

Efficacy of closantel, fenbendazole and ivermectin against GI helminths of cattle in central Kashmir

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Abstract Three trials were conducted to evaluate the therapeutic efficacy of closantel (@ 7.5 mg/kg body weight, orally), fenbendazole (@ 7.5 mg/kg body weight, orally) and ivermectin bolus (@ 0.2 mg/kg body weight, orally) against gastrointestinal (GI) helminth parasites of cattle in central zone of Kashmir valley. Twenty cattle suffering from GI helminth infection were randomly selected and divided into two groups in each trial. In each trial, one group comprising of fifteen animals were treated with anthelmintic and second group comprising of five animals were kept as infected untreated control. To determine the therapeutic efficacy of different anthelmintic drugs against GI helminths, faecal samples were directly collected from rectum before treatment and on 7th, 14th and 28th day post treatment and eggs per gram of faeces was determined by using Stoll's method. Then the efficacy of different anthelmintics was calculated by employing Faecal Egg Count Reduction Test. On 14th day post treatment closantel was found to be 100 and 94.44% effective against *Fasciola* spp. and strongyle worms, respectively, however, it was not found effective against *Trichuris* spp. The efficacy of fenbendazole was 100% against *Fasciola* spp., paramphistomes, *Moniezia* spp.,

Trichuris spp. and strongyle worms on 14th day post treatment. Ivermectin was found to be 100% effective against *Trichuris* spp. and strongyle worms on 14th day post treatment, however, it was not effective against *Fasciola* spp. and paramphistomes.

Keywords Closantel · Efficacy · Fenbendazole · Ivermectin · Gastrointestinal helminths · Cattle

Introduction

Gastrointestinal parasitism is a major constraint for livestock production causing heavy economic losses. The parasitic diseases inflict losses through morbidity, mortality, reduced FCR (feed conversion ratio), inefficiency of production and by way of costs incurred on treatment and control. The economic losses are also associated with reduced weight gain, retarded growth and decreased fertility (Perry and Randolph 1999; Sahoo et al. 2002). Since the control of these parasites in India is mostly undertaken using anthelmintics, the wide spread use, incorrect dosing and increased frequency of treatment have often lead to the development of resistance against anthelmintics. Resistance to anthelmintic agents has been reported among various species of GI parasites in livestock in all parts of the world including India (Gill 1996; Sutherland and Leathwick 2011; Jaiswal et al. 2013; Chandra et al. 2015). Only two studies, one in north Kashmir (Aiman 2014) and other in south Kashmir (Irshad 2015) on evaluation of the therapeutic efficacy of various anthelmintic drugs against GI helminths of cattle are on record till date from the valley. Since no such study has been conducted among cattle of central Kashmir, therefore, the present study was undertaken to evaluate the efficacy of commonly used

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anthelmintics against GI helminths of cattle in central zone of Kashmir valley.

Materials and Methods

The study was conducted in central zone of Kashmir valley in Ganderbal and Budgam districts. Total three trials were conducted. Twenty cattle suffering from GI helminth infection were randomly selected and divided into two groups in each trial. In each trial, one group comprising of fifteen animals were treated with anthelmintic and second group comprising of five animals were kept as infected untreated control. Fenbendazole was given @ 7.5 mg/kg body weight (orally) in Kangan area of Ganderbal district, closantel @ 7.5 mg/kg body weight (orally) in Sanpur area of Budgam district and ivermectin @ 0.2 mg/kg body weight (orally) in Manasbal area of Ganderbal district.

To determine the therapeutic efficacy of different anthelmintic drugs against GI helminths using Faecal Egg Count Reduction Test (FECRT), faecal samples were directly collected from rectum on “0” day before treatment and on 7th, 14th and 28th day post treatment and EPG was determined by using Stoll’s method. The efficacy of different anthelmintic drugs was calculated by comparing mean eggs per gram (EPG) on “0” day i.e. before treatment and post treatment on 7th, 14th and 28th day as described by Dash et al. (1988) using below mentioned formula:

FECR (%)

$$= \frac{\text{Mean EPG pre treatment} - \text{Mean EPG post treatment}}{\text{Mean EPG pre treatment}} \times 100\%$$

Results and Discussion

In the present study, a total of 98.11% reduction in faecal egg counts was observed on day 7th post treatment and the efficacy was 100% against *Fasciola* spp. and strongyle worms when the animals were treated with closantel. However, on 14th day post treatment a total of 90.56% reduction in faecal egg counts was observed and the efficacy was 100 and 94.44% against *Fasciola* spp. and strongyle worms, respectively. On 28th day post treatment an overall efficacy of 79.24% was observed and efficacy was 93.75 against *Fasciola* spp. and 80.55% against strongyle worms. However, closantel was not found effective against *Trichuris* spp (Table 1). Our results regarding efficacy of closantel against *Fasciola* spp. are similar to those reported by Shin-sung et al. (1995) who found closantel 100% effective in Korean cows naturally infected with *Fasciola hepatica* up to 2 weeks post treatment. Almost similar results have also been obtained by Ibarra-Velarde et al. (2002) and Vera-Montenegro et al. (2003) who found closantel 92.1 and 97.70% effective against *Fasciola* spp. in cows on 28th day post treatment, respectively. Similar results regarding efficacy of closantel against strongyle worms were reported by Aiman (2014) and Irshad (2015) against GI helminths of cattle in north and south zones of Kashmir valley, respectively on 7th day post treatment.

