

## EFFICACY OF VARIOUS COMBINATIONS OF ANTHELMINTICS AGAINST GASTRO-INTESTINAL NEMATODES IN NATURALLY INFECTED GOATS AT AN ORGANIZED GOAT FARM IN HISAR

PRIYANKA SINGH, SATYAVIR SINGH\* and J. S. POONIA<sup>1</sup>

Department of Veterinary Parasitology,<sup>1</sup>Department of Animal Genetics & Breeding,  
College of Veterinary Sciences  
Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar-125 004

### ABSTRACT

The efficacy of various combinations of anthelmintics against gastrointestinal nematodes in goats at an organized farm was determined using faecal egg count reduction test. Forty eight goats with eggs per gram of more than 150 were divided into four groups (groups I, II, III and IV) of 12 goats each. Groups I, II and III were administered fenbendazole+morantel, morantel+levamisole and levamisole+fenbendazole, respectively. Dose rates and routes of fenbendazole, morantel and levamisole were @ 10mg/kg b.wt. orally, 20mg/kg b.wt orally and 12mg/kg b.wt. subcutaneously, respectively. Group IV served as untreated control. Faecal egg count reduction percentages in groups I, II and III were 99.52, 99.04 and 99.68%, respectively on 13th day post-treatment. Coproculture from pre-treatment faecal culture revealed the predominance of *Haemonchus contortus* whereas no larvae were recovered from post-treatment faecal culture of all the three groups. Previously, three months ago, in October, 2011 efficacy of fenbendazole, morantel and levamisole was found to be 66.06, 99.10 and 98.19%, respectively and identification of infective larvae from both pre- and post-treatment faecal culture revealed the predominance of *H. contortus*. Thus, all the three anthelmintic combinations were more effective particularly against resistant *H. contortus* than when these drugs were administered separately, as no larvae were recovered in post-treatment faecal cultures of all the three anthelmintic combinations.

**Key words:** Anthelmintic combinations, fenbendazole, goat, *Haemonchus contortus*, levamisole, morantel

Parasitic gastro-enteritis caused by gastrointestinal nematodes pose a serious health threat and a limitation to the productivity of goats due to the associated morbidity and mortality (Nwosu *et al.*, 2007). Therefore, for economic goat farming the control of these gastrointestinal nematode infections is not only important but also essential. Anthelmintics are currently the cornerstones of the control of veterinary helminth infections and, due to the general lack of anti-parasitic vaccines, would probably remain so for the foreseeable future. There has not been a new class of anthelmintics introduced in marketplace in almost 25 years (Kaplan, 2004) and we rely on three broad spectrum anthelmintic families: the benzimidazoles, imidazothiazoles and the macrocyclic lactones. Unfortunately, resistance in nematodes has been recorded against these three broad spectrum families throughout the world (Artho *et al.*, 2007; Kumsa *et al.*, 2010) including India (Singh and Yadav, 1997; Das and Singh, 2005; Singh and Gupta, 2009; Singh and Rayulu 2011).

Therefore, to control the evolution of resistance, a simultaneous use of minimum two anthelmintics had been proposed (McKenna *et al.*, 1996; Andrews, 2000). Parasitologists generally agree that if delaying resistance is the prime objective, it is better to use a combination of two or more effective broad spectrum drenches than using these drenches alone (Dobson *et al.*, 2001). The aim of the present study was to determine the efficacy of fenbendazole+morantel, morantel+levamisole and levamisole+fenbendazole against naturally occurring gastrointestinal nematodes of goats.

### MATERIALS AND METHODS

During January 2012, a study was conducted at the Goat Breeding Farm of this University to determine the efficacy of various combinations of anthelmintics against gastrointestinal nematodes of goats using faecal egg count reduction (FECR) test. In October, 2011 the efficacy of fenbendazole, morantel and levamisole against gastrointestinal nematodes in this

\*Corresponding author: satyavirgrewal@gmail.com

farm, was found to be 66.06, 99.10 and 98.19%, respectively and *H. contortus* was found to be resistant to fenbendazole, morantel and levamisole as on post treatment faecal culture, larvae of *H. contortus* (100%) were recovered after these anthelmintic treatment (Singh *et al.*, 2012). Goats (n=48) naturally infected with gastrointestinal nematodes and had eggs per gram (EPG) of faeces > 150 counts prior to treatment were used for FECR test. The selected animals had not been administered any anthelmintic during the previous two months.

