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Original Research

Sero-Epidemiology of Bovine Brucellosis in Horro Guduru Animal Production and Research Centre, and Its Surroundings in Western Ethiopia

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Abstract

The research period spanned the months of 2017 and 2018. Of the 812 cattle that were serologically tested throughout three areas, 102 provided accurate answers on the questionnaires. After looking at 812 samples, the seroprevalence was found to be 0.73 (95% CI: 0.241-3.461). Seroprevalence was highest in Fincha at 4.41% (95% CI: 0.028-3.473), then at Horro Guduru Animal Production Centre at 0.31%, and finally in Guduru District at 0.99%. Using the Chi-square test, a statistical analysis discovered a substantial correlation between factors such retained foetal membrane (χ2=36.47: P<0.001), abortion time (χ2=9.756; P<0.05), abortion history (χ2=8.217; P<0.050), origin (\2=7.951: P<0.05), and abortion history. Furthermore, logistic analysis revealed that retained foetal membrane was a common risk factor for brucellosis in cattle (OR = 30.47, 95% CI). Respondents' levels of brucellosis knowledge changed by 38%, 18.18%, and 30% based on the size of the herd, respectively. The risk evaluation indicates raw milk consumption is highly relevant to zoonotic diseases. Horro Guduru, a cow ranching region in Western Ethiopia, has Brucella infections and risk factors, according to the study's results. Finding a treatment, protecting animals and humans, and reviving the area's economy all depend on additional research into the disease, which these findings highlight.

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INTRODUCTION

The research by Schlelling et al. (2003) states that the germs caused by the Brucella virus are extremely common and cause serious health problems for both humans and animals around the world. In addition, they stress that Brucella is the most common and economically important zoonotic disease affecting cattle. A number of negative outcomes, including economic losses, culling, infertility, delayed reproductive cycles, offspring loss, reduced meat and milk output, and delayed reproductive cycles, have been linked to trade limitations in tropical and subtropical countries (Mangen et al., 2002).

Brucella suis and melitensis can occasionally cause disease, but Brucella abortus is the most prevalent cause of bovine brucellosis. This zoonotic illness is highly infectious, widespread, and economically devastating. Causes of infertility and low milk production include retained placenta, secondary endometritis, and organisms released into uterine secretions and milk, as well as late-term miscarriage. Postpartum life

expectancy is low for all calves, including those born at full term. In especially vulnerable herds, the abortion rate can be anything from 30 to 80 percent (Anonymous, 2007). The six recognized species (nomen species) of the genus Brucella are B. abortus, B. melitensis, B. suis, B. ovis, B. canis, and B. neotomae. These species infect a wide range of animals, including cattle, sheep, pigs, rodents, and wild ungulates. Some antigenic or biochemical traits, as well as the primary host species, identify these species as nomen. Bacillus pinnipedialis was found in seals, Bacillus microti in soil, Bacillus inopinata in humans, and Bacillus ceti in cetaceans, according to recent studies by Scholz et al. (2009) and Foster et al. (2007).

Inside cells, there is a group of Gram-negative bacteria known as Brucella species that do not possess plasmids, endospores, or capsules. On top of that, acids aren't kind to them. Although thawing or freezing won't kill Brucella, most disinfectants that target Gram-negative bacteria will. The brucella bacteria is rendered inert in milk through pasteurization. Both the length and diameter of the bacterium can vary, ranging from 0.6 to 1.5 μ and 0.5 to 0.7 μ, respectively. The enzymes urease, catalase, and oxidase have a positive effect on Brunolla. Even though they are often thought of as non-motile, Brucella species really possess all the genes necessary for a functional flagellum (Fretin et al., 2005).

The economic toll that brucellosis has on animal producers is substantial. Georggios et al. (2005) enumerated some of these costs, including lost productivity in the workplace, medical bills, government support for eradication and research, decreased milk production, calf mortality, sick cow culling, and export limitations. Brucecellae multiply in the spaces between dendritic cells, macrophages, and trophoblasts that are still developing in the body. They attach to many different kinds of tissues. The infection, however, is capable of replicating in fibroblasts, endothelial cells, and epithelial cells, among other mammalian cell types (Allen et al., 1998).

