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Nematode resistance to common anthelmintics in naturally infected goats flocks of coastal Tamil nadu, India

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ABSTRACT

Faecal egg count reduction tests were conducted on goat flocks in Cuddalore, Tamil Nadu, India, to determine the efficiency of fenbendazole, levamisole and ivermectin given at recommended doses against nematode parasites. Untreated mixed sex, 5-15 mth old goats were naturally infested on pastures for 2 months. After, faecal egg counts were done on day 0 before treatment and 10 days later. At day 0 all goats were positive to parasites but by day 10, fenbendazole had reduced egg counts 74 to 91%, levamisole 90% and ivermectin 96 to 99% in the areas. Post-treatment fenbendazole and levamisole fecal culture revealed *Haemonchus contortus* larvae. Findings show that resistance occurred mainly in organized farms with intensive anthelmintic treatment schedules, not in small farms. Results suggest that resistance to fenbendazole and/or levamisole could have developed due to prolonged intensive under dosing. Ivermectin has only been recently used in the area and its use is not widespread.

KEY WORDS: Anthelmintic resistance, goats, Cuddalore)

*part of the PhD work done by the author.

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INTRODUCTION

Anthelmintic resistance (AR) has appeared in small ruminants during past decades. AR is of greater concern in goats than in sheep¹ because goats have a higher metabolic rate and require higher dose rates of drugs^{2,3,4,5}. The immune system of goats is also different. The modern broad-spectrum anthelmintics are currently used in prophylaxis and treatment of helminth infections in farm animals⁶. Anthelmintics can induce parasite resistance due to traditional treatment, over usage, low protein diet and inadequate dose levels^{7,8,9,10}.

Anthelmintic resistance can be assessed through *in vivo* critical and controlled anthelmintic test and faecal egg count reduction test or *in vitro* egg hatch and larval development assays^{13,14,15,16}. The faecal egg count reduction test (FECRT)¹⁷ is recommended by the World Association for the Advancement of the Veterinary Parasitology (WAAVP)¹⁸ and is the test of choice especially in the survey for resistance. We report status of Fenbendazole, Levamisole and Ivermectin resistances in gastrointestinal nematodes in goat flocks from the Cuddalore district, Tamil Nadu, India.

MATERIALS AND METHODS

The study was conducted in six small holder goat flocks of Chidambaram, Kattumannarkoil, Cuddalore, Panruti, Vridhachalam and Tittakudi taluks of Cuddalore district. One goat flock from each taluk was selected based on good management and having more than 60 animals. Cuddalore district is located between 11°11' to 12°35' North latitude and 78°38' to 80° East Longitude and is predominately an agricultural district. Average elevation of the district is 1 m (3 ft) above Mean Sea Level.

The selected goats were of mixed sex and of 5 to 15 months of age. The age of individual goats was determined from birth register maintained in the farm and also by dentition. Each goat was identified using a numbered ear tag. The selected goats were grouped into four each group consisting of 15 animals in all the field flocks. None of the goats received any anthelmintic two months before the start of the experiment. The goats were then naturally infected on pastures. Faecal egg counts expressed as egg per gram was done on day 0 before treatment and then 10 days after treatment with anthelmintics. The drugs and doses given to the goats are illustrated on Table 1 below

1. Anthelmintics used in the field flocks

Animals	Drugs	Company	Dose (mg / kg BW)	Route of Administration
Group I	Fenbendazole	Intervet India pvt Ltd	7.5	per os
Group II	Levamisole Hydrochloride	Virbac Animal Health India pvt Ltd	22.5	per os
Group III	Ivermectin Oral solution	Virbac Animal Health India pvt Ltd	2.5 ml / 10 kg BW	Per os
Group IV	Control	-	-	-

Rectal faecal samples were collected on day 0 before treatment and day 10 after treatment. 10 gm of samples were obtained from each goat by digital rectal extraction and then immediately placed in a plastic bag. The bag was air tightened as close to the feces samples as possible. The simple test tube flotation method (FEC) was used to detect nematode eggs. Identification of nematode eggs was done as described by Soulsby, 1982. FEC were determined as number of eggs per gram for each sample using a modified McMaster technique. The detection level of the McMaster method used was 100 epg.

The EPG of strongyle- type nematodes were subjected to the faecal egg count test (FECRT), to estimate anthelmintic efficiency faecal egg counts were used to calculate the percentage efficacy of each anthelmintic using the following formula:

$$\text{FECR} = \left\{ 1 - \left[\left(\frac{T_2}{T_1} \right) \times \left(\frac{C_1}{C_2} \right) \right] \right\} \times 100$$

Where T_1 and T_2 are pre-and post treatment arithmetic means of the egg per gram in treated groups, and C_1 and C_2 are pre-and post-treatment arithmetic means of the egg per gram in the control group. Efficacy of each anthelmintic was tested and interpreted according WAAVP recommendations [4]. Reduction in efficiency and presence of anthelmintic resistance is considered to exist if the FECRT percentage of an anthelmintic is < 95 %.

