

EFFECT OF NEEM (*Azadirachta Indica*) LEAVES AND TURMERIC (*Curcuma Longa*) POWDER ON GASTROINTESTINAL STRONGYLE PARASITISM IN GOATS

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Abstract

Gastrointestinal (GI) parasitism remains a major constraint in rural free range goat farming in Sri Lanka due to high cost and unacceptability of western medicine by the rural farmers. Therefore, this study was conducted to identify the effect of traditional veterinary treatment protocol prepared from Neem (*Azadirachta indica*) leaves and turmeric (*Curcuma longa*) dried tuber powder against GI strongyle parasitism in goats. An animal trial was conducted using 20, 3-6 months old Sri Lankan indigenous goats having natural strongyle GI strongyle parasitism. Goats were assigned to two groups; treatment group was treated with an oral paste (4 g) consisting of *Azadirachta indica* and *Curcuma longa* in 3:1 ratio, and control group was treated with albendazole (10 mg/kg body weight). Faecal egg counts (FEC) were obtained as parasitic eggs/gram of faecal matter (EPG) from each animal on days 0, 1, 2, 3, 7, 8, 9, 13, 14 and 15 by modified McMaster counting technique. Log transformed FEC ($\ln\text{FEC}=\ln(\text{FEC}+25)$) were analyzed by repeated-measures analysis of variance in MIXED procedure of SAS 9.2. Albendazole significantly lowered the FEC during day 0 to 3 compared to oral paste ($P<0.05$). However, the least-square means of FEC in treatment group (EPG:53.53±14.99) and control group (EPG:41.34±11.58) were not significant ($P>0.05$) at day 15 reflecting equal efficacy of oral paste to albendazole in controlling the GI strongyle parasitism in goats. In conclusion, the oral paste is also effective against goat GI strongyle parasitism similar to anthelmintic, albendazole. The oral paste is more suitable to control the GI strongyle parasitism at low faecal egg counts whereas albendazole can be used for severe acute cases of GI strongyle parasitism in young goats.

Keywords: Goats, Gastrointestinal strongyle parasitism, Neem, Turmeric, Tropical climate

INTRODUCTION

A total of 313,640 goats are distributed throughout Sri Lanka, and goat rearing is most popular in rural areas of dry and intermediate zone (Department of Census and Statistics, 2019). Even though the goat industry is not well developed as the chicken or beef industries in the country, goats are considered as an important livestock species in the rural economy of Sri Lanka (Devendra, 1988; Serasinghe and Marapana, 2011). Goats are mainly reared for meat purposes under smallholder

systems with minimum or no inputs (Silva *et al.*, 2009). There are many limitations in maximizing goat production and among those different constraints, gastrointestinal parasitism is a major problem. Gastrointestinal parasitism (GI) in goats can be identified as a mixed infestation under the field conditions of Sri Lanka. A higher prevalence of GI nematode infestation can be identified during the rainy season compared to the dry season. Simultaneous occurrence of coccidiosis can increase the production losses of due to GI

parasitism in goats (Faizal *et al.*, 1999; Faizal and Rajapaksha, 2001).

In the global scenario, anthelmintic are used widely in control of gastrointestinal parasitism in livestock. The high costs for anthelmintics (Kothalawala *et al.*, 2007) as well as the unacceptability of western medicine by the rural farmers, are the main reasons which limit the use of anthelmintics under the rural field conditions of Sri Lanka. Some farmers use traditional veterinary knowledge to overcome the GI parasitism in ruminants in certain areas of Sri Lanka such as the Jaffna Peninsula.

