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Anthelmintics against Ascariasis in Calves Inducing Hematological Parameters and Live Weight Indices at Sylhet Dairy Farm, Bangladesh

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ABSTRACT

Background: This study aimed to evaluate the efficacy of fenbendazole and piperazine citrate against ascariasis in naturally infected calves of Sylhet Dairy Farm, Sylhet, Bangladesh. The study included 84 calves of which 40 were naturally infected and randomly selected 20 on the basis of their weight and egg count. Twenty calves of 1-8 month old irrespective of sex infested with ascariasis were selected for this experiment and randomly divided into four equal groups (group A, B, C and D) where each group consisted of 5 calves and calves of group D were kept as control group. Two fenbendazole (7.5 mg kg^{-1} b.wt., orally) preparations (Globe Pharmaceuticals Ltd. and Techno drugs Ltd., Bangladesh) and piperazine citrate (220 mg kg^{-1} b.wt., orally) preparations (Ethical drugs Ltd., Bangladesh) were used for positive control of ascariasis as group A, B and C. Calves of group D was kept as control without giving any treatment. **Objective:** The present investigation was aimed to evaluate the effects of modern anthelmintics Fenvet® (Fenbendazole), Peraclear® (Fenbendazole) and Therazin® (Piperazine citrate) against ascariasis in calves irrespective to the species involved and their effects on the basis of EPG (eggs per gram) count, body weight of calves and hematological parameters like Total Erythrocyte Count (TEC), Hemoglobin (Hb%), Packed Cell Volume (PCV), Erythrocyte Sedimentation Rate (ESR) and Total Leukocyte Count (TLC) were also included in this investigation. **Results:** Before trials (day 0), total egg count, blood samples and initial body weight were recorded. During the study period the fecal and blood samples were collected directly from rectum on 7th, 14th, 21st and 28th day and examined using McMaster fecal egg counting method. Body weights were recorded on day 0 and day 28 following the treatments. The results of the comparative efficacies of different anthelmintic of fenbendazole were 95.50 and 95.58%, followed by piperazine citrate 97.27%, respectively. McMaster fecal egg counting method discloses the percentage of prevalence of ascariasis 35.71% (1-2 months), 24.00% (3-4 months), 21.74% (5-6 months) and 18.18% (7-8 months), respectively. After treatment with fenbendazole and piperazine citrate, Total Erythrocyte Count (TEC), Hemoglobin (Hb) content and Packed Cell Volume (PCV) were increased significantly ($p<0.01$ and $p>0.05$) in calves but Erythrocyte Sedimentation Rate (ESR) and Total Leukocyte Count (TLC) were decreased significantly ($p<0.05$ and $p>0.01$) in all treated calves and body weight was increased significantly ($p<0.01$) on day 28. The farm management practices along with results of the present study revealed the efficacy of multiple anthelmintic against gastrointestinal nematodes in calves. Additional detailed studies are required to clarify the current status of the efficacy of the anthelmintic widely used in different agro ecologies, animal species and livestock management systems in Bangladesh.

Key words: Anthelmintics, EPG, hematology, body weight, ascariasis, calves and Sylhet

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INTRODUCTION

Bangladesh is an agro-economy based developing countries of the world, where more than 80% rural people rear indigenous cattle. The livestock is an important sub-sector which is considered to be the backbone of agriculture in Bangladesh[1] and approximately 80% people depend on it directly or indirectly for their subsistence. Among the sub-sectors of agriculture, livestock is an important constituent of