It is common knowledge that nations plagued by brucellosis face significant economic and financial challenges. It also has a significant impact on public health. The disease usually causes reproductive failure in animals, which means they either have to abort their babies or have very frail babies. The genitourinary system is just one of several potential sites of illness. A "undulating fever" is a serious illness that mimics the flu in people and is marked by high fevers that come and go. The disease has the potential to worsen over time, leading to chronic conditions that affect internal organs (such heart failure) or joints (like arthritis). Consistent sufferers of this disease run the risk of total disability, which would leave them unable to earn an income and force their families to shoulder enormous medical costs (Pappas et al., 2006). The virus following an abortion in cattle and other Bovidae species is most commonly transmitted through interspecies contact. When animals eat food that has been contaminated with bacteria in their barns or pastures, it can spread infectious diseases. Infected milking cups can spread these diseases through many pathways, including the udders, skin, lungs, conjunctiva, and gastrointestinal tract. The risk of viral transmission increases when colostrum is consumed by calves from different cows.

Transmitted sexually, brucellosis in cows does not often alter its epidemiology. Artificial insemination can only be performed on animals whose medical records show that they are free of contagious diseases (Acha & Szyfers, 2001). Brucellosis has been common in Ethiopia since the 1970s, according to Ibrahim et al. (2010), Asgedom et al. (2016), and Geresu et al. (2016). Yimer et al. (2008) found that small ruminants, camels, and cattle were more likely to be affected in lowland areas by the disease. Furthermore, research has demonstrated that bovine individual brucellosis seroprevalence varies between 0.05% and 15.2% in extended management systems, and between 1.1% and 22.6% in intensive livestock management systems (Tolosa et al., 2010; Tesfaye et al., 2011). All of these results line up with what other studies have shown. The importance of brucellosis in the dairy cow sector and its effects on public health have been highlighted by recent results of Brucella species isolation and identification in dairy cattle at the farm level across the nation (Geresu et al., 2016).

There is a dearth of high-quality research on the incidence of bovine brucellosis, despite the fact that cattle represent a significant source of revenue for rural livestock keepers in western Ethiopia, particularly in the research region. The purpose of this study was to gain a better understanding of the sero-epidemiology of bovine brucellosis and its impact on public health in the region.

MATERIALS AND METHODS

Study area and Population

The Horro Guduru Wollega Zone of Western Ethiopia, specifically the Horro Guduru Animal Production Centre, is the location of the study. It is situated on the Gedo-Fincha Sugar Factory High Way, 275 kilometers west of Addis Ababa, between the longitudes 37026' East and 09029' North. Its location is an average of 22,296 meters above sea level. With the intention of expanding the variety of Horro cattle breeds and giving local farmers access to Horro-Jersey hybrids that would do well in the western part of the country, the Horro Guduru Animal Breeding Centre was founded in 1994 E.C. In zone areas, it is usual to raise both crops and cattle.

The cattle business is vital to the rural economy of farmers. Cows are breastfed during the time between milkings and are milked by hand twice daily. Two primary breeding methods utilized at the center provide 50% F1 offspring: biological insemination between females and bulls that are 100% pure Horro, and artificial insemination between females that are 100% exotic Jersey/Holstein Friesian and pure Horro. The local farming environment is ideal for Horo-jersey hybrids, and they can produce 10 to 15 liters of milk annually on average. Amazing cross-bred bulls and heifers are available at this facility for districts zones, institutes, research organizations, and investors to purchase.

Local cafeterias and motels purchase the 250-350 liters of milk produced daily by the plant. Individual dairy cows and small-scale dairy farms run by local farmers make up the research population. The study included all cattle that were at least six months old, regardless of whether they were milking or not. This encompassed animals that were not milking, as well as bulls and replacement heifers.

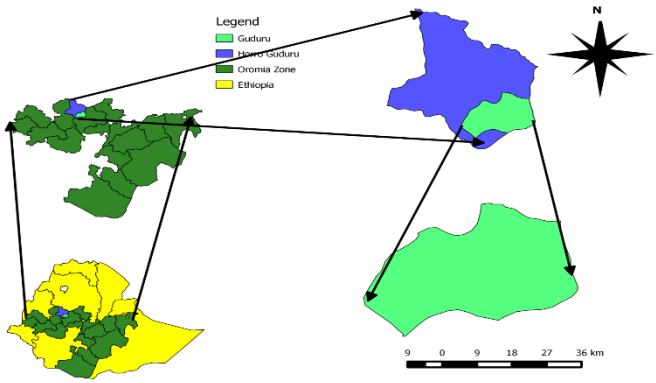

Figure 1 *Diagram of Study Area*

Study Design and Sample Size Determination

This cross-sectional study set out to investigate the prevalence of Brucella infection in the study area's cow population and, if so, to identify any risk factors linked to this finding. The study lasted from the fall of 2017 to the spring of 2018. Every single animal that took part in the research was at least six months old. A standardized questionnaire was used to gather important biodata on individual animals as well as farm-related data. The animals included in the sample were all carefully selected from the farm and the clinics.

