sharing common ecozone and management under a pastoral setting in Ethiopia. The present study therefore aimed at investigating the seroprevalence situations of brucellosis in the major livestock species kept together in the Borana pastoral system of Ethiopia. Hence, taking into account the above-mentioned scenarios, this research (study) on the seroprevalence of bovine brucellosis and its zoonotic importance was under taken by using two currently OIE recommended serological methods, Rose Bengal Plate Test (RBPT) and Complement Fixation Test (CFT), and questionnaire survey on potential risk factors for the disease in animals and zoonotic significance in humans, in the study area with the following objectives.

Objectives

✓ To estimate overall sero-prevalence of bovine brucellosis in the Dida Xuyura Ranch and adjacent pastoral herd.

✓ To assess the potential risk factors of bovine brucellosis in the study areas

✓ To assess the knowledge of pastoralist about the disease and its risk factors in the study area

Materials and Methods

Description of the Study Area

The study was conducted in Yabello district, Borana zone, Ethiopia **(Figure 1)**. The Yabello district comprises about 23 pastoral associations (PAs), in which 48% (11 PAs) and 52% (12 PAs) of the peoples dwelling in and around the district practice pastoral and agro-pastoral activities, respectively. Yabello area is featured by semi-arid to arid climate and scarcity of water is standing problem. As a result, livestock production play's important role in the livelihood of the community. Live stock is kept under extensive production system.

Sometimes agriculture is practiced when there is sufficient rain during major rainy seasons. Major rainy season is from mid March to May, which is 'GANNA'. The minor rain season is from mid September to October, which they call 'HAGGAYA.' There are veterinary services provided by veterinary doctors, animal health assistants, community animal health workers. The estimated total human population of Borana zone is 480,000 with annual population growth of 2.5–3% (Homan et al., 2003). The Borana zone supports a total of 1,771,589 cattle, 1,991,196 goats, 699,887 camels and 52,578 donkeys (CSA, 2008). Cattle are the livestock species highly valued by the Borana pastoralist. To this end, the government has established Borana cattle breeding and improvement center at Dida Xuyura. Dida Xuyura ranch is the only Borana cattle breeding and improvement premise found in the southern rangelands. The ranch is situated at about 550 km south of Addis Ababa and 20 km north of Yabello town.

Study design, Study Population and sample size

A cross-sectional study was conducted from November 2005 to April 2006 to estimate the seroprevalence of bovine brucellosis and to identify the potential risk factors associated with the occurrence of the disease in the study area. The study population used in this study is the Borana cattle raised at the Dida Tuyura cattle breeding and improvement ranch and Dida Yabello peasant association. The sample size for this study was determined as described by [26]. Using 11.2% expected prevalence of Brucellosis at Yabello distric [27] and 5% absolute precision at 95% confidence level, the number of animals needed for this study was calculated 153. Based on livestock population in the area the sample size was increased to 661 to make the samples representative and increase accuracy of the result.

Sample and Data Collection

In Dida Tuyara Ranch there are 35 herds each consisting of 40-50 cattle. From each herd 10 animals ≥ 3 years of age were randomly selected. Blood samples were collected from 350 animals. From each cattle about 10 ml of blood was collected from the jugular vein following standard procedures using plain vacutainer tubes. Besides blood samples, history of abortion, number services per conception, retained placenta, lactation stages were collected from the records for animals raised on the ranch. 11 samples which were not having clear information were discarded.

Whereas from Dida Yabello, 33 model cattle owner pastoralists were purposively selected and 322 blood samples were collected from their herds. Sample to be taken from each pastoralist herd was decided based on herd size. Animals ≥ 3 years of age were randomly selected and sampled. Besides blood samples, information about history of abortion, number services per conception, retained placenta, and lactation stages were collected for sampled animals from owners. Therefore 661 individual animals were included into the study to investigate bovine brucellosis in the study area. Accordingly, the collected blood samples were kept at room temperature overnight for clot retraction and serum was harvested separately into sterile tubes. The sera samples were stored at -20◦C until analyzed in the laboratory.

