Seroprevalence of bovine brucellosis in agro pastoral areas of Jijjiga zone of Somali National Regional State, Eastern Ethiopia

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Abstract

A cross-sectional study was carried out from October 2008- March 2009 to determine the sero-prevalence of bovine brucellosis in four districts of Jijjiga Zone, eastern Ethiopia. Purposive sampling technique was employed to select the four districts and nine peasant associations (PAs). A total of 435 blood samples were collected from cattle of 6 or more months of age with no history of previous vaccination against brucellosis. All serum samples were initially screened by Rose-Bengal-Plate Test (RBPT) and those positive reactors to RBPT (n=8) were further tested by complement fixation test (CFT) for confirmation. Out of the 8 RBPT positive sera 6 were found to be positive to CFT. Accordingly, the overall seroprevalence of bovine brucellosis in Jijjiga Zone was 1.38% (6/435). The seroprevalence of bovine brucellosis in the four districts namely Awbare, Harshi, Kebribayah and Fafan districtes were 0.78%, 2.91%, 2.06% and 0%, respectively. Statistically there is no significant deference among the four districts ($\chi^2 = 3.37$, df = 3, P = 0.268). The study also revealed absence of significant statistical variation in the seroprevalence of brucellosis in different age and sex groups of the study animals ($P > 0.05$). Result of this study showed that the seroprevalence of bovine brucellosis in the study area is low. However, it is highly likely that the disease spreads in unaffected animals and herds given the extensive production system prevailing in the area which may allow contact of animals during grazing and at watering points. The public in general and high risk group in particular should be made aware of the zoonotic importance of bovine brucellosis.

Keywords: Agropastoral, Bovine, Brucellosis, Ethiopia, Jijjiga, Seroprevalence

Introduction

Brucellosis occurs worldwide in domestic animals such as cattle, sheep, goats, camels and pigs and creates a serious economic problem for both the intensive and extensive livestock production systems in the tropics (Schwabe, 1984; Seifert, 1996). It also causes considerable economic losses in livestock production due to abortion, infertility and reduction in milk production. In addition, the zoonotic nature of the disease has a serious impact on public health (Garin-Bastuji *et al*., 1998). Generally, the susceptibility of cattle to *Brucella abortus* infection is influenced by age, sex, management and reproductive status of the individual animal (Radostitis *et al*., 2000).

In Ethiopia, so far higher seroprevalence reports are 39% in western Ethiopia (Meyer, 1980), 22% in a dairy farm in northeastern Ethiopia (Tariku Sintaro, 1994), 11%-15% in dairy farms and ranches in southwestern Ethiopia (Tekleye Bekele *et al*., 2000), 8.2% in Arsi area (Bayleyegne Molla, 1989) in central part of the country, 8.1% in dairy farms in and around Addis Ababa (Yilkal Asfaw *et al*., 1998) and 7.7% in Tigray region (Haileselassie Mekonn *et al*., 2010). Relatively low individual animal seroprevalence in intensive farms were recorded in different part of the country. Tadele Tolosa (2004) reported 0.77% in southwestern Ethiopia, Taddesse Yayeh (2003) observed a prevalence of 0.14% in north Gondar Zone and Kassahun Asmar *et al* (2007) documented 2.46% in Sidama Zone of southern Ethiopia. Furthermore, a recent study conducted in pastoral and agropastoral areas of East Shoa Zones of Oromia Regional State by Hunduma and Regassa (2009) reported the prevalence of bovine brucellosis to be 15.2% for pastoral and 4.1% for agro-pastoral areas. Similar other studies on livestock brucellosis were done in pastoral and agropastoral areas of East Africa. Omer *et al*. (2000) reported 8.2% sero-prevalence in Eritrea and El-Ansary *et al*. (2001) reported 5% in Sudan. So far there is no published data on bovine brucellosis for agropastoral areas of Somalia Regional State. Therefore, the objective of this paper is to determine the seroprevalence of bovine brucellosis and to identify the risk factors associated with the sero-prevalence in Jijjiga Zone of Somale Region of Ethiopia.

