Prevalence of besnoitiosis in domestic ruminants in Kenya: a preliminary survey

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ABSTRACT

A preliminary survey on the prevalence of besnoitiosis in domestic ruminants in Kenya based on field and farm visits, clinical and *post mortem* examinations and histopathological examination of tissues and biopsies, showed that goats are the most affected, followed by cattle, while sheep were unaffected. Caprine besnoitiosis occurred in a continuous belt in 5 of the 8 provinces in Kenya stretching from the Coast, Eastern, North Eastern, Nairobi and the Rift Valley Provinces. Mandera, in the North Eastern Province, had the highest prevalence rate of 36 %, followed by Kwale (35 %), Isiolo (35 %), Marsabit (33 %), Wajir (28 %), Nairobi (26 %), Meru (24 %), Garissa (21 %), Taita Taveta (18 %), Embu (17 %), Kitui (9 %), Machakos (7 %), Laikipia (3 %), Kajiado (2 %) and Turkana and Elgeyo-Marakwet (1 % each). In all flocks where the prevalence rates were over 6 %, kids were observed to be affected. There were no significant differences ($P < 0.05$) between the prevalence rates in bucks and does (18 % and 18.4 %, respectively), but kids were less (4 %) affected. Bovine besnoitiosis was found only in the Tana River District, with an infection rate of 11 %.

Key words: besnoitiosis, domestic ruminants, Kenya, prevalence.

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INTRODUCTION

Bovine besnoitiosis was first reported in southern France in 1912 by Besnoit and Robin[12]. Since then it has been reported in Portugal, South Africa, Swaziland, Botswana, Namibia, Zimbabwe, Angola, Kenya, Tanzania, Uganda, Democratic Republic of Congo, Sudan, Cameroon, Nigeria, Israel, former USSR, South Korea and Venezuela[1]. The prevalence is known only in South Africa, Namibia, Zimbabwe, Israel and the former USSR. Caprine besnoitiosis has been reported only in Kenya[3–7,10] and Iran[8].

While Bwangamoi *et al.*[7] stated that goat besnoitiosis was an economically important disease at the Embu, Meru and Isiolo goat breeding stations, its extent in the other goat-producing areas in Kenya is unknown, since no survey has been conducted. This study was undertaken to determine the extent of the occurrence of besnoitiosis in domestic ruminants and whether it warrants attention.

MATERIALS AND METHODS

This study was carried out in purposely selected livestock-producing districts in the Coast, North Eastern, Eastern, Central, Rift Valley, Nyanza and Western Provinces of Kenya and the main livestock market in Nairobi. The districts selected in a province were those with the highest numbers of livestock[9]. Cattle, goats and sheep on Government- and privately-owned farms, livestock markets, watering holes, slaughter houses, communal dips and roadsides were examined for the presence of cysts in the eyes as outlined by Bigalke and Naudé[2].

To confirm the diagnosis, skin biopsies (2 × 1 cm) were aseptically taken on the lateral aspect of the thighs after anaesthetising the area with 2 % lignocaine hydrochloride (Dawa Pharmaceuticals). The wound was closed using a simple interrupted suture pattern (No. 2 nylon, Johnson and Johnson, Kenya) and tetracycline spray applied (Alamycin®, Norbrook, Kenya). The biopsies were fixed in formalin for 48 hours, sectioned, stained with haematoxylin and eosin and examined microscopically.

Data storage and statistical analysis

Data files of clinical and histopathological results were prepared in DBase IV plus (Ashton-Tate Corporation, Torrance, USA). All statistical analyses were carried out using analysis of variance, sign test and descriptive statistics[15].

RESULTS

A total of 16 014 cattle, 40 955 goats and 14 818 sheep were examined in 35 districts.

Bovine besnoitiosis was found only in Tana River district in the Coast Province, where 260 (11 %) of 2340 cattle examined had chronic besnoitiosis with the typical elephant skin appearance and many *Besnoitia* cysts in the different tissues macroscopically and histologically.

Goat besnoitiosis was widely distributed and was found in 16 districts (Table 1, Fig. 1). Statistical analysis did not reveal significant differences ($P > 0.05$) between the prevalence rates in males (18.4 %) and females (18 %), but kids had significantly lower infection rates (4 %; $P < 0.05$) than the adults. The prevalence rates were categorised into areas of high prevalence (>30 %), which included Mandera, Kwale, Isiolo and Marsabit, medium prevalence (10–29 %), which included Wajir, Nairobi, Meru, Garissa, Taita-Taveta and Embu, and low prevalence (<10 %), which included Kitui, Machakos, Laikipia, Kajiado, Turkana and Elgeyo-Marakwet (Table 1).

