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Comparative Efficacy of Moxidectin Ivermectin Doramectin and Fenbandazole Against Natural Infection of Gastrointestinal Nematodes in Sheep at Hisar

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ABSTRACT

This study aim to evaluate the effectiveness of moxidectin (cydectin), ivermectin (Neomec), doramectin (dectomax) and fenbendazole (Panacur) against gastrointestinal nematodes in naturally infected sheep at central sheep breeding farm, Hisar, Haryana. The study includes 50 crossbred sheep divided randomly into five groups (group A, B, C, D and E) of 10 animal in each. Group A, B and C were treated with moxidectin, ivermectin, doramectin (@10 mg/ kg BW) and group D with fenbendazole (@5 mg/ kg BW) and group E served as the untreated control. The therapeutic efficacy was evaluated through determination of epg, body weight gain/loss and Hb concentration. Fecal, body weight and blood were collected before treatment on day 0, and on 7, 14 and 21 day post-treatment. The results showed that the fecal egg count reduction percentage in group A, B, C, D compared to control were 100, 90, 100 and 80 respectively on 21 day post treatment. The body weight of the treated group A, B, C sheep were slightly increased on 21 day post treatment but the differences was non-significantly ($P<0.05$) when compared with group D and E. The Hb values was significantly higher ($p<0.01$) between group A, B, C when compared with group D and E on day 21 post treatment. On the basis of these results it was concluded that moxidectin and doramectin proved the most effective against gastrointestinal nematodes of sheep in the present farm, while ivermectin being comparatively less and fenbendazole the least effective.

Keywords: Sheep, egg per gram, comparative efficacy, gastrointestinal nematodes

Parasitism is of supreme importance in many agro-ecological zones and still a serious threat to the livestock economy worldwide **(**Vercruysse and Claerebout, 2001). The gastrointestinal nematodiasis causes great economic losses in term of mortality (5-10%), stunted growth, weight loss, decreased milk and meat production and market value of animals (Herlich, 1978; Islam, 1985). Sheep are known to suffer from various endoparasites of which haemonchosis, with its very wide distribution, has become a very important production constraint in sheep farms in tropical, subtropical and temperate regions worldwide. Among the various gastrointestinal nematodes (GIN), *Haemonchus contortus* is considered main culprit causing anemia and hypoproteinemia in ruminants (Reinecke, 1983). Due to open grazing majority of sheep suffer with parasitic gastroenteritis may be in clinical or subclinical form. In general, control of gastrointestinal nematode infestation in sheep relies heavily on anthelmintic treatments. However, the indiscriminate use of these drugs has led to the widespread emergence of drug resistant strains of parasites. Therefore, to maintain the efficacy of the available anthelmintic, regular monitoring of the status of anthelmintic is required, at least once in two years which is an integral part of worm control programme.

Considering the above facts the present study was designed to the investigation the efficacy of routinely used four anthelmintics (moxidectin, ivermectin, doramectin and fenbendazole) against gastrointestinal nematodes in sheep at central sheep breeding farm, Hisar. Emphasis was placed on determining the correlation of these nematodes

infection as eggs per gram on haematocrit values and body weight of the sheep.

MATERIALS AND METHODS

Study area: The present trial was conducted at central sheep breeding farm, Hisar. The farm is situated in Haryana State at latitude of 29'-10º north and longitude of 75'-46º east and at an altitude of 215.2 mtr from the sea level. The average annual rainfall is about 300 to 350 mm.

Animals: Fifty adult cross bred sheep (Nali and Sonadi cross with Rambouillet) having marking on ear belonging of either sex were selected for the present study. The eggs per gram were estimated and the sheep were divided into five groups of 10 animals each. The groups were formed based on the uniformity of body weight and age aiming at homogeneous distribution of infection. Group A, B, C, and D were treated with moxidectin (Cydectin, Fort Dodge) at 10 mg/kg body weight (BW) subcutaneously, ivermectin (Neomec, Intas) at 10 mg/kg BW subcutaneously, doramectin (Dectomax, Fizer) at 10 mg/kg BW subcutaneously and fenbendazole (Panacur, Intervet) at 5 mg/kg BW orally respectively. The animals of group E were used as untreated control.

Sample collection and examination: Fecal samples from 50 adult sheep were collected directly from the rectum, stored in plastic bags. Rectal fecal samples were processed for nematode fecal egg counts (FECs) following the modified McMaster method described by Miller *et al*. (1998) with supersaturated sugar solution in order to quantify the number of EPG, using 2 grams of feces from each animal.