The method described by Thrusfield (2007), which is outlined below, was used to calculate the sample size (n) for the sero-screening of cattle on this particular farm. Based on a 95% confidence interval, a 5% degree of precision, and an expected prevalence of 50%, the calculation was done.

$$n = \frac{Z^2 P_{exp}(1-P_{exp})}{d^2} = 384$$

Pexp is the expected prevalence (50%), d is the desired absolute accuracy (95% CI), n is the required sample size, and Z is the reliability coefficient (z=1.96 for d=0.05 or 95% CI). Since no prior research on bovine brucellosis had been carried out in the research region, the approach employed the 50% predicted prevalence. Consequently, 384 animals from the center required to be sampled; however, it could be wise to raise this number to 812 animal samples in order to attain the requisite precision.

Sample Collection

Questionnaire survey

Agricultural workers and worried housewives in the research area were given a standardized questionnaire. Collecting personal demographic data using the recommended format included questions about age, sex, educational background, and brucellosis knowledge, attitude, and practice. The animals were given a list of possible experiences, such as foetal membrane retention, stillbirths, abortion, a labor and delivery pen, or interaction with other herds. Bulls, AI, and a

combination of the two were the three primary types of breeding services. Other ways to get rid of afterbirths included burying, burning, or dumping the dead baby, placenta, and aborted tissue in a landfill. In order to develop culling criteria, agricultural animals were categorized according to whether they had reproductive problems, non-reproductive disorders, or both. Any farm's replacement stock could be either from outside sources or raised in-house. We divided the animals into two age groups: those under three years old and those older than three years old, according to their cross- or local origin. All of the animals were accepted for adoption by Horro Guduru A/P/R/Center (HG Ranch), Fincha, and Guduru Vet Clinic. Regardless of whether they were categorized as primiparous, pluriparous, or not relevant, farm animals were not exposed to the first, second, or third trimester abortion phases.

Collecting blood samples

Using sterile needles and basic vacutainer containers, ten milliliters of blood were obtained from each animal's jugular vein. After the blood samples were left to cool at room temperature for one night, the serum was removed by spinning them at 1500 × g for 10 minutes. Separation of cryovials, labeling, and dispatch of ice packs to the Addis Ababa University College of Veterinary Medicine in Bishoftu, Ethiopia, preceded by the shipment of sera. Serological testing was used to confirm the antibodies against spontaneous Brucella exposure. Following this, the antibodies were kept at -20°C.

Serological Laboratory Techniques

Rose Bengal Plate Test (RBPT)

In compliance with protocols set forth by the Office International des Epizooties (OIE) (2016), the Veterinary Microbiology Laboratory of the Addis Abeba University College of Veterinary Medicine and Agriculture screened all sera samples using commercially prepared Brucella antigen-coated materials. Thirty milliliters of serum and antigen were taken out of the refrigerator thirty minutes prior to the test and processed in accordance with the specified protocols.

Competitive enzyme-linked immunosorbent assay (c-ELISA)

Our ability to identify the presence of antibodies to Brucella in cow serum samples was supported by a commercial c-ELISA kit (BRUCELISA) (160+400) from the Veterinary Laboratories Agency in the UK. The developers strictly followed the protocol. Laboratory testing at Addis Abeba University's Akililu Lemma Institute of PathoBiology (AAU-ALIPB) was carried out on samples of RBPT seropositive serum. After the test, the positive and negative controls were diluted to 1/40 per the manufacturer's instructions. The substrate-chromogen mixture and conjugate were added to the plate at the recommended concentration. After that, it had to be incubated. After that, the reaction strength could be measured using an automatic ELISA reader that was calibrated to 405 nm.

The tested serum changes color to a well-defined shade when anti-Brucella antibodies

are present. We used a 10% cutoff on the average OD of the eight control wells that came back positive to find out if a sample was positive or negative. In order to evaluate the test sera, a final dilution of 1/200 was employed. The final tally for all test samples was a positive OD result of this magnitude or more.

Test for complement fixation (CFT)

For the analysis of sera that tested positive for the RBPT, the experts at the National Veterinary Institute (NVI) in Bishoftu, Ethiopia, utilized standard B. abortus antigen S99 from the Veterinary Laboratories Agency in the United Kingdom. The sera were tested for the presence of anti-Brucella antibodies using the standard B. abortus antigen for CFT. The reagent formulation was tested using titration to see if it met the standards set by the World Organisation for Animal Health (OIE, 2009). Complete hemolysis, 50% fixation of complement (2+) at a dilution of 1:10 or higher, or less than 75% fixation of complement (3+) at a dilution of 1:5, were all indicators of negative serums, whereas robust reactivity was indicative of positive serums.

