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Comparative effects of single and mixture of indigenous medicinal plants on gastro-intestinal nematodes and growth of calves

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Abstract

An experiment was designed to study the efficacy of three indigenous medicinal plants in single as well as mixture of them on gastro-intestinal nematode infection and growth of calves under rural situation. Twenty-five growing calves were divided into five groups (A, B, C, D & E) and randomly assigned to five anthelmintic treatments- Neem leaves, Atis leaves, Pineapple leaves, mixture of the three leaves and patent drug Albendazole, respectively. Faecal samples were examined immediately before treatment and on 7th, 14th, 21st and 28th day post-treatment. Live weight was measured prior to treatment and thereafter fortnightly until 60th day post-treatment. There were no significant differences in the efficacy (FECR %) values of the herbal anthelmintics on 7th day post-treatment, however, FECR% on 14th and 21st day post-treatment of Pineapple leaves (71.67&75.33) were significantly ($P<0.01$) higher than that of the others. In these periods of study, Neem leaves gave the second highest value (57.36&58.79) that was slightly higher than those of the mixture of leaves. On 28th day, Pineapple leaves as well as the leaf mixture gave significantly ($P<0.05$) higher values (60.45&59.08%, respectively) than those of the other leaves. All the efficacy values of individual leaves decreased after 21st day post-treatment while that of the mixture of leaves continued to increase up to 28th day. Although there were no significant differences in the mean values for the parameters, the highest live weight gain was observed in the Albendazole group and the lowest value was in the Atis group.

Keywords: Medicinal plants, GI nematode, Calves, Growth

Introduction

More than eighty per cent livestock population of Bangladesh is concentrated in the rural areas where they are being reared under mixed farming system with crop, fish and fruit production (Akbar *et al.*, 1995). In this system little care is taken for feeding, nutrition and management of these animals. Infection with parasite is an important limiting factor in livestock development in most of the tropical and subtropical countries of the world. Parasitic infection causes significant loss in production in developing countries through mortality and reduced production of milk, meat and work potential (Dorny *et al.*, 1995; Beriajaya and Stevenson, 1986). Among the parasitic diseases nematodiasis is a serious problem in the newborn calves. The calves get infection directly from their mother by both pre-natal and transmammary infection and cause serious health hazards and a high percentage of calf mortality (Solusby, 1986). There has been an increasing interest in the utilization of traditional system of medicine for promotive, preventive and curative health globally (WHO, 1993). Plants, as a traditional system of therapy, have been used from ancient times to cure diseases of humans and animals (Akhtar *et al.*, 2000). Although chemical preparation of medicine is available in the urban areas, it is expensive as well as scarce in rural areas. Even in urban areas, herbal treatments sometimes given preference over chemical medicines since it is natural, having no side effects on the physiological system like chemical treatment and it needs no cost. Moreover, in the rural areas chemical anthelmintics are not easily available and is very expensive. Therefore, present experiment was conducted to study the efficacy of different herbal anthelmintics for controlling nematode infection in calves and also their feeding effects on growth of calves in rural condition.

Materials and Methods

Selection and grouping of the experimental animals

Faeces from 53 indigenous growing calves of Digharkanda and Mashkanda villages of Mymensingh district were collected and examined for parasite egg counts in the laboratory of the Department of Parasitology, Bangladesh Agricultural University (BAU), Mymensingh. Most of the animals were having different parasites, but only 25 of them were selected for the experiment based on the severity of infection in terms of nematode egg counts of 300 and above. Live weight of the animals were also considered in the selection process. The age of the animals varied from 1 to 2 years and the live weight from 33-90 kg. They were randomly distributed in five groups (A, B, C, D & E), each group consisted of 5 animals.

Feeding pattern of animals

The animals were allowed to graze in the fallow land /homestead for part of the day ~ 6 hours and also supplied with straw-based feeds (rice straw + wheat bran). There was no significant difference among the groups in terms of feeding pattern.