Some individual goats flocks in Mandera and Isiolo Districts had prevalence rates as high as 51 %. Examination of goats from Somalia and Ethiopia along Dauwa River that forms the northeastern border of Kenya revealed infection rates between 30 and 51 %.

Unweaned kids (including all kids <4 months of age) in areas categorised as having medium and high caprine besnoitiosis prevalence rates were observed to be infected except in Nairobi. No kids were examined in Garissa, Wajir and Marsabit, as all the goats in these districts were examined in livestock markets.

All the sheep examined were negative for besnoitiosis.

DISCUSSION

The results of this preliminary survey indicated that besnoitiosis is an important disease requiring attention in both cattle and goats.

Bovine besnoitiosis was found in Tana River district, an area bordering the Tsavo East National Park. It is therefore important to determine whether wild animals

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Table 1: **Infection rates in goats naturally infected with besnoitiosis.**

Province	District	Goats (total)	Does (*n*)	Infected does (*n*)	Bucks (*n*)	Infected bucks (*n*)	Kids (*n*)	Infected kids (*n*)	% infected goats
Coast	Lamu	407	252	0	84	0	71	0	0
	Kilifi	384	234	0	78	0	72	0	0
	Tana River	433	267	0	91	0	75	0	0
	Kwale	1161	651	275	290	123	220	11	35
	Taita Taveta	550	372	74	102	19	76	6	18
North Eastern	Mandera	4168	2498	1078	836	351	834	84	36
	Wajir	289	105	30	174	51	0	0	28
	Garissa	167	56	13	101	22	0	0	21
Eastern	Marsabit	230	96	31	134	45	0	0	33
	Isiolo	2821	1694	693	567	239	560	49	35
	Meru	2411	1368	378	582	157	461	23	24
	Embu	1831	1091	189	548	106	161	11	17
	Kitui	1298	756	67	416	156	126	6	9
	Machakos	2799	1710	110	829	52	260	101	7
Nairobi	Nairobi	1052	394	114	475	155	183	0	26
Central	Kiambu	505	320	0	98	0	87	0	0
	Murang'a	752	450	0	150	0	152	0	0
Rift Valley	Kajiado	3208	1800	32	1028	19	348	0	2
	Narok	2413	1115	0	1028	0	270	0	0
	Nakuru	1000	600	0	284	0	116	0	0
	Baringo	3410	1991	0	903	0	516	0	0
	Elgeyo Marakwet	711	364	4	189	2	158	0	1
	West Pokot	2141	1209	0	570	0	362	0	0
	Turkana	1618	778	8	709	7	131	0	1
	Laikipia	633	404	14	129	4	100	0	3
	Tranzoia	455	177	0	138	0	140	0	0
Western	Bungoma	277	124	0	41	0	62	0	0
	Busia	270	142	0	47	0	81	0	0
	Vihiga	138	72	0	25	0	41	0	0
Nyanza	Kisumu	442	279	0	93	0	70	0	0
	South Nyanza	388	196	0	67	0	128	0	0
	Kisii	115	43	0	22	0	50	0	0

play a role in its epidemiology. More intensive surveying is also necessary to determine the true incidence of the disease in cattle and wild ungulates, as shortage of funds, lack of security, and inaccessibility of some places, limited the scope of this survey.

Caprine besnoitiosis occurs in a continuous belt extending from the Coast, Eastern, North Eastern, Nairobi and Rift Valley Provinces. It is possible that infection stretches southwards from Kwale into Tanzania, from Mandera northwards into Ethiopia and from Wajir and Garissa eastwards into Somalia. The statement by Bwangamoi[4] that goat besnoitiosis was endemic in Northern and Eastern Kenya, and that only a comprehensive survey could determine the real situation, is supported.