Administration and Interpretation of Data

The lab surveys and examinations' coded data was used to construct a Microsoft Excel spreadsheet (Microsoft Corporation). Subsequently, SPSS for Windows® version 20.0 (SPSS Inc., Chicago, Illinois) was used to import the data and perform the necessary statistical analysis. By dividing the total number of samples tested by the number of samples that came back positive, the seroprevalence was determined. When looking for a correlation between risk factors and Brucella seropositivity, Pearson's Chi-square test was used. Breed, age, parity, length of parity, herd size, farming system, separate parturition, and abortion were the criteria. We used multivariate logistic regression to further examine the variables that were positively correlated with the serostatus (origin, source of stock replacement, abortion history, abortion time, and previous history of retained foetal membrane). This was done after we used the Chi-square test to investigate the association of exposure variables with Brucella seropositivity at the individual animal level. Using variables with p-values in Chi-square analysis of less than or equal to 0.05, a multivariate logistic regression model was created to identify potential risk factors linked with Brucella infection in animals.

RESULTS AND DISCUSSION

Results

Demographic characteristics of the respondents

A total of 102 individuals were surveyed to gauge their level of knowledge, attitudes, and behaviors regarding brucellosis. The great majority of the farmers in households were men (84.3%). Among those who took the survey, 16.6% had no formal education at all, 60.7% had only completed elementary school, and 1 had completed high school and beyond. Half of those who filled out the poll were in the 35–45 age bracket. Fifteen individuals, or

16.6% of the total, were active in maintaining herds, primarily through milking; sixty people, or 58.8% of the total, were herders; and twenty-five people, or 24.0%, were herders' owners. In addition, Table 1 shows that 24.5% of the participants were married, while 75.5% were single.

Table 1

Features of the respondents' demographics

Demographic variables	category	No.	%
Gender	male	86.	84.3
	female	16	15.7
Age	18-34	15	14.7
	35-45	52	50
	>45	35	34.3
Marital status	married	76	74.6
	singe	26	25.4
Education level	informal	17	16.6
	primary	62	60.9
	secondary	7	6.8
	College/universi ty	16	15.7
Responsibility in farm	Owner	60	58.8
	Herder/feder	25	24.6
	Milker	17	16.7

Understanding brucellosis and best strategies for managing herds

With 33.5% being small, 37.5% medium, and 29.1% large, most of the people who took part in this survey were farmers. Even among animals, most of these people had never heard of brucellosis. Hence, according to Table 2, only 29.5% of the population knew that brucellosis was an illness. While 32.35 percent of farmers had herds of 10–20 cattle, 29 percent were involved in raising herds of 21 or more cattle. On the other hand, 38.23% of cow owners only kept ten or less cows.

Table 2

Farm owners' Knowledge, Attitudes, and Practices (KAP) on brucellosis and varying herd sizes

Variable	category	No	%
Knowing of Brucellosis	No	72	70.6
	Yes	30	29.4
After birth dispose	Protective glove	13	12.7
	Without p/glove	89	87.3
Action to uterus discharge	Fed dogs	35	34.3
	Burying	30	29.4
	Through over field	37	36.3
Table.2 continues..			
Drinking raw milk	No	9	8.8
	yes	93	91.2
Assisting parturition	Yes	40	39.2
	No	62	60.8

Almost nine in ten women (88 out of 100) reported not having a specific place to give birth, such as a shed. Just 34% of farmers disposed of their farm waste appropriately, according to Table 3.

Table 3

Features of farms in three research area districts

		Proportion of Respondents (n %)		
Variables	Categories	HG Ranch (25)	Fincha (40)	Guduru (37)
Having parturition pen	No	11(12.83)	40(45.45)	37(42.04)
	Yes	14	-	-
Having Disposal Area	No	15(22.38)	30(44.77)	22(32.83)
	Yes	10(28.57)	10(28.57)	15(42.85)
	Very good	0	1(100)	0
Hygiene of the house	Good	3(33.3)	4(44.)	2(2)
	Satisfactory	11(23.9)	19((41.3)	16(34.7)
	Poor	11(23.9)	16(34.7)	19(41.3)
Service type	AI	0	6(31.57)	13(68.42)
	Bull	0	34(58.6)	24(41.37)
	Both	25(100)	0	0
Source of stock	Raise /growing	20(24.40	33(40.2)	29(35.3)
	purchased	5(25)	7(35)	8(40)

HG=Horro Guduru, n=number, %=percent

Occupational risk and awareness among farm owners and workers

In the study conducted in intensive farms, around 25% of the participants were aware that brucellosis was a disease. It was expected that 73.1% of people who took the survey would know very little about brucellosis. On top of that, a whopping 92 percent of respondents from intensive farms and 90.7 percent from large farms said they often drink raw milk. At the 0.05 level, the data in Table 4 indicate a notable decrease in activity.