Preparation of bolus with leaves for oral administration

Leaves of Neem (*Azadirachta indica*), Atis (*Annona reticulata*) and Pineapple (*Ananas comosus*) plants were collected in the morning and washed with clean water. The leaves were then freeze dried. The freeze dried leaves were then ground by using grinding machine. They were mixed with equal amount of molasses to form the bolus. The amount of powder from each plant leaves taken to make boluses was at 200 mg/kg live weight of animals (Akbar *et al.*, 2003). Albendazole was added to the bolus at 7.5 mg/kg live weight. Boluses were made with Neem, Atis and Pineapple leaves separately as well as mixture in equal proportion of these three leaves and were stored (one night) in coloured plastic pails until use.

Lay out of the animal experiment

Four groups of animals (A, B, C and D) were treated with the following herbal anthelmintics where the animals of group E were administered with synthetic drug, Albendazole (Endokill[®], ACI Ltd.). The treatments were allocated randomly to different groups of animals.

Feeding anthelmintics to the animals

The prepared boluses were fed to four different groups of calves (A, B, C and D) in the morning. Care was taken so that no wastage of the boluses occurred. Albendazole in the tablet form was bought from market and fed to calves (group E) directly at the same time.

Collection of faeces and examination for helminth eggs

Diagnosis of helminths inhabiting the digestive tract was made by the examination of faeces, because the helminths of this tract produce ova which are present in the faeces. The faecal samples were examined in the laboratory of the Department of Parasitology, BAU, Mymensingh. About 10-15 g faecal samples were obtained directly from the rectum and each sample was then placed in a separate plastic bag, packed and immediately transferred to the laboratory for helminth egg counts. Samples were collected in the morning for evaluation of pre and post-treatment load for worm ova. Firstly the faecal samples were examined for qualitative purpose by direct smear method and if the samples were positive then quantitative determination of helminths ova were made by McMaster method as described by Rahman *et al.* (1996). Efficacy of different treatments was determined by faecal egg count reduction test using the formula mentioned by Rahman *et al.* (1996).

Recording of live weight of animals

Pre-treatment live weight of each calf of all groups was taken at the beginning of the experiment and thereafter every fortnight interval till 60th day of the experiment. The weights were taken with the help of weigh band by applying 5 kg tension in the morning before feeding.

Statistical analysis

The experimental data were analyzed using "MSTAT" statistical programme to compute analysis of variance and treatment means for each parameter and were compared using least significant difference (LSD) test. Data related to growth of calves were adjusted for initial live weight. Data related to faecal egg counts were analyzed to compute analysis of variance for Completely Randomized Design (CRD).

Results and Discussion

Prevalence of gastro-intestinal nematodes in calves

Out of the total 53 randomly selected calves, 41 (77.35%) were found to be infected with gastro-intestinal nematodes (Table 1) as detected by faecal sample examination. This finding was supported by Brouchet *et al.*, (1969) cited by Hossain (1998), who found the values at 76.4%. Asaduzzaman (1998) reported even higher value (85.5%) than that of the present study. It can be seen from the table that, the highest prevalence rate (45.28%) occurred by *Strongyles*. Out of 53 animals 24 animals were affected by this type of parasite. The second position was occupied by *Strongyloides* spp. (9.43%). This was followed by mixed infection (7.55%). *Trichuris* spp. and *Bunostomum* spp. combinedly placed 4th position. The lowest infection was occurred by *Capillaria* spp.

Table 1. Prevalence of gastro-intestinal nematodes in 53 calves under study and their proportional prevalence rate

Types of nematodes	No. of animals affected*	Prevalence (%)
Strongyles	24	45.28
<i>Strongyloides</i> spp.	5	9.43
<i>Trichuris</i> spp.	3	5.66
<i>Capillaria</i> spp.	2	3.77
<i>Bunostomum</i> spp.	3	5.66
Mixed infection	4	7.55
Total	41	77.35