Materials and Methods

Study Area

The study was conducted in four districts (Kebribeyah, Awbare, Gursum and Harshin) of Jijjiga Zone of Somali National Regional State. Jijjiga Zone

is situated in Eastern part of Ethiopia about 630km East of Addis Ababa with human population of 430,634. The altitude of the zone ranges from 500 to 1650 meter above sea level and it is located between $9^0$20'North latitude and $45^0$56'East longitude. The climate of Jijiga Zone is semi-arid type which is characterized by high temperature. The mean annual rainfall in the area ranges from 600 to 700 mm. Agro-pastoralism is the dominant production system in Jijjiga Zone.

Study Animals

The study animals were indigenous cattle breeds kept under extensive management system in the area. All cattle in the study area with the age of 6 months or above were considered as the study animals.

Study design, sampling method and sample size

The study design was a cross-sectional study carried out in indigenous cattle breed using serological tests where Rose Bengal Plate Test (RBPT) was used as screening test and Complement Fixation Test (CFT) was used for confirmation. The study was undertaken from October 2008 to March 2009.

The sampling method used was purposive sampling method. First the four study districts were selected purposively from Jijjiga Zone of Somalia Regional State (first stage). Then the nine peasant associations (PAs) within the selected districts were selected purposively, on the basis of prior information on the problem, farmers' cooperation, logistics, and accessibility. The name of PA's from where the samples were taken were Tahogilo and Harshika from Kebribeyah District; Gobare, Shibirbichara and Laru from Awbare District; Alidala and Dehawar from Harshin District and Fafan from Gursum District. The sample size for each district was determined by the formula recommended by Thrusfield, (1995) as indicated below:

$$\mathbf{N = 1.96^2 \times PQ/D^2}$$

Where **N** is required sample size, **P** is expected prevalence based on previous preliminary surveys, **Q** is 1-**P** and **D** is the level of precision **(5%).** Since there was no previous study carried out on bovine brucellosis in the study area, a 50% expected prevalence as used in the formula.

Accordingly, the total number of animals to be bled from each district was 384, which makes a total sample size of 1536 for the four districts. However,

due to the unwillingness of livestock owners to let their animals bled we only managed to collect 435 blood samples: 97 (79 female and 18 male) from Kebribeyah District, 130 (96 female and 34 male) from Awbare District, 103 (88 female and 15 male) from Harshin District and 105 (76 female and 29 male) from Guirsum District.

Blood Sample Collection

Approximately 10ml of blood sample was collected from the jugular vein of each animal using plain vacationer tube and needles. Each sample was labeled by using codes describing the specific animal. Serum was separated from clotted blood by centrifuging. Separated serum was collected in a screw caped sterilized plastic vial and stored at -20^{0}C until tested.

Serological Tests

Rose Bengal Plate Test (RBPT)

Rose Bengal Plate Test was performed according to the standard procedure described by Alton *et al* (1975). The test was carried out at Jijjiga Regional Veterinary Diagnostic and Research Center (JRVDR). The antigen of RBPT, consisted of a suspension of *Brucella abortus*, was obtained from Institut Purquier 326 (Rue de la Galera, 34097 MONTPELLIER CEDEX 5, France). The results were read by examining the degree of agglutination in good light source and when deemed necessary using magnifying glass. Any visible agglutination was considered positive (OIE, 2004).

Complement Fixation Test (CFT)

Sera, which reacted positive to RBPT, were retested by Complement Fixation Test (CFT) (OIE, 2004) as confirmatory test to eliminate any cross reaction at the National Veterinary Institute (NVI), Debre Zeit. Antigen, control sera and complement were obtained from the BgVV, Berlin, Germany. The reading of results for the CFT was carried out as follows: When there was complete fixation (no haemolysis) with clear water supernatant, result was recorded as ++++, nearly complete fixation (75% clearing) as +++, partial haemolysis (50%) as ++ and some fixation (25% clearing) as +. Complete lack of fixation (complete haemolysis) was recorded as 0. For positive reactions final titrations was registered (OIE, 2004).Interpretation: Serum with strong reaction, more than 75% fixation of complement (3+) at a dilution of 1: 5 and at least with 50% fixation of complement (2%) at a dilution of 1:10 and at dilution of 1:20 were classified as positive (OIE, 2004).

