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THE PREVALENCE AND INTENSITY OF INFECTION WITH *EIMERIA* SPECIES IN SHEEP IN NYANDARUA DISTRICT OF KENYA

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ABSTRACT

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The prevalence and numbers of coccidian oocysts in faecal samples from young (less than 6 months old), immature (6–12 months old) and adult (over 12 months old) sheep on 15 farms in Nyandarua district were studied during the dry and wet seasons. The species of *Eimeria* occuring in these sheep were also identified. The proportion of animals shedding coccidian oocysts did not vary significantly with season. The prevalence of the oocysts was significantly higher ($p<0.05$) in young sheep (mean 85.3%) compared to immature (mean 40.2%) and adult sheep (mean 32.15%). OPG counts (oocysts per gram of faeces) were significantly higher ($p<0.01$) in the young sheep compared to immature and adult sheep during both seasons. Prevalence and OPG did not differ between immature and adult sheep. There was no significant difference in OPG during the wet season (mean 328 ± 997) compared to the dry season (mean 219 ± 773). The sex of the sheep had no significant effect on prevalence or OPG. Eight species of *Eimeria* were recognized. They (and their prevalence) were *E. bakuensis (ovina)* (43.6%), *E. ovinoidalis* (23.6%), *E. ahsata* (15.2%), *E. intricata* (8.27%), *E. granulosa* (4.8%), *E. faurei* (2.8%), *E. parva* (1.06%) and *E. pallida* (0.67%).

Keywords: coccidia, Kenya, intensity, oocyst, sheep, prevalence

Abbreviations: OPG, oocysts per gram of faeces

INTRODUCTION

Coccidia are generally regarded as ubiquitous parasites of animals and continue to be a serious cause of lowered productivity and ill-health (Soulsby, 1982). Surveys based on the examination of ruminant faeces have shown that most animals are infected with a wide variety of *Eimeria* species from an early age (Vercruysse, 1982; O'Callaghan *et al.*, 1987; Amarante and Barbosa, 1992). Although climatic conditions over most parts of Kenya are conducive for the sporulation and survival of coccidian oocysts throughout most of the year, information on the prevalence of coccidia in sheep in Kenya is limited to a report by Kanyari (1990). That report compared the prevalence and infection levels of coccidian oocysts in sheep and goat faecal samples submitted for diagnosis to the Faculty of Veterinary Medicine, University of Nairobi between 1969 and 1986. The species of *Eimeria* in the samples were not identified. Identification of *Eimeria* species may be important because of differences in pathogenicity. The first objective of this study was to determine the prevalence and intensity of infection with coccidia in various age groups of sheep during the dry and wet seasons in Nyandarua district, while the second objective was to identify the species of *Eimeria* occurring in these sheep.

MATERIALS AND METHODS

The survey was conducted on eight large (more than 50 sheep) and seven small (fewer than 20 sheep) farms randomly distributed within four divisions of the district. All the farms had Corriedale or Corriedale × Merino sheep that grazed on pastures. Rotational grazing was practised on all farms with stocking rates of between 2 and 5 animals per acre. The pastures had mainly Kikuyu grass (*Pennisetum clandestinum*). Samples were collected during the months of March (dry season) and May (wet season). Three age groups of sheep (young, less than 6 months of age; immature, 6–12 months old; and adults, over 12 months old) were selected on each farm and sampled. On the larger farms, 10–20 animals, chosen at random, were sampled per age group while all the sheep on the smaller farms were sampled. Faeces (3–5 g) were collected directly from the rectum of each sheep, placed in labelled plastic containers and stored at 4°C until examined. The number of coccidian oocysts per gram (OPG) of faeces was determined for each sample by a modified McMaster technique (Whitlock, 1948) using magnesium sulphate solution (specific gravity 1.14).