Table 4

Occupational hazards and farm workers' and owners' knowledge of brucellosis

Variables	Semi-intensive (%)	Extensive (%)	X^2	P -value
Knowing of Brucellosis				
Yes	7(23.3)	23(76.6)	0.104	0.474
No	19(26.38	53(73.6)		
Table. 4 continues...				
Drinking raw milk				
No	2(22.2)	7(77.7)		
Yes	24(25.8)	69(74.1)	12.68	0.013*
Human housing				
Common	3(17.6)	14(82.35)	0.661	0.316
Separate	23(27.05	62(72.94)		
Assisting parturition				
Yes	10(33.3)	20(66.6)	0.08	0.55
No	16(25.80)	46(74.2)		

*-Significant

Serological Results

Results for RBPT were positive in 28 (or 27.5% of the total) of the 102 cattle herds tested in the study region, whereas results for c-ELISA and CFT were positive in 6 (or 5.8% of the total) herds. Out of 812 calves tested for antibodies to B. abortus, 28 (3.4%) tested positive for sero-prevalence using rodent blood testing. The total number of animals in the research region with positive CFT and c-ELISA values is 0.73%, with six animals (95% CI: 0.5-1.7) in this group contributing to this total. All of the possible risk variables' Pearson's chi-square test correlations are displayed in Table 5. We discovered some interesting correlations between variables such as stock replacement source, abortion duration, foetal membrane retention, abortion history, and prevalence of bovine brucellosis in different districts. The X2 values were 36.47, 8.436 (P = 0.001), and 2 = 9.756 (P = 0.02).

Table 5

The overall animal seroprevalence of brucellosis and its relationship to risk variables

Variables	Group	No.	Prevalence rate		X^2	P-value
			+ve	%		
Origin/Site	HG Ranch	643	2	0.31		
	Fincha	68	3	4.41	14.19	0.001*
	Guduru	101	1	0.99		
Breed	local	718	5	0.6	0.15	0.69
	Cross	94	1	1.06		
Parity	primiparous	169	-			
	Pluriparous	582	6	1.03	2.38	0.303
	No parity	61	-			
Age	Young	45	-			
	Adult	767	6	0.78	00.35	0.55
Sex	Female	753	6	0.79	0.474	0.34
	Male	59	-			
Mating type	AI	149	-			
	Bull	476	5	10.84	1.88	0.39
	Both	178	1	0.56		
Herd size	Small	299	2	0.66		
	Medium	272	2	0.73	0.47	0.977
	Large	241	2	0.82		
Source of stock	Growing (Rasing)	693	5	0.72	8.436	0.015*
	Purchased	119	1	0.84		
Abortion history	Aborted	17	2	11.76	8.217	0.04*
	Non aborted	795	4	0.50		
Abortion Time	1st trimister	4	0	-		
	2nd trimister	8	0	-		
	Last trimister	12	2	16.6	42.17	0.000*
	No abortion	788	4	0.50		
Historyof RFM	Yes	30	3	10	36.47	0.001**
	No	782	3	0.38		
Farming System	Intensive	137	2	1.45	1.16	0.280
	extensive	675	4			0.59

*RFM= Retain Fetal Membrane, *: =Significant, No.=number of animals, X^2 =Chi-square*

District level of seropositive prevalence of bovine brucellosis in the present study

The 812 animals that were serologically examined came from several places, including the Horro Guduru Animal Production Centre (HG Ranch), the Fincha district (Kombolcha), and Guduru (Guduru). In Table 5, you can see what percentage of these 812 cattle were found. There is a notable disparity ($\chi 2$ = 7.951, P = 0.019, df = 2) among the remaining 8.37 cattle (68 heads) from these three districts (stations).

Host-related seropositive prevalence of bovine brucellosis in the present study

A total of 638 native Horro breeds (representing 78.57%) and 174 hybrids (21.43%) were found in the research area. There was a significant increase in the proportion of antibrucella antibodies in cross-breeds from 0.66 percent in pure Horro breeds to 1.06%. If the p-value is higher than 0.05, it indicates that there was no significant difference in the prevalence rates.

