The Sero-Prevalence Study of Bovine Brucellosis and Its Risk Factors in and Around Waliso, Oromia, South West Shawa, Ethiopia

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Abstract

Background: Brucellosis is a contagious bacterial zoonotic disease that has economic importance. The disease causes abortion, sterility in male animals, transmitted from animal to animal by contact, and distributed worldwide.

Methods: A cross-sectional study design was conducted from November 2017 to May 2018 in the selected district of southwest Shewa zone of Oromia region (Waliso) with the objectives of determining the seroprevalence of bovine brucellosis and assess the potential risk factors. In this study, a total of 384 cattles aged from 6 months and above were screened for bruccella antibodies using Rose Bengal Plate Test and c-ELISA (used both as a screening test and confirmatory).

Results: Nineteen (19) sera samples out of 384 (4.95%) reacted positively for RBPT and fourteen (14) samples were reacted positively for c-ELISA (3.65%). In the current finding, the prevalence in male and female (sex), breed, and age were not significantly associated with brucellosis seroprevalence (p>0.05) but there is a significant association of sero-postivity of bovine brucellosis with history of abortion (P<0.05).

Conclusion: the overall seroprevalence of bovine brucellosis in the study area was low. However, it is highly likely that the disease spreads in unaffected animals and herds gave the extensive production system prevailing in the area which may allow contact of animals during grazing and at watering points. The public in a general and high-risk group, in particular, should be made aware of the bovine brucellosis and its zoonotic importance.

Key words: Bovine Brucellosis, Cattles, c-ELISA, RBPT, Sero-prevalence, Zoonotic.
Introduction

Brucellosis (Undulant Fever, Malta Fever, Contagious Abortion, Bang's Disease) is a contagious bacterial zoonotic disease of public health importance worldwide. It is caused by members of the genus Brucella, such as Brucella abortus in cattle, B. melitensis or B. ovis in small ruminants, B. suis in pigs, and B. canis in dogs. Some Brucella species are also maintained in wildlife populations. Wildlife reservoirs including feral pigs, bison, elk, and European hares complicate eradication efforts for B. abortus and B. suis.¹ The disease affects the reproductive system of animals, leading to considerable productivity losses, such as reduced milk production, abortion, weak offsprings, weight loss, cull and condemnation of infected animals due to infertility, lameness, and impediment for trade and export.²

The disease is characterized by abortion in the last trimester or birth of an unthrifty newborn in the female, orchitis, and epididymitis with frequent sterility in male animals (OIE, 2008). In dairy production, the disease is a major obstacle to the importation of high yielding breeds and represents a significant constraint to the improvement of milk production through crossbreeding.³

In cattle and other Bovidae, Brucella is usually transmitted from animal to animal by contact following an abortion. Pasture or animal barn may be contaminated and the organisms are probably most frequently acquired by ingestion but inhalation, conjunctival inoculation, skin contamination and udder inoculation from infected milking cups are other possibilities. The use of pooled colostrums for feeding newborn calves may also transmit infection. Sexual transmission usually plays little role in the epidemiology of bovine brucellosis. However, artificial insemination can transmit the disease and semen must only be collected from animals known to be free of infection.⁴

Common sources of infection for people include contact with animal abortion products; ingestion of unpasteurized dairy products from cows, small ruminants or camels; ingestion of undercooked meat, bone marrow, or other uncooked meat products; contact with laboratory cultures and tissue samples; and accidental injection of live brucellosis vaccines. Human to human transmission is rare but has been reported after blood transfusion, bone marrow transplantation, or sexual intercourse.¹

Brucellosis occurs worldwide and remains endemic among Mediterranean countries of Europe, Northern, and Eastern Africa, Near East countries, India, Central Asia, Mexico, and Central and South America.⁵ Several countries in Western and Northern Europe, Canada, Japan, Australia, and New Zealand are believed to be free from the agent. Brucellosis has been an emerging disease since the discovery of Brucella melitensis by Bruce in 1887.⁶

