



Frequency of feline and bovine trichomoniasis in livestock production units in the central zone of the state of Veracruz, Mexico



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Abstract:

Trichomoniasis is a disease caused by the protozoan *Trichomonas foetus* (*T. foetus*), which causes reproductive problems in cattle and is an intestinal parasite in cats, causing intermittent diarrheal processes when they are young and asymptomatic in adults. *T. foetus* lives in the reproductive tract of cows, being related to infertility, uterine infection and even abortions. Coexistence with cats in livestock areas can transmit *T. foetus* to cattle. Therefore, the aim of this study was to determine the frequencies of feline and bovine trichomoniasis and its association in livestock production units in the central zone of Veracruz, Mexico. Fifty-five (55) samples were collected and inoculated in specific commercial culture media. The frequency of trichomoniasis-positive animals and the odds ratio were calculated to estimate the risk factors for infection. Out of the samples, 30.91 % were positive for *T. foetus*

while intraspecies frequency was 36 % (95%CI: 18.70-57.3) in cows, 14.3 % (95%CI: 2.52-43.85) in bulls and 37.5 % (95%CI: 16.28-64.13) in cats, respectively. No risk ($P>0.05$) was found for *T. foetus* infection in cattle due to cohabitation with cats. In the present study, the presence of *T. foetus* was only identified in different livestock production units where cattle and cats coexist.

Keywords: *T. foetus*, Interspecies transmission, Epidemiological association, Cross-sectional study, Humid tropics.

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Trichomoniasis in animals, is a disease caused by the protozoan *Trichomonas foetus* (*T. foetus*), genus *Trichomonas*, family Trichomonadidae, class Phytomastigophorea, and phylum Sarcomastigophora. This is a flagellated pyriform or ovoid parasite of worldwide distribution which mainly affects cattle and felines⁽¹⁾. This protozoan has three anterior free flagella as locomotor organs, and a recurrent flagellum directed towards the posterior end attached to the body by a wavy membrane that continues as a free flagellum. The cell cytoplasm contains axostyle, pelta, costa, and parabasal filaments, which, together with the flagella form the cytoskeleton. Nourishing comes from pinocytosis and phagocytosis processes, obtaining its energy from the anaerobic metabolism of carbohydrates. Its reproduction is asexual by longitudinal binary fission⁽²⁾.

In cattle, this protozoan is responsible for causing bovine trichomoniasis, a disease of venereal transmission that results in endometritis, infertility and even abortion generating some economic losses in livestock. Venereal infection is characterized by repeated estrus and embryonic death^(3,4). Bulls are considered asymptomatic carriers and responsible for spreading the protozoan. The parasite is lodged in the preputial crypts and the penile mucosa, so at the moment of copulation, the stimulation and erection of the penis favor the opening of the penile crypts and the exit of the parasite⁽⁵⁾. Transmission occurs mainly during mating; however, it can happen by artificial insemination since *T. foetus* can be contaminated and remain viable in cryopreserved semen. Males' genital organs usually remain unaffected, but in some occasions, balanoposthitis can be observed^(6,7).

On the other hand, the pathogenesis of *T. foetus* in bovine females is characterized by the proliferation of the parasite in the vagina during estrus. Later, the reproductive tract mucosa is colonized, and the parasite adheres to epithelium cells. The increase in vaginal epithelium keratinization results in parasite cell adhesion^(8,9). This infectious process induces a systemic

and local immune response in the reproductive tract of the female, where mucosal immunity plays an important role. It has been described that *T. foetus* can live from 90 to 190 d in the reproductive tract of post-infected cows. However, in other cases, the female remains infected as asymptomatic carrier for more than one year^(6,10), then a short-lived immunity is produced, and there is a possibility of re-infection again. Abortions occur in the second third of gestation, and its incidence rate ranges between 5 and 10 %. Many embryonic losses occur around two to three weeks after conception^(4,7,11). If a pregnant cow is infected before the second third of gestation, it is likely that the calf will be carried to term.