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the mixed farming system practiced and this sector provides a greater contribution in Bangladesh. Among all agricultural activities, cattle farming occupy large area and play a vital role in the national economy. The contribution of agricultural sector on the gross domestic product (GDP) is 20.16%[2.] The total contribution of animal farming sector in Bangladesh to Gross Domestic Products (GDP) is approximately 3.02%[3] and livestock sector contributing about 2.67% GDP[2]. The livestock population in Bangladesh is currently estimated to comprise 26.828 million cattle, 0.544 million buffalo, 16.242 million goat and 1.221 million sheep[4] which plays an important role in the rural economy[5.] Ruminants constitute the major portion of livestock, which are used for draft purpose, meat, milk and also important for good quality leather and a source of income to farmers. The agro-ecological and geo-climatic condition of Bangladesh is favorable conditions for parasites of which the helminth parasite predominates. It depends upon directly or indirectly on several interacting factors, which include climate, weathers, management, age, hereditary and physiological state of the health of the host. Parasitism has been considered as one of the major constraints of livestock production[6]. Despite the special emphasis on the rearing ruminants, the development of the industry in Bangladesh is seriously threatened. It is thought to be one of the major constraints that hinder the development of livestock population[7]. The cattle farming are facing various constraints in Bangladesh and parasitic diseases are the most common among the problems and causes great economic loss to dairy industry by way of retarded growth and low productivity[8, 9, 10, 11] throughout the world due to impacts on economy also[12] and market value of the living animals[13] with a high rate of anthelmintic resistance prevalence[14, 15] and increased susceptibility of animals to other infections[16]. The infection causes productivity losses through reduced feed intake and decreased efficiency in feed utilization due to subclinical or chronic infections that are responsible for economic losses[17]. The cattle kept at high level of nutrition and in better management yet declined in their health and productivity, due to their regular infestation with gastrointestinal parasites. Asian development Bank[18] estimated that the loss of animal production due to parasitic diseases was 50% in Bangladesh. Parasitism, the problems are often neglected and overlooked as majority of the infected animals show a number of little obvious clinical signs during their productive life and their effects are gradual and chronic[19]. Among the parasitic diseases ascariasis is a serious problem in the new born calves. The calves get infection directly from the mother by both prenatal and transmammary infection and causes serious health hazards and a high percentage of calf mortality[20]. It is assumed that ascariasis is the major impediment for growth and development of cattle in Bangladesh. The use of sustainable, integrated parasite control systems, using scientifically proven non-chemical methods and limited use of drugs is being considered to ensure animal health and food safety[21]. We can prevent and control the parasitic diseases by using a routine prophylactic anthelmintics measurement. The present investigation was aimed to evaluate the effects of modern anthelmintics Fenvet® (Fenbendazole), Peraclear® (Fenbendazole) and Therazin® (Piperazine citrate) against ascariasis in calves irrespective to the species involved and their effects on the basis of EPG (eggs per gram) count, body weight of calves and hematological parameters like Total Erythrocyte Count (TEC), Hemoglobin (Hb%), Packed Cell Volume (PCV), Erythrocyte Sedimentation Rate (ESR) and Total Leukocyte Count (TLC) were also included in this investigation.

MATERIALS AND METHODS

Study placement and duration: The experiment was conducted in the Department of Physiology and Pharmacology, Faculty of Veterinary and Animal Science, Sylhet Agricultural University and Government Dairy Farm, Sylhet was selected for this study. The research was carried out during the period of September to December, 2010.

Allotment of trial: The following procedures were adopted for performing the experiment. The study included 84 calves of which 40 were infected and randomly selected 20 on the basis of their weight and egg count. Twenty calves of 1-8 months old are selected within the randomly sampling calves which were severely infected with ascariasis irrespective of the species of parasites involved. These twenty calves were randomly divided into four groups each comprising of five calves and marked as A, B, C and D. Calves of group A were treated with Fenvet® (Fenbendazole 250 mg, Globe Pharmaceuticals Ltd., Bangladesh) orally at the dose rate of 7.5 mg kg^{-1} b.wt., group B were treated with Peraclear® (Fenbendazole 250 mg, Techno drugs Ltd., Bangladesh) orally at the dose rate of

7.5 mg kg^{-1} b.wt., group C were treated with Therazin® (Piperazine citrate 100 g, Ethical drugs Ltd., Bangladesh) orally at the dose rate of 220 mg kg^{-1} b.wt. and calves of group D served as untreated control.

EPG (eggs per gram) count: Weekly EPG (eggs per gram) count was done on day 7th, 14th, 21st, 28th post treatment by McMaster egg counting technique. McMaster fecal egg count method described by[22] was used.

