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A field investigation of bacterial etiology of abortions among migratory sheep and goats in North-West hill states of India

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ABSTRACT

A field study on the bacterial etiology of abortions among sheep and goats having migratory practices in the northwest hilly states of India was carried out. A total of 203 flocks were investigated. Abortion outbreaks occurred in 51 flocks and sporadic abortions occurred in 114 flocks. Vaginal swabs from aborted sheep and goats were collected and processed for isolation of bacterial agents from 37 flocks with abortion outbreaks and 56 flocks with sporadic abortions. Bacteria known to cause abortions were identified in 30 flocks with abortion outbreaks including *Chlamydophila* spp. (17 flocks), *Brucella melitensis* (4 flocks), *Listeria monocytogenes* (8 flocks), and one *Salmonella* Dublin. *L. ivanovii* was also isolated from sheep in one of the flocks with *L. monocytogenes*. No specific causes of abortion were identified in flocks having sporadic abortions. The results also show that *Chlamydophila* spp. abortions are more likely to occur in goats than in sheep and that *Brucella* abortions occur more often in sheep.

Key words: bacterial abortions, migratory sheep, goats

Introduction

Reproductive diseases and the resulting economic losses are a major problem for the livestock industry. These losses are due to abortions, repeat breeding, costs of treatment and transmission of infectious agents among the herd. It has been estimated that up to 90% of these losses are due to infectious agents (HUBBERT et al. 1973; MURRAY, 1990). Most of the studies on the causes have been done with cattle; however, similar problems

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are seen in sheep and goats. A wide array of microbial agents has been incriminated. The most frequently isolated agents include: *Brucella* spp., *Campylobacter* spp., *Leptospira* spp. *Listeria* spp., *Salmonella* spp., *Chlamydophila* spp., *Mycoplasma* spp., and a variety of viruses and mycotic agents (KIRKBRIDE, 1990).

The diseases which are commonly associated with abortion and other reproductive problems have been studied in farm flocks; however, information on these diseases in rangeland or migratory flocks is limited. In the northern states of India (Himachal Pradesh and Jammu and Kashmir), the Gaddi people still raise over two million sheep and goats. A typical flock is 200 to 600 animals and includes both sheep and goats. These migratory flocks are moved by the shepherds from winter to summer pastures and up and down the Himalayan Mountains in search of pastures. A flock will commonly travel 300 to 400 miles from the winter to summer pastures, grazing along the way. The sheep and goats are raised exclusively by grazing the available pastures without the feeding of any concentrates or hay. These animals are provided no shelter and face extremes of weather (temperatures range from 0 to 40 ºC; varying humidity, wind and rain, etc.) throughout the year. The animals are subjected to constant stress and poor management. The lambing/kidding occurs during the winter months. During this time, shepherds will restrict flocks to limited areas increasing the risk of disease transmission.

Flock owners were contacted and persuaded to report immediately when abortions were noticed in their flock(s). During the course of study, flocks were visited for clinical histories, clinical examination, and to collect samples for processing in the laboratory. In view of the fact that no organized study was previously carried out on abortions and its etiology, we envisaged it and this paper describes the field investigation on the prevalence of abortions along with bacterial causes of abortions in the migratory flocks of Gaddi sheep and goats in the region.

Materials and methods

The owners of migratory flocks were contacted personally and encouraged to report abortions directly to the veterinary college. For follow-up on the percent of abortions, the owners were provided with a self-addressed, stamped envelope. Responses were obtained from 203 migratory flocks having 33,790 sheep and 27,737 goats. Of those reporting abortions, 93 flocks were visited to obtain case histories and to collect representative samples for isolation of bacterial etiological agents. The flocks were classified on the percentage of abortions reported. An outbreak was taken as a flock which reported more than 10% abortions in a current season. A flock with sporadic abortion was taken as flocks reporting abortion rates under 10% and was usually 1-2% abortion rates. A number of flocks reported no abortions.

