

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.710.245>

Anthelmintic Efficacy of Polyherbal Formulation in Goats Naturally Infected with *Haemonchus contortus*

Vinayak Khanolkar*, C.G. Panchbhai, G.R. Bhojne, V.M. Dhoot and A.J. Athaley

Department of Veterinary Clinical Medicine, Ethics and Jurisprudence, Nagpur Veterinary College, Nagpur, India

*Corresponding author

ABSTRACT

The study was conducted at Department of Veterinary Clinical Medicine, Ethics and Jurisprudence. The polyherbal tablet comprising *Artimisia maritima*, *Butea frondosa*, *Vernonia anthelmintica* and *Holarrhena antidysentrica* was prepared and its anthelmintic efficacy and effect on body weight was studied on goats naturally infected with *Haemonchus contortus*. Total 140 goats were selected which were naturally infected with *Haemonchus contortus*. Out of 140 goats, 100 goats were selected as Group I (Polyherbal Treatment), 20 goats were selected as Group II (Positive control) and 20 goats were selected as Group III (Negative control), respectively. For the positive control albendazole (10 mg/kg BW) was given to the control group goats and in negative control goats maintained untreated. Group I animals were given polyherbal polymer complex anthelmintic and Group II animals were given albendazole. The faecal samples were examined on 0th day before and 3rd, 7th, 15th and 30th day post treatment. Body weights of goats under treatment were recorded on day 0 i.e. before treatment and on 15th and 30th day post treatment. There was significant reduction in Egg per Gram (EPG) count seen in Group I and Group II, whereas, the EPG count increased significantly in Group III. Increase in body weight was observed significantly in Group I and Group II whereas, there was decrease in body weight observed in Group III. Further it was concluded that the polyherbal anthelmintic tablet was effective in elimination of *Haemonchus contortus* which could be the reason for increase in body weight during the trial.

Keywords

Artimisia maritima, *Butea frondosa*, *Vernonia anthelmintica*, *Holarrhena antidysentrica*

Article Info

Accepted:
15 September 2018
Available Online:
10 October 2018

Introduction

Small ruminant rearing is an asset of livelihood for the farmers among poor and developing countries. The diseases caused by helminth parasitism especially gastrointestinal parasitism in small ruminants are one of the major health problems and productivity constraints in the tropics and subtropics. Mini *et al.*, (2013) reported that among the various

helminthes, nematodes are considered to be of utmost importance considering their prevalence and adverse effect worldwide.

Nematodes that are dependent on blood prehension such as *Haemonchus contortus* have specific clinical and subclinical symptoms and great economic losses to small ruminant farmers. Perry *et al.*, (2002) discussed that *Haemonchus contortus* is the

highly pathogenic nematode parasite capable of causing acute disease and high mortality. McKenna *et al.*, (1995), Chartier *et al.*, (2001) and Soulsby (2006) reported that haemonchosis is characterized by haemorrhagic anaemia due to the blood sucking activities of the worms in the abomasum. The morbidity is observed through anaemia and gastroenteritis resulting into loss of body weight, stunted growth, diarrhoea etc. that greatly hampers the normal growth and production of goats.

In developing countries, the expensiveness and unavailability of these drugs is a main hurdle to farmers in rural areas. Waller and Prichard (1985) discussed that the control of this parasite over the past five decades has been achieved mainly through intensive use of synthetic anthelmintic drugs. The repetitive and improper dosing of synthetic anti-parasitic products has led to the development of Anthelmintic Resistance (AR). Also, there is a problem of chemical residue and toxicity of synthetic anthelmintics. Mohammed *et al.*, (2013) reported that conventional method of controlling parasites by just using chemical dewormer is ineffective. For several reasons, this parasite is developing resistance against most of the chemical dewormers available in the market.

A need to decrease the reliance on these chemotherapeutic drugs for parasite control was discussed by Chandrawathani *et al.*, (2003) and Githiori (2004) the growing concerns about the adverse consequences on the ecosystem and biodiversity.

This menace has given impetus to the search for new drugs, with attention focusing on the search and application of plant products as alternative methods of parasite control. Alternate options like traditional medicinal plants and biological control are getting attention.

Ethno-veterinary Medicine (EVM) are becoming more relevant. Ferreira *et al.*, (2013) reported that the uses of plants with anti-parasitic properties as well as the use of traditional herbal remedies. Satpute *et al.*, (2014) reported that for many centuries, plants have been providing various remedies for several diseases. Herbal medicine has been the base of treatment in India since ages and has been demonstrated in Ayurveda, Unani and Sidha.