Data Analysis

Data was stored in the Microsoft Excel spread sheet program and analyzed using STATA 8.0 (2003). The seroprevalence was calculated by dividing the number of CFT positive animals by the total number of animals tested. Chi-square test was utilized to measure the association between the seroprevalence with categorical variables (districts). In addition, Fisher's exact test was utilized when the outcome variable was below five in number as a substitute for Chi square test in comparing two factors among each other.

Results

Out of the total 435 serum samples, 8 (1.84%) were positive to RBPT. The 8 RBPT positive sera were retested with CFT and 6 (1.38%) were found to be positive. The overall seroprevalence of bovine brucellosis in Jijjiga Zone is thus 1.38% (6/453). The individual animal seroprevalence of bovine brucellosis in the four district of Jijjiga Zone ranged from 0% to 2.91% (Table 1). There was no statistically significant variation in individual animal seroprevalence of brucellosis among the four districts ($p>0.05$). Comparatively, the highest seroprevalence of brucellosis was recorded in Harshi District (2.91%) and no seropositive animal was found in Gursum District.

Table1. Sero-prevalence of bovine brucellosis in four districts of Jijjiga Zone, Eastern Ethiopia

District	No animals tested	RBPT positive	CFT positive	95% CI for CFT
Awbare	130	3 (2.31 %)	1 (0.78 %)	0.74- 0.82
Gursum	105	0 (%)	0 (%)	-
Harshin	103	3 (2.06%)	3 (2.91%)	2.78- 3.06
Kabribayah	97	2 (2.06%)	2 (2.06%)	1.98- 2.14
Total	435	8(1.84 %)	6(1.38 %)	1.35- 1.41

$\chi^2 = 3.97$. DF = 3, P = 0.268

The seroprevalence of brucellosis in female animals was 1.77% while there was no seropositive male animal. However, the overall and district level differences in seroprevalence between the two sexes were not statistically significant ($p>0.05$).

Table 2. Sero-prevalence of Bovine Brucellosis in relation to sex in the four districts of Jijjiga zone, Eastern Ethiopia

District	Sex	Number of animals tested	CFT positive	Prevalence (%)	Fisher's exact test P-value
Awbare	Female	96	1	1.04	0.738
	Male	34	0	0	
Gursum	Female	76	0	0	
	Male	29	0	0	-
Harshin	Female	88	3	3.41	0.620
	Male	15	0	0	
Kabribayah	Female	79	2	2.53	0.662
	Male	18	0	0	
Overall	Female	339	6	1.77	0.346
	Male	96	0	0	

The sero-prevalence of brucellosis in the young and adult age groups is presented in (Table 3). All the seropositive cattle were above 2 years of age (adult) (1.5%) although there was not statistically significant difference between the two age groups ($P > 0.05$).

Table3. Seroprevalence of bovine brucellosis in two age groups in four districts of Jijjiga Zone

Age	No. animals tested	CFT positive	Prevalence (%)	Fisher's exact test P-value
6 month to 2 years	35	0	0	
>2 years	400	6	1.5	0.608
Total	435	6	1.38	

Discussion

The present study revealed that the overall seroprevalence of bovine brucellosis was 1.38% in the four district of Jijjiga Zone. This low sero-prevalence is comparable with other reports in different parts of Ethiopia; 4.9% in Arsi by Abay (1999), 4.2% in Ghibe and Gobe by Tekleye Bekele *et al.* (1989), 2.15% in central highlands of Ethiopia by Assegid Bogale (1987), 1.92% in Sidama Zone by Kassahun Asmare *et al* (2007), 0.61% in Jimma by Tadele Tolosa(2004), no positive reactors in Selale and Addis Ababa by Kelay Belihu (2002)., 1.49% in Tigray Region by Gebretsadik Berhe (2005), 1.113% from cattle slaughtered at Addis Ababa and Sululata Abattoirs by Mulugeta Tefera (2006) and 2.3% in

Adaa Liban Dairy Cooperatives by Abrham Abebe *et al.* (2008). Slightly higher seroprevalence was recorded in agropastoral areas of East Shoa Zone (4.1%) by Hunduma and Regassa (2009) and in Bahir Dar milk shed (4.63%) by Mussie Hailemelekot *et al* (2007).