The 93 flocks visited for case histories and collection of samples included 37 flocks having abortion outbreaks and 56 flocks having sporadic abortions. Deep vaginal swabs (0-15 days post abortion) were collected for isolation of etiologic agents. A total of 409 vaginal swabs comprising of 197 from sheep and 212 from goats were collected; however, no aborted fetuses were available for the studies due to the migratory nature of the animals. All of the samples were collected in duplicate, i.e. in sucrose phosphate glutamate (SPG) medium with antibiotics and in sterilized normal saline solution (NSS). The samples were transported to the laboratory on ice. One set of vaginal swab samples in SPG was processed for chlamydial isolation(s) using standard embryonated egg inoculation procedures (STORZ, 1990), whereas, the other set was inoculated on 5% sheep blood agar, MacConkey's agar, and brilliant green agar plates for isolation(s) of other bacteria involved. The inoculated plates were incubated aerobically and in a candle jar at 37 ºC and later observed for any bacterial growth. The *Chlamydophila* spp. isolates were verified using the microimmunofluorescence test (MIFT) (ANDERSEN, 1998; ANDERSEN, 1991). Antigens for the MIFT were prepared from yolk sacs of embryos dying 3 to 7 days post infection. Smears were made from the antigen and were stained with antichlamydial group specific monoclonal antibodies. Other bacterial isolates were identified on the basis of cultural, morphological and biochemical characteristics (BUCHANAN and GIBBONS, 1974; CARTER, 1990). *Brucella melitensis* isolates were confirmed serologically by the reference laboratory at the Indian Veterinary Research Institute (I.V.R.I.), Izatnagar, and the *Salmonella* Dublin isolates were confirmed by the Central Research Institute (C.R.I.) Kasauli, H.P.

Results

Information on the incidence of abortions was obtained from 203 migratory flocks. Out of these, 51 flocks (25.1%) were classified as abortion outbreaks with abortion rates for the current season of over 10%. In addition, 114, or 56.2%, of the flocks reported having sporadic abortions which usually was a 1 to 2% abortion rate. The remaining 38 flocks, or 18.7%, reported no abortions for the season.

Samples were obtained for isolation from 37 flocks with abortion outbreaks and 56 flocks reporting sporadic abortions. The samples from the 37 flocks with abortion outbreaks included 112 samples from sheep and 148 samples from goats. The distribution of the known abortion pathogens is given in Table 1. The isolation numbers were high enough to establish the etiological pathogens for 30 of the outbreaks. Also, only one known pathogen was isolated from any given flock with the exception that both *L. ivanovii* and *L. monocytogenes* were isolated from one flock. The cause of abortions in the remaining 7 flocks could not be established. The *Chlamydophila* spp. isolates were from 17 flocks including the 4 flocks where sheep were infected. *Listeria monocytogenes* was isolated

from vaginal swabs of 10 sheep and 12 goats. These were from 8 flocks. Three isolations of *L. ivanovii* were made from sheep in one of the flocks from which *L. monocytogenes* was isolated. *Brucella melitensis* biotype-I were isolated in pure cultures from 12 samples in sheep involving 4 outbreaks of abortions; however, only 2 isolations of this organism were made from goats in the same flock. Similarly, 3 isolates of *S.* Dublin were made from sheep in an outbreak. Isolation attempts were made from 85 sheep and 64 goat samples from 56 flocks reporting non-specific abortions. The non-pathogenic organisms isolated from both the outbreaks and the sporadic abortions are given in Table 2.

Table 1. Abortion pathogens isolated from 112 ovine and 148 caprine samples from flocks having abortion outbreaks

	Sheep	Goats	Combined
Chlamydophila spp.	8 (4)*	46 (17)	54 (17)
Brucella melitensis	12 (4)	2 (1)	14 (4)
Listeria monocytogenes	10 (8)	12 (8)	22 (8)
Listeria ivanovii	3 (1)	-	3 (1)
Salmonella Dublin	3 (1)	-	3 (1)

*( ) = the number of flocks involved. Often both sheep and goats were involved in the same flock.

Table 2. Bacterial isolates not recognized as pathogens from abortions in sheep and goats

	Ovine	Caprine
Escherichia coli	33	42
Staphylococcus aureus	49	59
Staphylococcus epidermidis	24	18
Streptococcus pyogenes	14	17
Arcanobacterium pyogenes	11	16
Proteus spp.	9	6
Klebsiella spp.	7	-
Unidentified cocci	16	6
Unidentified rod-shaped	10	9

Discussion

A survey of representative flocks in the northern hill area of India indicates that 25% of the migratory flocks experience losses of over 10% per season and that an additional 56% of the flocks had sporadic abortion losses of at least 1 to 2%. These losses are easily

attributed to increased disease presence in the area and lambing procedures. Lambing/kidding occurs during the winter months, before the flocks are moved to the summer pastures. During this period, the sheep and goats are confined to a limited area which offers the ideal situation for the spread of infection and ingestion of food and water contaminated with the infected discharge and placental membranes from animals which have aborted. This observation matches that of LINKLATER and DYSON (1979). Also, no vaccination programs against any microbes are practiced in these migratory flocks.