There are currently an increasing number of controlled experimental studies that aim to verify, validate and quantify the property of a particular plant. The development of herbal product depends upon the local botanical flora. A larger number of plants are naturally available which possess ability of treating many parasitic diseases of livestock. David (1990) reported that several medicinal plants have been investigated for their anthelmintic properties; however, scientific evidence on the anthelmintic efficacy of most plant products is limited, regardless of their wide ethno veterinary usage.

Based on the information obtained from ethno-medicinal survey and Indian traditional medicinal system, has made use of the different parts of plants in different types of diseases including anthelmintic activities. Kirthikar and Basu (1975) reported that *Butea frondosa*, popularly known as 'palas', is commonly distributed throughout India. Seeds of *B. frondosa* are reported to have anthelmintic property and largely used in treatment of round worms. Zafar *et al.*, (2006) reported that *Vernonia anthelmintica* seeds possess anthelmintic activity against nematodes. Zafar *et al.*, (2004) reported that some species of genus *Artemisia* like *Artemisia maritima* have been evaluated for their anthelmintics activity. Satpute *et al.*, (2014) reported that the stem bark of *Holarrhena antidysentrica* was also

traditionally used to treat nematode infestation in goats.

The anthelmintic drugs of plant origin are safer and affordable to resource limited small scale livestock keepers, and thus there is need to scientifically validate their use through research and will lay a foundation and set a targeted platform for ethno-pharmacological studies and development of novel anthelmintic product. Sunandhadevi *et al.*, (2017) proposed that a polyherbal anthelmintic formulation of *Butea frondosa*, *Vernonia anthelmintica*, *Artemisia maritima* and *Holarrhena antidysentrica* could have a synergistic effect among the phytochemicals of the plants used.

The present study is proposed for the evaluation of the anthelmintic efficacy of the polyherbal formulation comprising of *Artemisia maritima*, *Butea frondosa*, *Holarrhena antidysentrica* and *Vernonia anthelmintica* with pH sensitive polymer coated targeted tablet and its effect on body weight of *Haemonchus contortus* infected goats.

Materials and Methods

The formulation of dose of four herbal extracts viz. *Artemisia maritima* (75mg/ml), *Butea frondosa* (200mg/ml), *Vernonia anthelmintica* (75mg/ml) and *Holarrhena antidysentrica* (75mg/ml) was done at Department of Veterinary Medicine, Ethics and Jurisprudence; Nagpur Veterinary College Nagpur (Panchbhai, 2018) and hence the same preparation was used in the present study. The tablet formulated was pH dependent and disintegrates in an acidic pH (2-4) of abomasum.

Total 140 goats were selected on the basis of faecal sample collected and examined before treatment. Out of 140 goats, 100 goats were selected as Group I (Polyherbal Treatment),

20 goats were selected as Group II (Positive control) and 20 goats were selected as Group III (Negative control), respectively. For the positive control albendazole (10 mg/kg BW) was given to the control group goats and in negative control goats maintained untreated. Goats naturally infested with *Haemonchus contortus* were selected by examining the faecal sample by standard sedimentation and salt floatation techniques as described by Soulsby (1982). Further, positive samples were examined by Modified Stoll's dilution technique as described by Soulsby (1982) on 0 day before and 3rd, 7th, 15th and 30th day post treatment to determine the Egg per Gram of faeces (EPG). Body weights of goats under treatment were recorded on day 0 i.e. before treatment and on 15th and 30th day post treatment.

Results and Discussion

Egg per gram count

The average EPG value (Table 1) (Fig. 1) in Group I observed in goats infested with *H. contortus* on the onset of study was 1520.00± 29.54 indicating heavy parasitism in the selected goats. After administration of polyherbal tablet, the average of EPG value on 3rd day was 194.00± 13.39. Thereafter, on 7th, 15th and 30th day post treatment the EPG values recorded were nil. In Group II, the EPG values before administration of albendazole was 1580.00± 30.43. Post treatment EPG value in positive control group on 3rd day 260.00± 11.23; whereas, on 7th, 15th and 30th day post treatment the EPG values observed were nil. However, in Group III, the EPG values recorded on the onset of study was 1590.00± 29.82 and on 3rd, 7th, 15th and 30th day were 1710.00± 26.05, 1745.00± 27.60, 1790.00± 26.05 and 1805.00± 29.44, respectively. There was an increasing trend observed in the EPG values of Group III which indicate that infestation of *Haemonchus*

contortus in goats was in an ascending pattern of parasitism.