Hematological studies: Blood samples were collected from each calf and after prescribing a proper identification tag it and were immediately brought to the Physiology and Pharmacology Laboratory, Sylhet, Bangladesh for fecal examination. For the hematological examination, blood was collected with sterile syringe and needle maintaining aseptic condition, 5 mL of blood sample was collected from jugular vein of each calf and kept in vials containing anticoagulant (sodium-EDTA) and this was done on day of 0, 7th, 14th, 21st and 28th during experimental period. The hematological parameters were examined in the laboratory of the Department of Physiology and Pharmacology, Sylhet, Bangladesh. The body weights of all experimental cattle were taken on day "0" and 28th day of experiment. The body weight of each cattle was measured as per method cited by[23]. Body weight = Length × $(Girth)^2/300\times2.2$ kg Here; Length = Length from the point of shoulder to the buttock in inches. Girth was also measured in inches at the point of xiphoid cartilage. All the calves of treated and control groups were closely observed for 28 days after treatment. The fecal samples were collected from the treated and control groups of calves on 7th, 14th, 21st and 28th day of treatment to investigate the fecal egg count. The blood samples were collected from the treated and untreated control groups on the day '28' of treatment and hematological parameters TEC, Hb, PCV, ESR and TLC were determined as per method by[24].

Statistical analysis: All the data were statistically analyzed by the computer using statistical package programmed MSTAT-C developed by[25] and following the standard methods by[26] and student "T" test[27]. The eggs of parasites were identified on the basis of morphological characteristics as described by[28] and then counted. The percentage of reduction of EPG (eggs per gram) was calculated as N1-N2/N1×100; N1 = Number at day "0"; N2 = Number on next counting day. The body weight, hematological parameters and total egg count of ascariasis were recorded prior to administration of drugs.

RESULTS AND DISCUSSION

Effects of fenbendazole and piperazine citrate on egg count EPG (eggs per gram) in calves: The results of the effects of fenbendazole and piperazine citrate based on fecal egg counts reduction on naturally infested calves are presented in Table 1. In the treatment group A were treated with Fenvet® (Fenbendazole 250 mg, Globe Pharmaceuticals Ltd., Bangladesh) orally at the dose rate of 7.5 mg kg^{-1} b.wt. The mean EPG (eggs per gram) count before treatment 800.00±70.71 and after treatment mean EPG (eggs per gram) on 7th, 14th, 21st and 28th day were 384.00±33.25, 190.00±16.04, 116.00±8.86 and 36.00±44.30, respectively. The rate of reduction of mean EPG (eggs per gram) on 7th, 14th, 21st and 28th day after treatment were 52.00, 76.25, 85.50 and 95.50%, respectively. These findings are in agreement with the earlier workers. Gautam *et al*.[29]found that fenbendazole at the dose rate of 7.5 mg kg^{-1} b.wt. and 10 mg kg^{-1} b.wt., on calves found 100% effective

Table 1: Effects of fenbendazole and piperazine citrate on egg count EPG (eggs per gram) against ascariasis in calves

Groups and treatment	Pre-treatment 0 (day)	Post-treatment 7 (day)		14 (day)		21 (day)		28 (day)	
	Mean±SE	Mean±SE	%	Mean±SE	%	Mean±SE	%	Mean±SE	%
G_A Fenvet®	800.00±70.71	384.00±33.25**	52.00	190.00±16.04**	76.25	116.00±8.86**	85.50	36.00±44.30**	95.50
G_B Peraclear®	770.00±51.47	367.00±23.85**	52.34	185.00±6.52**	75.97	121.00±6.78**	84.29	34.00±2.21**	95.58
G_C Therazin®	824.00±2.21	418.00±25.38**	49.27	224.00±12.08**	72.82	117.00±3.74**	85.80	39.00±0.24**	97.27
G_D Control group	746.00±20.39	772.00±20.83**	3.37	800.00±18.17**	6.75	812.00±18.28**	8.13	826.00±18.60**	10.72

**: Significant at 1% level ($p<0.01$), values are Mean±SE

at both doses levels. Prasad[30] stated that fenbendazole at the dose rate of 10 mg kg^{-1} b.wt., on calves were found 96, 98 and 100% effective, respectively. Haque[31] showed that fenbendazole at the dose rate of 7.5 mg kg^{-1} b.wt., was 100% effective against gastrointestinal nematodes in naturally parasitized calves in Bangladesh. Miller *et al*.[32] showed that fenbendazole at the dose rate of 5 mg kg^{-1} b.wt., has reduction 100% egg count in parasitized calves. Thejeomoorthy *et al*.[33] recorded that fenbendazole at the dose rate of 5 mg kg^{-1} b.wt., was 100% effective as tablet and 97.9% as a drench. Maqbool *et al*.[34] reported that fenbendazole at the dose rate of 7.5 mg kg^{-1} b.wt. and the rate of reduction egg count was 92.4%. Similar results have also been stated by some researchers,[35] in sheep and[36] in buffaloes. It seems that a few works was carried out previously to determine the efficacy of these anthelmintics in Bangladesh. It occurred due to the potency of different anthelmintic against gastrointestinal nematodiasis in calves.

