EPIDEMIOLOGY AND CONTROL OF GASTROINTESTINAL HELMINTH INFECTIONS IN SHEEP IN A SEMI-ARID AREA OF KAJIADO DISTRICT OF KENYA

By

Chege J. Ng’ang’a, BVM, MSc. (Nairobi)

Department of Veterinary Pathology, Microbiology and Parasitology

Faculty of Veterinary Medicine

University of Nairobi

P.O. Box 29053, Nairobi

KENYA

A Thesis submitted to the University of Nairobi in partial fulfillment of the requirements for the degree of Doctor of Philosophy (Ph.D)

December 2002
ABSTRACT

Gastrointestinal helminth parasites impose severe economic constraints on sheep production worldwide. For rational and sustainable control of these parasites, comprehensive knowledge on the epidemiology of the parasite as it interacts with the host in a specific climatic, management and production environment is crucial. The helminth infections have primarily been controlled by use of anthelmintics due to their ease of application and high efficiency. However, in developing countries, there are poor or ineffective set plans of prophylactic control of gastrointestinal helminths and the use of anthelmintics is mainly irregular and haphazard. No previous information was available on the epidemiology and control strategies of gastrointestinal helminths of sheep in the semi-arid area of Kajiado District. The main objective of this thesis was therefore to establish the epidemiology and control strategies of gastrointestinal helminths in sheep in this area.

A survey on the prevalence and intensity of infection with gastrointestinal helminths of sheep in relation to age, breed and weather factors was carried out during the period May 1999 to May 2000. Faecal samples from Dorper and Red Maasai lambs, yearlings and adult breeding ewes were examined for helminth egg output and species composition. The results indicated that the prevalence and intensity of strongyles and tapeworms infections were highest for lambs and lowest for the yearlings in both breeds. The proportions of infected animals were higher during the wet season than in the dry season. Mixed infections were detected in both breeds of sheep where *Trichostrongylus* (53 %), *Haemonchus* (29.5 %), *Cooperia* (11.3 %) and *Oesophagostomum* (6.2 %) were the most frequently encountered species throughout
the study period. The prevalence of infection with gastrointestinal nematodes was significantly higher ($p < 0.05$) for the Dorpers than the Red Maasai in all the age groups. The findings indicated that the prevalence and intensities of infection with gastrointestinal helminths in this area were influenced by the age of the host, the breed and weather factors.

An investigation on the occurrence of peri-parturient rise in trichostrongylid nematode egg output in breeding ewes was carried out for 3 breeding seasons during the period June 1999 to December 2001. Each season, 20 ewes randomly selected from the breeding stock and 20 others selected from the un-mated yearlings were examined. A significant peri-parturient rise in faecal egg output occurred at around the time of lambing and throughout the lactation period in the mated ewes, but not in the un-mated yearlings. Higher peri-parturient rise in faecal egg output occurred when lambing coincided with the end of the dry season before the short rains, a time when the resumption of development of hypobiotic larvae occurred. The occurrence of peri-parturient rise in breeding ewes contributed to higher pasture contamination at a time when the number of susceptible lambs were increasing. Control of gastrointestinal nematode parasites in this area should therefore aim at reducing the effects of this phenomenon through treatment of ewes just before lambing and during lactation.

A study on the prevalence and intensity of gastrointestinal nematode infections in lambs in relation to seasonal effects was carried out over a period of 2 years between November 1999 to November 2001. Each year a total of 20 lambs were randomly recruited at the age of 6 weeks and their faecal samples examined for strongyle eggs
for a period of one year. The results obtained during this period indicated that strongyle infections started building up in lambs as they began to rely heavily on pastures at around the age of 9-12 weeks. High strongyle egg counts occurred between the age of 12 weeks and 7 months, with peak counts at the time of weaning (4-5 months) thus significantly contributing to pasture contamination. The declining levels in faecal egg output at the age of 7 months and the ability to self-cure at the age of 10-12 months was attributed to the development of acquired immunity. The mean faecal strongyle egg counts in these lambs were significantly higher during the dry season (geometric mean EPG 867) than in the wet season (geometric mean EPG 462) in the first year of study, but significantly higher during the wet season (geometric mean EPG 1062) than in the dry season (geometric mean EPG 449) in the second year of study. The lower counts during the wet season in the first year of study were attributed to low amounts of rainfall during the long rains season in the year 2000. During the study period, clinical signs of helminthosis were observed both in the wet and the dry seasons. Helminth control programmes in lambs in the study area should therefore aim at reducing the levels of infection during both seasons with particular emphasis on the 9 weeks to 7 months old lambs.

