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Research Article

EFFECT OF WITH DRAWL OF ANTHELMINTICS ON FENBENDAZOLE AND MORANTEL RESISTANCE STATUS OF HAEMONCHUS CONTORTUS IN SHEEP AND GOATS

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ABSTRACT

Faecal egg count reduction test was employed to detect the efficacy of fenbendazole (@ 5mg/kg, orally) and morantel (@ 10mg/kg. orally) in sheep and goats naturally infected with gastrointestinal nematodes in Hisar, Haryana (India). Fenbendazole and morantel reduced faecal egg counts by 92.14% and 51.89%, respectively in sheep at University Sheep Breeding Farm and 86.93% and 98.43%, respectively in goats at University Goat Breeding Farm on day 10 post-treatment. In a previous study, conducted 10 years ago, fenbendazole and morantel on these farms were only 42% and 61% effective in sheep and 76% and 65% effective in goats, respectively. This indicated reversion towards susceptibility of fenbendazole and morantel resistant *Haemonchus contortus* after withdrawal of these drugs for 10 years from these farms, as the predominant species present in cultured composite faecal samples was *H. contortus*. However, at University Sheep Breeding Farm, anthelmintic resistance status of morantel resistant *H. contortus* remained unchanged as the use of this drug continued, though rarely.

Key words: Fenbendazole, goat, *Haemonchus contortus*, morantel, reversion, sheep

Parasitic gastroenteritis caused by gastrointestinal nematodes is an important disease in sheep and goats. In India, *Haemonchus contortus* is the species responsible for high mortality and morbidity (Yadav, 1997) and causes heavy economic losses (Gordon, 1974). Conventional anthelmintics have been used indiscriminately for control of this parasite. Anthelmintic resistance against the gastrointestinal nematodes in small ruminants has become a widespread problem in many parts of the world including India (Singh and Yadav, 1997; Das and Singh, 2005). Once resistant nematode population develops, it may continue to persist for years in the field. There are few studies documenting the length of time required for reversion to susceptibility of a drug resistant parasite population (Kelly and Hall, 1979; Rowan *et al.,* 1996; Singh and Gupta, 2009). This work was also designed to study the efficacy of fenbendazole and morantel on sheep and goat farms from where these drugs were withdrawn 10 years ago following a report of anthelmintic resistance on these farms (Singh and Yadav, 1997).

MATERIALS AND METHODS

The study was conducted on naturally infected sheep and goats with gastrointestinal nematodes on Sheep Breeding Farm (Farm A) and Goat Breeding Farm (Farm B), CCS Haryana Agricultural University, Hisar, Haryana to assess the efficacy of fenbendazole and morantel against gastrointestinal nematodes using faecal egg count reduction (FECR) test. These farms had a history of *H. contortus* resistance to fenbendazole and morantel (Singh and Yadav, 1997). The animals were being maintained on permanent pastures for the last several years and had received regular anthelmintic treatment (Table 1). Thirty animals with faecal egg count of at least 150 egg per gram (EPG) were weighed and identified from each farm and allotted to three treatment groups (I, II, III) of 10 animals each on the basis of their faecal egg counts. Animals of group I were treated with fenbendazole @ 5mg/kg orally (Panacur, Intervet Labs Ltd., Pune) and group II with morantel citrate @ 10 mg/kg orally (Banminth, Pfizer, Ltd.. Mumbai) as described in Table 2. Group III served as the untreated control.

Faecal samples were collected per rectally from each animal to estimate the faecal egg counts by modified McMaster technique before treatment and 10 days after treatment. Pooled faecal cultures were made from each group to ascertain the larval composition of third stage larvae (L_3) by standard technique (Anonymous, 1977). Percent reduction in faecal egg counts and 95% confidence limit were determined by the method of the World Association for the Advancement

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of Veterinary Parasitology (Coles *et al.*, 1992) using arithmetic mean egg counts. Resistance was considered to be present if the egg count reduction following treatment was less than 95% and the 95% confidence interval value was less than 90%. These results were compared with the earlier report of Singh and Yadav (1997) to judge the effect of removing anthelmintic selection pressure on resistance status of *H. contortus.*

RESULTS AND DISCUSSION

Mean faecal egg counts and percent reduction in faecal egg counts (FECR) are shown in Table 2. On University Sheep Breeding Farm (Farm A), fenbendazole and morantel reduced the faecal egg counts by 92.14% and 51.89%, respectively and the 95% confidence limit was less than 90%. On University Goat Breeding Farm (Farm B), fenbendazole reduced faecal egg count by 86.93% and the 95% confidence limit was less than 90% and morantel reduced faecal egg counts by 98.48% and the 95% confidence limit was 94%. The nematode larvae recovered from faecal culture in treated groups comprised only of *H. contortus*.

