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Research paper

Comparative study of efficacy of commercial anthelmintic response against gastrointestinal nematodes in goats of Jhenidah district, Bangladesh

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Abstract

Background: Parasitic disease constitutes 60-70% diseases affecting the animals and has serious economic implication in livestock entrepreneurship by direct and indirect production loss. Indiscriminate use of anthelmintic drugs has made the situation even more precarious. A similar problem was encountered in goat from Holidhani, Jhenidah, where goats with complain of intermittent diarrhea and loss of body condition was reported despite of routine deworming.
Objective: Determining the efficacy of conventional anthelmintics used and its comparison with some unexploited antiparasitic drugs for the same reason.
Methods: Sixty-five goats were divided into five groups. Group A goats were kept as the control, Group B (I, II, III), group C (IV, V, VI), group D (VII, VIII, IX) and group E (X, XI, XII) goats were treated with levamisole, albendazole, fenbendazole and ivermectin respectively. All the treated and control goats were kept, housed for 21 days after the first treatment. Fecal samples were collected and counted on 1st, 7th, 14th and 21st day by using McMaster counting method.
Results: Among the three doses of levamisole, albendazole, fenbendazole and ivermectin, the doses of 7.5, 7.5, 5.0 and 0.2 mg/kg body weight, body weight were found to be most effective against gastrointestinal nematodes in goats with a maximum reduction of fecal egg count to the extent of 95.38, 97.13, 98.08 & 99.16 percent respectively.
Conclusion: The study revealed low efficacy of levamisole and hence ivermectin is a better drug than albendazole and fenbendazole to control gastrointestinal nematodes in goats.

Keywords: *Parasitic Disease; Goat; Anthelmintic; Fecal Eggs and Efficacy.*

1. Introduction

Bangladesh is one of the most densely populated country in the world with an estimated 1,033 people/km^2 (United Nations, 2011). Livestock density is also the highest in the world with an estimated 145 large ruminants/km^2 compared with 90 for India (BARC Bangladesh, 2010). It is estimated that 54.75 million of livestock in Bangladesh of which small ruminants constitute 29.33 millions of which goats 25.93 million and sheep 3.40 million (Livestock Economy, 2017). Goat is the second most important livestock of farmers in Bangladesh.
There are about 300 breeds and varieties of goats domesticated in Indian subcontinent. In Bangladesh, a native goat breed commonly known as Black Bengal goat, exotic breeds such as Sirohi, Beetal and Jamnapari and crossbreds between the Black Bengal goat and Jamnapari are found all over the country. Most of the goats in Bangladesh belongs to indigenous Black Bengal variety and the remaining are White Bengal and crosses of Jamunapari (Husain, 1993). Black Bengal goat is an interesting breed, which possesses a number of outstanding features. In addition, into its production of high-quality meat and world-famous skin, its fertility rate is higher, about 95%, compared to other breeds in this subcontinent (Hasan *et al*., 2014).
Black Bengal Goat comprises more than 90% of the total goat population (Amin *et al*., 2001). The correlations between the number of goats per inhabitant and the mean income of the farmer are 0.77 and 0.52 respectively (Morand-Fehr and Boyazoglu, 1999), justifies the old saying "the goat is the poor man's cow" and is true for developing country like Bangladesh. Goat rearing plays very important role in rural economy and could be used as a tool for poverty reduction in Bangladesh. These animals are also important for good quality of meat, milk and leather. The goat ranks second in position in terms of meat, milk, and skin production, representing about 28, 23 and 28 percent respectively of the total livestock in Bangladesh (FAO, 1999). The skin of goat of our country is world famous and play an important role

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in country's economy to earn foreign currency. Bangladesh earn 1.13 billion US dollar in the year of 2014-15 (Export Promotion Bureau, Bangladesh, 2014-15). Goat rearing plays the most important role for this purpose.

In Bangladesh, there are some constraints for goat rearing and production, among which various diseases and disorders of goat are the most important. Parasitism is the most important limiting factor of goat production in Bangladesh. It is established that infestations due to helminths undermine the health and productivity of goats. Asian Development Bank (ADB) report clearly mentioned the loss of productivity of animals in term of mortality, loss of milk, meat, generation loss and loss of reproductive rate due to animal parasite are to the extent of 50% in Bangladesh. Undoubtedly, the geo-climatic condition of Bangladesh is suitable for growth, development and subsistence of various parasites (Hossain *et al*., 2004; Qadir, 1967; Haq and Shaikh, 1968). Several epidemiological studies have been carried out on gastrointestinal parasites of small ruminants in different regions of Bangladesh, which were affected by various intestinal helminths (Poddar *et al*., 2017; Sangma *et al*., 2012; Hassan *et al*., 2011; Islam and Taimur, 2008; Mohanta *et al*., 2007). In the torrid-zone, 60-95% of sheep and goats had helminthiasis; of which, *Haemonchus* and *Trichostrongylus* were the two most commonly involved genera (Raza *et al*., 2014; Mbuh *et al*., 2008; Gathuma *et al*., 2007; Mondal *et al*., 2010). Sheep and goat are mainly reared for meat, wool and skin production (Hossain *et al*., 2004).

