

Risk factors for the transmission of brucellosis on mixed sheep and springbok (*Antidorcas marsupialis*) farms in the //Kharas region

O. Madzingira^{1*}; C. M. E. McCrindle²

¹Division of Veterinary Public Health, Directorate of Veterinary Services, P. O. Box 27, Gobabis, Namibia

²C/C SSHPH, Faculty of Health Sciences, University of Pretoria, P. Bag X20, Hatfield 0028, South Africa

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Abstract

A questionnaire survey was carried out on eleven randomly selected farms in the //Kharas region rearing both sheep and springbok to find out the factors which may favor the transmission of brucellosis in either direction. Sheep (69%) and springbok (*Antidorcas marsupialis*) (21%) were the main species on the farms, with varying numbers of cattle, goats, Oryx (*Oryx gazelle*) and kudu (*Tragelaphus strepsiceros*). The introduction of replacement rams and ewes of unknown brucellosis status on the farms; the absence of vaccination of sheep against *Brucella melitensis* (n=11); the close interaction between sheep and springbok throughout the year (n=8) at watering points and in areas with good grazing (n=3) were identified as factors that may favor the introduction and cross-transmission of brucellosis between the two species. The study identified that farm workers on three farms were at risk of brucellosis because they consumed raw sheep milk.

Keywords: *Questionnaire Survey; Brucellosis; Sheep; Springbok; Risk Factors.*

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*Corresponding author: E-mail: omadzingira@unam.na (O. Madzingira)

1 Introduction

Game farming in Namibia commenced in 1967 following the conferment of commercial rights of game species on farms to farm owners (Lindsey 2011) and has developed over the years as a way of offsetting constraints associated with livestock farming such as diseases, high input costs and low profitability (Godfroid 2002). The development of the game farming industry has resulted in the rearing of livestock and game species in close proximity and this has been implicated as one of the causes of the re-emergence of zoonotic diseases such as brucellosis in domestic species (Godfroid 2002). Game species may complicate control measures for brucellosis that are based on the implementation of biosecurity measures and the test-and-slaughter approach (McDermott & Arimi 2002, Godfroid et al. 2004, CFSPH 2007) by acting as reservoirs of infection after the disease has been eradicated in domestic livestock (Muma et al. 2007). The disease in game species may eventually enter the human population through livestock products such as meat and milk (Böhm et al. 2007).

Brucella abortus and *B. melitensis* are the agents commonly associated with brucellosis in cattle, sheep and goats respectively (Seleem, et al. 2010) and can be transmitted to humans. *Brucella melitensis* was first reported in Namibia in Karakul sheep in 1953 (Godfroid et al. 2004) and causes the most severe disease in humans (FAO 2003). Evidence of *Brucella* infections in game species has been reported in unspecified antelope species in Namibia (Depner 1993) and game species such as springbok (*Antidorcas marsupialis*) and Oryx (*Oryx gazella*) are increasingly becoming part of the human food chain. *Brucella* infections in sheep and humans have been reported on a farm in Namibia (Magwedere, Hoffman & van Schalkwyk 2009).

This study was carried out as a preliminary to a serological study of brucellosis in sheep and springbok reared together in the //Kharas region. A questionnaire survey was carried out on eleven randomly selected farms rearing both sheep and springbok to understand the management of these mixed farms and to find out management factors which favor the introduction and transmission of brucellosis between the two species.

2 Materials and methods

The study was conducted in the //Kharas region of Namibia, a major sheep producing area of the country. Eleven commercial farms were selected for the study using a simple random sampling technique from a list of farms rearing both sheep and springbok in this region. Between April and May 2011, questionnaire interviews were carried out on the selected farms using pretested questionnaires. All the farm owners or their managers were interviewed

by the same interviewer to prevent interviewer bias. The questionnaire comprised of five sections A to E and was used to gather information relating to the farm and its management, vaccination history and practices, infertility, stillbirths and abortions, clinical and serological history and actions taken in case of positive cases, lambing areas, time of lambing, disposal of aborted material and the marketing of animals and animal products. Numerical data generated was stored and analyzed using Microsoft Excel[®].

3 Results and Discussion

The numbers of animal species that were kept on the eleven farms is shown in Table 1. As expected sheep (69%) and springbok (21%) were the main species on the farms. The average size of the sheep breeding population, that is, ewes and rams, was 1231 ± 802 (range: 248-2634) sheep per farm. The average size of the springbok herd per farm was 370 ± 269 (range: 40-1000). The predominance of sheep and springbok is due to the fact that both species are well adapted to the semi-arid conditions (Estes 1992) prevailing on the farms and their relatively high breeding capacity (van Schalkwyk, et al. 2011). Cattle, goats, kudu and Oryx were present on some farms in variable numbers. Their presence may complicate the epidemiology of brucellosis and control because sheep have been reported to be susceptible to *B. abortus* infections carried by cattle (FAO 2003); goats are highly susceptible to *B. melitensis* (Corbel & Brinley-Morgan 1984) and serological evidence of *Brucella* infections in kudu and Oryx has been documented (Muma et al. 2007).

