Preventive Veterinary Medicine 109 (2013) 158–161

Contents lists available at SciVerse ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Short communication

Flock-level risk factors associated with leptospirosis in dairy goats in a semiarid region of Northeastern Brazil

Severino S.S. Higino[a], Fabrine A. Santos[a], Diego F. Costa[a], Carolina S.A.B. Santos[b], Maria L.C.R. Silva[a], Clebert J. Alves[a], Sérgio S. Azevedo[a,*]

[a] Academic Unit of Veterinary Medicine, Center of Rural Technology and Health, Federal University of Campina Grande, 58700-970, Patos, PB, Brazil
[b] Department of Preventive Veterinary Medicine and Animal Health, Faculty of Veterinary Medicine and Zootechny, University of São Paulo, 05508-270, São Paulo, SP, Brazil

ARTICLE INFO

Article history:
Received 18 May 2012
Received in revised form 6 September 2012
Accepted 8 September 2012

Keywords:
Leptospira spp.
Small ruminants
Risk factors
Control

ABSTRACT

A cross-sectional study based on a planned sampling was carried out to determine flock-level risk factors associated to *Leptospira* spp. infection in dairy goat flocks in a semiarid region of Northeastern Brazil. Serum samples from 975 adult dairy goats from 110 flocks were examined for *Leptospira* spp. antibodies by MAT using 24 serovars. A structured questionnaire focusing on risk factors for leptospirosis was completed for each flock. Of the 110 flocks 48 (43.6%; 95% CI: 34.2–53.4%) presented at least one seropositive animal, and most frequent serovar was Autumnalis (10.9%). Ninety-eight (8.7%; 95% CI: 5.7–12.9%; design effect = 4.23) of the 975 goats tested seropositive at MAT, and serovar Autumnalis was also the most frequent (1.74%). Presence of rodents (OR = 2.78; $P = 0.015$) was identified as a risk factor. There was also association between history of infertility (OR = 14.74; $P = 0.015$) and prevalence of positive flocks. We suggest that a program of rodent control should be included in the flock management practices aiming to reduce transmission of the agent and then to reduce prevalence of positive flocks and occurrence of reproductive disorders such as impaired fertility.

1. Introduction

Goats are economically important in many countries, including Brazil, where this species is an important source of meat and milk for humans, particularly in Northeastern region, in which 93.7% of the goats are concentrated (Brasil, 2009). Dairy goat breeding is an increasing economic activity in Brazil, and in spite of its large number of animals, of approximately 12 million, the country ranks as only 18th in terms of the amount of goat milk produced, mainly due to the low per goat milk productivity. Amongst other factors, infectious diseases such as leptospirosis may contribute to this problem, leading to impaired milk production (Lilenbaum et al., 2008).

In small ruminants, leptospirosis may present in an acute form, with pyrexia, depression, jaundice, anorexia, and anemic or hemorrhagic syndromes. However, most infected animals present a chronic form with impaired fertility, abortions, neonatal deaths and decreased milk production, resulting in economic losses (Faine et al., 1999; Lilenbaum et al., 2007, 2008).

Several recent works on leptospirosis in goats indicate prevalence values ranging from 5.1% to 20.9% (Favero et al., 2002; Schmidt et al., 2002; Lilenbaum et al., 2008). Lilenbaum et al. (2008) found that frequency of professional veterinary supervision, climate, and grazing for more than 2 hectares/day were identified as risk factors associated with leptospirosis in goats. However, studies based on a systematic sampling are lacking. The aim of this study

* Corresponding author. Tel.: +55 83 8735 3288; fax: +55 83 3511 4659.
E-mail addresses: sergio.azevedo@pq.cnpq.br, sergio@vps.fmvz.usp.br (S.S. Azevedo).

0167-5877
http://dx.doi.org/10.1016/j.prevetmed.2012.09.005

was to identify and to quantify risk factors associated with flock-level prevalence of leptospirosis in dairy goats from a semiarid region of Northeastern Brazil based on a planned sampling.

2. Material and methods

2.1. Study area

The present study was conducted from March 2009 to March 2010 in the county of Monteiro (7°53′S, 37°5′W), Cariri Ocidental microregion, semiarid region of the State of Paraíba, Northeastern Brazil. Climate is semiarid, and temperature varies from 18 °C at night to 31 °C during the day, with mean temperature of 22 °C. The altitude is 599 above sea level. Monteiro excels in the goat milk production in Paraíba State and in Brazil, and has the major number of goats in the state with 30,240 animals (Brasil, 2009).