Extensive use of anthelmintics that too in inadequate dose has resulted in emergence of anthelmintic resistant strains of parasites (Silvestre *et al*., 2002 Wolstenholme *et al*., 2004). There are numerous reports of anthelmintic resistance from various parts of India (Ram *et al*., 2007; Buttar *et al*., 2012; Rialch *et al*., 2013). Khajuria (2010) has also reported the benzimidazole resistance in sheep and goats of Jammu. So, the objective of present study was to find out the comparative efficacy of levamisole, albendazole, fenbendazole and ivermectin against gastrointestinal nematodes in goats, maintained at Holidhani village, Jhenaidah district, Bangladesh based on fecal egg count reduction test.

2. Materials and methods

2.1. Study area and study population

The study was conducted at Holidhani, a village of Sadar Upazila of Jhenidah district, which is located near the campus of the Jhenidah Government Veterinary College, Jhenidah. Sixty-five goats were selected from Holidhani Village, in 30 households, of either sex weighing in a range of 20-25 kg body weight and age group between 2-3 years old. All goats were allowed to graze on pasture for about one month. After one month, they were housed with symptoms of intermittent diarrhea, poor body weight gain, anorexia and anemia.

2.2. Sampling method and treatment

All the goats were randomly divided into five groups. Group A containing 5 goats were kept as control without giving any treatment. Group B (sub-group I, II, III, each sub-group contains 5 goats) goats were treated with levamisole with the dose rate of 6.5, 7.0, 7.5 mg/kg body respectively; albendazole were administered to group C (sub-group IV, V, VI, each sub-group contains 5 goats) goats at the dose rate 6.5, 7.0, 7.5 mg/kg body weight respectively; group D (sub-group VII, VIII, IX, each sub-group contains 5 goats) goats were treated with fenbendazole at the dose rate of 4.0, 4.5, 5.0 mg/kg body weight respectively, group E (sub-group X, XI, XII, each sub-group contains 5 goats) goats were treated with ivermectin at the dose rate of 100 µg, 150 µg, 200 µg/kg body weight respectively. Prior to the start of the experimental trial, each goat was identified by ear tagging. The drugs Levamisole (Levavet Tablet), Albendazole (Benazol Tablet), Fenbendazole (Fenazole Vet Tablet) & Ivermectin (A-Mectin Vet) were purchased from a veterinary drug store located in the study area (Holidhani Bazar, Jhenidah, Bangladesh).

2.3. Fecal sample examination

All the goats were kept under stall-fed condition during study period. Fecal samples were collected per rectum in air-tight bags and taken to the laboratory for analysis on 1st (before drug administration), 7th, 14th and 21st day. Fecal egg counts were carried out by the McMaster counting method (Soulsby 1986).

2.4. Statistical analysis

Fecal egg count reduction percentage was determined by using arithmetic mean count (Coles *et al*., 1992). Obtained data were analyzed by using online Student's t-test Comparison of two means. Student t-test was applied for testing the level of significance.

3. RESULTS AND DISCUSSION

3.1. Levamisole (Levavet tablet)

Oral administration of all the 3 doses (6.5, 7.0 and 7.5 mg/kg body weight) of Levamisole significantly decreased the fecal egg count from 3rd day onward of first treatment and continued till the 21st day of treatment (Table 1). The reduction of fecal egg counts were 64.30, 83.30 and 95.38 percent following (6.5, 7.0 and 7.5 mg/kg body weight) of Levamisole respectively (Table 1). More or less similar results were reported at a dose rate of 7.5 mg/kg body weight by Ali *et al*., (1997); Keyyu *et al*., (2002); Islam *et al*., (2015). On the other hand, Byaruhanga *et al*., (2013) reported a less efficacy (91%) of levamisole against gastrointestinal nematodes in goats. But Godara *et al*., (2011) reported only 63.70% efficacy of levamisole against gastrointestinal nematodes in Jamunapari goats in India.