In Ethiopia, several serological surveys have shown bovine brucellosis is an endemic and widespread disease in urban, peri-urban, highland and lowland, extensive and intensive farming, smallholder farms and ranches of the country.⁷ The highest prevalence, 18.6% (52/280), was recorded at the ArsiNegele district. In the pastoral area, the prevalence of brucellosis was 15.2% whereas in agro-pastoral 4.1%.⁸ An overall prevalence rate of 1.5% of bovine brucellosis in Addis Ababa dairy farms.⁹ 3.1% overall seroprevalence in the Jimma zone of the Oromia region have been reported by.¹⁰ The epidemiology of cattle brucellosis is influenced by several factors including factors associated with disease transmission between herds, factors influencing the maintenance, and spread of infection within herds.¹¹ Understanding the epidemiology of brucellosis is, therefore, vital for strategizing evidence-based disease control measures. However, such information is inadequate in sub-Saharan Africa. Consequently,
appropriate preventive measures have not been undertaken in this part of the world.\textsuperscript{12} Even though some literature was published in Ethiopia on the prevalence of brucellosis, yet it is not studied in many areas of the country including the present study area. Therefore the objectives of this study were: to determine the seroprevalence of bovine brucellosis in and around Waliso district; to investigate associated risk factors of bovine brucellosis, and to give recommendations regarding possible preventive measures based on the findings of this study.

Materials and Methods

\textbf{Study Area:} The study was conducted in and around Waliso town of southwest Shewa zone, which is situated at 8°32′N latitude and 37°58′E longitude with an elevation of 2063 meters above sea level in central Oromia, 114 km southwest of Finfinne/Addis Ababa. It is characterized by temperate weather, which is locally called “Bada-dare (mid-altitude)” and the district is covered by different vegetation. It receives an annual rainfall of 1400mm and 1600mm minimum and maximum respectively and has a minimum 10°C and a maximum 30°C daily temperature with the average temperature of 62°F (17°C) and 42% Humidity. The highest rainfall concentration occurs from June to September. The people in and around the area practice mixed farming system that is crop production and livestock rearing. Livestock is a major agricultural resource in this area. The livestock population in the area includes 224,334 bovine, 39,543 ovine, 51,042 caprine, 7,625 horses, 2,101 mules, 16,320 donkeys, 127,679 poultry, and 27,789 poultry according to 2006 woreda veterinary statistics.\textsuperscript{13}

\textbf{Study Population:} In Ethiopia livestock rearing is classified into rural smallholder (mixed crop-livestock) production, pastoral and agro-pastoral production, urban and peri-urban smallholder dairy production, and commercial dairy production systems.\textsuperscript{14} This study focuses on rural smallholder and urban and peri-urban livestock production systems specifically bovine.

The study consisted of cattle that were managed under the extensive and semi-intensive production system. The cattle under study comprised of the local breeds, exotic and crossbreeds with no history of vaccination against brucellosis. Both sexes and different age groups greater than six months were included in the study as the disease was not common in the cattle less than 6 months of age due to maternal antibody.

\textbf{Study Design:} Cross-sectional study design was conducted from November 2017-May 2018 to determine the seroprevalence of Brucella infections in both male and female cattle and to identify potential risk factors associated with seropositivity. A simple random sampling method was implied to sample animals.
Sample Size Determination: To determine the sample size, an expected prevalence of 50% was taken into consideration since there was no research work on Brucella infection in the study area (waliso). The desired sample size for the study was calculated using the formula given by \( n = \frac{1.96^2 \times P_{exp} (1-P_{exp})}{d^2} \) with a 95% confidence interval and 5% absolute precision. The formula is \( n = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2} \); Where \( P_{exp} = \) expected prevalence (0.5); \( d = \) absolute precision (0.05); \( n = \) sample size. Therefore, the estimated sample size was 384 animals.

Sampling and Data Collection: Collection of serum samples and transportation: Approximately 5-8ml of blood samples were collected from the jugular vein of each randomly selected animals using plain vacutainer tube and needle. Identification of each animal like origin, age, sex, and history of abortion was gathered with vacutainer tubes and kept over-night at room temperature to allow clotting and sedimentation. The next day, sera were collected from the clot to another tube called cryovial. Serum samples were kept at \(-20^\circ C\) at woliso veterinary clinic laboratory until it was transported to the national animal health diagnosis and identification center (NAHADIC) serology laboratory. Serum was transported to NAHDIC by a cold chain and tested by using Rose Bengal Plate Agglutination Test (RBPT) and competitive enzyme-linked immunosorbent assay (c-ELISA) routinely.