Cats are also affected by *T. foetus* which causes feline trichomoniasis. Numerous studies have shown that *T. foetus* can cause a digestive condition (chronic colitis); here, the parasite infects and colonizes the large intestine and can cause chronic, untreatable diarrhea. Stool frequency is increased, and affected animals frequently present proctitis and even fecal incontinence^(7,12,13). The infection is oral. It is transmitted by contact with diarrheal feces with the increased frequency of defecation. Pasty to liquid stools is sometimes accompanied by fresh blood or mucus. Kittens are usually affected. However, in communities where the infection has not been previously diagnosed and controlled, it can also be seen in adult cats and older cats in poor body condition. No gender or breed predisposition has been noted^(7,12,13).

It appears that there is 100 % genetic relatedness for the ten feline isolates, 100 % identity between the bovine isolates and a genetic distinction between cats and cattle of the *T. foetus* genotype⁽⁷⁾. This research aims to determine the association of feline and bovine trichomoniasis in livestock production units in the central zone of the state of Veracruz, Mexico.

This study was carried out in the central zone of the state of Veracruz, Mexico, where the climate is warm-humid subtropical with summer rains, annual average temperature is 23 °C, and rainfall averages 1,500 mm annually. The municipalities sampled were Soledad de Doblado, Tlalixcoyan, Cuitlahuac, Alvarado, Santiago, Jamapa, Camaron de Tejeda and Veracruz, which belong to the Papaloapan Basin and share similar climatic conditions⁽¹⁴⁾.

The inclusion criteria for this study corresponded to: 1) Felines, including those domestic cats that cohabited with cattle in the production units, if the cats presented diarrheic feces and slept in cattle feeders; 2) Bulls with mating experience, if records of previous andrological analysis were kept, quantification of the number of cows attended and loans to other production units; 3) Cows that have had abortions, repeated estrus, mummified fetuses, presence of vaginal secretions, stages in which abortion is performed, among others^(15,16).

A convenience sampling was carried out, where samples were obtained from 16 cats, 14 bulls and 25 cows that met the inclusion criteria presented in the surveys applied. In the case of felines, direct samples were taken from the rectum or diarrheic feces were collected by using sterile swabs, diluting the feces with 0.9% saline solution to be transported in sterile falcon tubes for observation of *T. foetus* under the microscope^(7,17).

On the other hand, in the case of bulls, a culture of *T. foetus* was performed in specific commercial growth medium from samples of preputial secretions by scraping, suction or washing, it was important that the bulls were kept in a sexual rest period of one or two weeks; before taking the sample, trichotomy and washing of the area was performed to avoid contamination with hair, mud, feces or urine. Finally, the cow samples were taken by aspiration of cervical or vaginal mucus with artificial insemination pipettes and, as for the bulls, they were cultured in specific commercial growth medium^(11,16).

The statistical design was cross-sectional to calculate the presence of the disease by studying the frequency and epidemiological association by risk quantification, using the free online program VassarStats to calculate frequencies. With the epidemiological platform WinEpi the odds ratios (OR) with their confidence intervals (95%CI) were calculated, and their statistical approximations were calculated according to Thrusfield⁽¹⁵⁾.

Table 1 shows the frequency of *T. foetus*. The highest frequency was found in the municipalities of Camarón de Tejada (50 %), Cuitlahuac (43 %) and Soledad de Doblado (40 %). A total of 55 animals were sampled; 16 corresponded to felines, with six positive animals (37.50 %) and 39 to bovines, with 11 positive animals (28.21 %). The overall frequency of trichomoniasis was 30.91 % (Table 2).