These animals were weighed, identified, their EPG estimated and divided into four groups (I, II, III and IV) of 12 animals each on the basis of their EPG. Groups I, II and III were dosed with fenbendazole+morantel, morantel+levamisole and levamisole+fenbendazole, respectively. Fenbendazole (Panacur, Intervet India Pvt. Limited Wagholi, Pune), morantel (Banminth, Pfizer Limited, Hyderabad) and levamisole (Lemasole, Vetnex Animal Health Limited, Haridwar, Uttarakhand) were administered @ 10mg/kg b.wt. orally, 20 mg/kg b.wt orally and 12 mg/kg b.wt. subcutaneously, respectively. Group IV served as untreated control. Faecal egg count of each animal was ascertained on 0 day and 13th day post-treatment (PT) by the modified Mc Master technique to an accuracy of one egg counted representing 50 EPG. Pooled faecal cultures at 27±2°C for 7 days were made to recover infective larvae, L3, from each group on day 0 and 13th day PT. The infective larvae were identified by standard technique. Percent reduction in faecal egg counts and confidence intervals (95%) were calculated by using the method of the World Association for the

Advancement of Veterinary Parasitology (Coles *et al.*, 1992). The combinations of drugs were considered to be fully effective when they reduced the egg counts by more than 95% and lower and upper confidence limits were higher than 90%.

## RESULTS AND DISCUSSION

Faecal egg counts (Mean ± S.E.) on 0 and 13th day PT, per cent FECR, variance of reduction and 95% upper and lower confidence limits in goats naturally infected with gastro-intestinal nematodes and treated with different combinations of anthelmintics are presented in Table 1. All the combinations of anthelmintics were found to be completely effective against all the gastrointestinal nematodes as no larvae were detected in PT faecal culture of all the three treatment groups (Table 2). This indicates that combination of fenbendazole and morantel, morantel and levamisole and levamisole and fenbendazole were more effective against resistant parasitic species than when these drugs were administered separately. As in individual efficacy trial conducted in October, 2011 on this farm, larvae of *H. contortus* (100%) were recovered from fenbendazole, morantel and levamisole treated groups indicating resistant *H. contortus* worms (Singh *et al.*, 2012). This finding is in agreement with previous finding by Miller and Craig (1996) who also reported a 62% reduction in faecal egg counts after administering the combination of fenbendazole and levamisole as compared to 1 and 23% reduction when fenbendazole and levamisole were administered alone, respectively. Further, Pomroy *et al.* (1992) reported multiple resistance in goats of ivermectin, oxfendazole,

**Table 1**  
**Response to anthelmintic combinations in goats naturally infected with gastrointestinal nematodes**

Group	No. of goats	Faecal egg counts on days PT (Mean ± S.E.)		Faecal egg counts reduction on 13 <sup>th</sup> day PT		Confidence limits at 95%	
		0	13	%	Variance	Upper	Lower
I	12	2400 <sup>a</sup> ±495	12.5 <sup>b</sup> ±8.6	99.52	0.506	99.88	97.95
II	12	2333 <sup>a</sup> ±468	25 <sup>b</sup> ±16.4	99.04	0.45	99.75	96.69
III	12	2388 <sup>a</sup> ±490	8.3 <sup>b</sup> ±5.4	99.68	0.45	99.90	98.74
IV	12	2367a±450	2617a±482	0	-	-	-

(Group I=Treated with fenbendazole @ 10mg/kg b.wt. orally+morantel @ 20mg/kg b.wt orally; Group II=Treated with morantel @ 20mg/kg b.wt orally+levamisole @ 12 mg/kg b.wt. subcutaneously; Group III=Treated with levamisole @ 12 mg/kg b.wt. subcutaneously+fenbendazole @ 10mg/kg b.wt. orally; Group IV=Untreated control); Means with same superscripts within a column or a row are not significantly different (P<0.05).

