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ORIGINAL RESEARCH

Effect of feeding TLMM based TMR on haemato-biochemical profile and cost per kg weight gain in Nellore brown lambs

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ABSTRACT

Present research was carried out to study the effects of feeding total mixed rationsupplemented with tanniferous leaf meal mixture on haemato biochemical profile and cost per kg weight gain in Nellore brown lambs. 18 Nellore brown lambs (3-4 months, 12.01+ BW) were divided into three groups NC (dewormed), C (Naturally parasitized), treatment group (T) of six animals in each. Control groups were fed with total mixed ration, while treatment group is fed with total mixed ration having tanniferous leaf meal mixture with 3%condensed tannin. The mean Hb (g/dl) levels were significantly (P<0.05) low in C group compared to other groups and significantly (P<0.05) high in T, NC groups. The mean PCV (%) values were significantly (P<0.05) low in C group compared to other groups. The mean serum urea (mg/dl) levels in the treatment group of lambs were found to be significantly (P<0.05) lower compared to both control groups.The feeding cost (₹) per kg live weight gain was 25% less in treatment group compared to the control. The results of the study further reveled that feeding of Condensed tannin even at 3% level in the diets of sheep does not cause any effect on health of the animal.

Key words: Total mixed ration, Tanniferous Leaf Meal Mixture, Condensed tannin, Haemato biochemical profile, cost per kg weight gain.

INTRODUCTION

The anticipated rise in demand for sheep and goat meat and meat products with the growing economy in the near future, will provide an avenue for resource poor farmers to increase production, improve their livelihood, reduce malnutrition and thereby, contribute to the goal of overall poverty alleviation in rural areas. Currently India occupies 2nd position in number of sheep with 6.8% of the world population and contributing to 4.9% of total meat production in the country.

Being located in tropical region, the small ruminant rearing in India is hindered by factors like non availability of good quality feeds and fodders coupled with the gastrointestinal nematode (GIN) infections. The poor quality roughages (wheat /rice straw) provide bulk to the ruminants, which are deficient in protein, energy, minerals and vitamins and adversely affects the nutritional status of the animals.

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 and Pathak *et al*., 2015).A wide variety of multi-purpose tropical trees grown at the farmer's field, therefore, can be used as supplementary feeds.Further researches indicated that feeding of tanniferous herbage at 2-4 % level increases the absorption of essential amino acid by 60% and also control gastrointestinal parasites (Krueger *et al*., 2010).Condensed tannin (CT) containing leaf meal mixture may be used as an alternative functional feed resource for organic animal production (Pathak *et al.,* 2016).

MATERIALS AND METHODS

This research was carried out at Livestock Farm Complex, NTR College of Veterinary Science, Gannavaram, Andhra Pradesh during the period from March 2019 to September 2019.

Experimental animals and feeding

A total of 18Nellore 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 three groups of 6 animals each in a completely randomized design.

Group I lambs were (Negative control (NC) fed with conventional TMR (Total Mixed Ration)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 were positive control (C) fed with conventional TMR and were not dewormed throughout the experiment Group III animals were served as treatment group they 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* at40:40:20 proportions so as to bring the condensed tannin levels 3% per cent of diet. 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.

Collection of blood

Blood from all experimental animals were collected early in the morning before feeding, by jugular vein puncture. About 4 ml of whole blood was collected from every animal in EDTA vaccutainer for analysing haematotological profile and another 4ml of blood was collected in another vaccutainer in which clot activator is there to hasten the clotting and allowed for clotting. After clotting, the tubes were centrifuged to collect sera. The collected sera samples were stored in deep freezer for further analysis.

Haematological parameters

Haemoglobin (Hb) and PCV were analysed using automatic MIND RAY haemoanalyser

Biochemical parameters

All the biochemical parameters were estimated by using Erba diagnostic kits (TRANSASIA BIO –MEDICALS LTD).

Feeding cost per Kg Weight Gain

The cost of experimental rations were calculated on the basis of the prevailing market prices of ingredients and processing cost. Cost of ground nut straw was ₹2 per kg and cost of leaf meal mixture was ₹1.5 including processing cost. Cost per kg weight gain was calculated based on the feeding cost and total weight gain of lambs during experimental period.

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. The degree of freedom of the treatments was portioned into orthogonal polynomial, depicting linear and quadratic trends associated with increasing levels of CT supplementation. 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 feeding tanniferous leaf meal mixture (TLMM) incorporated TMR on hematological parameters in Nellore brown lambs

Blood samples were collected from sheep on day one of the experiment and thereafter at 30 days intervals for a period of 120 days. The blood was used for estimation of hematological parameters *viz.*, Hemoglobin (Hb) level and packed cell volume (PCV).

Effect on haemoglobin (g/dl) and PCV (%)

The mean Hb levels (g/dl) and PCV (%) of lambs under different experimental groups were presented in Table 2. The mean Hb (g/dl) values were significantly (P<0.05) low in C group compared to other groups and significantly (P<0.05) high in T1, NC groups. The mean PCV (%) values were significantly (P<0.05) low in C group compared to other groups, while the difference was not significant (P<0.05) among other groups.