Samples from the three age groups of sheep were pooled together for each farm and the coccidian oocysts were isolated using a flotation technique. The faecal samples were crushed and magnesium sulphate solution was added, causing the oocysts to float. The sample was allowed to stand for 30 min and the supernatant was decanted. The magnesium sulphate solution was removed from the supernatant by dilution and repeated centrifugation to give a clean oocyst sediment. This sediment was suspended in a solution of potassium dichromate (2.5% w/v) and transferred into clean covered petri dishes, which were incubated at room temperature with constant aeration until the oocysts had sporulated. The oocysts were then identified on the basis of the morphological characteristics of the oocysts and sporocysts (Joyner *et al.*, 1966; Levine, 1973). A total of 50 oocysts were examined for each farm.

Statistical analysis

OPG counts were logarithmically transformed and analysed by analysis of variance and a paired *t*-test. A value of $p < 0.05$ was considered significant. The prevalence was defined as the percentage of faecal samples containing coccidian oocysts (Margolis *et al.*, 1982). The proportions of infected animals were compared using the χ^2 test in the EPI INFO statistical program.

RESULTS

The prevalence rates are presented in Table I. Of the 274 and 301 faecal samples examined during the dry and wet seasons, respectively, 117 (42.7%) and 136 (45.2%), respectively, were positive for coccidia. The prevalence of coccidian oocysts was significantly higher ($p < 0.05$) in the young sheep compared with either the immature or adult sheep in both seasons. There was no significant difference in the prevalence of coccidian oocysts between immature (40.2%) and adult sheep (32.1%) nor were there any significant differences between the seasons in the proportions of animals infected within each age group. Overall, the proportions of males (43.9%) and females (45.1%) shedding coccidian oocysts were more or less similar.

Table II shows the mean OPG values. Young sheep had higher ($p<0.01$) OPG than either immature or adult sheep in both seasons. OPG did not differ significantly between males and females, nor was there any significant difference in OPG between the dry and wet seasons.

Eight species of *Eimeria* were identified. Their occurrence on the 15 study farms is recorded in Table III. *E. bakuensis* (*ovina*), *E. ovinoidalis* and *E. ahsata* were the most commonly found species. These were found on all 15 farms. Six or more species were found in pooled faecal samples from 12 of the 15 farms (80%), the least number of species recorded on any farm being four.

DISCUSSION

This study provides evidence that sheep on the 15 study farms have low coccidial oocyst counts during both the dry and wet seasons. No significant seasonal fluctuations in prevalence or intensity of infection were observed, which is in accord with observations in sheep in Senegal (Vercruysse, 1982) and Australia (O'Callaghan *et al.*, 1987) and in goats in a semi-arid region of Kenya (Waruiru *et al.*, 1991). Poult (1969) reported that many oocysts are destroyed by complete dryness, exposure to direct sunlight or high temperatures. Omara-Opyene (1985) also observed that the highest frequency of coccidiosis and oocyst counts in calves in the arid Marsabit district of Kenya occurs during the wet season. Changes in the weather conditions in our study area may not have been severe enough to cause a significant difference in oocyst counts.

The prevalence of coccidian oocysts and the OPG were higher in the young than in either the immature or adult sheep. Similar observations have been reported previously in sheep (Mason, 1977; Gregory *et al.*, 1980; O'Callaghan *et al.*, 1987; Amarante and Barbosa, 1992), cattle (Omara-Opyene, 1985) and goats (Kanyari, 1988). This has been attributed to lower resistance to coccidia in young compared to older animals (Gregory *et al.*, 1980; Kanyari, 1988).

E. bakuensis (*ovina*), *E. ovinoidalis* and *E. ahsata* were the most prevalent species in sheep in the study area and were found on all farms. In 115 faecal samples from sheep in Senegal, the most prevalent species were *E. ovinoidalis*, *E. ovina*, *E. crandallis* and *E. ahsata* in decreasing order (Vercruysse, 1982). *Eimeria crandallis*, *E. ovina*, *E. ovinoidalis* and *E. parva* were found to be the most prevalent species in sheep in South Australia (O'Callaghan *et al.*, 1987) and in Sao Paulo state in Brazil (Amarante and Barbosa, 1992). Of the species recorded in these other areas, only *E. crandallis* was not recorded in this study. Coccidial infections in sheep in Kenya have been studied only by Kanyari (1990). He compared the prevalence and infection levels of coccidian oocysts in ovine and caprine faecal samples submitted for diagnosis to the Faculty of Veterinary Medicine, University of Nairobi, between 1969 and 1986, but the species of *Eimeria* in the faecal samples were not identified. It is therefore not known whether *E. crandallis* occurs in sheep in Kenya. Oocysts of *E. bakuensis* and *E. crandallis* are difficult to distinguish. *E. bakuensis* oocysts are more ovoid than those of *E. crandallis*, with the sides tending to be more straight (Joyner *et al.*, 1966; Vercruysse, 1982). The sporocysts are also more elongated than those of *E. crandallis* (Joyner *et al.*, 1966; Vercruysse, 1982). We considered that those we observed were *E. bakuensis*.