A series of plots were contaminated with sheep faeces every month and pasture samples collected weekly for the recovery and identification of larvae. The studies were carried out during the period July 2000 to June 2001 to determine the seasonal patterns of development and survival of gastrointestinal nematodes. The results from the examination of the pasture samples indicated that rainfall distribution was the major factor governing the development and survival of the pre-parasitic stages. No
Parasitic larvae were detected from the plots contaminated during the dry months from July to October 2000, but development and translocation of infective larvae on pastures occurred in plots contaminated during the rainy seasons and soon after when a relatively high moisture content was present in the herbage. During this period, peak larval counts occurred during the first and the second week post-contamination, then declined to undetectable levels between week 3 and 15 post-contamination. The lack of development of infective larvae during the dry season and the relatively rapid decline of their population during the wet season presents an opportunity for the use of pasture spelling as a means of helminth control in the study area.

The seasonal availability of infective larvae on naturally contaminated pastures from the paddocks grazed by sheep, around the night pen and the watering point was monitored by examination of herbage samples during the period May 1999 to December 2001. The larval availability on the pastures closely followed the rainfall distribution pattern. The overall trend in larval counts indicated increasing levels of availability during the rainy season with peaks just at the onset of the dry season. The larval availability levels then declined as the dry season advanced. Infective larvae were consistently recovered around the watering point throughout the year. This then can be an important source of infection for sheep especially during the dry season when the other pastures are non-infective. Observations made from this study therefore indicated that sheep infection with gastrointestinal nematodes in this area could occur both during the dry and the wet seasons and control measures should aim at reducing the levels of infection in both seasons.
The seasonal spectrum of gastrointestinal nematode infections and the relationship between worm burdens and faecal egg counts in sheep were investigated during the dry and the wet seasons from September 2000 to July 2001. Each season, 12 female Dorper sheep (9-12 months old) permanently on pastures at the Maasai Rural Training Centre Ranch were slaughtered, their guts examined for the total and differential worm counts and the rectal faecal egg output estimated. Regression analysis was performed to determine the relationship between the worm burdens and the faecal egg counts. All sheep examined had mixed infections with *Trichostrongylus, Haemonchus* and *Oesophagostomum* occurring in 91.7% and *Cooperia* in 83.3% of the animals respectively. During the study period, *Trichostrongylus* and *Haemonchus* were the most abundant genera encountered and constituted approximately 60.8% and 27.3% of the total worm counts respectively. Relatively higher worm counts were recorded during the wet season (mean 4766) than the dry season (mean 4216), but was not significantly different. The adult and immature worm populations co-existed in proportions that varied with seasons. The proportion of immature *Haemonchus* was significantly higher during the dry season (75.6%) than in the wet season (38.1%). This confirmed the occurrence of hypobiosis of this species in the study area. The proportions of immature *Trichostrongylus* species did not change significantly from the dry season (6 %) to the wet season (6.8 %). This indicated that this species mainly survived the dry season as adult populations. The relationship between the worm burdens and the faecal egg counts revealed positive correlations during both the wet season ($r = 0.75$) and the dry season ($r = 0.97$). This suggested that the faecal egg output could be used as an indicator of the levels of infection with gastrointestinal nematode parasites during the wet and the dry seasons in the study area.
An investigation was carried out to evaluate the effectiveness of the strategic use of anthelmintics in controlling naturally acquired gastrointestinal nematode infections in breeding ewes, lambs and yearlings from May 1999 to December 2001. Albendazole at the dose rate of 5 mg Kg\(^{-1}\) body weight was used based on the rainfall distribution pattern and the Maasai Rural Training Centre ranch breeding programme. Faecal egg output, weight gain and reproductive parameters were monitored. The results indicated that strategic treatment of breeding ewes pre-mating, pre-lambing and in mid-lactation resulted in significantly lower faecal egg counts and higher weight gains or lower weight losses compared to the un-treated controls throughout the study period. The lambs born of the treated ewes had higher birth weights and weight gains at 6 weeks. Strategic treatment of lambs at the age of 9-12 weeks and at the time of weaning (4-5 months) resulted in higher weight gains, lower weight losses and significantly lower faecal egg output compared to the un-treated controls. Also the strategic treatments of weaned lambs and yearlings three weeks into the rains, at the onset of the dry season in January and in mid-dry season in July resulted in higher weight gains, lower weight losses and significantly lower faecal egg output compared to the un-treated controls. These strategic treatments were considered effective in decreasing the levels of pasture contamination and improving the productivity of the animals. They are therefore recommended for use in the study area.