Laboratory Analysis

Rose Bengal plate test: All serum samples were screened using the RBPT, according to the procedures described by [28] and the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals of the World Organization for Animal Health [29]. The rose bengal antigen constituted a suspension of B. abortus (obtained from the Institute Pourquier, 326 rue de la Galéra, Parc Euromédecine, 34090 Montpellier, France). Thirty µl of serum was mixed with an equal volume of antigen suspension on a glass plate and agitated. After four minutes of rocking, any visible agglutination was considered a positive result.

Complement fixation test: All sera which tested positive to the RBPT were further tested using CFT for confirmation. The CFT was performed at the National Veterinary Institute, Debre Zeit, Ethiopia. A standard B. abortus antigen for CFT (Veterinary Laboratories Agency, United Kingdom) was employed to detect the presence of antibodies against Brucella in the sera. The control sera and complement were both obtained from the Federal Institute for Health Protection of Consumers and Veterinary Medicine, Germany. Sera with a strong reaction – more than 75% fixation of the complement (3+) at a dilution of 1:5 and with at least 50% fixation of the complement (2+) at dilutions of 1:10 and 1:20 – were classified as positive (+), according to the guidelines of the [29].

Sensitivity and specificity of the tests: For RBPT, sensitivity from 91% to 100% in affected areas [30], and from 96.7% to 100% on Brucella-free farms (20); specificity from 95% to 99% in affected areas (Faye et al., 2005), and from 79% to 91.9% on free farms [31]. For the CFT, sensitivity 96.7% to 100% and specificity from 88.8% to 97.7% used [31].

Data analysis

Putative biological and environmental factors believed to be associated with Brucella infection were recorded and entered into Microsoft excel spread sheet. All the necessary statistical analysis was performed using STATA version11.0 for windows (Stata Corp, College Station, TX) or R. Association of Brucella seropositivity with aforementioned exposure variables was assessed using logistic regressions.

Results

Results of seroprevalence of bovine brucellosis at animal level

In this study 16 cattle out of 661 (2.4%; 95 5 CI: 1.39, 3.9) tested using Rose Bengal Plate Test were found to be positive. The sero-prevalence was 2.94% (95% CI: 1.42, 3.53) in 339 animals sampled from Dida Tuyura Ranch where as it was 1.86% (95% CI: 0.68, 4.01) in 332 cattle sampled from pastoralist' herd surrounding the ranch. However, only 5 animals were found positive with Complement Fixation Test in animal sampled from Dida Tuyura Ranch yielding a prevalence of 1.47% (95% CI: 0.48, 3.41). From Six animals which gave positive reaction to Rose Bengal Test from pastoralists' herd in the vicinity of the ranch 2 also gave positive reaction to Complement Fixation Test yielding a prevalence of 0.62% (95% CI: 0.162, 4.73). Taken together the seroprevalence of bovine brucellosis as revealed by Complement Fixation Test was 1.1% (95% CI: 0.43, 2.17).

Results potential risk factors associated *Brucella* seropositivity at animal level

Table 1 present results of animal level *Brucella* seropositivity and their association with exposure variables using logistic regression. Accordingly, seroprevalence of bovine brucellosis did not show significant variations among parity, body conditions and sex ($P > 0.05$) using univariate logistic regression analysis. However, abortion history and RFM were the two potential

risk factors significantly associated with Brucella seropositivity (P<0.05) by using univariable analysis of logistic regression. Animals that have abortion history were 10 times at risk of being infected with *Brucella* than animals did not have abortion history whereas animals that had suffered from retained fetal membranes were 9.7 times at risk of being positive to *Brucella* infection than animals without such history.

Table 1: Univariable analysis of potential risk factors associated *Brucella* seropositivity.

