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ORIGINAL ARTICLE

Epidemiology of caprine brucellosis in the Central Zone of the State of Veracruz

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Abstract

Introduction: *Brucellosis is a disease of high morbidity that affects several animal species, is transmitted to humans and, therefore, is a zoonosis. It is caused by bacteria of the genus Brucella. In this study we aim to determine seroprevalence, risk factors, and spatial distribution of caprine brucellosis in 14 municipalities in the central region of the state of Veracruz.* **Materials and methods:** *This cross-stratified multistage study was conducted between 2009 and 2012. It included 572 animals of 81 production units selected by consensus according to the value tables of Cannon and Roe. The diagnosis was by Card Testing and Radial Immunodiffusion. The seroprevalence was determined with the VassarStats® risk factor program and odds.* **Results:** *The overall seroprevalence was 0.52% (95% CI: 0.13-1.65) and production units 2.47% (95% CI: 0.43-9.46). They were identified as risk factor for infection, production units in feedlot system and Card Testing seroconversion to vaccine against brucellosis; and as a protective factor, vaccination.* **Conclusions:** *Seroprevalence and distribution of goat brucelosis is low, the intensive system is a risk, and according with the Health Ministry in order that human cases are scarce.* (Gac Med Mex. 2017;153:23-7)

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Introduction

Brucellosis is regarded as the most important zoonosis and, it also generates important economic losses in meat and milk production. Most cases in humans are due to *Brucella melitensis*, the natural hosts of which are goats and sheep[1,2].

The highest prevalence of brucellosis is observed in zones where ecology enables high indices of cattle pasturing on stubbles in summer or rather because there is overgrazing and high density of animal population is favored[3].

In the State of Veracruz, in consistency with the national strategy against brucellosis, a massive vaccination plan against brucellosis was implemented at the zone of the Perote volcano and valley, which is where more than 90% of the state's goat stock is found, due to the presence of cases of human brucellosis on that region. Simultaneously, studies were carried out in order to know the prevalence of caprine brucellosis, which turned out to be higher than 35%[4].

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In the years 2004 and 2005, four vaccination operatives against caprine and ovine brucellosis with the RB51 strain, covering more than 90% of 322 producers' flocks and 5,168 heads of the communities of Frijol Colorado, La Gloria, Orilla del Monte, Tenextepec, Totalco and Tlalconteno, from the municipalities of Perote and Jalacingo, in the State of Veracruz, where brucellosis showed prevalences ranging from 0.5% to 38%. In 2006, brucellosis was only identified in flocks of the community of Tenextepec, with a prevalence of 5.5%[5].

The purpose of the present work was to characterize caprine brucellosis in 14 municipalities located in the Central Zone of the State of Veracruz in terms of seroprevalence, associated risk factors (RF) and spatial distribution, due to federal, state and municipal authorities intense participation against this infection, and because the Ministry of Health of the State of Veracruz currently identifies very few cases of this zoonosis[6].

Materials and methods

The study, which was cross-sectional, multistage and stratified, was carried out in the period encompassed between March 2009 and July 2012 in 14 municipalities (Chiconquiaco, Coacoatzintla, Coatepec, Emiliano Zapata, Ixhuacán de los Reyes, Jalacingo, Las Minas, Las Vigas de Ramírez, Perote, Tatatila, Yecuatla, Tlacolulan, Villa Aldama and Xico) of the Rural Development District (DDR – *Distrito de Desarrollo Rural*) 004 "Coatepec", where 90% of the state's caprine stock is found. The sample size was calculated with version 2.0 of the WinEpiscope program[7], under the modality of proportion estimation for an estimated prevalence of 50%, a 5% error and 95% confidence interval, with a sample of at least 386 animals being obtained. The number of production units (PU) to be sampled was selected by clusters with Cannon and Roe's tables of values for 50% prevalence, which yielded 81 PU. Female animals older than 3 months of age and all studs were randomly selected in order to obtain blood samples without anticoagulant, which were serially processed under the screening and confirmatory modalities with 3% test cards (TCs) and radial immunodiffusion (RID), respectively[9,10]. Two surveys were applied at each PU, a general one per PU, and another individual per sampled animal, in order to know the RFs. Seroprevalence was calculated with the VassarStats® online program for the calculation of proportions, and for RFs, the odds-ratio (OR) was used[11]. The PUs were georeferenced with a 60 Garmin® GPS device with an error margin of ± 3 m and the coordinates were taken in the pen using the UTM system, in order to construct maps with the ArcView GIS 3.3 program.

