Risk factors for sero-prevalence of tick-borne diseases of calves in Maasai pastoral herds in Kajiado District, Kenya.

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Summary

Risk factors for sero-prevalence of *Theileria parva, Theileria mutans, Anaplasma marginale* and *Babesia bigemina* were investigated in 729 calves from Maasai herds in Kajiado District, Kenya. Study herds were selected using a multi-stage sampling method. Serum antibodies were estimated using an indirect Enzyme-Linked Immunosorbent Assay and expressed as a percent positivity. The objective was to identify risk factors associated with sero-prevalence of tick-borne diseases in Maasai pastoral systems in Kajiado District. Sero-prevalence and associated risk factors varied between and within agro-climatic zones, group ranches and farms. Thus, targeted rather than blanket immunization of calves and other tick control should be conducted, with targeting being done at agro-climatic, group ranch and farm levels.

Introduction

Kajiado is one of Kenya's semi arid districts where livestock production is practiced by Maasai community through nomadic pastoralism (Bekure *et al.* 1991). The Government of Kenya formed Communal Group Ranches in 1960s to promote livestock improvement and marketing in the district. In the last 20 years, most group ranches have been subdivided into individual land holdings while human population has increased and livestock production has declined (Campbell *et al.* 2000)

East Coast fever (ECF) caused by *Theileria parva* and transmitted by *Rhipicephalus appendiculatus,* is a major constraint to improved calf health and production in Kajiado District (DVO 1998). Other tick-borne diseases (TBDs) are benign theileriosis caused by *Theileria mutans*, anaplasmosis caused by *Anaplasma marginale*, babesiosis caused by *Babesia bigemina* and cowdriosis caused by *Cowdria ruminatium.* Data on the prevalence of TBDs in pastoral systems of Kenya is lacking. The objective was to identify risks factors for sero-prevalence of TBDs and to assess the potential of controlling TBDs in pastoral systems of Kenya.

Materials and Methods

Study area and study herds

The study was carried out in Kajiado district located in the Southern part of Rift Valley Province of Kenya. The climate of Kajiado District falls within three major agro-climatic zones (ACZs): 4, 5 and 6 (Pratt *et al* 1977). The district has a bimodal rainfall pattern ranging between 500-250 mm. The long rains fall between March-May while the short rains fall between October-December. Mean diurnal temperatures range from 12^0C-34^0 C.

Three major ACZs (4, 5,6) were selected purposively. Then, six out of 55 group ranches, three subdivided and three non-subdivided, were selected randomly.

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To obtain a target of minimum 100 calves per ranch, 50 households were randomly selected. A total of 729 calves aged from birth to 12 months were sampled.

Data collection and analysis

A semi-structured questionnaire was used to record variables at group ranch (ACZ and subdivision status), farm (calf management and disease control) and calf levels (age, sex, breed). Each calf was then bled using a 10 ml plain vacutainer tube and sera separated by centrifugation at 3000 g for 10 minutes. The enzyme-linked immunosorbent assay (ELISA) technique was used to detect antibodies to *T. parva, T. mutans, A .marginale and B. bigemina.* Percent positivity (PP) values were computed from optical density values (Katende *et al.* 1990,Wright *et al.* 1993,Katende *et al.* 1998). For *T. parva* and *T. mutans,* PP value > 19 was considered positive. For *A. marginale* and *B. bigemina*, a PP value >14 was considered positive.

Descriptive statistics were used for the distribution of sero-conversion status for each parasite. Logistic Regression was used to investigate association between sero-positivity and potential risk factors stratified by group ranch, farm and calf variables. The final regression model was generated by backward elimination of non-significant variables ($p< 0.05$) from the overall model. ACZ and breed were forced in to the model. Clustering of responses at the group ranch and farm level were investigated using Generalized Estimating Equations.

Results

Except for *B. bigemina,* there were significant differences in sero-prevalence of other TBDs between ACZs and group ranch (Table 1).

Table 1 Distribution of sero-prevalence of *T. parva, T. mutans, A. marginale* and *B. bigemina* in 729 calves in Maasai pastoral systems, Kajiado District, Kenya.

Group Ranch	ACZ	Subdivided?	Total	Seropositivity%			
				T. parva	*T. mutans*	*A. marginale*	*B. bigemina*
Olosho Oiborr	4	Yes	106	70.8	29.3	38.7	23.6
Shompole	4	No	114	21.9	37.7	86.0	25.4
Olodonyo Orok	5	Yes	132	29.6	74.2	70.5	25.0
Emarti	5	No	105	19.1	52.4	67.6	29.5
Nantenai	6	Yes	110	60.0	56.4	67.3	22.7
Kuku 'B'	6	No	162	21.6	84.0	71.0	30.1

There were variations in herd sero-positivity within and between group ranches (Table 2). Majority of herds were endemically unstable.

Table 2 Proportion of herds within Group ranches with endemic stability (herd prevalence >80%) for TBDs in Kajiado District, Kenya.

Group Ranch	Proportion of herds (%)				
	Sample size	T. parva	T. mutans	A. marginale	B. bigemina
Olosho Oiborr	11	36	0	9	0
Shompole	7	0	0	71	0
Olodonyo Orok	7	14	29	43	0
Emarti	8	0	0	13	0
Nantenai	9	22	0	11	0
Kuku'B'	8	0	0	38	13

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Calves were at a higher risk of *T. parva* sero-positivity in the subdivided than in the unsubdivided group ranches. The risk of *T. mutans* sero-positivity was lower in ACZ 4 and 5 than in ACZ 6. This was also true for *A. marginale*. Frequent spraying (2-4 times per month) of calves to control ticks was associated with lower sero-prevalence of TBDs. The risk of sero-conversion for *T. parva* and *B. bigemina* increased with age. Female calves had a lower risk of sero-convertion for *B. bigemina* than male calves. Breed was not significant although borans and sahiwal x zebu crossbreds had apparently higher sero-conversion for *T. parva* than zebu.

Discussion

Variation in sero-prevalence of TBDs between ACZs was possibly due to environmental factors that affect the distribution of vectors. However, the variation between group ranches within ACZ, and between farms within group ranch suggest calf management factors other than environmental factors were more associated with sero-prevalence of TBDs.

Pastoral communities practice rotational grazing to control parasites (Karimi, unpublished). The unsubdived Shompole and Kuku'B' group ranches were vast and allowed more extensive grazing of animals compared to the relatively small and subdivided Olosho Oiborr and Nantenai group ranches. Majority of calves (71%) sampled were frequently sprayed (2-4 times per month) against TBDs. The method of spraying was ineffective probably due to poor restraint of animals and poor mixing of the acaricide.

In conclusion, majority of the herds sampled were endemically unstable and therefore highly susceptible to TBDs. The results suggest that although the majority of Masaai pastoralists frequently sprayed calves against ticks the method used was not effective. Efforts geared towards improved control of TBDs in pastoral systems should include education and demonstrations on appropriate methods of acaricide application. Alternative methods of tick control such as immunization against theileriosis should also be explored. It is recommended that targeted rather than blanket immunization of calves should be conducted, with targeting being done at ACZ, group ranch and farm levels.

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