Efficacy of ivermectin, closantel and fenbendazole against gastrointestinal nematodes of sheep in Kashmir valley

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Abstract The present work was undertaken to evaluate the therapeutic efficacy of ivermectin, closantel and fenbendazole under field conditions against Gastrointestinal Nematodes (GIN) of cross bred merino sheep in Budgam area of Kashmir Valley. A total of 115 sheep having Egg per gram of faeces (EPG) greater than or equal to 150 (mean EPG 258.89) were selected. The animals were randomly divided into four groups comprising of 30 animals each in three treatment groups (ivermectin, closantel and fenbendazole) and twenty-five in fourth untreated infected control group. Faecal samples from the selected animals were collected on day '0' pre treatment and on days 8th and 14th post treatment. Based on Faecal Egg Count Reduction Test (FECRT), ivermectin was found to be 98.80 % effective against strongyles on 8th day post treatment, however an efficacy of 100 % was seen against strongyle worms on 14th day post treatment. 98.80 and 100 % efficacy was observed on day 8th post treatment against strongyles in case of closantel and fenbendazole respectively, however efficacy decreased to 97.60 and 98.8 % respectively on 14th day post treatment. There was no evidence of development of resistance by GIN of cross bred merino sheep in District Budgam of Kashmir Valley to ivermectin, closantel and fenbendazole.

Keywords Closantel · Efficacy · Fenbendazole · GIN · Ivermectin · Kashmir · Sheep

Introduction

Profitable sheep rearing is posed with many constraints of which parasitic diseases, particularly GastroIntestinal (GI) parasitism is the major one resulting in severe economic losses to the sheep industry. In India helminth diseases alone are responsible for five per cent mortality and more than 10 % morbidity in sheep (Chakraborty and Lodhi 1994). Gastrointestinal nematode (GIN) infections are a common constraint to small ruminant industry throughout the world (Saddiqi et al. 2011). Therefore, there is alarming need of control measures to be taken to prevent the adverse effects of GI parasitism on sheep productivity. Despite of many control measures available, chemotherapy and chemoprophylaxis is still the most effective weapon to fight the occurrence of parasitic diseases. Frequent and indiscriminate use of anthelmintics has led to resistance in GIN against a wide range of drugs (Jaiswal et al. 2013) and over the past 10–15 years, a rapid increase has been witnessed in both the prevalence and magnitude of anthelmintic resistance (Kaplan and Vidyashankar 2012). Therefore, it is necessary to conserve the efficacy of currently available antiparasitic drugs by their use in a judicious and scientific manner. For evaluation of anthelmintic efficacy, different *In vivo* and *In vitro* tests are recommended (Coles et al. 1992) and the Faecal Egg Count Reduction Test (FECRT) is the most commonest method used for detection of anthelmintic efficacy (Presidente et al. 1985). So far no such study has been undertaken in District Budgam of Kashmir Valley, therefore, the present study was undertaken to evaluate the efficacy of commonly used anthelmintics viz; ivermectin, closantel and fenbendazole against GIN of sheep and to find out the evidence of development of resistance, if any.

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Table 1 Efficacy of commonly used anthelmintics based on FECRT at unorganized sector of District Budgam of Kashmir Valley

Group	Anthelmintic	Number of sheep	Mean EPG day 0	Mean EPG day 8	FECR %	Efficacy %	Mean EPG day 14	FECR %	Efficacy %
I	Ivermectin	30	273.33 ± 15.85	3.33 ± 3.33	99	98.80	0.00 ± 0.00	100	100.00
II	Closantel	30	233.33 ± 16.84	3.33 ± 3.33	99	98.80	6.67 ± 4.63	98	97.60
III	Fenbendazole	30	270.00 ± 17.39	0.00 ± 0.00	100	100.00	3.33 ± 3.33	99	98.80
IV	Control	25	261.20 ± 21.03	276.00 ± 19.39	–	–	280.00 ± 16.33	–	–

Materials and Methods

This study was carried out in locally reared cross bred merino sheep in District Budgam of Kashmir Valley. Budgam is situated at an average altitude of 5281 ft above mean sea level and at 75° East longitude and 34° North latitude. The topography of the district is mixed with both mountainous and plain areas. The climate is of temperate type with the upper reaches receiving heavy snowfall in winter.