**Table 2**  
**Effect of anthelmintic combinations on different genera of gastrointestinal nematodes of goats**

Group	Species	Per cent larval composition on day	
		0	13
I	<i>Haemonchus contortus</i>	83	0
	<i>Trichostrongylus</i> sp.	3	0
	<i>Oesophagostomum</i> sp.	1	0
	<i>Bunostomum</i> sp.	2	0
	<i>Strongyloides papillosus</i>	11	0
II	<i>Haemonchus contortus</i>	83	0
	<i>Trichostrongylus</i> sp.	3	0
	<i>Oesophagostomum</i> sp.	1	0
	<i>Bunostomum</i> sp.	2	0
	<i>Strongyloides papillosus</i>	11	0
III	<i>Haemonchus contortus</i>	83	0
	<i>Trichostrongylus</i> sp.	3	0
	<i>Oesophagostomum</i> sp.	1	0
	<i>Bunostomum</i> sp.	2	0
	<i>Strongyloides papillosus</i>	11	0
IV	<i>Haemonchus contortus</i>	83	87
	<i>Trichostrongylus</i> sp.	3	2
	<i>Oesophagostomum</i> sp.	1	1
	<i>Bunostomum</i> sp.	2	1
	<i>Strongyloides papillosus</i>	11	9

Group I=Fenbendazole+Morantel; Group II=Morantel+Levamisole; Group III=Levamisole+Fenbendazole; Group IV=Control

levamisole and fenbendazole to *O. circumcincta* but moxidectin+fenbendazole+levamisole, ivermectin+oxfendazole and ivermectin+levamisole combinations were effective in removing this nematode in goats. These drenches achieved reductions of 100%, 100%, 98% and 100%, respectively.

Previously, Anderson *et al.* (1988) had proposed that use of combinations of drugs from different chemical families is a valid strategy to delay the development of resistance and suggested that drug combinations may be efficacious against resistant nematode strains. McKenna *et al.* (1996) and Andrews (2000) had also proposed a simultaneous use of minimum two anthelmintics to control the evolution of resistance. Further, Bennet *et al.* (1980) found that treatment with mebendazole or levamisole alone caused no significant decrease in egg counts when administered to sheep with benzimidazole resistant *H. contortus*. However, when administered together, a reduction of 80% was found. Anderson *et al.* (1991) reported a reduction in resistant *Ostertagia* species and *Trichostrongylus colubriformis* of 97 to 98% and 95 to 100%, respectively when sheep were administered

combinations of albendazole and levamisole. Reductions of only 80 to 90% (*Ostertagia*) and 36 to 86% (*T. colubriformis*) were found when the drugs were administered singly.

Furthermore, Le Jambre *et al.* (2010) showed that the triple and quadruple combinations of benzimidazoles, levamisole, macrocyclic lactones and closantel were effective against most strains of gastrointestinal nematodes that were resistant to each of the components when drenched individually in sheep based on postmortem worm counts. However, because some strains of *T. circumcincta* and *T. colubriformis* were found to be resistant to all combinations currently marketed in Australia, it is clear that combinations should be used before resistance levels become too high.

Thus, the present study reveals that combinations of anthelmintics from different chemical families may be efficacious against nematodes that were resistant to individual drug. This finding has a great economic significance as anthelmintic resistance in gastro-intestinal nematodes against three broad spectrum families (benzimidazole, imidazothiazoles, and macrocyclic lactones) has been reported from throughout the world. No new anthelmintics with different modes of action are expected on the market in the near future, as development and release of new anthelmintic may take 6 to 8 years and cost involved in this process was estimated to be approximately US\$30 million (Hotson, 1985), however, these costs have been estimated to be increased to US\$230 million just after 9 years (McKellar, 1994).

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