

Effect of Feeding Tanniferous Leaf Meal Based TMR on Growth Performance and Haemonchus Control in Nellore Brown Lambs

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How to cite this paper:

Sireesha, K., Sessaiah, V., Sudhakar, K., Kumar, S., & Vinoo, R. (2021). Effect of Feeding Tanniferous Leaf Meal Based TMR on Growth Performance and Haemonchus Control in Nellore Brown Lambs. *International Journal of Livestock Research*, 11(6), 29-35.

<https://dx.doi.org/10.5455/ijlr.20200909065925>

Received : Apr 14, 2021

Accepted : May 13, 2021

Published : Jun 30, 2021

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Abstract

Anthelmintics have been used since long to combat the problem of gastrointestinal parasitism, but emergence of anthelmintic resistant strains in worm population possess a major threat to sustainable small ruminant production. In order to explore the alternates to chemical dewormers, the present research was aimed at studying the effect of feeding tanniferous leaf meal mixture (TLMM) based total mixed rations (TMR) on growth and Haemonchus control in lambs. A total of 30 Nellore brown lambs of 3-4 months age with uniform body weights (12.10 ± 0.31 kg), tested positive for Haemonchus infestation were selected and randomly divided into five groups of 6 animals each in a completely randomized design. The control groups i.e., positive control (C) and negative control (NC) were fed with TMR without TLMM and the treatment groups were fed with TMR in which part of the roughage portion was replaced with TLMM to get the CT content of the ration at 2% (T1), 3%(T2) and 4%(T3) levels for a period of 120 days. Only NC group of lambs were dewormed as per the schedule. Care was taken that all the experimental rations were isonitrogenous. The mean body weights and average daily gain (ADG) of lambs at the end of the experiment were significantly ($P<0.05$) higher in treatment groups compared to control groups and were significantly ($P<0.05$) higher in T2 group compared to other groups. The Feed conversion ratio (FCR) (kg DMI/kg gain) was significantly ($P<0.05$) low in T2 group compared to C and NC groups, while the difference was comparable among treatment groups. The faecal egg count (FEC) of Haemonchus was significantly ($P<0.05$) high in C group and were low in T2 group, while the difference was not significant among T1, T3 and NC groups. At the end of the experiment, the FEC were reduced by 66.67%, 85.85% and 71.63% in T1, T2 and T3 groups, respectively.

Keywords: Growth, Haemonchus Ova, Lambs, Tanniferous Leaf Meal, TMR

Introduction

Role of fodder tree leaves in the diet of ruminants is considered predominantly important in countries like India where small holdings and large ruminant densities result in severe problem of feed availability from conventional feed sources (Pal *et al.*, 2010). Tree leaves are a component of most natural pastures for small ruminant diets because they are rich in protein, soluble carbohydrates, minerals, vitamins and natural antioxidants (Dubey *et al.*, 2012; Pathak *et al.*, 2015). Some tropical tree leaves with bioactive compounds (tannins, saponins, essential oils, or other aromatic compounds) are usually considered as advantageous (Scalbert, 1991).

The gastro intestinal parasites, predominantly *Haemonchus species* are a serious problem to the small ruminants in this geographic area, particularly in those whose nutritional status is poor. Infestation with internal parasites causes significant production losses, ranging from 13 to 33% in grazing ruminants, which typically have reduced immunity to nematode parasites (Kaplan, 2004 and Stuedemann *et al.*, 2005). The usual mode of control of these GINS is by the use of anthelmintics. However, evolution of resistance against the most commonly used anthelmintics and public concern over drug residues excreted in milk and meat products and their potential risk as environmental contaminants has a negative impact on their use and alternative approaches for control are needed. Nutritional modulation of infected animals in order to improve the host resistance and resilience to GIN infections appears to be one of the best alternatives to control GIN infections and also to limit the dependence on conventional chemotherapy. Several research studies previously shown that CTs in tanniferous herbage exert anthelmintic effect (Singh *et al.*, 2015; Chandrawathani *et al.*, 2000 Chaichisemsari *et al.*, 2011; Hassanpour *et al.*, 2011).