The therapeutic efficacy of different anthelmintic drugs viz, ivermectin, closantel and fenbendazole was determined using the FECRT as per the guidelines of WAAVP (Coles et al. 2006). The study was conducted on cross bred merino sheep suffering from GIN infection (EPG ≥ 150, mean EPG 258.89). The animals were randomly selected from unorganised sector of Budgam area of Kashmir Valley irrespective of age, sex and weight and divided into four groups (Group I, II, III and IV). First three groups comprising of thirty animals each were treated with anthelmintics and fourth group comprising of twenty-five animals was kept as untreated infected control. Group I, II and III were treated with ivermectin @ 200 mcg/kg body weight subcutaneously, closantel @ 7.5 mg/kg body weight orally and fenbendazole @ 5 mg/kg body weight orally, respectively. Per rectal faecal samples were collected from each experimental sheep individually in separate polythene bags on day '0' before treatment and on 8th and 14th day post treatment. The samples were stored at 4 °C and were brought to the Divisional laboratory and EPG was determined by using Stoll's method. The data were then analyzed statistically as described by (Coles et al. 1992) using below mentioned formula:

$$R = 100 \left(1 - \frac{X_t}{X_c} \right)$$

where 'R' is percentage reduction in faecal egg count, 'X_t' is average EPG of treatment group and 'X_c' is average EPG of control group.

Results and Discussion

In the present study, efficacy of the three most commonly available and frequently used anthelmintics for sheep GIN

were evaluated. The percentage reduction in egg counts with ivermectin, closantel and fenbendazole against strongyle worms was recorded as 100.00, 98.00 and 99.00 %, respectively (Table 1). As per Coles et al. (1992) these values suggest that all the above three drugs are effective against strongyle worms of cross bred merino sheep in District Budgam of Kashmir Valley as the percentage reduction in egg counts is more than 95.00 % and as such there is no evidence of development of resistance by strongyle worms against these three anthelmintics.

Ivermectin was found to be 98.80 % effective against strongyle worms on 8th day post treatment. Our observation is in close agreement with Pandit et al. (2009), who also found ivermectin to be 98.56 % effective against naturally occurring GIN in Garole sheep of Kolkata. However, efficacy of the drug was 100.00 % on 14th day post treatment which is in agreement with Sudhan et al. (2007), who also reported 100.00 % efficacy of ivermectin against strongyle worms in Jammu. Studies of Gupta et al. (1990) and Kadam et al. (2009) also showed ivermectin to be 100.00 % effective against natural GIN infections in sheep of Jammu and Akola regions in India respectively. Studies of Nasreen et al. (2007) showed ivermectin to be 94.28 % effective on 14th day post treatment against GIN of sheep in Kashmir Valley, whereas Jaiswal et al. (2013) suspected ivermectin resistance against GIN in Mathura. Closantel was found to have 98.80 and 97.60 % efficacy against strongyle worms on 8th and 14 day post treatment, respectively. In New South Wales Wooster et al. (2001) reported closantel to have efficacy below 80.00 % and Fiel et al. (2011) reported closantel 80.60 % effective against *H. contortus* in Argentina. However, the efficacy of closantel against *H. contortus* was 100 % in Kenya (Waruiri et al. 1996) and Kadam et al. (2009) also reported 100 % efficacy of closantel against strongyle worms in Akola region of India. Fenbendazole was found to be 100.00 and 98.80 % effective against strongyle worms on 8th and 14th day post treatment. Our results are in agreement with Kumar and Yadav (1994) who reported greater than 99.00 % reduction in faecal egg counts of sheep after treatment with fenbendazole @ 5 mg/kg body weight in Haryana. In Kashmir Valley Nasreen et al. (2007) found fenbendazole to be 89.28 % effective on 14th day post

treatment against GIN of sheep and Gupta et al. (1990) reported fenbendazole to have 93.55 % efficacy in sheep of Jammu region. However, Jaiswal et al. (2013) reported fenbendazole resistance against GIN in Mathura. In Srinagar city of Kashmir Valley Bihagi (2013) reported that overall efficacy was highest for ivermectin at 83.54 and 90 % on 8th and 14th day post treatment, respectively and least for fenbendazole at 44.30 and 62.50 % respectively, Whereas the corresponding figures for closantel were 68.35 and 86.25 %, respectively against GIN of goats on Mountain Research Center for Sheep and Goats.

On the basis of the present study, it may be concluded that all the three drugs *i.e.* ivermectin, closantel and fenbendazole are having efficacy >95 %, which clearly indicates that they may be used in control programmes against GIN of cross bred merino sheep in District Budgam of Kashmir Valley judiciously and in a scientific manner. Moreover keeping in view the cost of treatment, fenbendazole is suggested to the farmers of the area for control of these parasitic infections in sheep.

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