Significant ($P<0.01$) difference in the EPG values on the onset of study and after administration of polyherbal tablet on 3rd day was observed in Group I which indicated that the polyherbal tablet was effective from 3rd day itself. Thereafter, EPG values observed on 7th, 15th and till 30th day were nil indicating that there was efficient anthelmintic activity exhibited by the polyherbal tablet and no further infestation was observed for 30th day. These observations are in corroboration with Zacharias *et al.*, (2008) and Biswas *et al.*, (2017).

Similarly, in Group II, there was significant ($P<0.01$) difference in the EPG values observed after administration of albendazole on 3rd day. Further, EPG values observed after administration of albendazole on 7th, 15th and 30th day were nil.

The reduction in the average EPG values from 0 day to 3rd day was more significant ($P<0.01$) in Group I after administration of polyherbal tablet as compared to albendazole. Hence, it could be stated that polyherbal tablet was more effective than albendazole.

The average EPG count reduction in Group I after administration of polyherbal tablet on 3rd day and till 30th day was significant ($P<0.01$) as compared to Group III which showed an increasing trend in EPG count indicating persistence increasing infection of *Haemonchus contortus* in the goats in Group III.

In Group III, there was significant ($P<0.01$) difference observed in EPG values before the treatment and 3rd, 7th, 15th and 30th day post treatment, respectively. Similar observations were reported by Ameen *et al.*, (2006) in which there were steady increase in the EPG

count on 21st day onwards, whereas Biswas *et al.*, (2017) observed increase in EPG from 0 day to 28th day, respectively.

In the present study, the faecal samples were examined on 3rd, 7th, 15th and 30th day post treatment for EPG count. However, no eggs were observed from 7th day post treatment till 30th day in Group I. The results corroborated with Bora and Sharma (2011) who opined that the anthelmintic activity of *Artemisia maritima* due to its active ingredient santonin; Mali and Mehta (2008) who observed that anthelmintic activity of *Butea frondosa* is due to palasonin; Shah *et al.*, (2010) who referred that conessine is the active phyto-constituent which is responsible for anthelmintic activity of *Holarrhena antidysenterica*; Zafar *et al.*, (2006) who described Vernolic acid is the active ingredient in *Vernonia anthelmintica* exhibiting anthelmintic activity. Hence in the present study the significant anthelmintic activity of polyherbal formulation in Group I might be due to the synergistic effect of *Artemisia maritima*, *Butea frondosa*, *Holarrhena antidysenterica* and *Vernonia anthelmintica*.

Body weight

In Table 3 (Fig. 2) the average body weight observed in Group I on the onset of study was 18.73 ± 0.20 kg. The average body weights after administration of polyherbal tablet on 15th day and 30th day were 19.00 ± 0.20 kg and 19.41 ± 0.20 kg, respectively.

In Group II the average body weight before the commencement of study was 17.78 ± 0.40 kg and after administration of albendazole on 15th and 30th day were 17.93 ± 0.39 kg and 18.09 ± 0.40 kg, respectively. Whereas, in Group III the average body weight observed on the onset of study was 19.94 ± 0.31 kg and on 15th and 30th day were, 19.77 ± 0.31 kg and 19.52 ± 0.31 kg, respectively.

Table.1 Average (\pm S. E.) of Egg per Gram (EPG) before and after treatment in goats

Group	EPG					Pooled Average (Group)
	0 th day	3 rd day	7 th day	15 th day	30 th day	
Group – I (Polyherbal treatment)	1,520.00 \pm 2 9.54 ^a	194.00 \pm 13 .39 ^b	00 \pm 00.00 ^c	00 \pm 00.00 ^d	00 \pm 00.00 ^e	342.80 \pm 27.3 4 ^A
Group- II (Positive control)	1,580.00 \pm 3 0.43 ^{af}	260.00 \pm 11 .23 ^g	00 \pm 00.00 ^h	00 \pm 00.00 ⁱ	00 \pm 00.00 ^j	368.00 \pm 62.07 ^B
Group –III (Negative control)	1,590.00 \pm 2 9.82 ^{ak}	1,710.00 \pm 26.05 ^l	1,745.00 \pm 2 7.60 ^m	1,790.00 \pm 26.05 ⁿ	1,805.00 \pm 29.44 ^o	1728.00 \pm 14. 43 ^C

Critical Difference (C.D.): For Group: 1.20344
For Interval: 2.40688

Note - Small letters indicate comparison between the days (column wise) for 1% level of significance.
Capital letters indicate comparison between different treatments (row wise) for 1% level of significance.