The anthelmintic properties in plant materials are identified as a remedy for anthelmintic resistance in parasites recently; especially in small ruminants (Holm *et al.*, 2014; Zanzani *et al.*, 2014; Wakayo and Dewo, 2015). Therefore, traditional veterinary knowledge can be utilized to treat GI strongyle parasitism in goats. Further, the use of traditional veterinary treatments will be a suitable option to overcome the unacceptability of western medicine for the treatment of livestock diseases by rural farmers. However, traditional knowledge related to ethnoveterinary practices is available with limited people and only a few studies have been conducted to identify the efficacy of these traditional veterinary treatment protocols. Hence, the present study was focused on traditional veterinary treatment protocol practised against gastrointestinal parasitism in ruminants in Jaffna Peninsula and the treatment protocol was obtained by direct interview of the traditional veterinary practitioner in the same area. Neem and turmeric powder are two common plants materials used in ethnoveterinary practices. Neem trees are commonly available in-home gardens in Sri Lanka due to their multipurpose benefits. Neem leaves are often used in traditional medicine in Sri Lanka and are also grown for shade. Turmeric is an essential spice in daily cooking in Sri Lanka. The readily availability of the materials can motivate

the farmers to utilize it as an anthelmintic. Therefore, this study was conducted to identify the effect of traditional veterinary treatment protocol prepared from Neem (*Azadirachta indica*) leaves and turmeric (*Curcuma longa*) powder against gastrointestinal strongyle parasitism in goats.

MATERIALS AND METHODS

Animal Selection

A total of 20 Sri Lankan non-descript local goats, naturally infected with gastrointestinal strongyle parasites were selected from a goat farm in Mallakam area of Thellipalai veterinary range at Jaffna District to identify the efficacy of traditional veterinary medicine. Goats were confirmed for gastrointestinal strongyle parasites infection using fecal egg counts where, all selected goats had an egg count higher than 500 eggs per gram (EPG) of fecal matter. None of the goats were dewormed during their lifetime. All the selected goats were at the age of three to six months with a mean body weight of 4.55 ± 0.64 kg. Goats were reared under semi-intensive management with daytime grazing and browsing in a restricted area while providing limited amount of feed to the sheds during night time.

Preparation of Traditional Veterinary Medicine

The traditional veterinary treatment for gastrointestinal strongyle parasitism mainly consisted of Neem (*Azadirachta indica*) leaves, and the oral paste was prepared according to the information collected from the traditional veterinary practitioner. Samples of Neem plant leaves were authenticated from the National Herbarium of Royal Botanical Gardens, Peradeniya. Tender Neem leaves were collected, washed with water, dried, and ground. Powder prepared from the Neem leaves were mixed with turmeric (*Curcuma longa*) powder in the ratio of 3:1. To prepare the

paste 10 mL of distilled water were added to 40 g of a mixture of Neem leaves and turmeric powder (4:1 W/V).

Animal Trial

Twenty goats included in the study were divided into two groups, and each group consisted of four males and six females. One group was treated with 4 g of oral paste prepared by Neem leaf and turmeric powder. The other group was the control group, and treated orally with albendazole, at a dose of 10 mg per kg of body weight. Fecal samples were collected directly from the rectum of each animal and faecal egg counts were obtained from each animal separately on days 0, 1, 2, 3, 7, 8, 9, 13, 14, and 15 after the treatment using the modified McMaster counting technique (Gorden and Whitlock, 1939). Fecal egg counts were expressed as eggs per gram of fecal matter (EPG).

Data Analysis

Fecal egg counts (FEC) were log-transformed ($\ln\text{FEC} = \ln(\text{FEC}+25)$) in order to normalize the FEC distribution. The log-transformed FEC were analyzed by repeated measures of analysis of variance of PROC-MIXED procedure using SAS 9.2 (SAS, 2009). The resulting least square means of $\ln\text{FEC}$ were back-transformed by $e^{\text{LSM}} - 25$ for the presentation of results.

RESULTS

Overall, the results revealed that the oral paste was equally effective as albendazole in reducing the FEC ($P>0.05$) (Table 1). At the beginning of the experiment (day 0), both treatment and control groups had a similar infection, and towards the end of the experimental period both groups showed a declining trend (Table 1). On day 15, the GI strongyle parasitic count was at a low level of 41.34 ± 11.75 in the control group and 53.53 ± 15.21 in the traditional treatment method.

There is a significant difference between treatment and time interaction on FEC ($P<0.05$) (Figure 1). During the first three experimental days, the control group had a significantly lower FEC compared to goats treated with traditional treatment protocol (Figure 1). Hence, albendazole rapidly reduced the parasitic load compared to the traditional veterinary treatment protocol.