Hence, the present study was planned to study the effect of dietary supplementation of tanniferous LMM through *Leucenea leucocephala*, *Ficus bengalensis* and *Psidium guajava* on body weight and *Haemonchus* control in Nellore brown lambs.

Materials and Methods

This research was carried out at Livestock Farm Complex, NTR College of Veterinary Science, Gannavaram Andhra Pradesh during the period from

Experimental Animals and Feeding

A total of 30 Nellore brown lambs aged 3-4 months with a mean live weight of 12.10 ± 0.31 kg, tested positive for *Haemonchus* infestation were selected and randomly divided into five groups of 6 animals each in a completely randomized design. Group I lambs (-ve control "NC") were fed with conventional TMR containing concentrate and roughage (ground nut straw) in the ratio of 60: 40 and dewormed using Albendazole suspension @ 10mg/kg body weight Group II lambs (+ve control "C") were fed with conventional TMR (Total mixed ration) and were not dewormed. The T1, T2 and T3 groups were fed TMR in which part of groundnut straw was replaced with dried and grounded tree leaves mixture of *L. leucocephala*, *F. Benghalensis* and *P. guajava* at 40:40:20 proportions so as to bring the condensed tannin levels to 2.0, 3.0 and 4.0 percent of diet, respectively. The ration schedule was changed every fortnight after recording the body weights of each animal to meet the nutrient requirements for growth (Kearl, 1982). All the animals were kept under uniform managemental conditions by housing them in a well-ventilated shed with facilities for uniform feeding and watering.

Growth Performance and Fecal Egg Count

The weight of the experimental lambs was recorded at fortnightly intervals in the morning before feeding and watering for four months in order to assess the change in body weight and average daily gain. Absolute rate of growth was estimated by using the following formula (Brody, 1945).

$$\text{Absolute rate of growth} = (W_2 - W_1) / (T_2 - T_1)$$

Where,

W_2 = Final body weight,

W_1 = Initial body weight, and

$T_2 - T_1$ = the time interval in days

The feed conversion ratio (kg DM intake/ kg live weight gain) was calculated for all the four groups.

Faecal samples were collected (per rectum) from experimental animals. Each sample was put in a plastic bag bearing a number of corresponding tag number of the animal. After collection, the samples were taken to the laboratory and egg counts were made using the modified McMaster technique (Roepstorff and Nansen, 1998).

Statistical Analysis

The results obtained were subjected to analysis of variance using SPSS 25.0 software and treatment means were ranked using Duncan's multiple range tests. Data were analyzed using one-way ANOVA to distinguish the impact of different dietary treatments. Significance was declared at $P < 0.05$ unless otherwise stated. All the statistical procedures were done as per Snedecor and Cochran (1994).

Results and Discussion

Effect of TLMM Supplementation on Growth Performance of Lambs

The mean fortnightly body weights of all experimental groups were presented in Table 1. There was significant ($P < 0.05$) influence of dietary treatments on the body weight of lambs recorded on day 75 of experimental feeding and subsequently the difference was continued up to day 120. It was observed that the mean body weights for TLMM (Tanniferous leaf meal mixture) based TMR fed groups were significantly ($P < 0.05$) higher compared to the control group.

The results of present study indicate that the feed in T2 group may has the optimum level (3%) of tannins for exerting noticeable effects, without showing any negative impacts. The results also point that at 3% CT (condensed tannin) level the binding effect of tannins might be more pronounced leading to bypass of protein to the gut and subsequently resulting in efficient use of protein for tissue growth which yielded better body weights. Similar to present findings were observed by Iqbal *et al.* (2007) in lambs where maximum weight gain was recorded in animals fed diets containing 3% CT.