Serology Tests (RBPT and c-ELISA): Rose Bengal plate test (RBPT): The sera samples were first screened using Rose Bengal Plate Test (RBPT) as described by \(^{16}\). RBPT Brucella antigen from (Veterinary Laboratories Agency, Addlestone, United Kingdom), together with positive and negative control sera were used. Briefly, 30 µl of sera samples were dispensed on to the plate, and 30 µl of RBPT antigen was dropped alongside the sera. Using an applicator stick, the antigen and the sera were mixed and rocked for about 4 minutes, and examined for agglutination. Of course, antigen for the Rose Bengal Plate Test was prepared from B. abortus strain 99 stained with Rose Bengal dye and suspended in acid...
buffer pH 3.65. Positive and negative controls were employed for interpretation of the results. Results of (RBPT Sn+SP) were interpreted as 0, +, ++, and +++ as has been described by Nielsen.16

**Competitive –ELISA (c- ELISA) Kit:** Competitive –ELISA (c- ELISA) Kit (SVANOVIR® (Svanova Biotech, Uppsala, Sweden), was used according to the manufacturer’s instructions. In this procedure, the samples together with a mouse monoclonal antibody (mAb) specific for an epitope on the o-poly saccharide portion of the S-LPS antigen are exposed to Brucella abortus smooth lipopolysaccharide coated wells on microtitre plates. If anti- Brucella antibodies are present in the test sample they will bind to the antigens in the well and block these antigenic sites. If anti-Brucella antibodies are absent in the sample, these sites will remain free and the mAb which was added after the sample will bind to these free antigenic sites. After an incubation period the unbound materials are removed by rinsing and a goat anti-mouse horseradish peroxidase (HRP) conjugated IgG is added to plate. The HRP conjugate will bind with specific mAb in the absence of anti-Brucella antibodies in the sample. Unbound materials are removed by rinsing before the addition of the substrate. Subsequently, a blue colour develops which is due to the conversion of the substrate by the conjugate. A negative result is indicated by the development of a blue color. The reaction is stopped by the addition of stop solution; the colour changes to yellow. The result can be read by a microplate photometer, where the optical density (OD) is measured at 450 nm. Sera from strain 19 vaccinated cattle do not compete with the mAb because of their specificity and lower affinity, leading to a negative reaction. Samples with PI values of ≥30% are considered to brucella infection whereas those with PI values <30% are considered as negative.

**Data Management and Analysis**

All the data collected was entered into a Microsoft Excel spreadsheet and coded appropriately. The coded data was transferred into STATA version 13 software. For data analysis, descriptive statistics were used but to test the association of the risk factors with the disease fisher’s exact test was used and an association was considered if the p-value is less than 0.05. Odds ratio (OR) was used to measure the degree of association between risk factors and seroprevalence of bovine brucellosis.

**Results**

**Prevalence of anti- Brucella Antibodies**

Among the 384 animals 158 males and 226 females, which includes 36 (9.375%) exotic, 334 (86.98%) indigenous14 (3.64%) cattle tested for bovine brucellosis, there were 19 (4.95%) sera samples (5 male, 14 female) which were form agglutination from slight to dense agglutination with RBPT. 15 samples were with about 25% agglutination and below (+), 4 samples (1 male and 3 female) with dense agglutination, and above 75% (+++). There was no sample with fine agglutination i.e (++) and 14 (3.64583) animals (5 males and 9 females) were screened and confirmed to have brucella antibodies against brucella antigen. Those samples with strong agglutination formation (i.e ++++) with the RBPT test had inhibition percentage of above 90%. The remaining samples had inhibition percentage which ranges from 35-50. The overall animal level seroprevalence of bovine brucellosis of the present study was 3.65% (95% CI: .017628, 0552886) (Table 1).

The overall seroprevalence of bovine brucellosis between kebeles was ranging from 0% to 1.56% without significant association (p>0.05). Out of 13 kebeles including town (4 kebele) higher prevalence were observed in badessakoricha i.e 1.56% (n=44) and zero seroprevalences were observed in four
kebeles. Seropositivity was not statistically associated with kebele which indicates no significant variation between kebeles with respect to seroreactors (Table 2).