Results

General seroprevalence by TC was 18.18% (95% CI: 15.15-21.64) in the study municipalities, but when seroprevalence was confirmed with the RID test, it decreased to 0.52% (95% CI: 0.13-1.65)

Seroprevalence by gender with TC was 19.76% (95% CI: 16.38-23.62) in female and 8.64% (95% CI: 3.84-17.54) in male animals. RID-confirmed seroprevalence in female animals declined to 0.4% (95% CI: 0.07-1.61) and to 1.3% (95% CI: 0.07-8.01) in males, which allows for vaccination efficacy in the study zone to be confirmed, since male animals are not vaccinated against brucellosis[9,15].

With regard to productive status, the highest seroprevalence with TC occurred in dry female animals: 25.93% (95% CI: 11.88-46.6); when confirmed with RID, the highest seroprevalence took place in weaned animals: 2.56% (95% CI: 0.13-15.07).

Only 3 PUs (3.7%; 95% CI: 0.96-11.18) were confirmed to be affected by means of RID and were found in the Perote municipality (Fig. 1), which means that the infection is demarcated and only that municipality should remain on brucellosis control phase, according to some Mexican regulatory criteria[9].

On the other hand, confirmation by RID helped to identify intensive management PUs as a RF (OR: 13.81; 95% CI: 1.24-154.2), which is consistent with reports by Díaz et al.[10] and Peniche et al.[12].

Discussion

General seroprevalence found with TC (18.8%) is higher than that reported by Javitt et al.[13] in caprine herds of Spain (3%); however, with RID, seroprevalence decreased to 0.52% (95% CI: 0.13-1.65), because it discriminates seroconversion by vaccinal diagnostic interference or by other microorganisms[5,10].

As for seroprevalence by gender, in the case of females it is higher than that reported by Ortega Sánchez et al.[13], who found 5.9% of seroprevalence in Durango[14], which can be explained by the fact that females are usually more susceptible to infection by smooth strains (*B. abortus*, *B. melitensis* and *B. suis*) and even the daughters of positive females can become immunotolerant and constitute a risk for the PU[1,9,10].

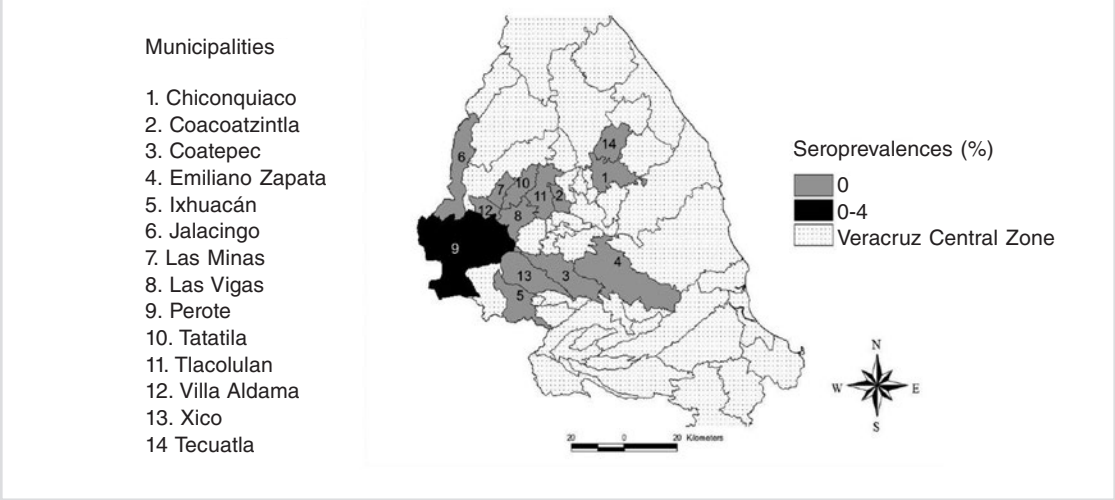

Figure 1. *Caprine brucellosis municipal prevalence in the central zone of the State of Veracruz.*

