ORIGINAL ARTICLE

Epidemiological analysis of bovine brucellosis in Tuntatacto, Guano Canton

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ABSTRACT

Introduction: bovine brucellosis is a zoonosis with significant health and economic impact that affects livestock production and represents a public health risk in rural communities.
Objective: to determine the prevalence of Brucella spp. in cattle from the community of Tuntatacto, Guano Canton, and to analyze the risk factors associated with its transmission.
Methods: an observational, cross-sectional, and analytical study was conducted in 2022 using probabilistic random sampling. A total of 398 cattle out of 1317 registered animals were evaluated, belonging to 57 farms classified by size. Blood samples were collected from the coccygeal vein and the Rose Bengal test was applied. Data were processed using Chi-square analysis, respecting bioethical principles of voluntariness and confidentiality.
Results: the overall prevalence was 7,5 %, while at the farm level it reached 28 %. Small producers showed 6 % seropositivity, medium producers 7 %, and large producers 11 %. Intrinsic and extrinsic risk factors were identified, such as history of abortion, lack of vaccination, inadequate management of placentas, and deficiencies in biosecurity. Larger herds showed higher incidence, linked to animal density and reproductive practices.
Conclusions: bovine brucellosis remains a relevant problem in Tuntatacto, with higher prevalence in large-scale farms. The findings highlight the need to strengthen vaccination programs, improve biosecurity practices, and promote health education to reduce productive impact and zoonotic risk in the region.

Keywords: Brucellosis, Bovine; Epidemiology; Veterinary Public Health; Zoonoses.

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INTRODUCTION

Bovine brucellosis is a zoonotic disease that causes significant economic and public health impacts in several countries worldwide. It is a priority to determine the prevalence of *Brucella* spp. in animals raised for human consumption—particularly as a source of protein and dairy products—due to the bacterium's ability to colonize humans and cause serious health damage.[1] Six species of the bacterial genus *Brucella* and multiple serotypes have been described, including *Brucella melitensis*, *Brucella abortus*, *Brucella suis*, *Brucella ovis*, *Brucella canis*, and *Brucella neotomae*. These bacteria are non-motile, aerobic, Gram-negative coccobacilli that lack spores and capsules, measuring 0,4-0,8x0,4-2,5 µm.[2]

A study on brucellosis in cattle and buffalo across Central America, the Caribbean, and South Africa reported an overall infectious disease prevalence of 3% , with higher rates observed in buffalo. No significant differences were found among regions over the past five years.[3]

A national bovine sampling campaign conducted by technicians from the Agency for Phytosanitary and Zoosanitary Regulation and Control (AGROCALIDAD), involving 290 farms and 3,752 female cattle, found a herd-level prevalence of 21,4 % and an animal-level prevalence of 5,7 %. In Pichincha Canton, Manabí Province, the prevalence was 10,00 % among 360 sampled animals, as determined by the Rose Bengal diagnostic test.[4]

In Zone 3 (Cotopaxi, Tungurahua, Chimborazo, Pastaza), risk factors for zoonotic diseases—including consumption of unpasteurized dairy products and contact with contaminated viscera or fluids—were linked to the presence of three zoonoses: *Leptospira*, brucellosis, and tuberculosis. Brucellosis prevalence in this zone was reported at 0,046 %.[5] Given this context, the present study aimed to determine the prevalence of *Brucella* spp. in cattle from the community of Tuntatacto, Guano Canton, and to analyze associated risk factors for transmission.

METHODS

An observational, descriptive, cross-sectional epidemiological study was conducted with both field and laboratory components. The study took place in the community of Tuntatacto, San Andrés Parish, Guano Canton, Chimborazo Province, Ecuador. The community comprises 273 families and 944 inhabitants, covering 360,17 hectares, with a typical highland Ecuadorian climate (temperatures ranging from 4 to 18°C).

The reference population consisted of 1,317 cattle registered in the latest AGROCALIDAD census (2022). Clinically healthy, crossbred animals with normal physiological parameters were included. Animals showing clinical signs of illness or undergoing veterinary treatment were excluded.