<table>
<thead>
<tr>
<th>Test type</th>
<th>Number of animal tested</th>
<th>Test result</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>95% (CI)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>.0276913 .0712671</td>
</tr>
<tr>
<td>C.ELISA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>158</td>
<td>226</td>
<td>14 (3.65)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.017628 .0552886</td>
</tr>
</tbody>
</table>

Table 1: Apparent Seroprevalence of Bovine Brucellosis at Animal Level Using RBPT, and c-ELISA.

<table>
<thead>
<tr>
<th>Kebele</th>
<th>RBPT</th>
<th>c.ELISA</th>
<th>Number of Animals Tested.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq.(+ve)</td>
<td>%</td>
<td>Freq.(+ve)</td>
</tr>
<tr>
<td>Maru</td>
<td>2</td>
<td>0.52</td>
<td>1</td>
</tr>
<tr>
<td>Abadho leman</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Badessakoricha</td>
<td>6</td>
<td>1.56</td>
<td>6</td>
</tr>
<tr>
<td>Caffemakana</td>
<td>1</td>
<td>0.26</td>
<td>1</td>
</tr>
<tr>
<td>Cirachawambari</td>
<td>4</td>
<td>1.04</td>
<td>2</td>
</tr>
<tr>
<td>Dire dulati</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Fodugora</td>
<td>3</td>
<td>0.78</td>
<td>1</td>
</tr>
<tr>
<td>Gururabaka</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
</tr>
<tr>
<td>Hobbi</td>
<td>1</td>
<td>0.26</td>
<td>0</td>
</tr>
<tr>
<td>Kumebadessa</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Leman ayetu</td>
<td>1</td>
<td>0.26</td>
<td>1</td>
</tr>
<tr>
<td>SOMBO</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Town</td>
<td>1</td>
<td>0.26</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>4.95</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 2: Present Results of Kebele Level Sero-prevalence of Bovine Brucellosis Using RBPT and c-ELISA by Fishers Exact Test.

Important Variables for Infection of Brucella Species at Animals level

Table 2 presents results of animal level Brucella seropositivity and their association with exposure variables using fisher's exact test. Hence, 2.94% and 3.80% seroprevalence were recorded in animals with young age and Adult age, respectively. However, the prevalence of bovine brucellosis was not statistically different between the age groups at animal-level (p >0.05). The seroprevalence of brucellosis in female animals was 3.98% and 3.16% seroprevalence was found in male animals even though sex was not statistically associated. Statistically, the seroprevalence of bovine brucellosis did not significantly associate with the breed, and sex (p> 0.05).

Abortion is highly associated with Brucella seroprevalence. Statistically, the seroprevalence of bovine brucellosis had significantly associated with abortion occurrence (p<0.05). Table 3 also shows animal
level univariable analysis showing the magnitude and association of the important variables with Brucella seropositivity. Seroprevalence of bovine brucellosis did not show significant variations among age, breed, and sex (p > 0.05) using univariate logistic regression analysis. However, abortion history results were significantly associated with Brucella infection at the animal level (P< 0.05). Animals that have an abortion history were nearly 8 times at risk of being infected with brucella than animals did not have an abortion history (Table 3).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>No of Animals Studied (+ve)</th>
<th>Prevalence (%) (95% Confidence Interval)</th>
<th>P-Value*</th>
<th>Odd Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Adult</td>
<td>316 (12)</td>
<td>3.80 (.0197734 .0653941)</td>
<td>1.000</td>
<td>.7879448</td>
</tr>
<tr>
<td></td>
<td>Young</td>
<td>68 (2)</td>
<td>2.94 (.0035821 .102241)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breed</td>
<td>Local</td>
<td>334 (14)</td>
<td>4.19 (.0231024 .0693288)</td>
<td>0.634</td>
<td>1.634012</td>
</tr>
<tr>
<td></td>
<td>Exotic</td>
<td>36 (0)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cross</td>
<td>14 (0)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>158 (5)</td>
<td>3.16 (.0103535 .0723025)</td>
<td>0.786</td>
<td>.7879448</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>226 (9)</td>
<td>3.98 (.0183687 .074248)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abortion</td>
<td>Aborted</td>
<td>1(1)</td>
<td>100</td>
<td>0.011</td>
<td>8.066628</td>
</tr>
<tr>
<td></td>
<td>RFM</td>
<td>8 (1)</td>
<td>12.50 (.0031597 .5265097)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-aborted</td>
<td>375 (12)</td>
<td>3.20 (.016642 .05523)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Based on Fisher’s exact test and univariate logistic regression.