In treatment group B were treated with Peraclear® (Fenbendazole 250 mg, Techno drugs Ltd., Bangladesh) orally at the dose rate of 7.5 $mgkg^{-1}$ b.wt. The pre-treatment mean EPG (eggs per gram) count was 770.00±51.47 and the post-treatment mean EPG (eggs per gram) count values at 7th, 14th, 21st and 28th day were 367.00±23.85, 185.00±6.52, 121.00±6.78 and 34.00±2.21, respectively. The rate of reductions were significantly increased to the extent of mean EPG (eggs per gram) on 7th, 14th, 21st and 28th day after treatment were 52.34, 75.97, 84.29 and 95.58%, respectively. The findings of the present study are more or less similar to the earlier researchers. Sinha *et al*.[37] studied that 99.68% efficacy of fenbendazole against ascariasis in calves. Bagherwal[38] examined 100% efficacy against *Toxocara vitulorum* in buffalo calves. Williams and Broussared[39] reported 100% efficacy of fenbendazole against gastrointestinal nematodes in calves. Thejeomoorthy *et al*.[33] reported 100% and 97.9% efficacy against gastrointestinal nematodes infection in calves. Maqbool *et al*.[34] showed 72-92.4% efficacy against ascariasis in buffalo calves. Quiroz-Romero and Mango-Gonzalez[40] studied 82, 98, 96 and 93% fecal egg counts reduction against gastrointestinal nematodes.

In treatment group C were treated with Therazin® (Piperazine citrate 100 gm, Ethical drugs Ltd., Bangladesh) orally at the dose rate of 220 mg kg^{-1} b.wt. The pre-treatment mean EPG (eggs per gram) count was 824.00±2.21 and the post-treatment mean EPG (eggs per gram) count values at 7th, 14th, 21st and 28th day were 418.00±25.38, 224.00±12.08, 117.00±3.74 and 39.00±0.24, respectively. The rate of reductions were significantly increased to the extent of mean EPG (eggs per gram) on 7th, 14th, 21st and 28th day after treatment were 49.27, 72.82, 85.80 and 97.27%, respectively. These results are more or less similar to the earlier researchers. Sinha *et al*.[37] studied 99.9% efficacy against ascariasis in calves. Steffan *et al*.[41] showed 99-100% efficacy against ascariasis in calves. Roberts[42] studied 42% efficacy against immature parasites in calves and 57% efficacy against mature parasites in calves. Danek *et al*.[43] recorded that piperazine citrate was 100% effective against ascarid worms in buffalo calves.

Mean body weight of untreated control group D (day 0) EPG (eggs per gram) count was 746.00±2.39 and on the EPG (eggs per gram) count values at 7th, 14th, 21st and 28th day were 772.00±20.83, 800.00±18.17, 812.00±18.28 and 826.00±18.60, respectively and the rate of EPG (eggs per gram) count was increased. The efficacies of the products were evaluated on the basis of the percentage of reduction in mean egg count compared to the mean egg count per gram of feces. A significant ($p<0.01$) reduction of EPG count was found on 7th, 14th, 21st and 28th day of treated goat of group A, B and C, respectively.

Effect of fenbendazole and piperazine citrate on hematological parameters

Total Erythrocyte Count (TEC): The effects of anthelmintics fenbendazole and piperazine citrate on TEC of calves for 28 days at 7 days interval was shown in (Table 2). The pre-treatment values of TEC (million/cu. mm of blood) were 5.94±0.07, 6.06±0.25 and 6.08±0.24 in the calves of group A, B and C, respectively. On the 28th day of the post-treatment, the mean values of TEC were increased up to 6.94±0.08, 6.84±0.04 and 6.99±0.18 in the calves of group A, B and C, respectively. The mean value of TEC in control group (group D) was 5.96±0.05 but the mean values of TEC started to decrease on 28th day and recorded as 5.70±0.12. The mean value of TEC was significantly increased ($p<0.01$ and $p>0.05$) on 28th day of the treatment of three anthelmintics. These results are more or less similar with the earlier researchers of [13, 44, 45, 46, 47, 48, 49] in calves.