Table 1: Number of domestic and game species on the 11 commercial farms

Farm Number	Farm size (ha)	Sheep		Goats		Cattle		Springbok	Orynx
		ewes	rams	does	bucks	cows	bulls		
1	9000	900	70	0	0	0	0	300	0
2	10324	2604	30	128	12	104	2	650	0
3	4812	890	15	25	2	25	1	435	0
4	6543	754	10	0	0	0	0	345	0
5	20600	2300	70	0	0	70	2	1000	60
6	7493	500	6	300	7	0	0	40	9
7	13347	643	20	0	0	76	3	300	70
8	12831	240	8	0	0	0	0	150	0
9	10365	1880	40	80	10	101	2	400	60
10	9561	1700	70	250	4	61	2	100	23
11	5237	740	48	281	32	52	22	350	0
Totals	110113	13151	387	1064	67	489	34	4070	222

The farms under study were large (4812-20600 ha) and managed extensively because of limited foraging resources in this hot and dry region. There were no fences separating

springbok from sheep. The overall stocking rate for all animal species was too low (0.03-0.34 animals/ha) to be considered a risk factor for brucellosis.

All respondents reported that they had observed sheep and springbok close to each other at watering points. In addition, the two species were observed in close proximity on one farm at new pastures immediately after the first summer rainfall. Close interaction between the two species was observed throughout the year on eight farms (73%); during the summer months (October-April) on two farms (18%) and after the first summer rains on one farm (9%). In this study, 73% ($n=8$) of the respondents had observed sheep and springbok in close proximity throughout the year suggesting that springbok were used to the presence of sheep in their environment. Wild animals generally stay away from domestic animals spatially and temporally (Bengis et al. 2002). Sheep and springbok came into close proximity at watering and grazing areas during day time, in particular, to graze the early flush of green grass after the summer rains. The sharing of grazing was expected because both species are predominantly grazers and were not separated by any fence. Watering points and good grazing areas are therefore high risk areas for brucellosis transmission especially as the first summer rains coincide with lambing for both species and possible significant contamination of the environment with *Brucella* bacteria. Previous studies have also identified the sharing of foraging and water resources between domestic and wild ruminants as points at which cross-infection of brucellosis occur (Martin et al. 2011). Cattle and goats were not observed in close proximity of game species and no respondents had seen Oryx or kudu in close proximity of livestock. However, it must be noted that game species that seemingly do not come into close contact with domestic animals may in fact indirectly have a role in the epidemiology of diseases of domestic animals through other game species with which they come into contact (Kock 2005).

Supplementary feeding of sheep with commercial mineral licks and fodder was practiced on seven farms (64%) during the dry season. All the farms were fenced off. However, it was reported that springbok could occasionally jump over fences and graze on adjacent farms especially during the hunting season.

All eleven farms did not vaccinate sheep against *B. melitensis* or *B. ovis* using *B. melitensis* Rev 1 and had no history of clinical brucellosis. However, on farms where cattle were present, heifers between 4 and 8 months were vaccinated against *Brucella abortus* infections using *B. abortus* strain 19 to meet legal requirements. Examination of farm disease records kept at the local State Veterinary Office confirmed that the eleven farms had no history of *Brucella* positive serological results.

Lambing in sheep and springbok was reported to occur throughout the year providing opportunities for year wide contamination of pastures with *Brucella* bacteria. However, the absence of designated lambing camps was identified as a factor that could help reduce the risk of within flock transmission of brucellosis (WHO 2006). Sheep were not penned at night

removing the possibility of overcrowding, which is a risk factor for the spread of brucellosis within flocks (McDermott & Arimi 2002).

Respondents had not seen aborted fetuses, dead lambs or fetal membranes from sheep or springbok on the farm in the past three years. It was surprising that all farmers had not seen signs that are suggestive of brucellosis such as abortions, stillbirths, weak lambs and poor reproductive performance in their flocks. Records from the local State Veterinary Office confirmed that the farms under study had no history of positive serological results and clinical cases of brucellosis. The fact that the eleven farms did not vaccinate sheep against brucellosis is strong evidence that the farmers did not view the disease as important in their flocks. In Namibia, farmers are not obliged by law to vaccinate sheep against brucellosis. The seven cattle farms that were part of this study vaccinated heifers of between 4 and 8 months of age because vaccination is compulsory to prevent and control bovine brucellosis.

Borehole water was the primary source of drinking water for sheep and springbok on all farms, although on some farms springbok and sheep had access to water in salt pans ($n=6$), dams ($n=2$) and natural water collections during the rainy season. The latter may have a role in the transmission of brucellosis between sheep and springbok if contaminated by aborted materials and vaginal discharges.

On all farms, sheep were marketed through auctions and direct exports to neighboring countries. Sheep and springbok meat was consumed on the farms as fresh meat and biltong and also marketed through local and export abattoirs. On 27% ($n=3$) of the farms, farm workers consumed raw sheep milk. Replacement rams on four farms (36%) and replacement ewes on all farms were sourced from farms of unknown brucellosis status. Two farms imported rams and ewes from other countries and serologically screened them for *B. melitensis* before introducing them into the flock. All respondents indicated that they had not introduced new springbok onto their farms in the past 20 years. The marketing of live sheep, sheep and springbok meat without prior brucellosis testing has the potential of disseminating brucellosis to other farms and exposing humans to brucellosis.

The consumption of raw sheep milk by farm personnel on three farms placed them at risk of contracting brucellosis. Unpasteurized milk is a major source of human brucellosis (Magwedere et al. 2011). Targeted public health education campaigns are therefore required to advocate for the boiling of raw milk before consumption to prevent exposure of farm workers to *Brucella melitensis* infections (FAO 2010).

4 Conclusion

Results of this study showed that watering points and areas with good grazing were the main factors that brought sheep and springbok into close proximity, which may lead to the cross-transmission of brucellosis. The introduction of sheep of unknown brucellosis status onto farms and the lack of vaccination against brucellosis could lead to the introduction and spread of brucellosis within sheep flocks. Farm workers are at risk of contracting human brucellosis through the consumption of raw sheep milk.

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