Table 1 Efficacy of closantel against GI helminths of cattle in central Kashmir

Days	Mean EPG of control group (n = 5)			Total	Mean EPG of treatment group and per cent efficacy (n = 15)			Total
	F	T	S		F	T	S	
0 day (pre treatment)	60 ± 27.38	20 ± 22.36	280 ± 22.36	360 ± 27.38	106.66 ± 29.39	6.66 ± 6.90	240 ± 26.34	353.33 ± 24.46
7th day (post treatment)	60 ± 27.38	20 ± 22.36	280 ± 22.36	360 ± 27.38	0.00 ± 0.00 (100.00)	6.66 ± 6.90 (NE)	0.00 ± 0.00 (100.00)	6.66 ± 6.90 (98.11)
14th day (post treatment)	80 ± 41.83	20 ± 22.36	300 ± 35.35	400 ± 35.35	0.00 ± 0.00 (100.00)	20 ± 20.70 (NE)	13.33 ± 9.40 (94.44)	33.33 ± 21.82 (90.56)
28th day (post treatment)	80 ± 41.83	40 ± 44.72	320 ± 41.83	440 ± 57.00	6.66 ± 6.90 (93.75)	20 ± 20.70 (NE)	46.66 ± 13.80 (80.55)	73.33 ± 29.39 (79.24)

Figures within parenthesis indicate percentage *F Fasciola* spp., *T Trichuris* spp., *S* strongyle worms, *n* no. of cattle, *NE* not effective

Table 2 Efficacy of fenbendazole against GI helminths of cattle in central Kashmir

Days	Mean EPG of control group (n = 5)					Mean EPG of treatment group and per cent efficacy (n = 15)					Total
	F	P	M	T	S	F	P	M	T	S	
0 day (pre treatment)	40 ± 27.38	20 ± 22.36	20 ± 22.36	40 ± 27.38	320 ± 22.36	440 ± 27.38	33.33 ± 13.80	20 ± 11.06	26.66 ± 15.86	360 ± 34.69	493.33 ± 29.39
7th day (post treatment)	40 ± 27.38	20 ± 22.36	20 ± 22.36	40 ± 27.38	340 ± 27.38	460 ± 27.38	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)
14th day (post treatment)	40 ± 27.38	40 ± 44.72	20 ± 22.36	40 ± 27.38	340 ± 44.72	480 ± 41.83	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)
28th day (post treatment)	40 ± 27.38	40 ± 44.72	20 ± 22.36	60 ± 44.72	380 ± 65.19	540 ± 27.38	6.66 ± 6.90 (87.49)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)	40 ± 13.55 (88.89)	53.33 ± 17.10 (89.19)

Figures within parenthesis indicate percentage *F. Fasciola* spp., *P. paramphistomes*, *M. Moniezia* spp., *T. Trichuris* spp., *S. strongyle* worms, *n* no. of cattle

Fenbendazole was found to be 100% effective on day 7th and 14th against *Fasciola* spp., paramphistomes, *Moniezia* spp., *Trichuris* spp. and strongyle worms. However, on 28th day, an overall efficacy was found to be 89.19% and efficacy was reduced to 87.49, 79.99 and 88.89% against *Fasciola* spp., paramphistomes and strongyle worms (Table 2). Our results regarding the efficacy of fenbendazole against strongyle worms are almost in agreement with those reported by Blagburn et al. (1987), Malone et al. (1990), Williams (1991), Miller and Morrison (1992) and Bagherwal (1992). Similarly, Sahoo et al. (2003) observed EPG count reduced to zero by 6th day in cows in Bhubaneswar infected with GI nematodes after treatment with fenbendazole. Studies of Rajkhowa et al. (2003) in mithuns of Nagaland with albendazole showed 100% reduction in the number of ova on 7th, 9th and 12th day after treatment. Aiman (2014) and Irshad (2015) also reported 100% efficacy of fenbendazole against GI nematodes of cattle in north and south zones of Kashmir valley respectively. Similarly, its effectiveness against paramphistomes and *Moniezia* spp. are in full agreement with those reported by Bagherwal (1992) in buffalo and buffalo calves in Madhya Pradesh. Effectiveness of fenbendazole against *Fasciola* spp. found in the present study has been reported by Soulsby (1982) and Mehlhorn et al. (2001).