Table 1: Number and frequency of *T. foetus* positive animals by municipality of origin

Municipality	n	(+)	Frequency (%)	95%CI	OR	P
Soledad de Doblado	15	6	40.0	17.46-67.11	2.33	0.33
Tlalixcoyan	9	2	22.22	3.95-59.81	1.0	-
Cuitlahuac	7	3	42.86	11.81-79.76	2.63	0.36
Alvarado	6	2	33.33	6.0-75.89	1.75	0.5
Santiago	7	2	28.97	5.11-69.74	1.4	0.6
Jamapa	4	0	0	0-36.76	-	-
Camarón de Tejeda	4	2	50	9.19-90.81	3.5	0.35
Veracruz	3	0	0	0-69	-	-

95%CI= confidence interval; OR= odds ratio.

Table 2. Overall frequency, measure of association and confidence interval of animals positive to *T. foetus* in the state of Veracruz, Mexico

Species	n	(+)	Frequency (%)	95%CI	OR	P
Feline	16	6	37.50	16.28-64.13	1.53	0.35
Bovine	39	11	28.21	15.55-45.11	1.0	-
Bulls	14	2	14.3	2.52-43.85	1.0	-
Cows	25	9	36	18.71-57.38	3.37	0.14
Total	55	17	30.91	19.52-44.97	-	-

95%CI= confidence interval; OR= odds ratio.

These results compares studies conducted in Coahuila, Mexico with a prevalence of 21.8 %, in Costa Rica and Argentina, 18.4 % and 28 % respectively^(15,16,17). For cats, the frequency was 37.50 %, which is well over other studies such 3.9 % in Brazil, 16.3 % in USA and 18.8 % in United Kingdom^(18,19,20). In the case of Costa Rica and Argentina, the same diagnostic methodology was used corresponding with specific commercial growth medium; while in Mexico, Brazil, the USA and the United Kingdom another PCR methodology was used.

The association was not significant ($P>0.05$) between bovine and feline trichomoniasis. Cats tested as positive for *T. foetus* got infected through vaginal fluids excreted by infected cows⁽⁷⁾. In turn, cows were infected by not tested bulls for their animal health status regarding this protozoan. Out of 11 bovines that tested positive to *T. foetus*, two were bulls and nine were cows, both bulls came from different farms.

A feline infected with *T. foetus* becomes a potential source of infection since it can contaminate the soil of facilities where the bulls rest in sternal decubitus position. In this place, the prepuce or penis has contact with contaminated surfaces. Therefore, when copulation occurs, the cow is infected and the infection cycle stays^(4,7,11).

A frequency of 37.50 % was found for feline trichomoniasis, higher than observed in Brazil (3.9 %), USA (16.3 %), and the United Kingdom (18.8 %). This enhances the importance of the potential risk for felines in Veracruz, Mexico, and, therefore, the risk of expanding infection to bovines in the farms^(20,21,22). According to the last information, feline trichomoniasis is a disease with a major impact on animal health. However, repeated sampling was not possible in the present study due to practical limitations, therefore the occurrence of *T. foetus* might be higher.

There seems to be an association between the variables, since it is common to carry out certain inadequate practices such as borrowing bulls, poor reproductive management, and presence of infected cats in the farm that favor the dissemination of *T. foetus*; however, this association is not significant ($P>0.05$). Thus, no significant risk was found, only the presence of the disease in different farms where bovines and felines coexist.

The frequency in cats was 37.50 % and 28.21 % in cattle (Table 2). It is worth mentioning that samples were taken in eight livestock production units in the central zone of Veracruz, Mexico (Table 1). No association was found between bovine and feline trichomoniasis or between bovines and felines ($P>0.05$), however, in both cases, it is not significant so far in the central zone of the state of Veracruz.

Institutional Review Committee Statement

The study was carried out in accordance with the guidelines of the Declaration of Helsinki and was approved by the Bioethics Committee of the Faculty of Veterinary Medicine and Animal Science of the University of Veracruz.

Conflicts of interest

The authors declare that this study was conducted without any commercial or financial relationships that could potentially create a conflict of interest.

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