2.2. Sampling design

The study was designed as a cross-sectional study of randomly selected dairy goat flocks. Blood samples were collected from female goats that were ≥12 months old. The number of flocks to be sampled was determined considering the number of dairy goat flocks in the region ($n = 180$, according to the data of the Center for Integrated Development of Goat Production, in Paraíba State), an expected flock prevalence of 50% (considering no a priori knowledge of the flock prevalence), and a 10% desired accuracy for a 99% level of confidence (Thrusfield, 2007), resulting in 86 flocks to be sampled.

Secondly, calculations of the sample size of goats to be selected in each flock was based on aggregated sensitivity and specificity value of the diagnostic test of at least 90% (Martin et al., 1992; Donald et al., 1994; Jordan, 1996). Calculations were performed by the software Herdacc 3.0 using the following parameters: (a) flock size; (b) sensitivity and specificity values of 80% and 100%, respectively, applied at individual level (Vasconcellos et al., 1990); and (c) detection of at least one seropositive animal for classifying positive flocks. If the flock had up to 100 female goats that were ≥12 months old, 12 animals of the same age were randomly sampled, or all existing goats if they did not totalize 12 animals; if the flock had more than 100 female goats that were ≥12 months old, 13 goats of the same age were randomly sampled. A total of 975 serum samples from 110 flocks were collected during March 2009 through March 2010.

Selection of goats to be sampled from each flock was based on a systematic random sampling (Thrusfield, 2007), where goats were put in a crush pen and systematically selected. In situations where handling infrastructure was absent, true random sampling was difficult to attain. In such situations, animals were put in a kraal and "randomly" captured.

2.3. Blood collection and epidemiological questionnaires

A 10 ml blood sample from each animal was collected from jugular vein using vacutainer tubes. Samples were allowed to clot and transferred onto ice as quickly as possible to the Transmissible Diseases Laboratory of the Federal University of Campina Grande, Patos, Paraíba State, Brazil. The sera were separated by centrifugation at 2000 rpm for 10 min and aspirated in eppendorf tubes and stored at −20 °C until testing.

A structured questionnaire focusing on risk factors for leptospirosis was given to each farmer at the time of blood collection. Information was collected on a total of 19 flock-level factors that included: management system, main farm activity, flock size, major goat breed, presence of cattle, equine, swine and wildlife, availability of veterinary services, animal purchasing, mineral supplementation, vaccination against infectious diseases, lend buck for breeding, pasture rental, pasture sharing, presence of rodents, presence of flooded pastures, use of disinfectants and use of maternity pens. History of abortions, infertility, premature birth, stillbirths and birth of weak animals were also included.

2.4. Serological diagnosis of Leptospira spp. infection

For the serological diagnosis of *Leptospira* spp. infection the microscopic agglutination test (MAT), using live antigens grown in liquid medium (EMJH) free of contamination or self-agglutination was carried out according to Galton et al. (1965) and Cole et al. (1973). A panel of 24 strains of live *Leptospira* spp. were used as antigens: *L. interrogans* serovars Australis, Autumnalis, Bataviae, Bratislava, Canicola, Copenhageni, Icterohaemorrhagiae, Pomona, Sentot and Wolffi; *L. borgpetersenii* serovars Castellonis, Hardjo, Hebdomadis, Javanica, Pyrogenes, Tarassovi and Whitcombi; *L. kirschneri* serovars Butembo, Cynopteri and Grippotyphosa; *L.noguchi* serovar Panama; *L. santarosai* serovar Shermani and *L. biflexa* serovars Andamana and Patoc. Samples that showed agglutinating antibodies at 1:100 dilution (cut-off point of the reaction) had the antibody titres further tested by twofold serial dilutions. The antigen with the highest titre was considered to be the infective serovar (Faine et al., 1999). By flock, serovar with the highest number of seropositive animals was the most frequent (Castro et al., 2008). Flocks that presented equal number of seropositive animals for different serovars were excluded from the calculation of the most frequent serovar.

2.5. Data analysis

Flocks that presented at least one seropositive animal were considered positive. Prevalence of positive flocks was

Table 1
Leptospira spp. serovars in dairy goat flocks in the county of Monteiro, semiarid region of the State of Paraíba, Northeastern Brazil, from March 2009 to March 2010.

Serovar	Proportion of positive flocks	Prevalence (%)	95% CI (%)
Autumnalis	12/110	10.9%	5.8–18.3
Whitcombi	9/110	8.2%	3.8–15.0
Sentot	8/110	7.3%	3.2–13.8
Patoc	8/110	7.3%	3.2–13.8
Butembo	5/110	4.5%	1.5–10.3
Andamana	4/110	3.6%	1.0–9.0