Table 1: Effect of Single Oral Administration of Levamisole (Levavet Tablet) Against Gastrointestinal Nematodes in Goats:

Group of animals	Dose mg/kg body weight	Time of feces collection (day) 1st	3rd	7th	14th	21st	Maximum rate of reduction
A	Control	2469 ±62.0	2470 ±78.4	2485 ±69.7	2489 ±45.7	2514* ±39.4	-
	6.5	2381 ±98.4	1073** ±59.5	932** ±58.6	894** ±43.0	850** ±85.8	64.30%

B	7.0	2527 ±70.9	748** ±49.3	626** ±58.1	534** ±48.9	422** ±54.7	83.30%
	7.5	2188 ±64.3	430** ±51.5	184** ±47.4	109** ±23.7	101** ±15.4	95.38%

Values given above represent the mean ±SE of 5 goats. * Significant decrease (P<0.05), ** Significant decrease (P<0.01).

3.2. Albendazole (Benazol tablet)

Oral administration of all the 3 doses (6.5, 7.0 and 7.5 mg/kg body weight) of Albendazole significantly decreased the fecal egg count from 3rd day onward of first treatment and continued till the 21st day of treatment (Table 2). The percentage of reduction of egg count were 65.83, 84.11 & 97.13 percent following (6.5, 7.0 and 7.5 mg/kg body weight) of Albendazole (Table 2). More or less similar results were reported at a dose rate of 7.5 mg/kg body weight by Sakhawat Ali *et al*., (1997); Oyeduntan *et al*., (2015); Rexford Pinkrah, (2017). Tsegaye Teklemariam *et al*., (2016), Akhter *et al*., (2016) reported 95% efficacy of albendazole against gastrointestinal nematodes in goats. Islam *et al*., (2015), reported 84.44% efficacy of Albendazole against gastrointestinal nematodes in goats. On the other hand, Ram *et al*., (2007), Byaruhanga (2013) & reported only 14 & 28.5% efficacy of Albendazole respectively in albendazole resistant goats.

Table 2: Effect of Single Oral Administration of Albendazole (Benazol Tablet) Against Gastrointestinal Nematodes in Goats:

Group of animals	Dose mg/kg body weight	Time of feces collection (day) 1st	3rd	7th	14th	21st	Maximum rate of reduction
A	Control	2469 ±62.0	2470 ±78.4	2485 ±69.7	2489 ±45.7	2514* ±39.4	-
C	6.5	2066 ±61.6	857** ±51.52	785** ±74.4	753** ±36.82	706** ±49.2	65.83%
	7.0	1995 ±73.5	561** ±55.4	458** ±42.7	385** ±39.7	317** ±44.8	84.11%
	7.5	2128 ±58.3	380** ±52.0	169** ±29.7	123** ±22.9	61** ±17.1	97.13%

Values given above represent the mean ±SE of 5 goats. * Significant decrease (P<0.05), ** Significant decrease (P<0.01).

3.3. Fenbendazole (Fenazole vet tablet):

Oral administration of all the three doses (4.0, 4.5 and 5.0 mg/kg body weight) of Fenbendazole significantly decreased the fecal egg count from 3rd day onward of first treatment and continued till the 21st day of treatment (Table 5). The reduction of fecal egg counts were 66.11, 85.17 & 98.08 percent following (4.0, 4.5 and 5.0 mg/kg body weight) of Fenbendazole respectively (Table 3). More or less similar results were reported at a dose rate of 5.0 mg/kg body weight by Kennedy TJ *et al*., (1975); P. Sharma *et al*., (2014); S.R. Tramboo *et al*., (2017). On the other hand, Sharma *et al*., (2015) reported 70.87% on 14th day; Islam *et al*., (2015) reported 93.93% efficacy of fenbendazole against gastrointestinal nematodes in sheep and goats. But Godara *et al*., (2011) reported only 23.66% efficacy of fenbendazole against gastrointestinal nematodes in Jamnapari goats in India.

Table 3: Effect of Single Oral Administration of Fenbendazole (Fenazole Vet Tablet) Against Gastrointestinal Nematodes in Goats:

l	Dose mg/kg body weight	Time of feces collection (day) 1st	3rd	7th	14th	21st	Maximum rate of reduction
A	Control	2469 ±62.0	2470 ±78.4	2485 ±69.7	2489 ±45.7	2514* ±39.4	-
D	4.0	1989 ±70.6	874** ±31.7	733** ±45.9	721** ±28.6	674** ±43.7	66.11%
	4.5	1868 ±50.6	521** ±37.1	460** ±36.6	353** ±38.6	277** ±50.6	85.17%
	5.0	2139 ±77.3	361** ±38.7	149** ±35.3	86** ±11.5	41** ±15.7	98.08%

Values given above represent the mean ±SE of 5 goats. * Significant decrease (P<0.05), ** Significant decrease (P<0.01).