Sample size was calculated using probabilistic random sampling, with a 96 % confidence level and a 4 % maximum acceptable error. A total of 398 cattle from 57 livestock farms were selected and classified by herd size:
- Small: 1–9 cattle
- Medium: 10–19 cattle
- Large: ≥20 cattle

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Procedures and techniques

Blood samples were collected in the field from the coccygeal vein of each selected bovine. Samples were processed in the laboratory using the Rose Bengal agglutination test to detect antibodies against *Brucella* spp.

Additionally, a structured epidemiological survey was administered to owners of all 57 farms to identify intrinsic risk factors (reproductive management, abortion history, vaccination practices) and extrinsic factors (water source, animal acquisition, waste disposal methods).

Primary variables included seropositivity to *Brucella* spp. (positive/negative Rose Bengal test result) and prevalence at both animal and herd levels. Secondary variables included herd size, management practices, reproductive history, and environmental conditions.

Statistical analysis

Data were analyzed using descriptive statistics, calculating absolute and relative frequencies of seropositivity. The Chi-square test was used to assess associations between prevalence and risk factors, with significance set at $p < 0,05$. Odds ratios (OR) were calculated for specific risk factors reported in the survey. Analyses were performed using specialized statistical software.

Ethical considerations

The study adhered to bioethical and animal welfare principles. Blood collection followed veterinary protocols to minimize pain and stress. Farm owners provided informed consent for animal participation and survey completion. The research complied with national AGROCALIDAD regulations and Helsinki Declaration principles adapted for veterinary studies.

RESULTS

Livestock farming is of major economic importance in Guano Canton, Chimborazo Province, and constitutes the primary income source for the community of Tuntatacto. Analysis was based on 398 samples obtained through finite probabilistic sampling from a total cattle population of 1,317. Animal-level prevalence of brucellosis was 7,5 % (30/398 seropositive animals).

The seroprevalence of brucellosis according to the categorization of productive establishments (Figure 1) is 6 % (10/163) among small farmers, 7 % (10/153) among medium producers, and 11 % (9/82) in large dairy establishments with more than 20 dairy units.
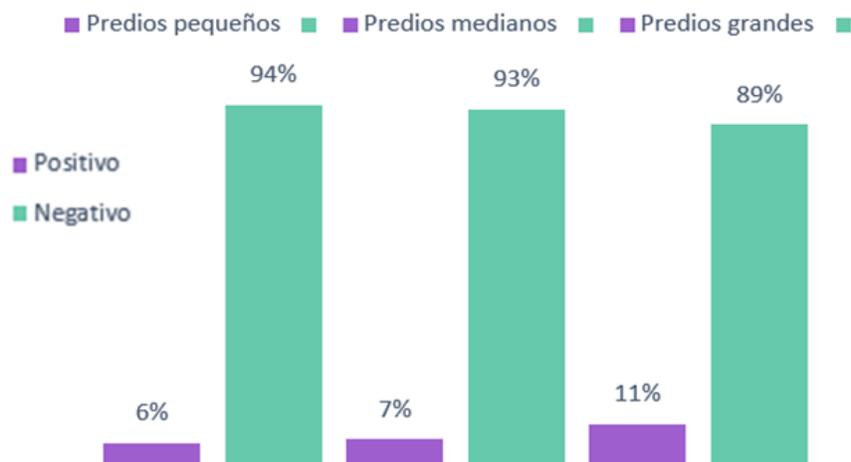
Fig. 1 Prevalence of brucellosis according to number of animals per farm.

Epidemiological surveys from 57 farms (Table 1) identified intrinsic and extrinsic risk factors significantly associated ($p < 0,05$) with *Brucella* spp. prevalence.

Table 1. Analysis of epidemiological risk factors for brucellosis.

