

Original Research Article

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Efficacy of Ivermectin against Gastrointestinal Nematodes in Small Ruminants of Unorganized Sector in Haryana

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ABSTRACT

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A total of 60 animals which include thirty sheep and 30 goats of Charkhi Dadri district, Haryana with egg per gram of more than or equal to 150 were divided into four groups i.e. G1, G2 of goats and S1, S2 of sheep, each of 15 animals. G1 and S1 was dosed with ivermectin, recommended dose in sheep and double dose in goats. Group G2 and S2 served as untreated control. Faecal egg count on day of treatment (0 day) and 14th day post treatment were determined by the modified McMaster technique. Results revealed that ivermectin in sheep reduced the faecal egg counts by 87.85% with upper and lower confidence levels as 94.99% and 70.51%, respectively indicating moderate resistance. In goats, ivermectin reduced the faecal egg count by 99.58% with upper and lower confidence levels as 99.90% and 98.22%, respectively indicating susceptibility. The post-treatment coproculture showed larvae of *Haemonchus contortus* and *Strongyloides* sp. Thus, the present study revealed presence of moderate anthelmintic resistance in sheep while effective in goats to ivermectin in unorganized sector in Charkhi Dadri district of Haryana.

Introduction

Small ruminant sector is an integral part of Indian farming especially in arid, semi-arid and mountainous areas (Kumar and Roy, 2013). Rearing of sheep and goats has been a major source of income especially to the marginal farmers of the country (Pathak and Pal, 2008). On an average, 15% of households in rural areas rear sheep/goat across the country and around 70% of these animals are

reared by small and marginal farmers and landless labourers, playing a vital role in their nutrition, supplementary income and livelihood security (CSWRI, VISION-2050). It has been seen that the gastrointestinal (GI) helminthic infections are one of the major constraint for profitable sheep and goat husbandry in tropical and subtropical countries including India. These animals are vulnerable to a number of GI helminths that not only undermine their health but also play

an important role in lowering the overall production (Sanyal, 1996). The degree of parasitism or worm burden greatly depends on the management and hygienic conditions of the area (Singla, 1995). Commonly occurring gastrointestinal parasitic diseases in goats and sheep are haemonchosis, strongyloidosis, oesophagostomosis, bunostomosis and trichostrongylosis. Among the nematodes, *Haemonchus contortus* is the most important GI nematode. These parasites cause both acute infections having a rapid onset along with high mortality levels and chronic infections, which are commonly subclinical, may lead to insidious and important economic losses (Singla, 1995) via reduction of live weight gain, reduced wool and milk production and poor reproductive performance (Sutherland and Scott, 2010). The problem of GI helminths is severe in tropical countries due to highly favourable environmental conditions for its transmission (Singh *et al.*, 2013). Control of GI parasites is mainly achieved by the use of anthelmintic drugs and it will continue to remain, as there seems to be no other alternative for helminth control in small ruminants (Sanyal, 2004). The development of anthelmintic resistance in GI nematodes of small ruminants is of major concern in developing countries of the world including India. The rate at which resistance to anthelmintics is being reported in India is alarming, as it narrows the choice of alternative anthelmintics.

The present study was envisaged to detect the status of anthelmintic resistance to ivermectin against gastrointestinal nematodes of sheep and goat in Charkhi dadri district of Haryana state using faecal egg count reduction test.

Materials and Methods

A study was undertaken at unorganized farm of sheep and goats in Charkhi dadri district of Haryana to determine the efficacy of

ivermectin against gastrointestinal nematodes using faecal egg count reduction (FECR) test. Thirty sheep and 30 goats at Badhra village in Charkhi dadri district, naturally infected with GI nematodes and having eggs per gram (EPG) of faeces ≥ 150 counts prior to treatment were selected. The selected animals were ascertained of not been administered any anthelmintic during the previous two months. These animals were identified, weighed, their EPG estimated and divided into four groups of 15 animals each on the basis of EPG counts i.e. G1, G2, S1 and S2. Group G1 and S1 was dosed with ivermectin (Trumectin®, Zydus Animal Health Ltd., Ahmedabad) @ 0.2 mg/kg b.wt. subcutaneously in sheep (S1) and double dose in goats (G2) (Silvestre *et al.*, 2002). Group G2 and S2 served as untreated control.

Faecal egg count of each animal was ascertained on 0 day and 14th day post treatment (PT), by the modified McMaster technique to an accuracy of one egg counted representing 50 EPG. Pooled faecal cultures at $27 \pm 2^\circ\text{C}$ for 7 days were made to recover infective larvae (L₃), from each group on day 0 and 14th PT. The infective larvae were identified as per criteria of Keith (1953). Faecal egg count reduction percentage and confidence intervals (95%) were determined following the method of the World Association for the Advancement of Veterinary Parasitology using arithmetic mean egg counts (Coles *et al.*, 1992). Resistance was considered to be present, if the egg count reduction following treatment was less than 95% and the 95% confidence limit was less than 90%.

Worm populations were considered as severely resistant when per cent reduction in faecal egg counts was less than 60% and moderately resistant when faecal egg count was reduced between 60 to 95%. Suspected resistance was considered when either of the

above mentioned criteria was met. All the recorded data was statistically analyzed by one way ANOVA test (SPSS software version 2.0).