3.4. Ivermectin (A-Mectin vet)

Sub-cutaneous injection of all the 3 doses (0.10, 0.15 and 0.20 mg/kg body weight) of Ivermectin (A-Mectin Vet) significantly decreased the fecal egg count from 3rd day onward of first treatment and continued till the 21st day of treatment (Table 4). The reduction of fecal egg counts was 63.11, 81.03 and 99.16 percent following (0.1, 0.15 and 0.2 mg/kg body weight) of Ivermectin respectively (Table 4). Ali *et al*., (1997) reported 97.02%; Ram *et al*., (2007) reported 96%; Godara *et al*., (2011) reported 98.11%; Byaruhanga *et al*., (2013) reported 98%; Sharma *et al*., (2015) reported 100%; Teklemariam *et al*., (2016) reported 99%; S. K. Tramboo *et al*., (2017) reported 98.80% efficacy of ivermectin against gastrointestinal nematodes in sheep and goats.

Table 4: Effect of Single Sub-Cutaneous Administration of Ivermectin (A-Mectin Vet) Against Gastrointestinal Nematodes in Goats

Group of animals	Dose mg/kg body weight	Time of feces collection (day) 1st	3rd	7th	14th	21st	Maximum rate of reduction
A	Control	2469 ±62.0	2470 ±78.4	2485 ±69.7	2489 ±45.7	2514* ±39.4	-
E	0.10	1884 ±63.9	957** ±60.0	792** ±78.0	734** ±34.4	696** ±31.0	63.11%
	0.15	1924 ±97.6	614** ±67.9	519** ±29.3	403** ±40.5	365** ±53.0	81.03%
	0.2	2264 ±131.0	293** ±64.3	112** ±17.1	42** ±13.5	19** ±6.2	99.16%

Values given above represent the mean ±SE of 5 goats. * Significant decrease (P<0.05), ** Significant decrease (P<0.01).

3.5. Comparative efficacy of four anthelmintics

Among the three doses of Levamisole (6.5, 7.0 & 7.5 mg/kg body weight), Albendazole (6.5, 7.0 & 7.5 mg/kg body weight), Fenbendazole (4.4, 4.5 & 5.0 mg/kg body weight) & Ivermectin (0.1, 0.15 & 0.2 mg/kg body weight), the most effective dosage of Levamisole is 7.5 mg/kg body weight, that of Albendazole is 7.5 mg/kg body weight, that of Fenbendazole is 5 mg/kg body weight and that of Ivermectin is 0.2 mg/kg body weight (Table 1, 2, 3 & 4).

It is evident that levamisole, albendazole, fenbendazole and ivermectin reduced the fecal egg count up to 95.38, 97.13, 98.08 & 99.16 percent respectively in goats (Table 5). Among four anthelmintics, ivermectin was the most effective (Fecal egg count reduction was 99.16 %) and levamisole was the least effective (Fecal egg count reduction was 95.38 %).

Table 5: Comparative Efficacy of Oral Administration of Levamisole, Albendazole, Fenbendazole & Sub-Cutaneous Administration of Ivermectin against Gastrointestinal Nematodes in Goats

Group of animals	Name of drug	Dos mg/kg body weight	Time of feces collection (day)					Maximum rate of reduction
			1st	3rd	7th	14th	21st	
A	-	Control	2469 ±62.0	2470 ±78.4	2485 ±69.7	2489 ±45.7	2514* ±39.4	-
B	Levamisole	7.5	2188 ±93.3	430** ±85.0	184** ±32.9	109** ±15.1	101** ±12.3	95.38%
C	Albendazole	7.5	2128 ±58.3	380** ±52.0	169** ±29.7	123** ±22.9	61** ±17.1	97.13%
D	Fenbendazole	5.0	2139 ±77.3	361** ±38.7	149** ±35.3	86** ±11.5	41** ±15.7	98.08%
E	Ivermectin	0.2	2264 ±131.0	293** ±64.3	112** ±17.1	42** ±13.5	19** ±6.2	99.16%

Values given above represent the mean ±SE of 5 goats. * Significant decrease (P<0.05), ** Significant decrease (P<0.01).

3. Conclusion

The study has shown that all four anthelmintics used in this study were effective to reduce the fecal egg count significantly against gastro-intestinal nematodes in goats in Holidhani, Jhenidah district. Strategies recommended to control helminths include a better use of existing drugs, use of vaccines for helminths, growth regulators, and biological control. Further studies, however, are needed to assess the efficacy status of levamisole, albendazole, fenbendazole and ivermectin in different animal species, and management systems.

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