

**Evaluation of anthelmintic efficacies in controlling gastrointestinal helminth infections in a sheep farm in Kabete Kenya with multiple drug resistance**

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## Introduction

- Gastrointestinal parasitism is one of the most important disease complexes of sheep.
- Over the past several decades, the parasites have been controlled through the use of anthelmintics, but the emergence of AR has threatened this chemotherapeutic approach.
- In some countries AR has reached alarming proportions in small ruminant industry, where numerous reports indicate widespread resistance to one or more anthelmintics (Fleming et al. 2006; Leathwick et al. 2001; Waller, 2003).

- In Africa, the overall prevalence of AR has not been extensively investigated, but resistance has been reported from at least 14 countries with most of the reports emanating from Kenya and South Africa (Maingi 1991; Van Wyk et al. 1999; Waruiru et al. 1997).
- On farms with multiple AR, the specific nature of the resistance will determine the efficacy of drugs and drug combination administration and only drench testing can determine this.
- In the farm under investigation, multiple AR to LEV, ivermectin (IVM), LEV – rafoxanide combination and ABZ had been earlier reported (Gakuya et al. 2007).

- The main goal of the current trial was therefore to compare the efficacies of Albendazole( ABZ), Oxyfendazole (OXF),Levamisole( LEV), the narrow spectrum Nitroxynil( NTX) and LEV co-administered with NTX to sheep on the farm.

## Materials and methods

### Study site and worm control history

- The study was carried out on a farm in Kabete, 20 Km west of Nairobi.
- The sheep enterprise on the farm consisted of 120 dorpers kept permanently on the farm and grazed the same paddocks for 2 years.
- The animals had been moved to these paddocks after the previous ones were found highly contaminated and the helminths resistant to a number of anthelmintics previously used for their control (Gakuya et al. 2007).

- Three weeks to the trial, the flock had been treated with ABZ (Valbazen<sup>®</sup> Ultravetis East Africa Ltd, Nairobi, Kenya).
- Mortalities persisted despite treatment, 5 animals had died in a period of one month and post-mortem results showed helminthosis as the main cause, thus prompting the current study.

## Experimental animals and sampling

- Rectal faecal samples were collected from the entire flock and examined for the presence of helminth eggs, and a modified McMaster technique as described in the MAFF (1986) manual used to determine the eggs per gram (EPG) of faeces.
- 60 animals with at least 100 eggs were identified and randomly assigned to six groups with equal numbers.
- Group 1 -oral dose of ABZ (Valbazen<sup>®</sup> Ultravetis East Africa Ltd, Nairobi, Kenya).
- Group 2 - mineralized oxfendazole (Bomatak C<sup>®</sup> Bayer Animal Health new Zealand Ltd. Hillcrest, Auckland).

- Group 3- levamisole (Levacide<sup>®</sup> Norbrook laboratories Ltd, Karuri, Kenya).
- Group 4 - injected with NTX (Trodux<sup>®</sup> Bimeda Ltd, Nairobi, Kenya).
- Group 5 co-administered LEV and NTX at the respective manufactures recommended dose rates.
- Group 6 - untreated control.
- Ethical standards were used observed when handling the sheep throughout the experiment.

- Rectal faecal samples were again collected from the selected animals on the day of treatment (0DPT) and 14 day post treatment (14DPT) then processed as earlier described.

### **Anthelmintic efficacy tests**

- Anthelmintic efficacies were based on the FECR% and the 95% confidence limit for the reduction calculated according to the method described in the World Association for the Advancement of Veterinary Parasitology (WAAVP) (Coles et al.1992).
- AR was declared when the FECR% was less than 95 % and the lower 95 % confidence limit was less than 90 %.

## Results

- FECR % indicated resistance to the broad spectrum ABZ (38.7%), OXF (-16.3%) and LEV (81.6%).
- The narrow spectrum NTX had FECR% of 62%, while LEV and NTX co-administered showed a significantly higher efficacy at 100% reduction

Arithmetic mean eggs per gram (EPG) of faeces							
Treatment	Pre-treatment (day 0)		Post-treatment (day 14)		FECR%	95% CI	Rmks
	Control	Treated	Control	Treated			
ABZ	1414	1500	1843	1129	38.7	-261.4	R
OXF	1414	2129	1843	2144	-16.3	-541.1	R
LEV	1414	2900	1843	340	81.6	71.1 - 88.3	R
NTX	1414	1689	1843	700	62	-128.1	NS
LEV + NTX	1414	1622	1843	0	100	100 - 100	S

## Discussion

- 3 most important broad spectrum anthelmintic classes available for the control of gastrointestinal helminths in ruminants and also extensively used in Kenya are :
  1. Benzimidazoles/ probenzimidazoles (including albendazole, Oxfendazole and fenbendazole)
  2. Imidazothiazoles/ tetrahydropyrimidines (levamisole and morantel)
  3. Macrocyclic lactones or Avermectins/milbemycins (including, ivermectin and moxidectin).

- Resistance within a chemical group tends to be common to all members of the group.
- Although difference in potency for the different members means that some drugs retain activity even when overt resistance has been recorded in others in the group (McKeller and Jackson 2004) rapid development of resistance develops with continuous use of this drug.
- The results of the FECR% in the current study indicated resistance to the two benzimidazoles ABZ and OXF.
- In this case, substituting ABZ with OXF was not going to be useful in the farm.
- LEV, the other broad spectrum tested was also not effective and the farmer was accordingly advised against the use of the three drugs individually nor any other members of the two classes to which they belong.

- In farms with AR, drugs do not effectively kill worms and their continued use does little good as they become less effective (Flemings et al. 2006).

### Consequently:

- The mean parasite burden tend to increase in a sheep flock, which implies several problems such as
- An increase in the number of treatment needed for parasite control
- Decrease in the reproductive indices
- Retardation in body development and an increase in mortality rate in the flock (Wolstenholme et al. 2004) as was seen in the current farm.

- For such farms to remain commercially viable, alternative chemotherapeutic agents and control methods should be sort.
- Where *Haemonchus* is the major problem, the use of narrow spectrum anthelmintics can be recommended.
- In the present study, the use of NTX was tested and posted a fairly high FECR% at 62%.
- However, earlier reports from this farm indicated a high proportion of *Trichostrongylus*, *Cooperia*, *Oesophagostomum* and *Trichuris* (Gakuya et al. 2007) and potentially responsible for the 38% egg output seen in this case.

- Drug combinations can possibly restore effectiveness of treatments even where absolute resistance has been reported to the individual chemical compounds.
- In the study farm, *Haemonchus* and *Trichostrongylus* were notably resistant to levamisole (Gakuya et al.2007).
- However, in the current study, co-administration of the broad spectrum LEV (81.6% FECR) and the narrow spectrum NTX (62% FECR) resulted in a significantly higher efficacy at 100% FECR.

- The higher efficacy was attributed to the possible synergistic effects between the two drugs and the fact that ABZ given earlier may have cleared the *Trichostrongylus* species resistant to LEV, but susceptible to ABZ (Gakuya et al. 2007).

## Conclusion

- The co-administration of LEV and NTX was recommended as an interim intervention measure in the farm.
- However, these resources are likely to become ineffective with long term use when parasites are resistant to the two different drugs.
- To prolong their usefulness, prudent management practices that reduce the use of the drugs were encouraged.
- These included rotational grazing, grazing the sheep alongside other animals and only treating clinical cases when they occur.

**THANK YOU**