Parasitological protocols: Among the tests used to detect anthelmintic efficacy, the fecal egg count reduction test (FECRT) was performed. The blood was collected from the animal at the time of fecal sample collection and haemoglobin was estimated by Easytouch blood hemoglobin test strips GHb model. The live body weight was also estimated at weekly interval. After this initial analysis, the treatment was carried for group A, B and C with moxidectin, ivermectin, doramectin (@ 10 mg/ kg bwt, s/c) and for group D with fenbendazole (@ 5 mg/ kg bw, s/c) and the group E works as untreated control. All treatments were carried out parenterally in a single dose. After 7, 14 and 21 days of treatment fecal samples were collected to perform EPG. At the simultaneous interval Hb concentration and body weight of all treatments were measured as indicator of efficacy of drug against natural infection.

The experiment was laid out in Randomized Block Design with ten replications per treatments. The recorded data was be analyzed as per Snedecor and Cochran, (1994) using optimum statistical procedure.

RESULTS AND DISCUSSION

The result of the drug trial in terms of percent reduction in EPG (mean) of all groups is given in Table 1. All 50 sheep were found positive for GI nematode parasites on day 0 of the experiment. Moxidectin, ivermectin, doramectin and fenbendazole reduced the fecal egg counts by 100, 75, 95 and 66%, respectively on day 14 post treatments and by 100, 90, 100 and 80 on 21 day of post treatment.

The between group differences in moxidectin (Gr-A) and doramectin (Gr-C) treated sheep were significant ($p < 0.05$) in comparison with fenbendazole (Gr-D), and untreated controls (Gr-E) on day 21. However, there was no significant difference between ivermectin (Gr-B) and fenbendazole (Gr-D). But there is significant difference between ivermectin (Gr-B) and fenbendazole (Gr-D) with untreated controls (Gr-E) on day 21. Moxidectin administered to animals of group A was found the most effective as the EPG value decreased from 2250 to 0 resulting in a 100% reduction on day 14 post-treatment. Similarly Espinoza et al., 2014 reported that moxidectin treatments reduced FECs of lambs and kids by 98–100% at day 14 post-treatment. Ivermectin in animals of Group B proved 90% effective against gastrointestinal nematodes with decrease in EPG count from 1465 to 320 on 21 day post treatment (Table 1).

Similarly Nasreen *et al.* (2007) have reported 93% efficacy of ivermectin against gastrointestinal nematodes in naturally infected weaner sheep in Kashmir valley and Espinoza *et al.* (2014) reported the reduction in FEC of lambs between 71–90% after treatment with ivermectin. These results were also in agreement with the findings of Westcott and Leamaster (1982) and Swan *et al.* (1984). In contrast to this finding Arece *et al.* (2004) and Melaku *et al.* (2013) reported a 100% efficacy of ivermectin against gastrointestinal nematodes in naturally infected sheep. Yadav *et al.* (1996) also observed 99-100% efficacy of

Table 1: Comparative efficacy of moxidectin, ivermectin, doramectin and fenbendazole against gastrointestinal nematodes in sheep

Group	Pretreatment EPG (Mean ± S.E)	Post treatment EPG (Mean ± S.E)				
	0 day	7 day	14 day	21 day	% reduction on 14 day	% reduction on 21 day
A	2250±561.71^{a}	240±56.66^{c}	00	00	100	100
B	1465±314.47^{a}	1595±419.36^{b}	775±256.40^{bc}	320±142.25^{bc}	75.43	90.61
C	1260±167.79^{a}	640±70.24^{c}	125±67.60^{cd}	00	95.82	100
D	1250±178.26^{a}	2310±385.19^{b}	1100±235.46^{b}	675±190.95^{b}	66.55	80.18
E	1195±190.68^{a}	3305±293.87^{a}	2990±444.89^{a}	3405±458.17^{a}	00	00

In a column values with same superscript do not differ significantly at $p>0.05$ where as values with dissimilar letter differ significantly $p<0.05$.
Group A: Treated with Moxidectin @ 10 mg/kg BW, subcutaneously; Group B: Treated with Ivermectin @ 10 mg/kg BW, subcutaneously; Group C: Treated with Doramectin @ 10 mg/kg BW subcutaneously; Group D: Treated with Fenbendazole @ 5 mg/kg BW orally.