Furthermore, there is a significantly higher sero-prevalence of bovine brucellosis in animals less than three years old (2.17 percent) compared to the older age group (0.5 percent). Our findings corroborate those of other studies showing that all infected animals were female, of native or hybrid breed, and either nursing or pregnant (Adugna et al., 2013). When there was no male seropositivity in the study area, female seropositivity (0.79%) was found. There was a greater danger to female cattle than males, according to this. No significant differences were identified, according to Table 5, except for the correlations between herd numbers, cow parity status, and sero-positivity for brucellosis.

Herd/farm management-related sero pre valence of bovine brucellosis

An apparent examination into serology found that extensive production systems had a positive test percentage of 0.5 percent, whereas semi-intensive manufacturing systems had a proportion of 1.4 percent. Similarly, farms that relied solely on bulls (natulary) for mating had a seroprevalence of 10.84% for brucellosis, whereas farms that used both methods more frequently had a seroprevalence of 0.56%.

Seroprevalence of bovine brucellosis associated with cattle physiology

In a study that looked at the seroprevalence of bovine brucellosis in a group with different farm management practices, there was a link (P <0.05) between having tested positive for brucellosis and having a history of abortion. The seropositivity of cows with a history of abortion was 11.76%, as shown in Table 5, compared to 0.50% for cows without a history of abortion.

Factors affecting the seroprevalence of Brucellosis in the study area

Results from logistic regression analyses for each risk factor are displayed in Table 5. Two putative risk factors—the origin (district), a history of abortion, and the retention of the foetal membrane—strongly affected the overall seroprevalence of brucellosis in the research region (P < 0.05). Both the duration of the abortion and the source of the additional supplies are significant from a statistical standpoint.

A compound effect multivariable logistic regression analysis using CFT data showed that calves with a history of retained foetal membrane had a higher infection probability (OR = 30.7, 95% CI: 4.4-212) compared to other cattle, as one of the potential risk factors associated with Brucella seropositivity (Table 6).

Table 6

Brucella seropositivity and potential risk factors: a multivariable logistic regression study using CFT

Variables	Crude estimate			Adjusted estimate		
	OR	CI	p-value	OR	CI	p-value
Abortion history	0.42	.023-7.43	0.014	0.065	-	.000
Retain Fetal Membrane	30.7	4.4-212	0.001	-	-	.000

OR:=Odds ratio; CI=Confidence interval

Discussion

Through the use of indirect detection methods and a range of sensitive and specific serological tests, several researchers in Ethiopia have determined the seropositive prevalence of bovine brucellosis. In light of these results, the current study in western Ethiopia was evaluated. The prevalence of brucellosis in cattle was found to be 0.738% in three randomly chosen districts of the Horro Guduru Wollega Zone, as reported in this study. According to this crucial but infrequent observation, the cattle in the area may be less prone to brucellosis.

This study's confirmed seropositivity result record is in agreement with previous research showing similar results in Jima Zone (0.77%), Southeast Somalia (0.9%), Oromiya (Adugna et al., 2013), Chench Gama Goffa Southern, Ethiopia (Yilma et al., 2016; 1.04), and Kenya (Kang'ethe et al., 2007; 1%).

In previous research by Bashitu et al. (2015) in Ambo and Debrebrihan, Alem and Solomon (2002), and Belihu (2002), 564 animals were screened in the eastern and western Showa zones of central Ethiopia using the Rose-Bengal Plate Test (RBPT), Serum Agglutination Test (SAT), and Complement Fixation Test (CFT). No sero-positive livestock were found. When compared to recent findings in other study locations, these examinations also revealed a lower seroprevalence of bovine brucellosis. Additionally, according to Belihu (2002), none of the 747 intensive dairy farms in the Addis Abeba region tested positive for reactors. Asmare et al. (2013) reported that similarly negative results for positive reactors were observed in Adama, central Ethiopia (n = 52) and Mekele and Gonder, northern Ethiopia (n = 252). These studies used a more diverse range of farm management approaches than the current analysis, which could explain why the seroprevalence results might be different. Yet, in other regions of the nation, bovine brucellosis seropositive rates have been reported to be higher. The East Wollega Zone and other portions of Ethiopia fall under this category. Degefu et al. (2011), Tolosa et al. (2010), Geresu et al. (2016), Tesfaye et al.

(2011), and Jimma et al. (2016) are among the further research that have examined the pastoral and agricultural areas of the Somali Regional State.