Table 3: Association of Bovine Brucella Sero-positivity with Animal-level Risk Factors

Comparison of Serological Test
When compared to c-ELISA (it can also be used both for screening and confirmatory tests (5, 2003). Rose Bengal Plate test diagnosed was resulted in one false negative and six false positives. Then; there was a substantial test agreement between RBPT and c-ELISA, according to Kappa value depicted in (Table 4).

<table>
<thead>
<tr>
<th>Variable</th>
<th>c-ELISA</th>
<th>Kappa value</th>
<th>Kappa Value Interpretation</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>13</td>
<td>6</td>
<td>0.7786</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>1</td>
<td>364</td>
<td></td>
</tr>
</tbody>
</table>

Source: (Everitt, 1989)  K = 0: no agreement; K = 1: perfect agreement; K = 0 – 0.20: slight.  K = 0.21 – 0.40: fair; K = 0.41 – 0.60: moderate; K = 0.61 – 0.80: substantial agree; K > 0.81: almost perfect agree.

Table 4: Kappa Test for Agreement between RBPT and c-ELISA for Diagnosis of Bovine Brucellosis
Discussion

Sero-Prevalence of Bovine Brucellosis at Study Area

The seroprevalence of Brucella antibodies was reported in many areas of Ethiopia and also studies have been underway in different parts of the country, but there was no report in and around Walsho town of southwest shewa zone of Oromia region. Since sensitivity and the specificity of C-Eelisa is very high (17-18)), it is the recent and recommended confirmatory test for brucellosis, the overall seroprevalence of bovine brucellosis in the study area was 3.65%.

This seroprevalence is relatively in agreement with previous findings of (19)3.19% in the extensive production system of Tigray region; (20) 3.1% in Jimma zone of Oromia region; (21) 3.5% traditional livestock husbandry practice in Southern and Eastern Ethiopia; (8) 4.1% in Pastoral and Agro-Pastoral Areas of East Showa Zone of Oromia Regional State.

In Ethiopia, even a lower seroprevalence which contradicts the current study were documented in previous findings of (22) 0.77% in Jimma Zone, Western Ethiopia; (42) 0.14% in North Gondar Zone; (23) 1.38% in Jijjiga Zone of Somali National Regional State, Eastern Ethiopia and (24) 1.5% in Addis Ababa dairy farms; (25) 1.9% in Bishoftu; (26) 0.9% in southeast Ethiopian pastoral livestock; (27) 1.0% in western Ethiopia; (28) 1.4% in Asella and Bishoftu towns, Oromia Regional State, Ethiopia and (29) 2.9% in three agro-ecological areas of Central Oromia, Ethiopia.

On the other hand, there were reports with a relatively higher seroprevalence of bovine brucellosis in other parts of the country (30)4.9% in Western Tigray; (31) 11.0% in Central Ethiopia (Wuchale-Jida district); (32) 6.1% in western Tigray, northern Ethiopia; (Tibesso et al., 2014) 4.3% in Adami Tulu, Central Ethiopia. Similarly, relatively higher seroprevalence was reported in other African countries by other authors: 24.5% (33) from Sudan; 24.0% (34) from Nigeria, 5.5% (35) from Zimbabwe; 8.5% (36) from Eritrea were some the reports. The difference in seroprevalence of bovine brucellosis reported from different parts of Ethiopia might be due to different reasons like of difference in a grazing system, and husbandry conditions among dairy farms (31). It has been reported that susceptibility of cattle to B. abortus infection is influenced by the age of an individual animal. Thus, sexually matured and pregnant cattle are more susceptible to infection with Brucella organisms than sexually immature animals of either sex.