Hemoglobin (Hb) concentration: The pre-treatment values of Hb (g %) were 6.58±0.17, 7.98±0.42 and

Table 2: Effects of fenbendazole and piperazine citrate on hematological parameters total erythrocyte count against ascariasis in calves

Groups and treatment	Pre-treatment 0 (day) Mean±SE	Post-treatment 7 (day) Mean±SE	%	14 (day) Mean±SE	%	21 (day) Mean±SE	%	28 (day) Mean±SE	%
G_A Fenvet®	5.94±0.07	6.30±0.16**	0.61	6.38±0.18**	0.44	6.74±0.07**	0.96	6.94±0.08**	0.46
G_B Peraclear®	6.06±0.25	6.34±0.09**	1.29	6.52±0.10**	0.89	6.68±0.17**	2.73	6.84±0.04**	2.88
G_C Therazin®	6.08±0.24	6.20±0.32**	2.59	6.64±0.11**	1.88	6.78±0.07**	1.78	6.99±0.18**	1.99
G_D Control group	5.96±0.05	5.98±0.30**	1.58	5.88±0.05**	4.67	5.82±0.04**	4.67	5.70±0.12**	8.67

**: Significant at 1% level ($p<0.01$ and $p>0.05$), values are Mean±SE

Table 3: Effects of fenbendazole and piperazine citrate on hematological parameters Hemoglobin (Hb %) against ascariasis in calves

Groups and treatment	Pre-treatment 0 (day) Mean±SE	Post-treatment 7 (day) Mean±SE	%	14 (day) Mean±SE	%	21 (day) Mean±SE	%	28 (day) Mean±SE	%
G_A Fenvet®	6.58±0.17	7.60±0.14**	6.37	7.90±0.33**	8.48	8.90±0.42**	11.49	9.70±0.04**	5.69
G_B Peraclear®	7.98±0.42	8.40±0.40**	6.79	8.80±0.41**	2.89	9.10±0.43**	14.87	9.56±0.29**	21.99
G_C Therazin®	8.30±0.46	8.60±0.48**	4.87	9.00±0.52**	5.78	9.20±0.48**	2.98	9.98±0.52**	3.89
G_D Control group	7.90±0.48	7.70±0.51**	-4.55	7.40±0.49**	4.53	7.20±0.43**	-9.56	7.00±0.47**	-6.78

**: Significant at 1% level ($p<0.01$ and $p>0.05$), values are Mean±SE

Table 4: Effects of fenbendazole and piperazine citrate on hematological parameters packed cell volume against ascariasis in calves

Groups and treatment	Pre-treatment 0 (day) Mean±SE	Post-treatment 7 (day) Mean±SE	%	14 (day) Mean±SE	%	21 (day) Mean±SE	%	28 (day) Mean±SE	%
G_A Fenvet®	32.00±0.70	32.50±0.50**	3.46	32.90±0.53**	3.68	33.10±0.43**	3.69	33.90±0.43**	5.67
G_B Peraclear®	32.40±0.58	32.70±0.49**	2.49	33.20±0.34**	2.99	33.60±0.48**	2.78	33.90±0.43**	4.79
G_C Therazin®	32.80±0.40	33.10±0.43**	3.49	33.60±0.43**	3.87	34.20±0.37**	3.99	34.70±0.37**	7.09
G_D Control group	34.20±0.37	34.00±0.32**	1.07	34.00±0.32**	1.89	34.00±0.32**	1.88	33.90±0.43**	2.35

**: Significant at 1% level ($p<0.01$ and $p>0.05$), values are Mean±SE

8.30±0.46 in the calves of group A, B and C, respectively was shown in (Table 3). On the 28th day of the post-treatment, the mean values of Hb (g %) were increased up to 9.70±0.04, 9.56±0.29 and 9.98±0.52 n the calves of group A, B and C, respectively. The mean value of Hb (g %) in control group (group D) was 7.90±0.48 but the mean values of Hb (g %) started to increase on 28th day and recorded as 7.00±0.47. The mean value of Hb (g %) was significantly increased ($p<0.01$ and $p>0.05$) on 28th day of three anthelmintics treatment. Similar results have also been stated with the earlier researchers of [44, 45, 46, 48, 50, 51] in calves.