Variable category	No of animal studied	Seroprevalence (%)	P value	OR (95%CI)
PA				
Dida Tuyura	339	1.47	0.299	2.4(0.46,12.4)
Dida Yabello	322	0.62	-	
Sex				
Male	57	1.73	0.584	1.7(0.21,14.4)
Female	604	0.99	-	
Body conditions				
Poor	195	2.3	-	1
Medium	317	0.3	0.056	0.12(0.014,1.05)
Good	149	0.7	0.229	0.26(0.01,0.06)
History of abortion				
Yes	80	5	0.003**	10.2(2.22, 46.2)
No	581	0.51	-	1
RFM				
Yes	50	6	0.004**	9.7(2.1,45.5)
No	611	0.65		1
Parity				
No parity	57	1.75	-	1
1st parity	280	0.71	0.461	0.40(0.037,4.51)
2nd parity	216	1.38	0.838	0.75(0.08, 7.72)
Above three	108	0.92	0.649	0.52(0.03, 8.52)

Statistically significant

Table 2 presents results of other potential risk factors analyzed using Fisher' exact test that came up with zero out come in their category. Accordingly, in the present study age groups were not significantly associated with *Brucella* seropositivity based on Fisher's exact test (P>0.05).

Table 2: Fisher's exact test results for association of potential risk factors with *Brucella* seropositivity.

Variable category	No of animal studied	Seroprevalnce (%)	P value*
Age			
Young-adult	142	0	0.525
Adult	336	1.5	
Old	183	1.1	

Multivariable analysis of animal level risk factors with Brucella sero-positivity

A risk linked abortion history was observed in final model of animal level analysis. Thus, in the multivariable analysis, only abortion remained to be independently associated with brucellosis seropositivity whereas other not **(Table 3)**.

Table 3: Multivariable model for risk factors of bovine *Brucella* seropositivity at animal level.

Variable category	Coefficient	SE	CI (95%)	P value	OR
Sex					
Male	1.67	1.24	-0.76, 4.11	0.178	5.3
Body conditions					
Medium	-2.07	1.1	-4.25, 0.09	0.061	0.12
Good	-1.41	1.11	-3.59, 0.76	0.204	0.24
Abortion history					
Yes	2.6	0.88	0.87, 4.32	0.003*	13.46
Constant	-4.68	0.74	-6.14, -3.22	0	1

Constant: female, poor and no variable category (references for each variable)

*: statistically significant

Results of Questionnaire Survey

A total of 33 livestock owners in the Borana pastoral areas surrounding Dida Tuyura Ranch, who are among the ones to whom the animals breed on the ranch are distributed were interviewed, based on their willingness to participate in the survey. The owners revealed that extensive management system was exercised in both Dida Tuyura and Liban Kara villages (Ollas) of Yaballo district. Cattle are either kept alone or together with other species of animals mainly for milk production (30/33=90.91%; 95% CI: 75.67, 98.08) and income generation (3/33=9.09%; 95% CI: 13.29, 45.52) through marketing. The highest proportion (27/33=87.88%; 95% CI: 71.79, 96.59) of the cattle herds were reared along with camels, sheep and goats, while (6/33=18.18%; 95% CI: 6.98, 35.46) of cattle herds were kept only with small ruminants, while only very few herds were kept along with either only equine or camels. Seven of the 33 interviewed pastoralists (21.21%; 95% CI: 8.98, 38.90) do not separate animals during parturition while the remaining provide separate parturition area for pregnant female cattle. The larger proportion of the respondents (19/33 =57.57%; 95% CI: 39.22, 74.52 and 20/33 = 60.60%; 95% CI: 42.14, 77.09) respectively do not have calving room and practice poor hygienic practice during assisting of parturitions. Ten of the interviewees (30.30%; 95% CI: 15.59, 48.71) experienced abortion in cattle on their farms and 29/33 (87.88%; 95% CI: 71.79, 96.59) of the dispose the aborted fetus in the environment. The questionnaire survey showed that over all of the interviewed owner's stated that they drank fresh raw milk frequently. Most of the milk originated from their own cattle, the rest was purchased. Almost about half of the pastoralists have their cattle tested for brucellosis previously. They also indicated that they knew that brucellosis affects other animal species.