Intensive management is regarded as a RF because animal overcrowding contributes to the occurrence of diseases in general, and of brucellosis in particular, because some actions, such as foremilk stripping onto the floor at the beginning of the milking process, maintaining females that have recently given birth or aborted, lack of general hygiene and others, increased contamination of the surroundings with *Brucella* spp and favor the rest of the PU animals to getting infected[10]. In addition, vaccination against brucellosis with the *B. melitensis* Rev-1 strain was observed to be responsible for the TC-detected seroconversion (OR: 2; 95% CI: 1.1-4), a situation already reported by Martínez[5,11] as a common consequence in herds of the region. However, vaccination with any of the strains used in the zone was identified as a protective factor (OR: 0; 95% CI: 0-0), which is consistent with observations reported in other works[2,5,10,16].

The study has also been useful to know that the brucellosis-affected zone is well demarcated and located in the Central Zone of the State (Fig. 2), and for this reason, according to current regulations in Mexico[8], the zone could easily shift to eradication phase if the required sanitation measures are established in the herds to clear the animals from infection[1,11].

In addition, it demonstrates that the vaccination operatives that have been established in the studied municipalities have been efficacious to contain the infection and that persistence of the agent may be due to environmental conditions and to production systems that favor infection with *Brucella* spp[17] or even to contiguity with other states with brucellosis-control inappropriate strategies[18], as it can be appreciated in figure 3.

This way, we know that the State of Veracruz has a solid vaccination operative in the 14 municipalities that concentrate the majority of the caprine stock of the state, but we don't know how it is carried out in the neighboring State of Puebla, which is contiguous to the Perote municipality.

Conclusions

It is concluded that brucellosis seroprevalence is low, with known and limited distribution, that exploitation in intensive systems contributes to infection, that there is coincidence with the low number of cases reported by the Ministry of Health in Veracruz and that goat vaccination has overwhelmingly contributed to control the infection.

Source of funding

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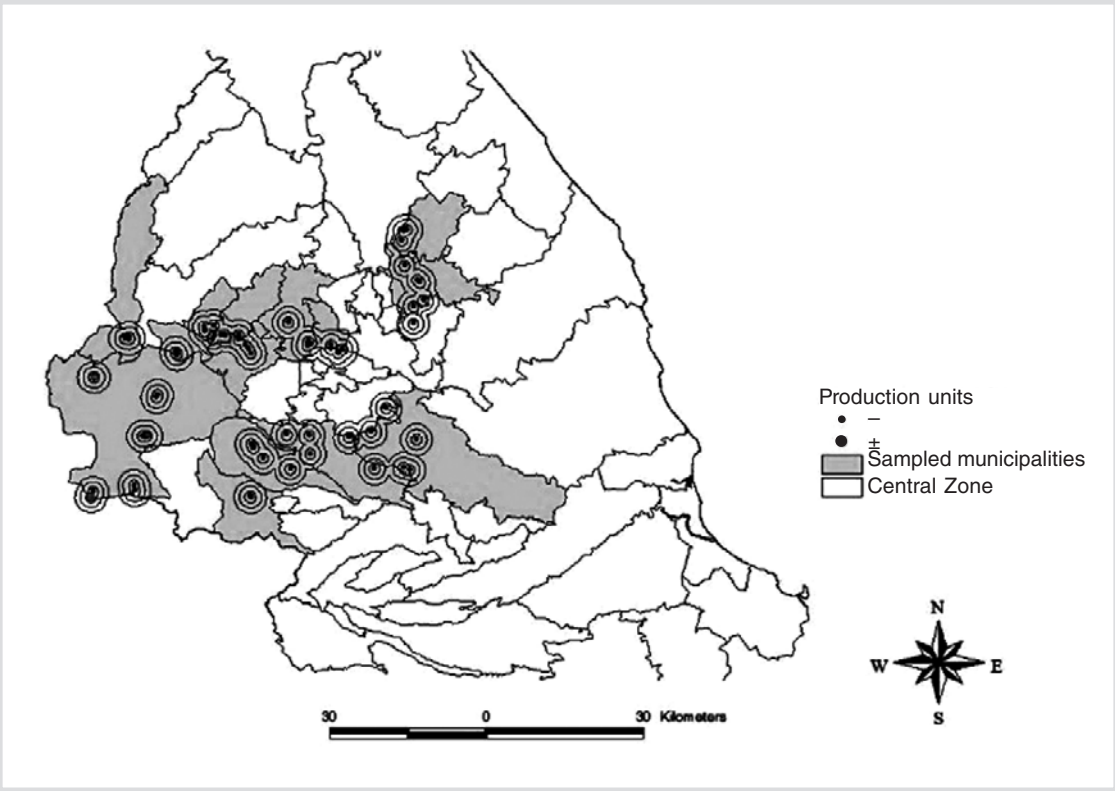