Ivermectin was found to be 100% effective on 7th and 14th day post treatment against *Trichuris* spp. and strongyle worms however, on 28th day efficacy was reduced to 90.56% against strongyle worms. The drug was found to be not effective against *Fasciola* spp. and paramphistomes (Table 3). The results regarding efficacy of ivermectin bolus against GI nematodes are almost in agreement with those reported by Yazwinski et al. (1995) and Rehbein et al. (1997). Furthermore, efficacies found in the present study were comparable to those of ivermectin administered through subcutaneous route by Mendoza-de-Gives et al. (1986), Gill et al. (1989), Kumar et al. (2004) and Sarkar et al. (2005). Aiman (2014) and Irshad (2015) reported ivermectin 100% effective against GI nematodes of cattle in north and south zones of Kashmir valley respectively. Similarly, Kumar et al. (2004) also reported ivermectin to be 100% effective against *Trichuris* spp. However, topical application of ivermectin has also been found to be 100% effective on 28th day post treatment against GI nematodes by Manfredi et al. (1988).

Table 3 Efficacy of ivermectin against GI helminths of cattle in central Kashmir

Days	Mean EPG of control group (n = 5)				Mean EPG of treatment group and per cent efficacy (n = 15)			
	F	P	T	S	F	P	T	S
0 day (pre treatment)	40 ± 27.38	20 ± 22.36	40 ± 27.38	340 ± 27.38	46.66 ± 13.80	33.33 ± 13.04	33.33 ± 16.49	353.33 ± 17.10
7th day (post treatment)	40 ± 27.38	20 ± 22.36	40 ± 27.38	360 ± 27.38	46.66 ± 13.80 (NE)	33.33 ± 13.04 (NE)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)
14th day (post treatment)	40 ± 27.38	20 ± 22.36	40 ± 27.38	380 ± 41.83	46.66 ± 13.80 (NE)	33.33 ± 13.04 (NE)	0.00 ± 0.00 (100.00)	0.00 ± 0.00 (100.00)
28th day (post treatment)	40 ± 27.38	20 ± 22.36	40 ± 27.38	420 ± 41.83	46.66 ± 13.80 (NE)	33.33 ± 13.04 (NE)	0.00 ± 0.00 (100.00)	33.33 ± 13.04 (90.56)

Figures within parenthesis indicate percentage *F Fasciola* spp., *P* paramphistomes, *T* *Trichuris* spp., *S* strongyle worms, *NE* not effective

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Author contributions BM executed the research work in the field; RAS designed the technical programme of the research work; IMA assisted in data analysis and writing of the manuscript; ZAW assisted at field level during execution of the research work.

Compliance with ethical standard

Conflict of interest The authors declare that there is no conflicts of interest.

Human and animal rights The authors declare that the study was conducted on naturally infected animals in the field. As no experimental infection was established during this research work, so there was no need to take the approval for execution of the work from animal ethics committee. The animals belonged to the local farmers of the central Kashmir and they had given full consent for this research work.