*Total number of animal under study=53

Effect of anthelmintics on egg counts (EPG) of nematodes in animal faeces

Number of eggs per gram of faeces (EPG) of the animals treated with different herbal anthelmintics is shown in Table 2. All the animals fed leaves showed reduced egg counts right from the 7th day post-treatment and continued up to 21st day and thereafter egg counts was slightly increased. In terms of statistical difference among the results of the treatments, it was also observed from Table 2 that on 7th day of post-treatment no significant difference was observed among the herbal treatment groups. On days 14 and 21, the values of egg counts for the Pineapple leaves group were significantly ($P < 0.01$) lower than those of the others. However, on the day 28 post-treatment, the egg count values of Atis leaves was significantly ($P < 0.05$) higher than those of the Pineapple and the group having mixture of leaves. The overall observation of the trend of action of individual herbal anthelmintics in the present study indicated that it continued to decrease egg count up to 21st day post-

treatment and thereafter it increased egg count. This trend of change in the egg counts due to treatment with herbal anthelmintics was also reported by Rahman (2005) who observed that the egg counts decreased up to 21st day post-treatment and then increased. However, it is noticeably interesting that the mixture of these leaves showed different results as regards to its effects on nematode egg counts. There was a progressive increase in the reduction of egg counts that started right from day 7 and continued up to 28th day post-treatment. This effect of mixture of herbal anthelmintics has an important bearing on the reduction of nematode egg burden in cattle as because its action on the GI nematode remained effective for longer duration than that of the individual plants. The reason for such an interesting result might be that there was possibly a combined effect of active principles of the three herbal anthelmintics which might have sustained for longer duration than that of the individual leaves. It can be mentioned here that the chemical drug Albendazole resulted in zero egg count, clearly showing its full action which was continued up to 28th day post-treatment.

Table 2. Egg counts of faeces (EPG) of the animals treated with Neem leaves, Atis leaves, Pineapple leaves and mixture of three leaves against gastro-intestinal nematodiasis in calves

Parameter	Dietary groups [#]				SED	Level of significance
	A	B	C	D		
Pre-treatment egg (EPG)	480	500	490	510	38.86	NS
EPG at different periods:						
7th day	230	250	180	230	35.94	NS
14th day	200 ^a	230 ^a	130 ^b	220 ^a	19.90	**
21st day	190 ^a	220 ^a	110 ^b	210 ^a	21.16	**
28th day	230 ^{ab}	270 ^a	190 ^b	200 ^b	23.94	*

^{a,b}Mean values having different superscripts in a row differed significantly ($P < 0.01$) & ($P < 0.05$)

A: Treated with Neem leaves

B: Treated with Atis leaves

C: Treated with Pineapple leaves

D: Treated with mixture of the three leaves

E (Albendazole) was not considered in the table as it reduced EPG from 490 to 0 throughout the study period

NS = Not significant

*, Significant at 0.05

**, Significant at 0.01

Efficacy of different treatments against nematode infection

There was no significant differences in terms of faecal egg count reduction percentage (FECR %) in calves at day 7 (Table 3) but significant ($p < 0.01$, $p < 0.05$) differences were observed in case of days 14, 21 and 28 post-treatment. The highest FECR% was observed in case of Pineapple leaves (75.33) followed by Neem leaves (58.79), mixture of the leaves (57.36) and Atis leaves (55.89) at day 21 which was supported by Akbar *et al.*, (2003) who found higher FECR% in Pineapple leaves than that of Neem leaves. It was reported that the Pineapple leaves had a proteolytic enzyme- bromelain which might have resulted in higher efficacy value through its detrimental effects on the nematodes. Mostofa (1983) stated that the Pineapple leaves had a medium spectrum of anthelmintic efficacy against gastro-intestinal nematodiasis in cattle. Rahman (2005) observed 62.0% FECR of Neem leaves in case of goat which was similar to the present study. However, on the 28th day post-treatment, the results were different. The efficacy values of all the individual leaves were decreased, but interestingly that of mixture of leaves increased (59.08%). The FECR% of Albendazole remained 100% throughout the study period which was supported by earlier report (Sharma, 1992). The trend of mixture of the leaves was progressively and steadily increased up to the end of the study period.