Figure 2. *Production units affected by caprine brucellosis in the Central Zone of the State of Veracruz.*

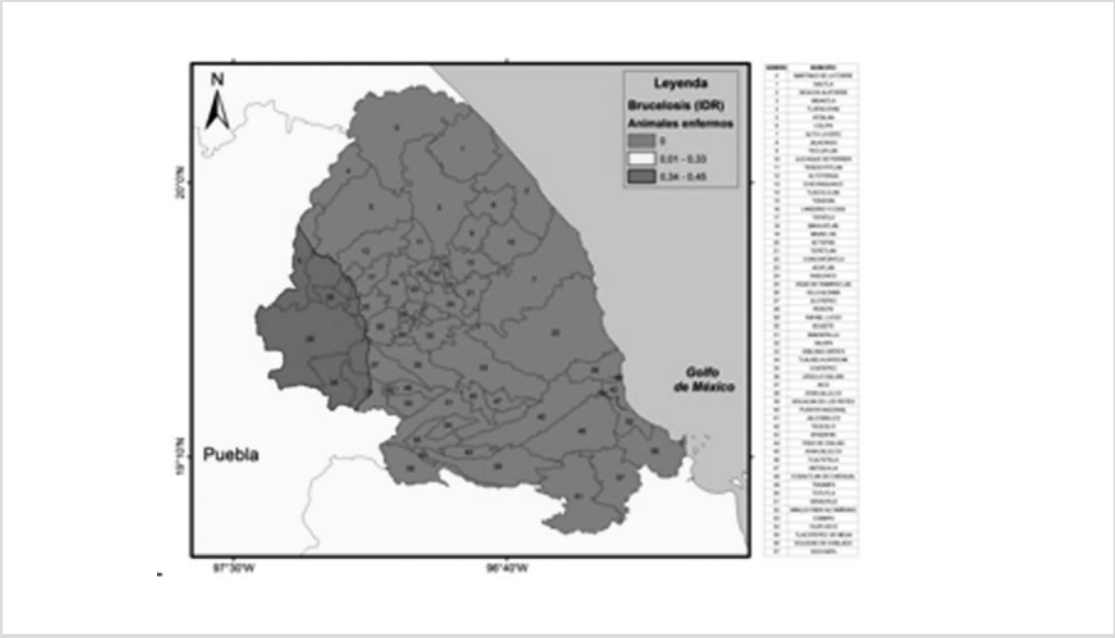

Figure 3. *Isopleth map of brucellosis behavior in the Central Zone of the State of Veracruz*

agents that affect the production of small ruminants), code number 30-2009-0869, under technical direction of Dr. David Itzcoatl Martínez Herrera.

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