Table.2 Analysis of variance using unequal factorial design with unequal number of observations for average Egg per Gram (EPG) before and after treatment in goats

Source	DF	SS	MSS	F (Cal)	F - 0.05	F - 0.01
SS G	2	163523862.9	81761931.4	4563.98888	3.01	4.64**
SS D	4	175894714.3	43973678.6	2454.6311	2.38	3.35**
GXD	8	38479165.71	4809895.71	268.490607	1.95	2.54**
Error	686	12289400	17914.5773			
Total	700					

Table.3 Average (\pm S. E.) of Body Weight (BW) in Kg before and after treatment in goats

Group	Body Weight (Kg)			Pooled Average(Group)
	0 th day	15 th day	30 th day	
Group – I (Polyherbal treatment)	18.73 \pm 0.20 ^a	19.00 \pm 0.20 ^b	19.41 \pm 0.20 ^c	19.05 \pm 0.12 ^A
Group- II (Positive control)	17.78 \pm 0.40 ^{ad}	17.93 \pm 0.39 ^e	18.09 \pm 0.40 ^f	17.93 \pm 0.23 ^B
Group –III (Negative control)	19.94 \pm 0.31 ^{ag}	19.77 \pm 0.31 ^h	19.52 \pm 0.31 ⁱ	19.74 \pm 0.18 ^C

Critical Difference (C.D.): For Group: 0.03152
For Interval: 0.0315

Note - Small letters indicate comparison between the days (column wise) for 1% level of significance.
Capital letters indicate comparison between different treatments (row wise) for 1% level of significance.

Table.4 Analysis of variance using unequal factorial design with Unequal number of observations for average Body Weight (BW) before and after treatment in goats

Source	DF	SS	MSS	F (Cal)	F - 0.05	F - 0.01
SS G	2	101.5081028	50.7540514	13.6337583	3.02	4.66**
SS D	2	15.77472762	7.88736381	2.11873552	3.02	4.66**
GXD	4	10.60814438	2.6520361	0.71240065	2.39	3.36**
Error	412	1533.74211	3.72267502			
Total	420					