Table 3. Faecal egg count reduction percentage (FECR %) or efficacy of three herbal anthelmintics and mixture of them in treated calves

Treatment group	Dewormer used	Pre-treatment EPG	FECR (%) at post-treatment (day)			
			7	14	21	28
A	Neem leaves	480	51.43	57.36 ^a	58.79 ^a	49.29 ^{ab}
B	Atis leaves	500	49.89	53.89 ^a	55.89 ^a	45.78 ^b
C	Pineapple leaves	490	62.45	71.67 ^b	75.33 ^b	60.45 ^a
D	Mixture of three leaves (Neem +Atis + Pineapple)	510	54.86	56.11 ^a	57.36 ^a	59.08 ^a
SED		38.86	6.23	3.58	4.16	5.59
Level of significance		NS	NS	**	**	*

^{a,b}Mean values having different superscripts in a column differed significantly ($P < 0.01$) & ($P < 0.05$)

A: Treated with Neem leaves B: Treated with Atis leaves

C: Treated with Pineapple leaves D: Treated with mixture of the three leaves

Group E (Albendazole) was not included in the table because it showed 100% FECR throughout the study period

NS = Not significant

Effects of anthelmintic treatments on live weight gain

The pre-treatment average live weight of calves in group A, B, C, D and E were similar (59.6 to 62.2 kg). Live weight of all calves in the treated groups increased when the post-treatment live weights were compared with the pre-treatment live weights of the respective group (Table 4). When live weight increase was divided into fortnight basis, it was also found that the differences among the treatments were not significant ($P > 0.01$). Although there was significant differences among the treated groups, the average live weight gain (kg/d) was the highest with Albendazole (0.173) followed by Pineapple leaves (0.163), the mixture of leaves (0.160) and then Neem leaves group (0.157), while Atis leaves group gave the lowest value (0.147). Motalib and Alam (1983) found a mean weight gain of 0.190 kg/d in the treated calves which were slightly higher than the result of the present study (0.173 kg).

Table 4. Effect of anthelmintic treatments on live weight (kg)

Parameter	Dietary groups [#]					SED	Level of significance
	A	B	C	D	E		
Pre-treatment live weight (kg)	62.2	59.6	61.8	60.2	59.8	3.04	NS
Post-treatment live weight (kg)	71.6	68.4	71.6	69.8	70.2	2.93	NS
Total live weight gain (kg)	9.4	8.8	9.8	9.6	10.4	0.48	NS
Live weight change at different periods (kg/d)							
Day 1-15	2.4	2.2	2.6	2.4	2.8	0.34	NS
Day 16-30	2.6	2.2	2.6	2.6	2.8	0.24	NS
Day 31-45	2.4	2.2	2.4	2.4	2.8	0.33	NS
Day 46-60	2.0	2.0	2.2	2.2	2.2	0.15	NS
Daily live weight gain (kg/d)	0.157	0.147	0.163	0.160	0.173	0.01	NS

#A= Treated with Neem leaves

B= Treated with Atis leaves

C= Treated with Pineapple leaves

D= Treated with Mixture of three leaves

E= Treated with Albendazole

NS=Not-significant

Nematode induced changes in animal body

After treatment with different anthelmintics there were mild but noticeable improvement in the appetite, dullness, weakness, rough hair coat, pale conjunctiva and pot-belly. No remarkable side effect was seen in any of the calves except Atis leaves group. There were slight loose faeces in three out of five calves when treated with Atis leaves, which went off after 2 days. No other adverse effects were seen throughout the study period.

In this study it appears that herbal plants possess anthelmintic activity although the mode of action on the helminths in the gastro-intestinal tract was not studied. The effectiveness of herbal plants was judged only by the decrease in eggs per gram of faeces (EPG) and body weight gain of calves. No significant side effects were observed. It needs no cost while chemical anthelmintics need Tk. 10.5 for one dose for a calf and Tk. 22.0 for adult cattle. From this observation it could be said that the herbal anthelmintics were effective in reducing nematode parasite burden and are safe to feed to the calves. It may be concluded from the above study that the herbal anthelmintics such as Neem leaves, Atis leaves, Pineapple leaves and mixture of these three leaves, all have positive effect in reducing the nematode parasite burden in growing calves. Among the individual leaves, Pineapple had the highest efficacy as herbal anthelmintics as well as growth of calves and those of Atis leaves had the lowest. The mixture of leaves was found to have steady but longer lasting effects on the reduction of nematode parasites. Considering the cost and availability of chemical anthelmintics, Pineapple leaves or mixture of the above leaves may be recommended for controlling GI nematode infection in calves.

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