On the other hand, younger animals tend to be more resistant to infection and frequently clear infections, although latent infection may occur.37

Risk Factors Associated with Brucella Sero-Prevalences

In the current study, there was a positive reactor among female and male animals with 3.16% in male animals and 3.98% in female animals, although the difference in seroprevalence between the two sexes was not statistically significant (p >0.05). This finding is in agreement with the work done by (38) reported a 0.11% seroprevalence among male animals in and around Addis Ababa; (39) reported 2.11% seroprevalence in the extensive management system in Bahir Dairy milk shed. On the other hand, (40) in Debrebirhan; and Ambo Towns; (41) in Tigray region, (7) in North Gondar Zone, and (43) in Jimma Zone; (23) in Agro-Pastoral Areas of Jijjiga Zone, who reported only female positive reactors.
Even though age was not significantly associated with Brucella seropositivity (P> 0.05), the majority of the reactors (82.29% n = 316) were detected in age strata above 4 years but in this study 2, (2.98%) animals from 68 young (between 6 months to 4 years) were found positive. This is a clear indication of age and sexual maturity being important determinants of the disease (43). The result of the current study agreed with (38) in and around Addis Ababa had reported a 1.3% infection rate in the age range below 2 years; (4) who reported 0.29% infection rate in young animals below 2 years at Sidama zone. However, no Brucella seropositivity (28) was observed in the young age group of dairy cattle in Asella and Bishoftu towns; this could be explained by sexual maturity and pregnancy due to the influence of sex hormones and placenta erythritol on the pathogenesis of brucellosis (45). The occurrence of seroprevalence in the young animal was might be due to reduced colostrum consumption after birth which serves as an immunity inducer.

All animals confirmed to have brucella antibodies against brucella antigen were indigenous breeds of cattle without statistical significance. This result somewhat contradicted with most other studies that report exotic animals were more susceptible to brucellosis. Alemu et al., (46) report 0.3% and 1.7% in local and exotic breeds in Eastern Showa. This result could be due to small sample size (n= (14+36= 50)), management practice, herd size, and others.

In the present finding, there was a statistical association of the history of abortion and the presence of infection in those animals (p<0.05). In highly susceptible non vaccinated pregnant cattle, abortion after the fifth month of pregnancy is a cardinal feature of the disease (47). This may be due to the fact that sex hormones and erythritol, which stimulates the growth and multiplication of Brucella organisms, tend to increase in concentration with age and sexual maturity.37

**Conclusion**

The current study revealed that the seroprevalence of bovine brucellosis in central Ethiopia (waliso district) was low (3.65%). Although this result is low, the low prevalence of the disease in the study area could serve as a source of infection to other cattle of the country as there is free movement of animals from one area to another area of the country. The society of the study area has no information about the disease. Even though the questioner’s survey was very important to study the disease distribution and public information, this study did not contain such work. The presences of sero-reactors animals of brucellosis in an area have economic and public health importance, especially in dairy animals. Based on this fact the following recommendations were forwarded: the presence of sero-reactor animals for the disease indicated the presence of foci of infection that could need great attention of the animals in and around the area to safeguard the public health; considering the economic and public health importance of brucellosis, avoiding mixing of cattle without screening for brucellosis, promoting the use self-contained units instead of shared facilities and test and slaughter policy was recommended to control the disease in the study area. And; further detail and full-fledged research are very important to have full and all-round information regarding the epidemiology of the brucellosis.

**Aknowledgement**

This study was funded by Addis Ababa University. The support of the Waliso town livestock and fishery heads, dairy farm owners, and individuals working in the study dairy farms is appreciated.
Ethics Approval and Consent to Participate
This study was granted ethical approval from the College of Veterinary Medicine and Agriculture Institutional Research and Review Committee. Human samples were collected following a prior explanation of the objectives of the study to the Farmworkers and sampled based on their consent.

Funding
Thematic Research Project on Major Infectious Disease, Addis Ababa University, provided funds for this study.

Abbreviations
C-ELISA: Competitive –Enzyme-Linked Immunosorbent assay; CSA: Central Statistical Authority; CSFPH: Center for Food Security and Public Health;5: Food and Agriculture Organization; HRP: Horseradish peroxidase; mAb: Mouse monoclonal antibody; OD: Optical density; OIE: Office International des epizooties; OR: Odds ratio; PI: Percentage of inhibition; RBPT: Rose Bengal plate test; RFM: Retained Fetal Membrane; S-LPS: Smooth- Lipopolysaccharides; WHO: World Health Organization.

References