Packed Cell Volume (PCV): The pre-treatment values of PCV were 32.00±0.70, 32.40±0.58 and 32.80±0.40 in the calves of group A, B and C, respectively was shown in (Table 4). On the 28th day of the post-treatment, the mean values of PCV were increased up to 33.90±0.43, 33.90±0.43 and 34.70±0.37 in the calves of group A, B and C, respectively. The mean value of PCV in control group (group D) was 34.20±0.37 but the mean values of PCV started to increase on 28th day and recorded as 33.90±0.43. The mean value of PCV was significantly increased ($p<0.01$ and $p>0.05$) on

Table 5: Effects of fenbendazole and piperazine citrate on hematological parameters erythrocyte sedimentation rate (mm h-1) against ascariasis in calves

Groups and treatment	Pre-treatment 0 (day)	Post-treatment 7 (day)		14 (day)		21 (day)		28 (day)	
	Mean±SE	Mean±SE	%	Mean±SE	%	Mean±SE	%	Mean±SE	%
G_A Fenvet®	0.08±0.02	0.06±0.02*	57.84	0.04±0.024*	87.43	0.02±0.02*	95.43	0.01±0.01*	94.47
G_B Peraclear®)	0.12±0.04	0.08±0.02*	57.31	0.06±0.024*	89.35	0.04±0.02*	87.88	0.02±0.02*	95.43
G_C Therazin®	0.06±0.024	0.06±0.02*	64.53	0.04±0.02*	88.87	0.02±0.02*	95.43	0.01±0.010*	97.94
G_D Control group	0.06±0.02	0.08±0.020*	46.66	0.10±0.00*	67.09	0.14±0.02*	84.07	0.18±0.02*	87.54

*: Significant at 5% level ($p<0.05$ and $p>0.01$), values are Mean±SE

Table 6: Effects of fenbendazole and piperazine citrate on hematological parameters total leukocyte count against ascariasis in calves

Groups and treatment	Pre-treatment 0 (day)	Post-treatment 7 (day)		14 (day)		21 (day)		28 (day)	
	Mean±SE	Mean±SE	%	Mean±SE	%	Mean±SE	%	Mean±SE	%
G_A Fenvet®	7.86±0.11	7.83±0.20*	0.49	7.79±0.22*	0.65	7.60±0.23*	0.67	7.57±0.21*	0.87
G_B Peraclear®	7.86±0.07	7.83±0.20*	4.59	7.68±0.33*	2.79	7.60±0.23*	3.12	7.56±0.20*	3.45
G_C Therazin®	7.98±0.07	7.90±0.07*	1.78	7.80±0.12*	0.56	7.59±0.23*	0.35	7.55±0.15*	0.17
G_D Control group	7.80±0.10	7.90±0.07*	0.49	7.98±0.07*	0.73	8.04±0.05*	0.79	8.08±0.86*	1.25

*: Significant at 5% level ($p<0.05$ and $p>0.01$), values are Mean±SE

28th day of three anthelmintics treatment. These results have are more or less similar with the report of[44] declined PCV value was observed in control group. Similar results have also been stated by the earlier workers of [44, 45, 46, 50, 52] in calves.

Erythrocyte Sedimentation Rate (ESR): The initial control values of ESR (mm h^{-1}) were 0.08±0.02, 0.12±0.04 and 0.06±0.024 in the calves of group A, B and C, respectively was shown in (Table 5). On the 28th day of the post-treatment, the mean values of ESR (mm h^{-1}) were increased up to 0.01±0.01, 0.02±0.02 and 0.01±0.010 in the calves of group A, B and C, respectively. The mean value of ESR (mm h^{-1}) in control group (group D) was 0.06±0.02 but the mean values of ESR (mm h^{-1}) started to increase on 28th day and recorded as 0.18±0.02. The mean value of ESR (mm h^{-1}) was significantly decreased ($p<0.05$ and $p>0.01$) on 28th days of treatment. This result is similar to the reports of [45, 47, 52, 53] in calves.

Total Leukocyte Count (TLC): The pre-treatment values of TLC were 7.86±0.11, 7.86±0.07 and 7.98±0.07 in the calves of group A, B and C, respectively was shown in (Table 6). On the 28th day of the post-treatment, the mean values of TLC were increased up to 7.57±0.21, 7.56±0.20 and 7.55±0.15 in the calves of group A, B and C, respectively. The mean value of TLC in control group (group D) was 7.80±0.10 but the mean values of TLC started to increase on 28th day and recorded as 8.08±0.86. The mean value of TLC was significantly decreased ($p<0.05$ and $p>0.01$) on 28th days of treatment. These present findings in agreement of the works with [45, 46, 50, 54, 55, 56] in calves.