Table 1: Effect of feeding TLMM incorporated TMR on mean body weight (kg)

Treatment	I	II	III	IV	V	VI	VII	VIII	IX
NC	12.12 ±0.81	13.48 ±0.85	14.88 ±0.89	16.32 ±0.88	17.78 ±0.89	19.28 ±0.95 ^{ab}	20.83 ±0.90 ^{ab}	22.43 ±0.84 ^b	23.82 ±0.82 ^b
C	12.08 ±0.88	13.12 ±0.88	14.18 ±0.90	15.27 ±0.85	16.38 ±0.78	17.53 ±0.74 ^a	18.75 ±0.77 ^a	19.88 ±0.78 ^a	20.97 ±0.80 ^a
T1	12.13 ±0.58	13.62 ±0.59	15.13 ±0.63	16.75 ±0.65	18.45 ±0.64	20.20 ±0.66 ^b	22.00 ±0.59 ^b	23.77 ±0.50 ^b	25.43 ±0.38 ^{bc}
T2	12.08 ±0.80	13.55 ±0.81	15.12 ±0.76	16.77 ±0.77	18.55 ±0.75	20.38 ±0.75 ^b	22.25 ±0.78 ^b	24.07 ±0.52 ^b	25.80 ±0.27 ^c
T3	12.10 ±0.65	13.45 ±0.64	14.92 ±0.62	16.43 ±0.62	18.02 ±0.54	19.68 ±0.58 ^{ab}	21.43 ±0.52 ^b	23.13 ±0.51 ^b	24.78 ±0.44 ^{bc}

^{abc} means with different superscripts with in a column differ significantly < 0.05

Similar trend of increased growth in sheep supplemented with CT was reported by Ngwa *et al.* (2002). Pathak *et al.* (2017) obtained similar results of increased body weights in lambs by feeding tannins from *Ficus infectoria* and *Psidium guajava* leaf meal mixture

Parallel to the present findings were also recorded by Dey *et al.* (2008) in lambs fed with *Ficus infectoria* leaves included diets but significantly higher weights were recorded in CT 1.5% group rather than in CT 1% and CT 2% diets. Source of tannin could be the contributing factor for the above variation as it plays a very important role in deciding the quantity of condensed tannin required to exhibit the adverse effect of tannins on the performance of animal. At appropriate concentration, the CT reduced the degradation of sulphur amino acids (SAA) in the rumen, increases the irreversible loss of cystine from plasma and increased the flow of cystine to body synthetic reaction (McNabb *et al.*, 1993) thereby improves the growth performance of lambs. In the present study the body weights of T1, T2 and T3 groups were found to be 21%, 23% and 18% higher than the control group. In consistent with the present findings, Montossi *et al.* (1996) observed 23% improvement in live weight gain in lambs grazed on *Holus*

lanatus (4.2 g CT Kg⁻¹ DM).

Effect on Average Daily Weight Gain (ADG) (g/day)

The mean daily weight gain (g/day) was found to be high in group of lambs fed TMR containing 3% CT (114.31 g/day) followed by CT 2% group (110.83g/day), CT 4% group (105.69 g/day), negative control (97.50g/day) and the lowest values were recorded in control group (74.03g/day). The CT supplemented groups were found to achieve significantly ($P<0.05$) better average daily weight gains when compared to control groups. Moderate levels of CT markedly reduce rumen degradation of soluble proteins and increase the absorption of methionine and a range of essential amino acids from the small intestine, subsequently its more efficient use for tissue growth (Mc Nabb *et al.*, 1993). This might be the reason in the present study for higher growth rates observed in lambs fed TMR containing 3% CT than either 2 or 4%.

In consistent with the present findings, higher growth rate was reported in kids fed oak leaves-based diet (Singh *et al.*, 1996) and in calves fed on *Q. semecarpifolia* and *Q. leucotricophora*, based diets (Sharma *et al.*, 2008). Rubzana *et al.* (2007) also reported that leaf meal supplementation of *Acacia nilotica* (52.8 g CT Kg⁻¹ DM) and *A. polyacantha* (98.3 g CT Kg⁻¹ DM) showed significant ($P<0.05$) increase in ADG (114.3 vs 42.9 g/day) in goats.