DISCUSSION

The oral paste made from Neem leaves and turmeric powder is effective as an anthelmintic and can be used to control the GI strongyle parasitism in goats. Similar findings were reported in the literature. For example, *Azadirachta indica* has been investigated for the control of gastrointestinal nematodes of ruminants, and Radhakrishnan *et al.* (2007) has reported Neem (*Azadirachta indica*) as a potential plant material that can be used as an effective anthelmintic. According to Radhakrishnan *et al.* (2007), Neem leaves consist of 0.0244% of azadirachtin which has shown anti-larval activity of *Haemonchus contortus* L₃ larvae. Further, the recent study of Nath *et al.* (2019) has shown 66% of fecal egg count reduction in goats treated with *Curcuma longa* hydro alcoholic rhizome extract (Turmeric rhizome extract) during gastrointestinal nematode infestation. The use of both compounds together in the present study may have contributed to the observation of anthelmintic effect similar to albendazole at the latter part of the study. There is no specialized knowledge required to prepare this oral paste. Therefore, this Neem and turmeric oral paste is a cost-effective anthelmintic treatment that can be easily prepared by farmers to control GI strongyle parasitism in goats in Sri Lanka, who are reluctant to use western veterinary medicine.

Table 1: Least square means of back-transformed fecal egg counts per gram of fecal matter ± standard error (EPG±SE) during the experimental period in two goat groups; goats treated with traditional medicine and goats treated with western medicine

Days	Traditional Medicine (EPG±SE)	Western Medicine (EPG±SE)
0	845.65±95.98 ^{*,a}	996.55±113.11 ^{*,a}
1	579.52±75.80 ^{*,b}	366.76±47.97 ^{**,b}
2	347.27±64.56 ^{*,c}	143.61±26.70 ^{**,c}
3	237.56±59.37 ^{*,c,d}	104.07±26.01 ^{**,c,d}
7	166.35±34.75 ^{*,d}	129.98±27.15 ^{*,c}
8	147.63±31.24 ^{*,d,e}	124.56±26.36 ^{*,c}
9	118.53±26.54 ^{*,e,f}	76.20±17.06 ^{*,d,e}
13	85.25±20.96 ^{*,f}	56.33±13.85 ^{*,e,f}
14	52.20±14.74 ^{*,g}	46.66±13.18 ^{*,f}
15	53.53±15.21 ^{*,g}	41.34±11.75 ^{*,f}

Least square means with different symbols within a row differ significantly (P<0.05)

Least square means with different superscript letters within a column differ significantly (P<0.05)