TABLE I

The prevalence of coccidian oocysts in faecal samples from young (under 6 months old), immature (6–12 months old) and adult (over 12 months old) sheep on 15 farms in the Nyandarua district of Kenya during the dry and wet seasons

Season	Under 6 months		6–12 months		Over 12 months		Females		Males	
	No.[a]	INF[b] (%)	No.[a]	INF[b] (%)	No.[a]	INF[b] (%)	No.[a]	INF[b] (%)	No.[a]	INF[b] (%)
Dry	47	38 (80.8)	96	39 (40.6)	131	40 (30.5)	160	63 (39.4)	114	54 (47.4)
Wet	49	44 (89.8)	113	45 (39.8)	139	47 (33.8)	140	71 (50.7)	161	65 (40.4)

[a]No. = number of samples examined

[b]INF = number and percentage of samples diagnosed positive

TABLE II

The mean numbers of coccidian oocysts per gram (OPG) of faeces, for males and females, young, immature and adult sheep, on 15 farms in the Nyandarua district of Kenya during the dry and wet seasons

Season	Mean OPG ± SD (range)					
	Under 6 months	6–12 months	Over 12 months	Females	Males	Overall
Dry	721 ± 1 724[a,b] (0–10 000)	122 ± 209[a] (0–1 000)	111 ± 221[b] (0–1 200)	194 ± 750 (0–6 500)	255 ± 1 340 (0–10 000)	219 ± 773
Wet	1 210 ± 2 415[c,d] (0–12 500)	225 ± 810[c] (0– 6500)	100 ± 182[d] (0–1 100)	296 ± 2 213 (0–12 500)	355 ± 1 110 (0–8 500)	328 ± 997

Data with the same letter (*a*, *b*, *c* or *d*) are significantly different ($p<0.01$)

TABLE III
Distribution of *Eimeria* species in faecal samples from sheep on 15 farms in Nyandarua district

Eimeria species	Mean percentage prevalence (range)	Number of farms on which the species was found
E. bakuensis (*ovina*)	43.6 (24–70)	15
E. ovinoidalis	23.6 (10 –36)	15
E. ahsata	15.2 (6–22)	15
E. intricata	8.27 (0–20)	11
E. granulosa	4.80 (0–12)	13
E. faurei	2.80 (0–16)	9
E. parva	1.06 (0–6)	5
E. pallida	0.67 (0–4)	4

The *Eimeria* species regarded as pathogenic in sheep are *E. ovinoidalis* (Catchpole *et al.*, 1976; Gregory *et al.*, 1989; Gregory, 1990), *E. crandallis* (Catchpole and Gregory, 1985; Gregory, 1990) and *E. ahsata* (Gregory, 1990). Most of the other species are of relatively low pathogenicity. In mixed infections, which is normally the case in the field, all the species present probably contribute when disease occurs. Most of the animals examined in this study had low oocyst counts and no clinical cases of coccidiosis were encountered. The occurrence of signs in coccidial infections is likely to depend upon the balance between the rate of development of resistance and the rate of infection. This balance may be affected by, among other things, the weather, type of management, hygiene, methods of feeding, weaning and presence of other infections (Vercruysse, 1982). Subclinical infections, especially in the young sheep, are likely to be frequent in the study area, with reduced feed intake, reduced weight gain and poor feed utilization.

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