Table 2: Effect of feeding TLMM incorporated TMR on ADG (g/day)

Group	I	II	III	IV	V	VI	VII	VIII	Mean
NC	91.10±2.8 ^a	93.33±7.10 ^a	95.57±6.13 ^a	97.77±3.71 ^a	100.02±5.16 ^b	103.32±5.64 ^b	106.65±12.77 ^{ab}	92.20±9.01 ^{ab}	97.50±2.46 ^b
C	68.88±4.45 ^b	71.12±7.44 ^b	72.22±6.31 ^b	74.45±10.39 ^b	76.67±6.62 ^a	81.10±4.37 ^a	75.57±6.59 ^a	72.22±3.18 ^a	74.03±2.19 ^a
T1	98.88±4.69 ^a	101.12±5.00 ^a	107.80±2.6 ^a	113.32±5.44 ^a	116.67±2.86 ^c	120.0±5.16 ^{bc}	117.77±11.37 ^b	111.12±10.5 ^c	110.83±2.43 ^{cd}
T2	97.77±4.10 ^a	104.45±5.04 ^a	110.00±2.8 ^a	118.90±4.68 ^a	122.22±4.44 ^c	124.43±5.61 ^c	121.10±13.76 ^b	115.55±11.0 ^c	114.31±3.66 ^d
T3	90.02±3.75 ^a	97.77±5.63 ^a	101.13±7.3 ^a	105.97±7.17 ^a	111.10±5.35 ^b	116.67±6.61 ^{bc}	113.32±3.45 ^b	110.00±6.14 ^c	105.69±2.26 ^c

^{abc} means with different superscripts with in a column differ significantly ($P<0.05$)

Effect on FCR (kg DMI/kg gain)

The present study observed significantly ($P < 0.05$) lower feed conversion ratio (FCR) (kg DMI/kg gain) in lambs fed TMR containing 3 % CT compared to either 2 or 4% levels (Table 3). The positive response of ADG and FCR for the diets fed at 3% level of CT in the present study gives an indication that the binding effect of tannins was pronounced only at this level which aids in bypassing the protein to the lower gut and subsequently it's more efficient use for tissue growth. Hence, 3% CT is apparently the optimum level, at which there are enough tannins to exert beneficial effects on performance of lambs. However, the present findings are contrary to the findings of Dey *et al.* (2008) who reported that positive impact was evident on the overall performance of lambs supplemented with *F. infectoria* leaves to 1.5% CT in the supplement, and decrease in the performance of lambs at 2%. This may be due to the difference in the source of tannins.

Table 3: Effect of feeding TLMM incorporated TMR on FCR

Group	I	II	III	IV	V	VI	VII	VIII
NC	5.58 ± 0.25 ^a	6.53± 0.33 ^a	7.23± 0.35 ^a	7.97± 0.33 ^a	8.56 ± 0.45 ^b	8.84 ± 0.50 ^b	9.51± 0.72 ^{ab}	11.61± 0.61 ^{ab}
C	7.57 ± 0.37 ^b	8.71± 0.41 ^b	8.99± 0.51 ^b	9.66± 0.62 ^b	9.81 ± 0.59 ^c	10.33± 0.42 ^c	12.64± 0.64 ^b	14.16 ± 0.52 ^b
T1	5.62 ± 0.26 ^a	6.37± 0.40 ^a	6.91± 0.30 ^a	7.28± 0.31 ^a	7.62 ± 0.29 ^{ab}	7.57± 0.31 ^{ab}	8.50 ± 0.51 ^a	9.57 ± 0.71 ^a
T2	5.31 ± 0.27 ^a	6.05± 0.24 ^a	6.48± 0.23 ^a	6.62± 0.28 ^a	6.97 ± 0.33 ^a	7.29 ± 0.31 ^a	8.94 ± 0.45 ^a	9.98 ± 0.77 ^a
T3	5.91 ± 0.25 ^a	6.39± 0.36 ^a	7.29± 0.47 ^a	7.79± 0.57 ^a	7.73 ± 0.27 ^{ab}	7.89± 0.53 ^{ab}	8.32 ± 0.31 ^a	9.01 ± 0.58 ^a

^{abc} means with different superscripts with in a column differ significantly ($P<0.05$)