Depending on the source, the prevalence of brucellosis in animals can be anywhere from zero to fifty percent. In certain agroecologies and farming systems, the disease has been linked to cattle, according to Alem and Solomon (2002) and Belihu (2002). Bovine brucellosis, which is among the top five zoonotic infections in Ethiopia (Pieracci et al., 2016) and is thought to be the most common bacterial zoonosis worldwide (Pappas and al., 2006), was the most surprising reactor finding in the Western cow herd. This study also looked at whether or not brucellosis is native to Ethiopia. Radostits et al. (2007) states that a decline of positive reactors is a solid sign of infection in the entire herd.

Brucellosis seroprevalence in cattle has dropped significantly in recent years. This might not be because of the semi-intensive management in this study, but rather because of the farm characterisation survey's findings of more widespread grazing circumstances. In dry regions, this kind of management has the potential to lessen pasture contamination and animal-to-animal interaction (Crawford et al., 1990). Horro Guduru Animal Production Centre and local farmers may be using animals from their flocks to augment their livestock in the research region, rather than importing them, according to another theory. Because of the area's stellar reputation for integrated farming and animal husbandry, land rotation in production has the potential to further lessen pasture contamination. Multiple studies that have used RBT and CFT have shown that native cattle kept in large production systems have a low prevalence of bovine brucellosis (Adugna et al., 2013; Asmare et al., 2013; and Abebe et al., 2010). To obtain the most reliable results in epidemiological research, two tests should be carried out in a specific order. Serial testing often involves RBT tests administered alongside CFT or c-ELISA tests. According to Godfroid et al. (2010), RBT is a somewhat sensitive field-applicable test, in contrast to the highly specific c-ELISA and CFT. By integrating these tests, the study's results may be more trustworthy. This study did more than just measure seroprevalence; it also looked at the factors that would increase the likelihood of getting sick. This study is in line with the majority of others that have found that cattle production methods mostly dictate the seropositivity of brucellosis in animals. Kebede et al. (2008) postulated that semi-intensive farms were responsible for the greater incidence seen in this study. Reports show a higher incidence among cattle in semi-intensive production methods, even though the diagnostic procedures used are the same.

Since most farmers do not follow proper hygiene procedures, the discrepancy could be because of the increased risk of infection between sick and healthy animals, or between these systems and materials that are otherwise healthy. Jergefa et al. (2009) revealed this heightened potential for interactions. Despite the notion that cattle herding is inherently transhuman, Gebretsadik (2005) posits that this fact might explain why complex management systems have proliferated in

northern Ethiopia. Such measures may hasten the transmission of disease.

The seroprevalence of brucella in cattle was shown to be strongly associated (P<0.05) with the three district regions in the present investigation. Compared to Guduru (0.99) and HG Ranch (0.31%), Fincha had a higher individual animal seroprevalence of 4.41%. It is possible that the varied approaches to disease management employed by the three study sites explain the observed differences in brucellosis seroprevalence. Additionally, various agroclimatic conditions influence the seroprevalence of brucellosis and the survival rates of Brucellae organisms, according to research (Radostits et al., 2007). despite the fact that no districts were located within the present study zone that were more than 20 miles apart. There appears to be a strong correlation between the HG ranch and the Guduru districts in terms of descriptive numbers for cattle seroprevalence, which could be explained by similar management approaches and related environmental conditions. The HG ranch is located in the Guduru districts, yet it has its own administration, which is noteworthy.

Although univariable logistic regression did not find a correlation between herd size and bovine brucellosis seroprevalence, this investigation did find an association. The results of this study were in contrast to those of Adugna et al. (2013) and Geresu et al. (2016), which found no correlation between herd size and Brucella seropositivity. In the Wuchale Jida area of Ethiopia's East Wollega zone, small-holder farms had an equal risk of Brucella seropositivity regardless of herd size, according to Kebede et al. (2008). The study site is close to this spot.

It is worth noting that all of the calves who tested positive for the antibody were female, even though there was no significant link between sex and seropositivity (P>0.05) (Table 9). The afflicted animals were all female, native to the area, hybrids, and either pregnant or nursing, according to earlier studies by Adugna et al. (2013), Tolosa et al. (2008), and Kebede et al. (2008). This outcome provides support for their conclusions. Their results demonstrate a strong correlation between sex and Brucella seropositivity, which is at odds with our study. According to the results, female cattle were at a higher risk of harm than their male counterparts. The shorter housing period for males compared to females may have reduced their exposure, which could explain this outcome (Mangen et al., 2002).