References

- Aiman (2014) Prevalence and therapeutic studies on gastrointestinal helminth parasites of cattle in North zone of Kashmir valley. M. V. Sc thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar
- Bagherwal RK (1992) Efficacy of fenbendazole against helminth of dairy buffaloes and calves. *Livestock Adviser* 17:18–20
- Blagburn BL, Hanrahan LA, Hendrix CM, Lindsay DS (1987) Efficacy of fenbendazole-medicated feed blocks against gastrointestinal nematode infections in calves. *Am J Vet Res* 48:1017–1019
- Chandra S, Prasad A, Latchumikanthan A, Rakesh RL, Praveen K, Khobra V, Subramani KV, Misri J, Sankar M (2015) Status of benzimidazole resistance in *Haemonchus contortus* of goats from different geographic regions of Uttar Pradesh, India. *Vet Parasitol* 208:263–267
- Dash KM, Hall HE, Barger LA (1988) The role of arithmetic and geometric mean worm egg counts in faecal egg count reduction tests and in monitoring strategic drenching programme in sheep. *Aust Vet J* 65:66–67
- Gill BS (1996) Anthelmintic resistance in India. *Vet Parasitol* 63:173–176
- Gill BS, Singh J, Gill BS, Singh A, Khehra SS, Rai A, Hussain O (1989) Efficacy of ivermectin against mange and gastrointestinal nematodes of buffaloes (*Bubalus bubalis*). *Vet Parasitol* 31:141–147
- Ibarra-Velarde F, Cristino NM, Vera-Montenegro Y, Bocanegra RC, Campos AH, Galvan PO (2002) Comparative efficacy of experimental fasciolicide, triclabendazole and closantel in cattle naturally infected with *Fasciola hepatica*. *Vet Mexico* 33:237–245
- Irshad (2015) Prevalence and therapeutic studies on gastrointestinal helminth parasites of cattle in South zone of Kashmir valley. M. V. Sc thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar
- Jaiswal AK, Sudan V, Shanker D, Kumar P (2013) Emergence of Ivermectin resistance in gastrointestinal nematodes of goats in a semi-organised farm of Mathura district-India. *Vet Archive* 83:275–280
- Kumar A, Prasad KD, Kumar RR (2004) Efficacy of ivermectin and tetramisole control packages against gastrointestinal nematodosis in cattle and buffaloes. *J Vet Parasitol* 18:31–33
- Malone JB, Williams JC, Lutz M, Fagan N, Jacocks M, Jones E, Marbury K, Willis E (1990) Efficacy of concomitant early summer treatment with fenbendazole and clorsulon against *Fasciola hepatica* and gastrointestinal nematodes in calves in Louisiana. *Am J Vet Res* 51:133–136
- Manfredi MT, Rocco M, Rosa M, Bossi P, Traldi G, Genchi C (1988) Efficacy of ivermectin as atopic formulation in the treatment of endoparasites and ectoparasites of feedlot cattle. *Obiettivi e Documenti Veterinari* 9:53–55
- Mehlhorn H (2001) *Encyclopedic reference of parasitology*, 2nd edn. Springer, Berlin, Heidelberg
- Mendoza-de-Gives P, Lopez Arellano ME, Ramblas Angeles JA, Najera Fuentes RA, Herrera Rodriguez D, Mejia Garcia RA (1986) Anthelmintic efficacy of ivermectin against gastrointestinal nematodes in cattle. *Tecnica Pecuaria en Mexico* 51:28–36
- Miller JE, Morrison DG (1992) Effect of fenbendazole and ivermectin on development of strongylate nematode eggs and larvae in calf faeces. *Vet Parasitol* 43:265–270
- Perry BD, Randolph TF (1999) Improving the assessment of the economic impact of parasitic diseases and of their control in production animals. *Vet Parasitol* 84:145–168
- Rajkhowa S, Bujarbaruah KM, Thong K, Rajkhowa C (2003) Comparative efficacy of ivermectin, levamisole and albendazole against naturally acquired nematodiasis of mithun. *Ind Vet J* 80:854–856

- Rehbein S, Pitt SR, Langholff WK, Barth D, Eagleson JS (1997) Therapeutic and prophylactic efficacy of the Ivermec SR Bolus against nematodes and *Psoroptes ovis* in cattle weighing more than 300 kg at the time of treatment. *Parasitol Res* 83:722–726
- Sahoo N, Mohanty TN, Sambal S (2002) Prevalence of gastrointestinal helminthic infection among grazing and stall-fed cattle in rainfed district of Orissa. *J Vet Parasitol* 16:61–62
- Sahoo N, Mohanty TN, Ray TK, Rao SV, Mallick B (2003) Effect of fenbendazole on milk production in gastro-intestinal nematode infected indigenous cows. *Ind Vet J* 80:570–571
- Sarkar AK, Ali M, Rahman A (2005) Efficacy of ivermectin against gastrointestinal nematodes in calves. *J Anim Vet Adv* 4:329–331
- Shin-Sung S, Lee-Chung G, Cho-Shinn H, Kim-Jong T, Wee-Sung H, Shin S (1995) Efficacy of closantel for the treatment of naturally acquired and experimentally induced *Fasciola hepatica* infections in cattle. *K J Vet Res* 35:347–352
- Soulsby EJJ (1982) Helminths, arthropods and protozoa of domesticated animals, 7th edn. ELBS and Baillere Tindal, London, p 809
- Sutherland IA, Leathwick DM (2011) Anthelmintic resistance in nematode parasites of cattle. A global issue? *Trends Parasitol* 27:176–181
- Vera-Montenegro Y, Ibarra Velarde F, Quiroz Romero H, Hernandez Campos A, Castillo R (2003) Field trial on the efficacy of an experimental fasciolicide compared with some commercial compounds in naturally infected cattle. *Parasitol Res* 91:1–4
- Williams JC (1991) Efficacy of albendazole, levamisole and fenbendazole against gastrointestinal nematodes of cattle, with emphasis on inhibited early fourth stage *Ostertagia ostertagi* larvae. *Vet Parasitol* 40:59–71
- Yazwinski TA, Featherston H, Tucker C (1995) Effectiveness of the ivermectin sustained-release bolus in the control of bovine nematodosis. *Am J Vet Res* 56:1599–1602

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