Effect on Fecal Egg Count of *Haemonchus*

The FEC of *Haemonchus* in treatment groups was comparable from day 0 to day 30, but the difference was observed to be statistically significant ($P < 0.05$) from day 45 to day 120 and the T2 group was having significantly ($P > 0.05$) lower FEC values when compared to other two CT groups whose FEC values (Fig. 1) were not significantly different. Kommuru *et al.* (2014) reported a decreased FEC within 1 week of feeding 90% *L. cuneata* ration to GIN-infected kids corroborated with present findings. The present study observed that the mean faecal egg counts (Egg per gram) on day 120 of the experiment were reduced by 66.67%, 85.85% and 71.63% in T1, T2 and T3 groups, respectively when compared with the day one of the experiment. Reduced FEC have been attributed to both direct (reduced fecundity, killing of adult worms: Shaik *et al.*, 2006) and indirect of effect of CT as dietary supplementation of CT improved the immune function against the GI parasites through enhanced protein supply (higher absorption of amino acids) that is required for the repair and immune response (Niezen *et al.*, 2002).

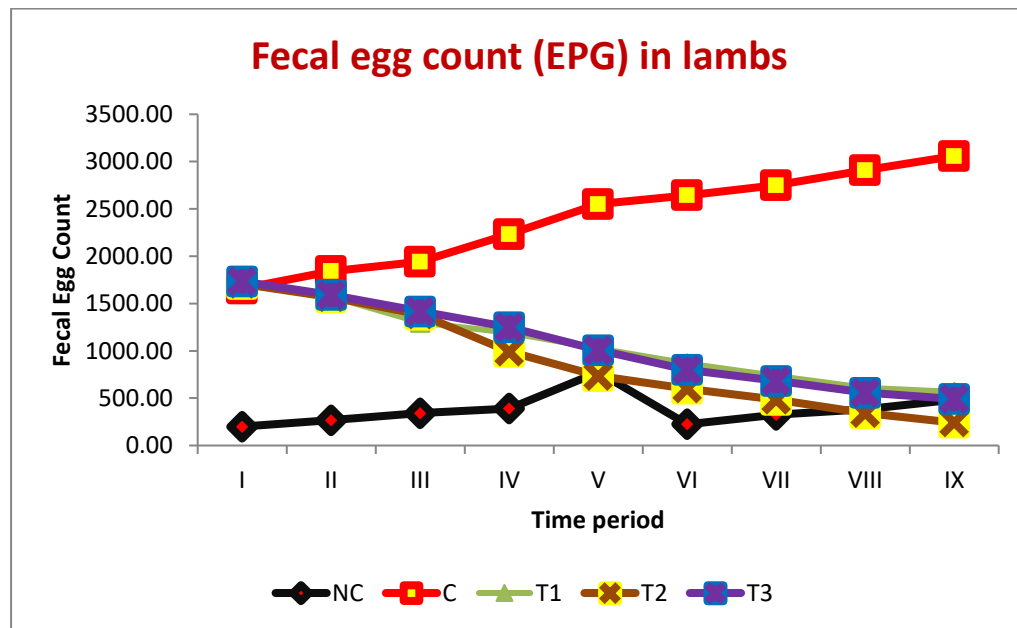


Figure 1: Effect of feeding TLMM incorporated TMR on Fecal egg count in lambs

The decreased faecal egg counts observed with feeding of CT based TMR in the present study have got implications on the epidemiology of infection. The reduced FEC in the sheep decrease the contamination of pasture with infective larvae which in turn results into less infection in the animals grazing on the pasture. Moreover, the mean FECs of the treated groups were much lower than the threshold level, which warrants for anthelmintic medication. Thus, the frequency of using anthelmintic drugs can be minimized. This is especially important in hot and humid climatic conditions like India where frequent medication is the only way to get rid of this menace (Dutta *et al.*, 2012).

Conclusion

The present study concluded that dietary supplementation CT at 3% of the diet through locally available tanniferous LMM has the potential to improved feed efficiency and growth rate in lambs by decreasing fecal egg count of *Haemonchus* in lambs. Therefore, tanniferous herbage may be routinely included in the diets of small ruminants to prevent helminthes infestation, thereby reduce the use of chemical dewormers.

Acknowledgements

The authors are immensely grateful to Sri Venkateswara Veterinary University, Tirupathi and Livestock Farm Complex, Dept of Animal Nutrition, NTR college of Veterinary Science, Gannavaram for provision of funds and allowing to conduct research.

Conflict of Interests

There is no conflict of interest.

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