Risk Factor	Survey Question	*p*-value
Intrinsic	Are animals vaccinated against brucellosis?	<0,001
	Has your herd experienced abortions?	<0,001
	Do you have a designated calving paddock?	<0,001
	Do you change needles between animals when administering vaccines/medications?	<0,001
	How do you dispose of placentas after calving?	0,013
Extrinsic	Where do you acquire new animals?	0,004
	What is the water source for your animals?	<0,001
	Do you purchase or rent pastures to feed your animals?	0,034

DISCUSSION

Regarding the observed prevalence of bovine brucellosis, similar results were obtained by D'Pool et al.,[7] in a study conducted in the province of Manabí, where a total of 375 cattle from 55 farms were sampled, with a bovine brucellosis prevalence of 7,73 % in 29 seropositive animals. Conversely, a prevalence of 6 % was reported in a nationwide study, with 2 % in Cañar, indicating the presence of this zoonotic disease.[8]

In Colombia, a study reported a prevalence of 15–28 % in cattle farms, similar to the findings,[9] yet much higher than the seroprevalence of 5,56 % observed in the Espejo canton according to the analyzed animal production units (5/90), where 396 animals were evaluated.[10]

When analyzing the prevalence of bovine brucellosis among small, medium, and large producers, the results obtained are consistent with those reported by Zamora et al.,[3] who indicated that the prevalence of brucellosis in herds located in the Andean region is 9,94 %, considerably lower than the results obtained in the coastal region, which estimate a seroprevalence of 27,52 %.

Higher prevalence in large farms may be attributed to animal grouping under electric fencing systems, which facilitates transmission. Bovine placental cells express abundant mannose receptors that bind terminal LPS molecules of *Brucella*. Additionally, *B. abortus* exhibits tropism for bovine placental erythritol, promoting bacterial replication.[11,12] Thus, infected females shed large quantities of bacteria during calving or abortion, constituting the primary infection source in herds.

This disease primarily affects the reproductive system, with multiple transmission routes. [13] Peridomestic dogs, improper disposal of calving waste, and uncontrolled animal acquisition are common risk factors predisposing dairy herds to brucellosis.[14,15] Intensive systems increase transmission risk due to high animal density and frequent contact, whereas extensive systems—with lower density—reduce exposure. However, disease incidence rises with prolonged animal cohabitation, as seen in managed herds.

Studies indicate that cows with parity ≥4 have 7,82 times higher odds of brucellosis infection than primiparous cows, and those with abortion history show 5,89 times greater odds.[16] Logistic regression analyses have shown that lactation status, anestrus, reproductive disorders, milk yield, number of lactations, trimester, and abortion are significantly associated with seropositivity. Specifically, cows in production (OR: 2,59), producing <2 L/day (OR: 29,6), producing 2–12 L/day (OR: 4,8), or with reproductive disorders (OR: 3,2) had higher seropositivity odds. Large herds also showed greater risk than small ones.[17,18]

In a study of 18,990 cows in Minas Gerais, Brazil, 113 were seropositive (apparent prevalence: 0,81 %). Prevalence increased with parity, reaching 56,82 % in high-parity animals. Significantly higher rates were observed in cows with abortion history and repeated breeding services. Large farms showed 88,89 % prevalence versus 64,44 % in small farms.[19]

Logistic regression models revealed that farms with repeated reproductive failures had 6,25 times higher odds of brucellosis.[20] Seroprevalence was 20 % in cattle >6 years old versus 14,9 % in 3–6-year-olds, and higher in females (18,7 %) than males (1,2 %).[21] Multivariable logistic regression confirmed that significant determinants of bovine brucellosis include parity, abortion history, repeated breeding, and other reproductive anomalies.[22,23]

CONCLUSIONS

The analysis conducted in Tuntatacto, Chimborazo Province, confirms the presence of bovine brucellosis in dairy herds, underscoring its relevance as a sanitary and productive challenge. Results show that infection affects producers across all scales, highlighting the need for control and prevention measures at every level. The identification of positive farms emphasizes the urgency of strengthening epidemiological surveillance, farmer training, and biosecurity strategies to reduce pathogen transmission. In this context, bovine brucellosis must be prioritized in animal health management and public health protection due to its impact on productivity, local economy, and zoonotic transmission risk in the region.

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