The common bacterial causes of abortion were seen in the study. These include: *Chlamydophila* spp.*, Brucella melitensis, Listeria monocytogenes, Listeria ivanovii,* and *S.* Dublin. These are the same organisms that are commonly associated with abortions in other parts of the world (RADOSTITS, 2000; CARTER, 1990). These organisms were always associated with outbreaks resulting in losses of over 10%. When sporadic abortions occurred, a number of organisms usually considered non-pathogenic were isolated. These included a wide variety of Gram-positive and Gram-negative organisms as given in Table 2. Their significance was not determined. Though, the isolation of *Streptococcus pyogenes*, mainly a human pathogen, is attention-grabbing.

The study shows that goats are more susceptible to *Chlamydophila* spp. and that sheep are more susceptible to *Brucella melitensis*. The differences in susceptibility were marked as only 4 out of 17 flocks with *Chlamydophila* spp. abortions also had abortions in the sheep. This increased susceptibility of goats to *Chlamydophila* spp. has also been reported in France (RODOLAKIS et al., 1984). The reverse was seen with *Brucella melitensis* which has usually been considered primarily a pathogen of goats. In these flocks, where approximately equal numbers of goats and sheep run together, 86% of the diagnosed cases of abortion due to *Brucella* were in the sheep. The number of abortions due to *Brucella melitensis* in the migratory flocks was low compared to *Chlamydophila* spp.. This was unexpected, as *Brucella* is the primary problem in farm flocks in the area (SHARMA et al., 1995).

The abortion outbreaks were usually due to only one known abortion pathogen in each flock. The exception to this was the isolation of *L. ivanovii* from sheep in a flock where *L. monocytogenes* was also isolated. The finding of only one pathogen in each flock was unexpected as in a previous study on outbreaks in farm flocks in the area often had 2 or more pathogens involved (SHARMA et al., 1995).

The vaginal swabs, when collected from a number of animals that had aborted in a flock during an abortion outbreak, provided a reliable diagnosis in 30 out of 37 flocks. The 81% diagnostic rate using vaginal swabs taken within 15 days of abortion is comparable to what is obtained in most laboratories using placental and fetal samples. The swabs are easy to take, are available when the placenta or fetus is not available, and can be collected up to 15 days post abortion. Collection of vaginal swabs should be considered even when

the placenta and fetus are available as they may be obtained more aseptically. However, their use in diagnosing sporadic abortion cases is more questionable.

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SAŽETAK

U radu su provedena terenska istraživanja bakterijske etiologije pobačaja u ovaca i koza kod nomadskog načina stočarenja u sjevero-zapadnim brdovitim državama Indije. Pretražena su 203 stada. Pobačaji su se masovno javljali u 51, a sporadično u 114 stada. Vaginalni obrisci uzeti su od ovaca i koza iz 37 stada s masovnom pojavom pobačaja te iz 56 stada sa sporadičnim pobačajima. Bakterije poznate kao uzročnici pobačaja dokazane su u 30 stada s masovnom pojavom pobačaja. Tako je dokazana *Chlamydophila* spp. (u 17 stada), *Brucella melitensis* (u 4 stada), *Listeria monocytogenes* (u 8 stada), a u jednom stadu *Salmonella* Dublin. *L. ivanovii* izdvojena je iz ovaca u jednom stadu zajedno s vrstom *L. monocytogenes*. Specifični uzročnici pobačaja nisu bili dokazani u stadima sa sporadičnom pojavom pobačaja. Rezultati su pokazali da su se klamidijski pobačaji češće javljali u koza nego u ovaca, a oni uzrokovani brucelama češće u ovaca.

Ključne riječi: bakterijski pobačaji, ovca, koza, nomadsko stočarenje