Discussion

Brucellosis is a serious zoonotic disease affecting man and all domestic animals. It is considered to be one of the great public health problems all over the world [25]. In Ethiopia, bovine brucellosis has been extensively studied in intensive dairy cattle [18]. However, little attention has been paid to this disease in pastoral areas of Borana. Control of brucellosis in humans depends on the availability of reliable and up to date information on its occurrence and distribution in animals.

In the present study, all the 661 cattle were clinically normal at the time of sampling and according to the ranch attendants and owners, none had previously shown clinical signs of brucellosis. The seroprevalence of bovine brucellosis reported in Dida

Tuyura Ranch and pastoral herds is 1.1%. This finding in apparently healthy animals indicates that many infected cattle might be silent carriers for brucellosis and their products may pose a serious health problem for the community. In consent to this study previous authors showed lower prevalence of brucellosis in cattle [18] and in camels [32; 33].

The seroprevalence result of the present study is lower than many of the earlier reports in Ethiopia. For instances, higher prevalence than the current report was observed by various authors (4.2% in Borena, Oromia region by [34], 1.7% in Tigray by [32], 7.6 % in Afar by [25] and 2.43 % in Jijiga by [36]. The findings in the present study were also lower than reported in other African countries. For instance, a prevalence of 2.0 to 15.4% was reported in Kenya [37], 3.1% in Eritrea [38] and 3.1% in Somalia [29]. Differences in seroprevalence observed in this study, as opposed to those recorded by previous researchers, might also be due to differences in herd size, sample size, tests used, agro ecological and management conditions, and the presence or absence of infectious foci, such as *Brucella*-infected herds, which could spread the disease among contact herds. In general, the occurrence of brucellosis in cattle bear on ranch is significant. It may act as a source of infections for cattle owned by pastoralists if the heifers distributed are not tested regularly. This may bear huge impact the economy the area in general.

There was no statistically significant difference (P>0.005) in seroprevalence of *Brucella* between Dida Xuyara ranch and Dida yabello pastoralist cattle. This finding is in line with report by [40] that, there is no significant variation in seroprevalence of *Brucella* among PAs. Even though, it was not statistically significant, high prevalence of *Brucella* was observed in the cattle of Dida xuyara ranch (1.47) than dida yabello pastoralist (0.62%). This may be related to the report that, increase with reproductive diseases increases with the change from pure extensive to intensive management [41].

Though in the present study the seroprevalence of bovine brucellosis *is not statistically significant* between the sexes, the result showed that infection was higher in male (1.73%) than female (0.99%). The similarity of the result could be due to similarity in management even though females is more susceptible to the infection than males. Therefore, contrary to this finding many previous studies showed that female is at higher risk of contracting brucellosis than male for example: [40]; [42]; [43]. Moreover, there was report that serologic response of male animal is limited and the test of infected male animals were usually observed to be non-reactor or shown to be low antibody titers. And also, there were some reports that male cattle are more resistance than female [40]. Still, it could due to accidental appearance of positive animals in males sampled in small numbers 5% of animals with history of previous abortion and 6% of animals with history of retained foetal membrane had *Brucella* antibody in their serum according to recent study. Statistical analysis also revealed associated between *Brucella* seropositivity and history of previous abortion (P<0.003). With history of retained foetal membrane too (P<0.004). This finding is consistence with [44] (6.1%) from Mekele dairy farm and [45] from north Gondar. But lower than the report of [46] (17.39) from in and around Asella and Bishoftu towns. This may be due to fact that the seroprevalence of brucellosis is lower in low-land agro-climate, which is unsuitable for survival of *Brucella* organisms than highlands [47]. Generally, abortion or still birth and retained placenta are typical outcomes of brucellosis. In addition, in highly susceptible non vaccinated pregnant cattle, abortion after the 5th month of pregnancy is cardinal feature of the disease [46].