Nairobi has a high prevalence (26 %) compared to the neighbouring districts of Machakos (7 %), Kajiado (1 %) and Kiambu (0). In our opinion this was due to marketing of goats from areas with high prevalence rates, including Mandera, Marsabit, Isiolo, Wajir and Garissa, in Nairobi. The fact that most goats are brought to Nairobi for slaughter may also

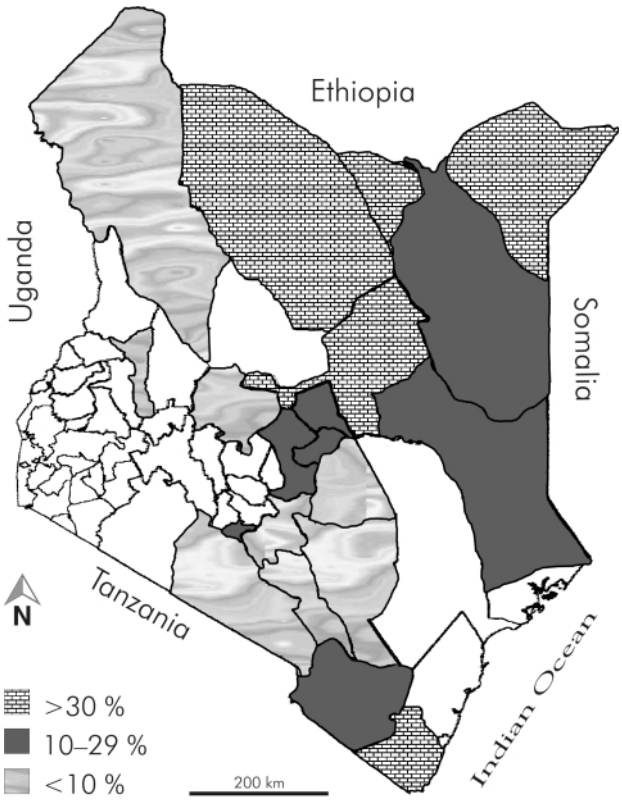

Fig. 1: **Distribution in Kenya of goats naturally infected with besnoitiosis. Districts in which infection was found are shaded.**

explain why unweaned kids in Nairobi were not infected despite the medium prevalence rates. The finding of many infected goats in markets in Nairobi, Garissa, Wajir and Marsabit districts warrants more stringent veterinary restriction of movement of affected animals, as they can spread the disease to areas that do not have the problem.

The finding of no infected goats in Tana River, Kilifi and Baringo, all of which border upon districts with besnoitiosis, does not mean absence of the disease. A more comprehensive survey is necessary to ascertain the true situation, as indicated by the fact that Bwangamoi[3] reported goat skins with besnoitiosis from Baringo.

The findings of this study indicate no correlation between the distribution of bovine and caprine besnoitiosis, as no infected cattle were found in any of the districts where goats were infected; moreover, no infected goats could be detected in Tana River district, where bovine besnoitiosis occurred. This confirms the statement by Bwangamoi *et al.*[7] that cattle raised together with infected goats were apparently free from the disease. These observations, however, need to be confirmed by serological diagnosis. Inoculation of cystozoites orally or ocularly and blood containing endozoites orally to healthy recipients does not result in infection.

Njenga *et al.*[13,14] demonstrated, by infection experiments and electron microscopy, that caprine besnoitiosis is not caused by *Besnoitia besnoiti,* which is the aetiological agent of the disease in cattle, but by a different species, which they named *B. caprae,* as it was host-specific to the goat and ultrastructurally unique.

The reports on caprine besnoitiosis in Kenya have been scant[3–5,7,10,12]. In our view the reason for this was a lack of awareness about the disease among veterinarians; indeed, many of them were surprised that the disease was so easy to diagnose using the method of searching for scleral-conjunctival cysts[2]. During meat inspection the disease is easily noticed and carcasses condemned, but was often erroneously attributed to *Sarcocystis* infection. This situation calls for greater emphasis on the disease during training of all cadres of veterinary personnel to enable them to make a prompt and accurate diagnosis and promote control of the disease.

No sheep with besnoitiosis were found in this survey. This was in contrast to a previous report of 3 infected sheep[7] in Kenya and a report of *Besnoitia*-like infection in lambs in New Zealand[11]. However, neither histopathological nor serological confirmation of infection in sheep has been attempted in Kenya[7]. In our opinion, the reported conjunctival cysts of *Besnoitia* were most probably bulbo-tarsal glands, which are prominent in sheep and thus easy to confuse with cysts. The fact that there is only 1 other report on besnoitiosis in sheep[11] makes the animal an unlikely host of *Besnoitia.*

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