Fig.1 Average Egg Per Gram (EPG) before and after treatment in goats

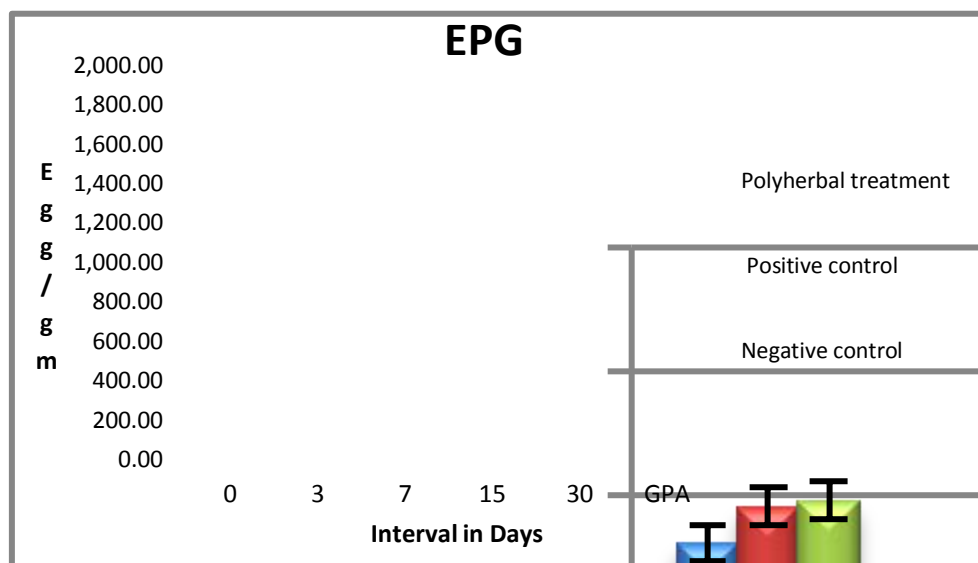


Fig.2 Average Body Weight (Kg) before and after treatment in goats

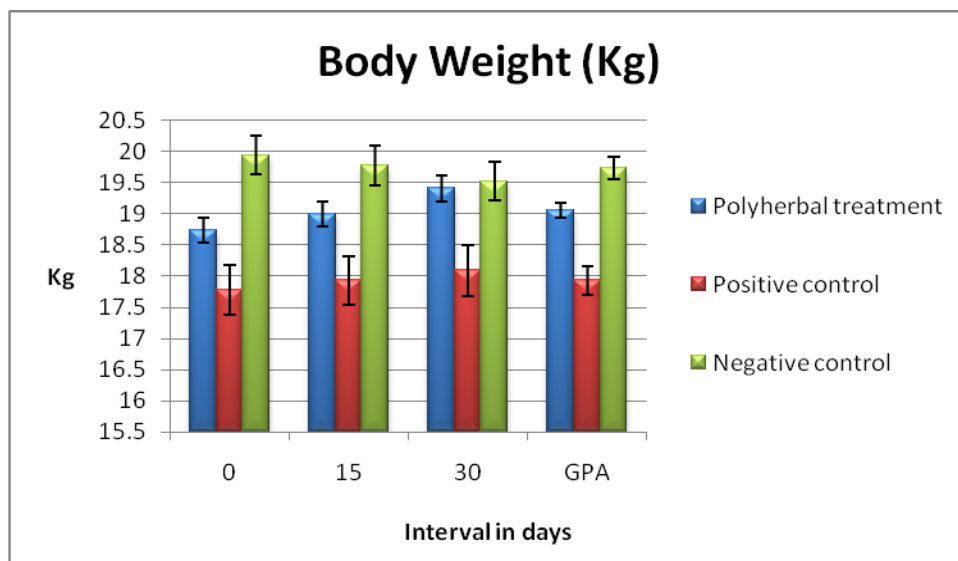


Fig.3 Rough Body coat and soiled hind quarters on the onset of trial



Fig.4 Improved body condition on 30th day of trial



Significant ($P<0.01$) difference between average body weight in Group I was observed on 0 day, 15th day and 30th day, respectively. Slight increase in body weight was observed after administration of polyherbal tablet which might be due sudden elimination of *H. contortus* larvae which are voracious blood suckers, thereby the feed utilization proportion increased and hence there was gain in the body weight observed. Similar observations were recorded by Zacharias *et al.*, (2008) in which there were weight gain observed after administration of polyherbal anthelmintic.

In Group II, significant ($P<0.01$) difference was observed in the average body weight on the onset of study and on 15th day and 30th day after administration of albendazole.

The average weight gain was more significant ($P<0.01$) in Group I on 30th day after administration of polyherbal tablet as compared to Group II and Group III.

In Group III, significant ($P<0.01$) difference was observed on the onset of study and on 15th and 30th which could be co-related with the worm infestation. The decrease in body weight could be co-related with the gradual increase in the EPG of Group III throughout the course of study. Similar results were reported by Rahman and Collins (1990) and Abakar *et al.*, (2000) in which they observed that when lambs infected with haemonchosis they lose body weight of 1.5kg to 2 kg in 30th day, respectively.

Weight gain observed in Group I on day 30th could be co-related with the reduction in EPG values on 3rd day, increase in Hb and PCV percentage and increase in serum total protein value on 15th day after administration of polyherbal tablet. Due to presence of *Haemonchus contortus* in abomasum, there was huge loss of amino acids resulting in the

damage to the mucosa which increased the level of nitrogen in the abomasum. Increased nitrogen in the abomasum might be indirectly responsible for inappetance and dehydration in goats, leading to weight loss. After administration of polyherbal tablet, the efficient elimination of *H. contortus* was observed because of the synergistic activity of the phytochemicals of four extracts of *Artemisia maritima*, *Butea frondosa*, *Holarrhena antidysentrica* and *Vernonia anthelmintica* present in the polyherbal tablet which resulted in gradual weight gain in goats.

From the study conducted, it was observed that the polyherbal anthelmintic tablet was effective in efficient elimination of *Haemonchus contortus* which might be the reason for significant weight gain in goats under trial. Further study could be done on various polyherbal anthelmintic formulation against Haemonchosis for a more potential anthelmintic activity.

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How to cite this article:

Vinayak Khanolkar, C.G. Panchbhai, G.R. Bhojne, V.M. Dhoot and Athaley, A.J. 2018. Anthelmintic Efficacy of Polyherbal Formulation in Goats Naturally Infected with *Haemonchus contortus*. *Int.J.Curr.Microbiol.App.Sci*. 7(10): 2133-2142.
doi: <https://doi.org/10.20546/ijcmas.2018.710.245>