Geresu et al. (2016) and Berehe et al. (2007) both came to the same conclusion: there is no correlation between parity and seroprevalence. Table 9 shows that no animals in the study areas tested positive for brucellosis. Although there is no statistically significant link between parity and brucellosis seropositivity, there was a slightly higher seroprevalence (0.89%) in pluriparous cattle compared to primiparous cattle (0.57%). Results from this study's analysis of brucellosis seroprevalence in pluriparous cattle were consistent with prior research conducted by Asmare et al. (2013), Geresu et al. (2016), and Adugna et al. (2013).

Age did not associated with Brucella seropositivity (P>0.05) in the same way that parity and other factors did. There was no

evidence of brucella seroprevalence in the young cows at the study sites, but 0.79% in the adult age group. This investigation confirmed the findings of Magona et al. (2009), which indicated that the seroprevalence of Brucellosis was higher in mature cattle. One possible explanation is that sexually mature cows are more likely to get Brucellae than sexually immature livestock, such as bulls or cows. One possible explanation is that the bacteria feed on erythritol, a substance found in steroid hormones and many tissues of pregnant women (Radostits et al., 2007).

Abortion was shown to be significantly associated with brucellosis seropositivity (P <0.05), which provided evidence of the cattle's ancestry. In cows that had previously given birth, the seropositivity rate was 11.76%, while in those that had never given birth, the rate was 0.50%. The seroprevalence in North Gondar was 6.7%, as reported by Yayeh (2003), Geresu et al. (2016), and Tolosa (2008). The seroprevalence in Mekele dairy cattle was 6.1%, according to Tesfaye et al. (2011).

WHO statistics show that comparable rates were present in 17.6% of the locations selected by Ethiopia. This could be due to the fact that brucellosis frequently causes other difficulties such stillbirths, miscarriages, and retained placentas (Radostits et al., 2007). Brucellosis seropositivity test results were also significantly associated with retained fetal membrane history in the current study. Tolosa et al. (2008), Ibrahim et al. (2010), and Adugna et al. (2013) are only a few of the research that have demonstrated a robust correlation between seropositivity and the timing of abortions. These two instances of correlation provide credence to this link. Metritis, an inflammation of the uterine wall, and placenta retention are common complications of brucellosis abortions (Radostits et al., 2007). The infected cow population will proliferate three to four times faster than the non-infected cow population, according to Aparicio's (2013) predictions.

Additionally, this outcome was observed to be significantly correlated with the duration of the abortion (10.0% seropositive Brucellosis) (X2 = 36.42; P = 0.001) in the current study. In their separate study, Geresu and colleagues (2016) also came to the same conclusion. Possible explanation: beginning in the fifth trimester of pregnancy, components of allantoic fluid, such as erythritol, produce an increase in placental and foetal fluid and stimulate Brucella development (Radostits et al., 2007; Coetzer & Tustin, 2004). This may explain why seropositivity is highest in the second trimester of a cow's pregnancy. The majority of farms in this survey (58.6%) used bulls for mating, whereas a smaller percentage (18.3%) used artificial insemination or other methods. While the AI mating approach was superior in terms of seroprevalence rate (10.84%), the disparity was not statistically significant (p > 0.05). Bull service came out on top. Nonetheless, there were no reported occurrences of seropositive. Nevertheless, the results showed that the replacement stock sources had a significant impact on the prevalence of bovine brucellosis in the studied locations (p < 0.05). Due to their increased susceptibility to brucellosis in comparison to cattle feed, imported animals were used to replace the herd. Based on these two features,

it seems that the current research region should take precautions to prevent brucellosis by providing proper care to cattle that have been imported from other farms and by utilizing artificial insemination while mating. The proportion of participants who tested positive for seroprevalence did not match the results of this study. Previous study may have found different results due to factors including varying herd numbers, different management practices, or the existence or absence of infectious foci. For example, this data could be different if there are nearby farms or ranches that supply replacement animals but have Brucella infections.

CONCLUSIONS

Although the disease's frequency in individual cattle is very low, this study in Western Ethiopia utilized three-step testing of collected sera to demonstrate that bovine brucellosis is still a significant animal health problem in Ethiopia. The study's three main risk variables were the origin of the sample district, the source of the original stock, and the source of the replacement stock. Other major risk variables in the research region were keeping the fetal membrane and having an abortion history. There are significant zoonotic risks connected with drinking raw milk, and this study adds to that by illuminating the viewpoints, knowledge, and behaviors of brucellosis-affected occupational workers and animal owners.

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DECLARATION

The authors declare that they have no competing interests.

DATA AVAILABILITY

The authors confirm that the data supporting the findings of this study are available within the article materials.

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