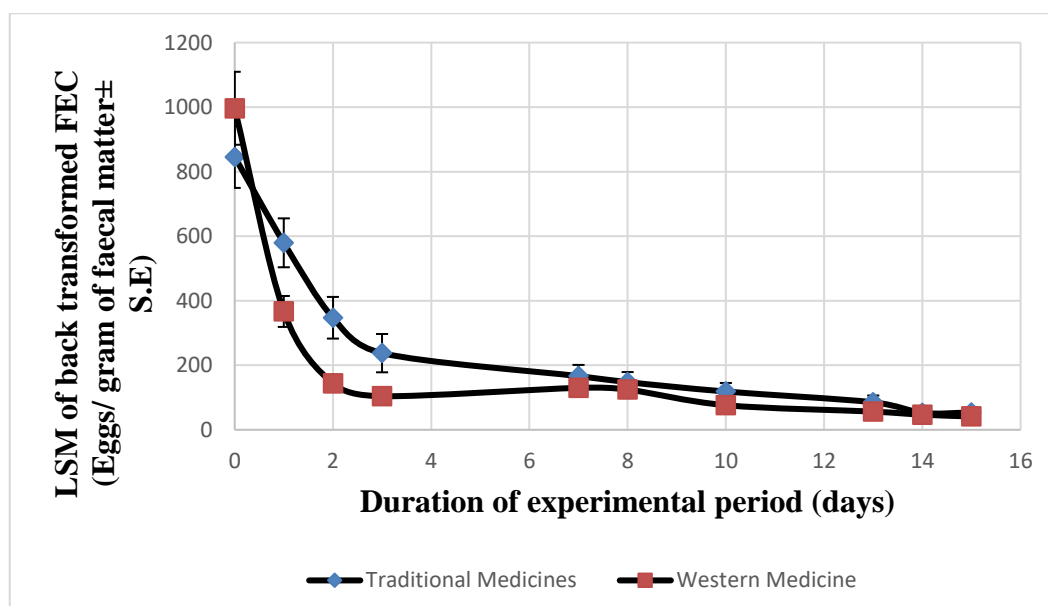


Figure 1: Trend of least square means (LSM) of back-transformed faecal egg counts per gram of faecal matter ± standard error (EPG±SE) during the experimental period in two goat groups; goats treated with traditional medicine and goats treated with western medicine

The difference in the way of FEC reduction between the two treatment groups may be due to the difference in the time taken by two different medicines to act upon the GI strongyle parasites. Albendazole act on the

GI strongyle parasites very rapidly at the initial stage of the experiment whereas traditional medicine with Neem and turmeric showed a slow response initially and then reached the same level of efficacy

as albendazole at the latter part of the experiment. The longer time taken by the oral paste to be effective against GI strongyle parasites can be due to the limitations in the availability of active compounds in the herbal preparation. Further, the indirect mode of action of herbal compounds, such as immunomodulation, requires time to exert the response of herbal medicine against the parasite (Kamaraaj *et al.*, 2010; Hoste *et al.*, 2010). Albendazole is an anthelmintic compound belonging to the chemical class of benzimidazoles which has a broad-spectrum efficacy. After oral administration, albendazole is absorbed into the bloodstream and metabolized in the liver to its sulfoxide derivative, which has also anthelmintic efficacy. The high plasma levels of albendazole sulfoxide make it effective against adult worms and immature stages in various host tissues and organs outside the GI tract (Capece *et al.*, 2008). Further, most of benzimidazoles also have an ovicidal effect (Ryan, 2018). Therefore, albendazole rapidly reduces the FEC upon treatment in goats, as seen in the initial stage of our experiment. Hence, albendazole will be more effective compared to traditional veterinary treatment when there are acute severe cases of GI strongyle parasitism in goats. The absence of negative control group in the study may lead to the argument of reducing parasitic egg counts are possible with the other uncontrolled factors in the present study such as climatic, feed etc. Since the both groups of the present study exposed to the other factors in a similar manner and observation of two different patterns in the faecal egg count reduction in two different groups suggest that the possible parasitic egg count reduction is due to the effect of albendazole or ethnoveterinary treatment. The present study has to be restricted to two groups due to the limitations in finding same age animals in similar management conditions. The inclusion of a negative control group to the study can improve the results of the present study.

Present study revealed that there is an anthelmintic effect of traditional veterinary treatment composed of Neem and turmeric administered as an oral paste. The results of the present study validate our ancient knowledge on using herbal medicines as anthelmintics and opening up new avenues for research on sustainable control of gastrointestinal nematodes.

CONCLUSIONS

The present study revealed that traditional veterinary medicine prepared from Neem (*Azadirachta indica*) and turmeric (*Curcuma longa*) in a 3:1 ratio is effective against GI strongyle parasitism in young goats aged between three to six months similar to the anthelmintic, albendazole. Further, as a primary remedy the oral paste is recommended to control the GI strongyle parasitism with less severity whereas albendazole can be used when there are severe acute cases of GI strongyle parasitism in goats. To make a recommendation extended studies are needed on the ratios of the ingredients, the dose and frequency.

Future Scope

The findings of the present study can be further strengthened by identifying the active compounds in *Azadirachta indica* and *Curcuma longa*, effective dose of active compound in *Azadirachta indica* and *Curcuma longa* against GI strongyle parasites in goats, as well as scientific assessment of these medicines for phytochemical, biological and pre-clinical and clinical studies.

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