Table 2: Effect of moxidectin, ivermectin, doramectin and fenbandazole treatment on haemoglobin concentration and body weight in sheep

Group	Haemoglobin concentration (Mean ± S.E)				Body weight (Mean ± S.E)			
	Pre-treatment	Post-treatment			Pre-reatment	Post-treatment		
	0 day	7 days	14 days	21 days	0 day	7 days	14 days	21 days
A	7.67±0.21	8.01± 0.23	8.87± 0.38^{a}	9.06± 0.28^{a}	16.3±1.14	15.8± 1.01	16.0±1.01	16.55± 0.97
B	8.04±0.30	7.9± 0.91	8.65± 0.27^{ab}	8.8± 0.30^{a}	16.4±0.89	16.4± 0.89	16.70± 0.87	16.70± 0.87
C	7.36±0.22	7.65± 0.19	8.45± 0.20^{ab}	8.84± 0.14^{a}	15±0.39	15± 0.39	15.1±0.40	15.8±0.35
D	8.23±0.31	8.00± 0.25	8.05± 0.24^{bc}	7.63± 0.29^{b}	15.3±0.77	14.9± 0.62	14.8±0.68	14.65± 0.68
E	7.65±0.25	7.55± 0.26	7.55± 0.25^{c}	7.75± 0.22^{b}	17.6±0.79	17.2± 0.75	16.9±0.54	16.25± 0.75

In a column values with dissimilar superscript differ significantly $p<0.01$.

Group A: Treated with Moxidectin @ 10 mg/kg BW, subcutaneously; Group B: Treated with Ivermectin @ 10 mg/kg BW, subcutaneously; Group C: Treated with Doramectin @ 10 mg/kg BW subcutaneously; Group D: Treated with Fenbendazole @ 5 mg/kg BW orally.

ivermectin against gastrointestinal nematodes in sheep and goat at the dose rate of 0.2 mg/kg body weight.

Doramectin shows 95% and 100% efficacy on day 14 and 21 post treatment (Table 1). The present finding is in accordance with the earlier report of Ram *et al.* (2007) who reported 94% efficacy of doramectin against gastrointestinal nematodes on 14 day post treatment in Pashmina goat. The high efficacy of doramectin against various nematodes also reported by Dorchies *et al.* (2001) in sheep.

Fenbendazole in sheep of group D was least effective against gastrointestinal nematodes with a decrease in EPG from 1250 to 675 at the end of the trial period. The reduction in EPG was only 80.18% on 21 day post treatment in the animals of this group. Similar results have been reported by Srivastava *et al.* (1983). A decrease of 88% in epg value in fenbendazole treated group of sheep infected with nematodiasis in Kashmir valley, reported by Nasreen *et al*. (2007). The study indicated that fenbendazole at the recommended dosage was not effective against GI nematodes in sheep on this farm. Reduced efficacies of the fenbendazole against GI nematode parasites have been documented earlier by several workers (Ram *et al.,* 2007; Godara *et al.,* 2011). In untreated naturally parasitized control group E the mean epg was 1195 on 0 day and on 7th, 14th and 21st days were 3305, 2990 and 3405 respectively (Table 1).

Haemoglobin concentration

Effect of different anthelmintics treatments on hemoglobin

concentration presented in Table 2. There is no significant difference between different groups with control on day 7 post treatments for hemoglobin concentration. But significant difference were observed between (Gr-A), (Gr-B) and (Gr-C) with infected control (Gr-E) however not between (Gr-B), (Gr-C) with (Gr-D) on day 14 of treatment. On day 21 of treatment significant difference ($p<0.01$) in Hb content were observed in the group treated with moxidectin, ivermectin, doramectin compare to fenbendazole treated and control group. The parasites are common blood feeders that cause anaemia as a result of decrease in the number of hemoglobin and erythrocyte Dede *et al*. (2002). It was observed in the present study that low levels of hemoglobin in parasite-infected group improved along with the treatment. Similarly significant increase in haemoglobin concentration was reported by Qamar and Maqbool (2012) when sheep and goats treated with ivermectin for haemonchosis.

Body weight

The mean value of body weight of treated and untreated naturally infected sheep with nematodes shows no significant difference (Table 2). Similarly Taylor *et al.* (1997) observed no significant differences between the rates of weight change in any of the groups treated with moxidectin, ivermectin and albendazole in ewe and lambs. However there is slight increase in body weight as a result of treatment in A, B and C on day 21 post treatment but increased was not significant with group D and E. The body weight was increased and this may be due to removal of parasitic load, proper absorption and metabolism of nutrient in the parasite free gastrointestinal tract Akanda *et al*. (2014). The body weight significantly decreased in untreated control group due to overload of parasites within the body of sheep. In contrast, (Pandit *et al.* 2009; Akanda *et al.* 2012) found significant improvement in body weight after treatment, which may be due to difference in parasitic burden.

On the basis of these results it was concluded that moxidectin and doramectin proved the most effective against gastrointestinal nematodes of sheep on the present farm, ivermectin being comparatively less and fenbendazole the least effective. The high efficacy of moxidectin might be attributed to the recent use of this drug for deworming in the studied farm. However, ivermectin was found to be less effective and suspected for resistance against gastrointestinal nematodes.

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