Coproculture was done on pooled pre-treatment samples and post treatment samples for identifying the species of infecting nematodes. Mature third stage larvae were identified based on morphological characters²².

Data were analysed statistically for reduction in egg counts by the RESO programme. Reduction in egg counts from <90% to <95% confidence limit is indicative of resistance against the drug⁹.

RESULTS AND DISCUSSION

All goats were infested by GI nematodes at day 0 of screening. Examination by 10 days after treatment was used to calculate egg reduction in faecal samples (Table 2). All field flocks had developed resistance to fenbendazole of 74, 88, 90, 90, 91 and 91 in Chidambaram, Kattumannarkoil, Cuddalore, Panruti, Vridhachalam and Tittakudiaras respectively. Low resistant to Levamisole was found in field flocks of Chidambaram, Cuddalore, Vridhachalam and Tittakudi. Resistance to fenbendazole could be attributed to the prolonged and intensive use of the drug over the years. The drug is being widely used by the farmers for deworming their livestock even without proper veterinary advice, often leading to under dosing. In the present study, ivermectin was found effective with a percent egg count reduction of 96– 99 per cent in all the goat farms of Cuddalore

district. This can be attributed to the fact that the use of oral ivermectin for deworming has been introduced only recently and its use is not widespread.

From the results on Table 2, fenbendazole at the recommended dose was not effective against gastrointestinal nematodes at the field goat flocks of Cuddalore district. Similarly, levamisole was not effective against GI nematodes of field goat farms in certain taluks of Cuddalore district. The post-treatment (fenbendazole and levamisole) larval culture revealed the presence of *Haemonchus contortus* larvae. Anthelmintic resistance occurs mainly in organized farms with intensive anthelmintic treatment schedules. Resistant GI nematodes from these farms can be transmitted to smaller farmers' flocks. Anthelmintic resistance from small holder farmers' flocks are rare or uncommon, but if the present use of anthelmintics is continued, the situation could become unmanageable⁹.

Thus the detection of anthelmintic resistance in small holder farmers' flocks is significant and warrants implementation of proper anthelmintic treatment strategies to check further development of resistance¹⁶. It clearly demonstrated that the goats in the coastal areas of Tamil Nadu have retained resistance to both Fenbendazole and Levamisole as a result of frequent and routine usage. Withdrawing that type of anthelmintic from use and replacing it with an alternate drug along with suitable grazing methods could be the need of this hour.

2. Mean faecal egg counts and faecal egg count reduction values on pre and post anthelmintic treatments in goats.

Sl No	Smallholder flocks	Anthelmintic	Mean faecal egg count (EPG)		Mean faecal egg count in control group (EPG)		FECR (%)	95% confidence limit	
			before treatment	after treatment	before treatment	after treatment		Upper	Lower
1.	Chidambaram Taluk	FBZ	1540±50.30	406.66±34.20	1786.66 ± 48.30	2133.33 ± 53.13	74	78	68
		LEV	1786.66±96.29	160±22.13			91	93	88
		IVM	1920±84.03	73.33±15.13			96	98	94
2.	Kattumanarkoil Taluk	FBZ	1613.33±58.78	186.66±26.47	1680 ± 73.67	2093.33 ± 62.65	88	91	84
		LEV	1666.66±56.84	153.33±30.07			91	94	86
		IVM	1793.33±80.47	66.66±16.49			96	98	94
3.	Cuddalore Taluk	FBZ	1733.33±55.93	166.66±39.98	1680 ± 64.04	2253.33 ± 93.60	90	94	84
		LEV	1660±84.39	166.66±29.73			90	93	85
		IVM	1953.33±70.61	40±16.90			98	99	95
4.	Panruti Taluk	FBZ	1440±84.39	140±31.62	1106.66 ± 46.80	1553.33 ± 58.78	90	94	84
		LEV	1680±72.98	46.66±17.10			97	99	94
		IVM	1333.33±69.74	40±13.55			97	99	94
5.	Vridhachalam Taluk	FBZ	1220±51.70	106.66±18.80	1113.33 ± 52.35	1593.33 ± 61.83	91	94	87
		LEV	1320±54.58	66.66±13.04			95	97	92
		IVM	1146.66±49.34	73.33±15.86			94	96	90
6.	Tittakudi Taluk	FBZ	1253.33±63.78	106.66±21.34	973.33 ± 52.94	1513 ± 50.37	91	94	87
		LEV	1160±54.21	60±13.55			95	97	92
		IVM	1273.33±79.19	53.33±13.80			96	98	93

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