

**Nematode Prevalence, Helminth
Management Practices and
Anthelmintic Resistance
in Small Ruminants in
the Mid-Rift Valley of
Ethiopia**

BY

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Declaration

I, Desalegn Lidetu Woldemariam, do hereby declare that the work on which this thesis is based is original work, except where acknowledgements indicate otherwise. Neither the full dissertation nor any part of it has been, is being, or is to be submitted for another degree at this or any other University.

Candidate: _____

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Dedicated to

Genet Getahun Mekoya

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Summary

Parasitic helminths, mainly nematodes, are the most important causes of diseases of sheep and goats in the relatively warmer climatic areas of Ethiopia. This thesis comprises five related studies on the gastro-intestinal parasites namely, (1) the intensity of gastro-intestinal nematodes and coccidia in a semi-arid area, (2) the fluctuation of parasitic diseases in arid and semi-arid environments, (3) a questionnaire survey to study the perception of farmers and animal health workers on the control of worms by using anthelmintics and implications to the development of resistance, (4) a survey on the occurrence of anthelmintic resistance in selected areas and (5) the evaluation of the effectiveness of selective anthelmintic treatment using the FAMACHA[®] system. Data that were collected both during the pilot and the main studies in 1998-1999 and 2002-2003, respectively, are presented here.

The overall results of the longitudinal study on gastro-intestinal parasites of sheep and goats indicate that nematode egg counts were higher at all sites after the rainy seasons and declined during the dry seasons. The mean egg counts during the long rainy seasons in the initial survey were 536, 554 and 483 eggs per gramme of faeces for young, juvenile and adult goats, respectively, while sheep of the same age group had 560, 487 and 637 eggs per gramme of faeces, respectively. The two most prevalent of worms recovered from the 48 lamb tracers were *Haemonchus contortus* (91-100%) and *Trichostrongylus colubriformis* (90-100%) followed by *Oesophagostomum columbianum* (33-83%) and *Trichuris ovis* (8-33%). Significant differences in worm counts were observed between seasons ($P < 0.05$). The mean faecal nematode egg counts during the rainy seasons of 2002-2003 were 1 887, 2 085 and 2 273 for young, juvenile and adult goats, respectively, while sheep of the same age group had 2 000, 2 186 and 2 243 eggs per gramme of faeces, respectively. The overall nematode count was significantly higher than the nematode count during the initial study. The worms that were recovered during the different seasons of 2002-2003 from 57 lamb and 53 kid tracers showed *H. contortus* (91-100%) and *T. colubriformis* (90-100%) to be predominant, followed by *O. columbianum* (33-83%) and *Trichuris ovis* (8-33%). Similarly, *H. contortus* (95-100%) and *T. colubriformis* (83-100%) were predominant in the 53 kid tracers, followed by *O. columbianum* (58-83%) and *T. ovis* (41-74%). A significant difference in worm count was observed within seasons ($P < 0.05$) and sites. The mean worm burden during this study was found to be much higher than the initial period (1998/1999) in almost all study sites during the worm seasons.

The species composition of nematodes does not vary between sites. Other helminths such as *Moniezia expansa*, *Taenia hydatigena* and *Echinococcus* spp. were found in sheep and goats in East Shewa.

This study also presents evidence that coccidiosis is a highly prevalent condition in lambs and kids in the Rift Valley areas. A total of 710 (83%) of sheep and 625 (74.2%) of goat faecal samples contained *Eimeria* oocysts. Lambs and kids had a significantly higher oocyst count than juvenile or adult sheep and goats ($P < 0.05$).

Information on worm management practices with emphasis on the use of anthelmintics and their implications for the development of resistance was obtained through a questionnaire survey involving 100 smallholder farmers and 64 animal health workers in North and East Shewa zones. The main factors identified in this study, which may contribute significantly to the selection of worm resistance to anthelmintic according to Coles and Roush (1992) and Waller (1997) were failure to alternate classes of anthelmintics, under-dosing and the use of poor quality anthelmintics. The majority of farmers in North Shewa and East Shewa did not alternate anthelmintics and only 2% of the 64 animal health workers alternated anthelmintics.

The results obtained from faecal egg count reduction tests carried out in selected areas of East and North Shewa and on institutional farms indicate the presence of anthelmintic resistance of nematodes in sheep and goats in 4 out of 22 smallholder farms and on one institutional farm, where *H. contortus* was predominant. Resistance to levamisole was also detected on one smallholder farm and one institutional farm.

The alternative approach in the management of haemonchosis by selective anthelmintic treatment using the FAMACHA[®] method was studied using experimental sheep and goats. Correlations between the haematocrit values and FAMACHA[®] scores, faecal egg count and haematocrit values and worm and faecal egg counts were all significant ($P < 0.05$) for both sheep and goats in the selective treatment group. Sheep and goats that were selectively treated gained significantly more weight than non-treated ($P < 0.05$), or animals treated on single occasion ($P < 0.05$). Animals treated monthly (Group I) had significantly higher weight gains than the other groups. The sensitivity of the FAMACHA[®] test to identify animals that fall into categories 3, 4 and 5 was 72.7% while the specificity was 94.9%. The FAMACHA[®] method was found to be a simple and cheap alternative to use in an integrated control programme for nematode parasites, particularly when *H. contortus* is the primary pathogen.