In addition to this, seroprevalence as high as 38.7% was reported in cattle owned by the Institute of Agriculture Research (IAR) by Muktar Reshid (1993), 22% in Chafa State Dairy Farm by Tariku Sintaro (1994), 19.5% in Abernosa Cattle Breeding Ranch by Taye Yirgu (1991), 16.65 % in and around Bahirdar by Abeje Shiferaw (1994) and 15.8% in Sidamo by Endrias Zewdu (1989). Similarly, moderate seroprevalence rates were reported by Bayleyegn Molla (1989) in Arsi (8.2%), by Gebreyesus Mekonnen (2001) (unpublished). in North Western Amhara on local indigenous zebu (8.2 %) and by Yilkal Asfaw et al (1998) in urban and peri-urban areas around Addis Ababa (8.11%). The different in seroprevalence of bovine brucellosis reported from different parts of Ethiopia might be due to difference in management and grazing system, and husbandry conditions.

In the current study, there was no positive reactor among male animals, although the difference in seroprevalence between the two sexes was not statistically significant. This finding is in agreement with the work done by Tesfaye Abebe (2003) in Tigray region, Taddess Yayeh (2003) in North Gondar Zone, and Tadale Tolosa (2004) in Jimma Zone who reported only female positive reactors. On the other hand, Yilkal Asfaw *et al.* (1998) reported a 0.11% seroprevalence among male animals while Mussie Hailemelekot *et al* (2007) reported 2.11% seroprevalence in extensive management system. Although no controlled study has been conducted on the relative susceptibility of female and male cattle to brucellosis, based on reactor rates it is probable that bulls are more resistant than sexually mature heifers and cows, however, are less resistant than sexually immature heifers (Nicoletti, 1980). It is important to note that serological data may underestimate *Brucella abortus* infection in males as infected bulls tested might be generally non-reactors or only had low antibody levels (Crawford *et al.*, 1990).

In this study, higher seroprevalence of bovine brucellosis was observed in older age category (>2 years of age) (1.5%) than younger age category (6 months to 2years) (0%), although the difference was statistically insignificant. This observation is in agreement with that of Yilkal Asfaw *et al.* (1998) where seroprevalence of bovine brucellosis in older cattle (4%) was higher than in younger ones (1.9%). Tariku Sintaro (1994) had also found higher proportion

of old cattle being affected, but the difference among age groups was not statistically significant. Kassahun Asmare *et al* (2007) reported that the majority (97.87%) of sero-reactors were detected in the animals older than 2 years in both the extensive and intensive management systems. Tadele Tolosa (2004) and Mussie Hailemelekot *et al.* (2007) too reported significant variation among age groups in extensive production systems with higher seroprevalence rates in older animals. Similar result was also reported by Abraham Abebe *et al* (2008) in east Showa. It is evident that susceptibility of cattle to *Brucella abortus* infection is influenced by age of individual animals. Young and sexually immature animals tend to be more resistant to infection and frequently clear infection, although latent infections do occur (Radostits *et al.,* 2000).

In conclusion, the result of this study showed that the seroprevalence of bovine brucellosis in Jijjiga Zone is found to be low. However, it is highly likely that the disease spreads to the unaffected animals and herds given the extensive production system prevailing in the area which may allow contact of animals during grazing and at watering points. Thus, there is a need to design and implement control measures aiming at preventing further spread of the disease in the Region through the use of better management practices. In addition, the public in general and high risk group in particular should be made aware of the zoonotic potential of brucellosis.

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