Results and Discussion

Faecal egg counts (Mean \pm S.E.) on 0 and 14th day post-treatment (PT), percent reduction in faecal egg counts (FECR%), variance, upper and lower confidence limits (95%) of goats and sheep naturally infected with gastrointestinal nematodes and treated with ivermectin at Badhra village in Charkhi dadri district are given in table 1. In goats, ivermectin reduced the faecal egg count by 99.58% with upper and lower confidence levels as 99.90% and 98.22%, respectively indicating its susceptibility. The susceptibility of ivermectin has been reported by Kumsa *et al.*, (2010) at Oromia Regional State in Southern Ethiopia, Sheferaw *et al.*, (2013) at Dale district in Southern Ethiopia, Kumar *et al.*, (2017) at Sub-Himalayan region of Northern India and Islam *et al.*, (2018) at Bangladesh.

Results in sheep revealed that ivermectin reduced the faecal egg counts by 87.85% on 14th day PT with upper and lower confidence levels as 94.99% and 70.51%, respectively indicating moderate resistance of drug against gastrointestinal nematodes. The resistance of ivermectin has also been reported by many workers *viz.* Howell *et al.*, (2008) in Southeastern United States, Falzon *et al.*, (2013) at Ontario in Canada, Pena-Espinoza *et al.*, (2014) in Denmark, Sharma *et al.*, (2015) at Hisar and Kumar and Singh (2016) also at Hisar. As this drug has been used infrequently in the flock, so moderate resistance is recorded. Coles *et al.*, (1999) have also reported the development of anthelmintic resistance even when two or three treatments are given annually.

The effect of anthelmintics on different genera of GI nematodes of goats and sheep surveyed at Badhra village, Charkhi Dadri are presented in table 2. Based on faecal culture, larvae identified before treatment (0 day) comprised mainly of *H. contortus*, followed by *Strongyloides* sp., *Trichostrongylus* spp. and *Oesophagostomum* spp. in all groups of goats and sheep.

The PT coproculture revealed that only larvae of *H. contortus* were identified in sheep of Charkhi Dadri. The presence of only *H. contortus* larvae was also reported by Vadlejch *et al.*, (2014) in Czech Republic and Suresh (2016) at Hisar. The PT coproculture in goats of Charkhi Dadri revealed the predominance of *Strongyloides* sp. larvae followed by *H. contortus*. In the present study predominance of *Strongyloides* sp. larvae might be due to their reinfection in experimental animals due to short prepatent period of *Strongyloides* sp. (Soulsby, 1982). Identification of larvae in untreated control groups of both goats and sheep on 0 day and 14th day comprised predominantly of *H. contortus*, followed by *Strongyloides* sp., *Trichostrongylus* spp. and *Oesophagostomum* spp.

In conclusion, there is moderate resistance to ivermectin in sheep and no resistance in goats against gastrointestinal nematodes of Charkhi Dadri district, Haryana. The faecal culture of treated animals shows predominance of *Haemonchus contortus* indicating resistance. The resistant GI nematodes of small ruminants, necessitates implementation of urgent measures to control their propagation. Therefore, animal owners should be advised to avoid unnecessary anthelmintic drug therapies and not to use the same drug for longer duration. The current study emphasizes the need to explore the status of anthelmintic resistance in other region of the state and country.

Table.1 Response to various anthelmintics in goats and sheep naturally infected with gastrointestinal nematodes at Badhra village, Charkhi Dadri

Group	Anthelmintic	Dose (mg/kg)	No. of goats treated	Route of administration	Faecal egg counts on days (Mean ± S.E.)		Faecal egg counts reduction on 12 th day post treatment		Confidence limits at 95%	
					0	12	%	Variance	Upper	Lower
G1	Ivermectin	0.4	15	S/C	2366.67 ^a ± 430.58	13.33 ^b ± 9.09	99.58	0.50	99.90	98.22
G2	Control	---	15	---	2560.00 ^a ± 334.49	3173.33 ^a ± 556.13	0	---	---	---
S1	Ivermectin	0.2	15	S/C	2766.67 ^a ± 456.97	260.00 ^b ± 111.61	87.85	0.19	94.99	70.51
S2	Control	---	15	---	2360.00 ^a ± 120.63	2140.00 ^a ± 120.63	0	---	---	---

Means with same superscripts in column are not significantly different (p<0.05)

Table.2 Anthelmintic effect on different genera of gastrointestinal nematodes of goats and sheep at Badhra village, Charkhi Dadri

Group	Species	Goat		Sheep	
		Per cent larval composition on day		Per cent larval composition on day	
		0	14	0	14
Ivermectin treated	<i>Haemonchus</i> spp.	86	35	88	100
	<i>Trichostrongylus</i> spp.	5	0	4	0
	<i>Oesophagostomum</i> spp.	1	0	2	0
	<i>Strongyloides</i> sp.	8	65	6	0
Untreated Control	<i>Haemonchus</i> spp.	86	87	89	89
	<i>Trichostrongylus</i> spp.	6	6	5	4
	<i>Oesophagostomum</i> spp.	1	1	1	1
	<i>Strongyloides</i> sp.	7	6	5	6

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