Effects of fenbendazole and piperazine citrate on body weight: The mean initial body weight on day '0' of calves in group A, B and C were 42.20±2.46, 42.60±3.50 and 41.80±3.26 kg, respectively was shown in (Table 7). On the 28th day of the post-treatment, the mean values of body weight were increased up to 43.30±1.79, 43.60±1.03 and 44.80±3.26 in the calves of group A, B and C, respectively. The body weight increased significantly ($p<0.01$) after treatments in group A, B and C. The body weight was increased and this may be due to removal of parasitic load, proper

Table 7: Effects of fenbendazole and piperazine citrate on body weight (kg) gain/loss against ascariasis in calves in various treatment days

	Pretreatment (day 0)	Post-treatment (day 28)			
Groups and Treatment	Body weight (kg)	Body weight (kg)	Change (%)	Improvement (%)	Live weight gain/loss (kg)
G_A Fenvet®	42.20±2.46	43.30±1.79**	3.02	+1.1	+2.5
G_B Peraclear®	42.60±3.50	43.60±1.03**	2.93	+1	+2.3
G_C Therazin®	41.80±3.26	44.80±3.26**	1.44	+1	+2.3
G_D Control group	39.60±2.06	38.60±1.50**	-0.90	-1	-2.5

**: Significant at 1% level ($p<0.01$ and $p>0.05$)

absorption and metabolism of nutrient in the parasite free gastrointestinal tract. The body weight gains in the ivermectin, levamisole and albendazole treated goat are supported by[57] in heifers. On the other hand, the body weight significantly decreased in untreated control group due to overload of parasites within the body of calves. The improvement percentage in calves of group A, B and C after 28th day was 2.5, 2.3 and 2.3%, respectively. It may be concluded that the post-treatment improvement of body weight in calves due to better utilization of food. The body weight almost similar to their pre-treatment values. In the control group (group D) body weight was reduces to the extent of -0.90% after 28th day (Table 3). Some workers found earlier improvement in body weight after treatment with anthelmintics[58, 59, 60, 61, 62, 63, 64].

During the study of hematological parameters it was found that after treatment with Fenvet® (Fenbendazole), Peraclear® (Fenbendazole) and Therazin® (Piperazine citrate) TEC, Hb and PCV were significantly ($p<0.01$ and $p>0.05$) increased and on the other hand, ESR and TLC was significantly ($p<0.05$ and $p>0.01$) decreased in treated groups (Table 2). The mean value of Hb, PCV and TEC were decreased and ESR, TLC values were increased in untreated naturally parasitized control group. This study indicated that Therazin® (Piperazine citrate) is a more effective drug against ascariasis in calves than that of Fenvet® (Fenbendazole), Peraclear® (Fenbendazole).

CONCLUSION

The findings of the present study reveal that Fenvet® (Fenbendazole), Peraclear® (Fenbendazole) and Therazin® (Piperazine citrate) are highly effective for the reduction of EPG of ascariasis in calves. This study indicated that Therazin® (Piperazine citrate) are highly effective on egg count (EPG) and hematological parameters (TEC, Hb, PCV, ESR and TLC) in ascariasis in calves than that of Fenvet® (Fenbendazole) and Peraclear® (Fenbendazole) during the experiment. These three anthelmintics have wide therapeutic index and are capable of killing or inhibiting egg production of gastrointestinal nematodes. From this study, calves should be regularly monitored through faecal examination for the presence of gastrointestinal parasites in order to provide rational treatment and to make the cattle farming profitable. The findings of the present study may help the future researchers to explore the details pharmacokinetic and toxic effects, for wide therapeutic uses in Bangladesh for the treatment and control of parasitic infection in calves. Further studies are required to clarify the efficacy of the anthelmintics widely used in different agro ecologies, animal species and livestock management systems in Bangladesh. From these research findings the veterinarian may use the specific anthelmintics for ascariasis in calves. Further studies on anthelmintics pharmacokinetic and toxicity would be helpful. The approach to take further widespread study related to these infections which will help to take obligatory preventive and control measures against parasitism.

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