Once the benzimidazole resistant population of nematodes has developed , it continues to persist in the absence of any benzimidazole use over years in the field (Webb and McCully, 1979; McKenna, 1990). Borgsteede and Duyn (1989) demonstrated that benzimidazole resistance in *H. contortus* remained unchanged even after continuous use of levamisole for over 6 years. In the present study, the efficacy of fenbendazole and morantel was 92.14% and 51.89%, respectively on Farm A and 86.93% and 98.48%, respectively on Farm B. The history of these farms revealed that *H.contortus* had developed resistance to the recommended doses of fenbendazole and morantel 10 years ago and were only 42% and 61% effective, respectively in sheep and 76% and 65% effective, respectively in goats (Singh and Yadav, 1997). These result indicated partial reversion to susceptibility of originally fenbendazole resistant *H. contortus* after withdrawal of this drug for 10 years from both farms. Earlier studies by Kelly and Hall (1979) and Martin *et al.* (1988) reported reversion to benzimidazole susceptibility, particularly after use of levamisole for 5 years and 4 years, respectively. Donald *et al.* (1980) and Waller *et al.* (1983) reported a reduction in benzimidazole resistance in a strain of *Ostertagia*, resulting from either counter-selection by levamisole or the effect of levamisole on the population dynamics in *Ostertagia*.

However, at Farm A, the anthelmintic resistance status of morantel resistant *H. contortus* remained unchanged as the use of this drug continued along with other drugs though rarely, as per availability and convenience of management. Jackson (1993) reported that when the predominant resistant species have a high biotic potential and are also highly pathogenic as in case of *H. contortus*, then the risk associated with reintroduction of the drug is very high. Further, Jackson and Coop (2000) reported that reintroduction of the drug can result in a rapid return to resistant state. But the complete reversion to susceptibility of morantel was observed in the present study by originally resistant *H. contortus* on Farm B after withdrawal for 10 years. Withdrawal of a drug when population is comprised mainly of heterozygotes will allow a measure of reversion to susceptibility (Jackson and Coop, 2000). Singh and Gupta (2009) reported partial reversion to susceptibility of fenbendazole and levamisole resistant strain of *H. contortus* on an organized sheep farm after switching over to ivermectin and closantel for 12 years. However, Rowan *et al.* (1996) and Zajac and Gipson (2000) reported complete reversion to susceptibility of levamisole after withdrawal of drug for 3 years and 1 year in sheep and goats, respectively.

It is clear from the present study that if the withdrawal of a drug is for a prolonged period under permanent grazing system, partial to complete reversion of drug susceptibility occurs. This finding has a great economic significance as development and release of new alternative anthelmintic may take 6 to 8 years and costs around $ US 30 million (Hotson, 1985).

Table 1
The management routines on the sheep and goats farms

Name of farm	No. of animals	Breeds	Grazing system	Anthelmintic used during last 10 years	No. of treatments/year during last 10 years
University Sheep-Breeding Farm	350	Nali and its crosses with Corriedale	Permanent	Closantel, rafoxanide, doramectin, rarely morantel	4
University Goat-Breeding Farm	170	Beetal and Black Bengal	Permanent	Closantel, rafoxanide, doramectin	4

Table 2
Per cent faecal egg count reduction (FECR) in treated sheep and goats

Farm	Group	Anthelmintic	No. of animals treated	Faecal egg counts (Mean±S.E.) on day post treatment		FECR	95% confidence limits	
				0	10		Lower	Upper
A	I	Fenbendazole (5mg/kg, orally)	10	$1650^{a} \pm 597$	$125^{b} \pm 40$	92.14	81	97
	II	Morantel (10mg/kg, orally)	10	$1651^{a} \pm 608$	$765^{b} \pm 132$	51.89	67	86
	III	Control	10	$1605^{a} \pm 528$	$1590^{a} \pm 430$-	-	-	-
B	I	Fenbendazole (5mg/kg, orally)	10	$1685^{a} \pm 575$	$215^{b} \pm 95$	86.93	57	96
	II	Morantel (10mg/kg, orally)	10	$1640^{a} \pm 576$	$25^{b} \pm 13$	98.48	94	99
	III	Control	10	$1625^{a} \pm 574$	$1645^{a} \pm 627$	-	-	-

A: University Sheep Breeding Farm, B: University Goat Breeding Farm
Means with different superscripts within a row differ significantly ($P<0.05$)

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