[40]; [48]; [49] and others reported that there was statistically significant difference among different age groups to *Brucella* seropositivity. There reason was mentioned as; brucellosis appears to be more associated with sexual maturity and higher prevalence reportedly reported in sexually mature animals. Seroprevalence may increase with age as a result of prolonged duration of antibody responses in infected animals and prolonged exposure to pathogen, particularly in traditional husbandry practice where female animals are maintained in herds for long period of time [48]. But according to the present study, there was no statistically significant different among age groups to *Brucella* seropositivity. This may be due to fact that only sexually matured animals above the age of 3 years were sampled and majority was between 3-6 years of age.

Significant difference in sero positivity was not observed among 4 parity groups (P>0.05). This finding is similar with [17] but opposite to the findings of [46]; [41] and [46] who had reported significant difference in seropositivity among parity groups. Finally, body condition had no significant association to *Brucella* seropositivity, findings by [50] and [49] supports this.

The questionnaire survey has provided information regarding the knowledge and practices of cattle owners about brucellosis in Yabello district southeast Ethiopia. Knowledge of diseases is a crucial step in the development of prevention and control measures [46]. Despite huge efforts of the government and non-government institutions to promote and improve animal production in the areas, this study highlighted that general knowledge of brucellosis among the pastoralists was poor. Cattle rearing pastoralists in Borena zone of Oromia regional state practiced a high degree of ruminant diversification, i.e., in addition to cattle, they kept camels, sheep and goats. Mixing of animals although having its own economic importance increases the chances of transmission of brucellosis among the different species [50]. In most of the areas in the study zones, animals had direct access to water sources like pond/dam water and contaminated it through discharges. This is shown by the fact that most of the pastoralists dispose the aborted fetuses in the environment freely. However, the exposure rate may not be very high due to the fact that cattle herds are mobile; this does not restrict them to a specific category of the water resources. Most of the pastoralists in the area indicated that they consume raw milk frequently. Moreover, they indicated that their animals were tested previously for brucellosis but no action was taken. This adds to the problem of the pastoralists as they consider it not to be serious. On top of this most of them didn't have any knowledge about the transmission of brucellosis through consumption of raw milk. The pastoralists of the study area consume raw milk and often assist delivery by themselves despite practicing unhygienic producers. These practices expose pastoralists to brucellosis and clearly show the public health importance the disease in the pastoral areas.

Conclusion and Recommendations

In the present study, respective 1.47% and 0.62% *Brucella* prevalence in apparently healthy cattle in Dida Tuyura Ranch and pastoralists' herd in the vicinity of the ranch was obtained. The study also revealed 1.1% over all prevalence to *Brucella* seropositivity in the area. This low seroprevalence of brucellosis in apparently healthy cattle observed in this study showed that these animals are reproducing normally and serve as permanent

carriers of brucellosis. Previous history of abortion and retained fetal membranes were significantly associated with sero-positivity to brucellosis. Animals that have abortion history were 10 times at risk of being infected with *Brucella* than animals did not have abortion history whereas animals that had suffered from retained fetal membranes were 9.7 times at risk of being positive to *Brucella* infection than animals without such history. Finally, the study clearly showed that the pastoralists have less knowledge of the disease and are at risk of acquiring the infection. The herding practices also showed that cattle could be good sources of *B. abortus* for other animal species. Since this low seroprevalence of bovine brucellosis is not the result of informed policy, there is no guarantee that it will continue unchanged. It is, therefore, an important period of consolidation for pastoralists and local authorities to keep the disease burden low. Therefore, the following are recommended:

- There should be education of the pastoralists about transmission, economic and public health importance of Brucellosis in the study area
- There should be extension service on the handling of aborted fetuses and assistance of delivery
- Animals must be tested and confirmed to be negative before distributed to pastoralists
- The public health authorities should teach the pastoralists to boil milk before consumption
- Further research on the isolation and characterization of circulating *Brucella* species in other livestock (small ruminants, camel, equine and dog) of Ethiopia should be initiated.

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