Epidémiol. santé anim., 1997, 31-32

RISK FACTORS ASSOCIATED WITH *THEILERIA PARVA* INFECTION IN CATTLE IN SMALLHOLDER DAIRY FARMS IN MURANG'A DISTRICT, KENYA ; A LONGITUDINAL STUDY

Gitau G.K.[1,2], Perry B.D.[2], McDermott J.J.[3], Katende J.M.[2], Maribei JM[1]

Une des maladies provoquées par les tiques des plus importantes en Afrique de l'est, centrale et de l'ouest est la Fièvre de la Côte Orientale (East Coast Fever) causée par Theileria parva et transmise par la tique Rhipicephalus appendiculatus. Une étude longitudinale a été réalisée dans le district de Murang'a, Province Centrale du Kenya entre mars 1995 et août 1996 dans trois zones agro-écologiques définies selon le climat, l'altitude et les activités agricoles. Deux zones agro-écologiques (AEZ) ont été stratifiées par types de système de gestion des pâturages (élevage hors sol et pâturage libre). 118 petits producteurs laitiers ont été délibérément choisis suivant une étude réalisée préalablement à travers tout le district. 225 veaux femelles ont été choisis délibérément et ont fait l'objet d'un suivi régulier d'abord dans les deux semaines qui ont suivi leur naissance ensuite toutes les deux semaines jusqu'à l'âge approximatif de six mois. Le risque d'exposition à T.parva, estimé par les anticorps sériques comme taux de séro-conversion, n'était pas significativement différent à travers les trois zones agro-écologiques: 48.7%, 50.8% et 58.2% ($p<0.05$). L'incidence de la morbidité et de la mortalité dues à la fièvre de la côte orientale était significativement différente entre les AEZs ($p<0.05$). Les taux de morbidité étaient 20.7%, 4,1% et 33.0% alors que les taux de mortalité étaient de 8.3%, 0% et 13.2% pour les 3 AEZs. Les taux de morbidité stratifiés dans les deux AEZs pour les deux types des management étaient: 2,9% et 18.4% dans une zone, et 11,1% et 24,7% dans l'autre. Les taux de mortalité stratifiés pour les mêmes types de management étaient 0% et 8,3% dans une zone et 2.3% et 11,17% dans l'autre. Les résultats ci-dessus indiquent donc une différence d'incidence et d'impact de la fièvre de la côte orientale dans toutes les zones agro-écologiques.

INTRODUCTION

In Kenya, the vast majority of dairy farms are owned and run by smallholder farmers. These farms are estimated to produce 75-90% of the milk sold in Kenya (Mbogoh, 1984a, b); about 65% of dairy cattle in the smallholder farms are stall-fed for the greater part of the year (Gitau *et al.*, 1994). Dairy farming provides an income through the sale of milk and meat and tends to be a more consistent source of income than many other farming enterprises, in the medium to high potential farming areas. A number of factors limit the further development of the dairy industry, including diseases, poor management, inadequate nutrition and lack of farm inputs (Goldson and Ndeda, 1985). Among the diseases, tick-borne infections, in particular East Coast fever (ECF) caused by *Theileria parva* and transmitted by the tick *Rhipicephalus appendiculatus*, are the most important.

MATERIALS AND METHODS

A one-and-a-half-year longitudinal study was conducted in Murang'a District, Central Province of Kenya, between March 1995 and August 1996 to estimate the incidence of *T. parva* infections among the smallholder dairy farms. Three agroecological zones (AEZs) classified by climate, altitude and agricultural activities (Jaetzold and Schmidt, 1983), namely, Upper Midlands 1, 2 and 4, (UM 1, UM 2 and UM 4) were selected following a cross-sectional study conducted earlier to characterise risks of tick-borne diseases by sero-prevalence in the District (Gitau *et al.*, 1997 *in press*). Two of the AEZs studied were identified as having highest and lowest risk for morbidity and mortality to ECF and the third was a zone between them. Study farms were also stratified by grazing pattern (restricted versus unrestricted or stall fed and pasture) for the high and low risk areas. All farms in the intermediate zone practised restricted grazing. A total of 188 smallholder dairy farms were selected purposively and were visited once every two weeks. Individual calves were recruited within the first two weeks of life after birth and were observed up to six months. Data on routine farm management practices such as tick control procedures and access to pastures/grass were collected during the biweekly visits. In addition, data on calf morbidity and mortality were collected and the specific causes of calf morbidity and mortality were established by clinical diagnosis. Tick infestation was estimated by counting the number of *R. appendiculatus* nymphs (total and engorged) and adult ticks (males, females - non-engorged and engorged) on the body of each calf. On every visit, the weights of calves were measured and recorded and whole blood samples were taken for serum preparation.

RESULTS

The mean number of cattle in these smallholder farms was 2.6. A total of 225 female calves were recruited as follows: 76 in UM 1, 50 in UM 2 and 99 in UM 4. In UM 1, 35 and 41 calves were from farms which practised

[1] Department of Clinical Studies, University of Nairobi, P.O. Box 29053, Nairobi
[2] International Livestock Research Institute, P.O. Box 30709, Nairobi
[3] University of Guelph, Guelph, Ontario, N1G 2W1, Canada

restricted and unrestricted grazing respectively while in UM 4, 51 and 48 calves were from farms which practised restricted and unrestricted grazing respectively. Both exotic and indigenous breeds of cattle and their crosses were present, with the former predominating.

The risk of exposure to *T. parva*, estimated by determining the incidence of sero-conversion as measured by a rise in antibody titre using an ELISA test, was not significantly different across the three AEZs; (48.7%, 50.8 % and 58.2% in UM 1, UM 2 and UM 4 respectively, $p<0.05$). However, the incidence of East Coast fever (ECF) morbidity and mortality were significantly different across the AEZs and between grazing management within the AEZs ($p<0.05$). The crude ECF-morbidity rates were: 11.3%, and 18.0%, while ECF-fatality rates were: 8.3%, and 6.8% in the areas characterised to be of low and high risk respectively. When further stratified by grazing management, farms with restricted grazing had lower ECF morbidity rates than farms with unrestricted grazing (2.9% versus 19% in lower-risk zone and 10.5% versus 24.4% in higher-risk zone) and mortality (0% versus 8.6% and 2.3% versus 11.0% in the low and high risk zones) respectively.

The risk factors associated with sero-conversion from a multiple logistic regression model are shown on Table I. Calves in UM 2 were at lower risk of sero-conversion than calves in UM 1 and UM 4 combined. Zebu calves and their crosses were at higher risk of sero-conversion than the exotic breeds and their crosses while younger calves were at lower risk of sero-conversion than older calves. Calves that received forage feed from outside the farm were at higher risk of sero-conversion than those that received forage from within the farm while calves that suffered from any clinical illness were associated with lower risks of sero-conversion than those that experienced no clinical illness. The presence of any class of *R. appendiculatus* appeared to be associated with lower risks of sero-conversion.

Table I
Risk factors associated *T. parva* exposure from the Multi-variable model

Variable	b	Se(b)	p-value
Upper midlands 4 (UM 4=1; other AEZs=0)	-0.93	0.2086	0.0001
Breed of calf (Zebu & crosses=1; Taurine=0)	1.13	0.2718	0.0001
Age of calf (in days - absolute values)	-0.03	0.0018	0.0001
Source of forage (within farm=1; outside farm=0)	-1.30	0.2147	0.0001
Calf sickness (yes=1; no=0)	-1.27	0.4245	0.0029
Males *R. appendiculatus* (present=1; none=0)	-0.96	0.3084	0.0019
Females (total) *R. appendiculatus* (present=1; none=0)	-0.82	0.2963	0.0054
Nymphs (engorged) *R. appendiculatus* (present=1; none=0)	0.81	0.2624	0.0020

DISCUSSION

The results showed that *T. parva* infection status was different across the AEZs and was associated with feeding management. Calves raised in the lower altitude zones were at a higher risk of *T. parva* infection than those raised in higher altitude zones. This study showed that the incidence of ECF was strongly correlated with AEZs and feeding management. An interesting finding from the study was that the incidence of ECF across the AEZs and between grazing systems was much more different than was sero-conversion to *T. parva* which was not different. It appeared that the dose of exposure or tick infection rates were lower in higher altitude zones than in lower altitude zones. The risk of morbidity and mortality from ECF was higher for calves that were raised in the lower altitude zone (UM 4) than those raised in the other two higher zones (UM 1 and UM 2). This was probably attributed to the more suitable climatic conditions that favoured the establishment of the tick vector *R. appendiculatus,* whose numbers were higher in this zone than the other zones. The higher risk of ECF morbidity and mortality among the calves in the open (unrestricted) grazing compared to the calves in the confined (restricted) grazing was attributed to higher exposure of these calves to ticks. This was further supported by the fact that the presence of *R. appendiculatus* ticks were associated with the risk of both ECF morbidity and mortality. Calves raised in the open grazing system were normally pastured in the communal or privately owned paddocks that were a major source of ticks. This continually exposed the calves to ticks and increased the risk of infection with *T. parva*. On the contrary, calves that were raised in a confined manner had fodder (forage) feeds brought to them in the housing area and this reduced possible contact with the ticks and thus reduced the risk of exposure to *T. parva*. Further, the fodder given to these confined calves was mostly cultivated forage grass from within the respective farms, reducing contact with ticks. These results indicated that the risk of *T. parva* infections and incidence of ECF was mainly associated with agro-ecological zones and grazing management. The study further showed that irrespective of the AEZ, open grazing management was associated with higher risk to *T. parva* infections and ECF morbidity and mortality as calves

raised under open grazing in the two AEZs showed higher risks than those raised in confined grazing. The results from this study quantified the various impact parameters of ECF in such systems of production in highland East Africa and therefore can assist in the optimal targeting of disease control measures and suggest that different control strategies are required for ECF across different AEZs and grazing management system.

REFERENCES

Gitau, G.K., O'callaghan C.J., McDermott, J.J., Omore, A.O., Odima, P.A., Mulei, C.M. and Kilungu, J.K., 1994. Description of smallholder dairy farms in Kiambu District, Kenya. *Preventive Veterinary Medicine*, 21: 155-166.

Gitau, G.K., Perry, B.D., Katende, J.M, McDermott, J.J., Morzaria, S.P. and Young, A.S., 1997. The prevalence of serum antibodies to tick-borne infections of cattle in smallholder dairy farms in Murang'a District, Kenya; a cross-sectional study. *Preventive Veterinary Medicine*, in press.

Goldson, J.R. and Ndeda, J.O., 1985. Cattle in Kenya. 1. Milk production. Span, 111-113.

Jaetzold, R. and Schmidt, H., (1983). Farm management Handbook of Kenya, vol. IIB, Central Kenya. Ministry of Agriculture, Kenya.

Mbogoh, S.G., 1984a. Dairy development and internal marketing in sub-Saharan Africa: Performance, policies and options. LPU Working Paper No. 5. International Livestock Centre for Africa, Addis Ababa, Ethiopia.

Mbogoh, S.G., 1984b. Dairy development and internal dairy marketing in sub-Saharan Africa: Some preliminary indicators of policy impacts. ILCA Bulletin No. 19. International Livestock Centre for Africa, Addis Ababa, Ethiopia, pp. 8-16.