In the present study, the Hb (g/dl) levels and PCV(%) values were found to be within the normal physiological range except for control group. The results of present study indicated that the general health of lambs may not be affected with the inclusion of tanniferous leaf meal at 3% level of CT in the diet. The results of this study are consistent with the findings of Dey *et al.* (2008) and Pathak *et al*. (2016) who reported that inclusion of CT at 3% level in the diets has no adverse effect on the hematological parameters (Hg, PCV) of lambs. Similar findings were also reported by Dubey *et al.* (2007) in kids fed with tanniferous tree leaves. However, Bhatta *et al*. (2002) reported lowered blood haemoglobin (g/dl) levels in kids fed on tanniferous leaves of *Prosopis cineraria.*

Table 1: Effect of feeding TLMM incorporated TMR on haemoglobin concentration (g/dl) and packed cell volume (%) in lambs

Treatment	Day 1	120 Day	Mean
Haemoglobin concentration (g/dl)			
NC	8.82±0.10	8.77 ± 0.13^{b}	8.92 ± 0.06^{c}
C	8.82±0.20	6.94 ± 0.10^{a}	7.87 ± 0.14^{a}
T	8.85±0.14	8.77 ± 0.13^{b}	8.97 ± 0.06^{c}
	Packed cell volume (%)		
NC	40.01±0.39	40.91 ± 0.23^{b}	40.83 ± 0.18^{b}
C	39.97±0.60	24.63 ± 1.36^{a}	31.36 ± 1.11^{a}
T	40.12±0.30	41.42 ± 0.80^{b}	40.39 ± 0.34^{b}

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

*****NC: Negative control, C: Control, T: Treatment

Effect of feeding TLMM incorporated TMR on serum biochemical parameters in lambs

Different biochemical parameters studied during the experiment were serum glucose, serum proteins (Total protein, Albumin, Globulin & AG Ratio), calcium, phosphorous, copper, total cholesterol, serum creatinine, serum urea, SGOT and SGPT.

Effect on liver function tests

The mean serum total protein, albumin and globulin (g/dl) levels and AG ratio values for different experimental groups at different periods of the experiment were presented in Table 2. Significant (P<0.05) difference in the mean serum total protein levels between treatment and control groups were observed from the day 60 and the difference was continued till the end of the experiment. The mean serum total protein (g/dl) values at the end of the experiment were significantly (P<0.05) lower in control group compared to other groups, while the difference was not significant among other groups.

Table 2: Effect of feeding TLMM incorporated TMR on on serum total protein, albumin, serum globulin and AG ratio in lambs

Treatment	Day 1	120 Day	Mean
	Serum total protein (g/dl)		
NC	5.65±0.11	6.23±0.06^{b}	5.93±0.05^{b}
C	5.54±0.13	4.43±0.10^{a}	5.06±0.08^{a}
T	5.68±0.16	6.20±0.15^{b}	5.92±0.08^{b}
	Serum albumin (g/dl)		
NC	2.64±0.07	3.12±0.05^{c}	2.84±0.04^{b}
C	2.73±0.10	2.18±0.04^{a}	2.41±0.04^{a}
T	2.63±0.07	2.93±0.07^{bc}	2.77±0.04^{b}
	Serum globulin (g/dl)		
NC	3.00±0.10	3.11±0.09^{b}	3.08±0.04^{b}
C	2.81±0.09	2.25±0.13^{a}	2.65±0.06^{a}
T	3.05±0.11	3.27±0.11^{b}	3.15±0.06^{b}
AG ratio			
NC	0.89±0.04	1.01±0.04	0.93±0.02
C	0.98±0.05	0.99±0.08	0.92±0.02
T	0.87±0.02	0.9±0.03	0.89±0.02

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

Serum globulin levels (g/dl) showed significant (P<0.05) difference from the day 60 and levels were significantly (P<0.05) low in control group compared to other groups, while the difference was not significant among other groups. However, there was no significant difference in AG ratio was observed among the experimental groups.The reduction in serum total protein, albumin and globulin (g/dl) levels in the control group might be attributed to the diversion of amino-N and energy from muscle, bone and collagen fiber. This in turn increases the endogenous losses of protein through urinary and faecal excretion. Some of it might be required for the synthesis of specific proteins for tissue repair and for immunological reaction to

infection (MacRae, 1993). Present results are in conformity with the findings of many workers (Van Houtert and Sykes, 1996; Pathak and Tiwari, 2012), who reported that sheep and kids offered a higher plane of nutrition are better able to withstand the pathological effects of nematode infection.

No significant difference was observed among different experimental groups with respect to serum enzymes concentrations. The mean SGOT, SGPT (Table:3) levels were linearly increased throughout the experiment from day one to day 120 in all the groups. No significant difference was observed among different groups with respect to SGOT (IU/L) and SGPT (IU/L). Similar findings were reported by Dey *et al.* (2008) in lambs fed with *Ficus infectivora* leaves and Acharya*et al*. (2015) in lambs fed with *Sericea lespedeza* a perennial legume rich in condensed tannins.

Table 3: Effect of feeding TLMM incorporated TMR on liver enzymes

Treatment	Day 1	120 Day	Mean
	SGOT (IU/L)		
NC	40.81±1.73	90.48±1.80	68.78±3.33
C	38.71±1.81	93.35±2.70	68.40±3.84
T	37.36±1.05	87.41±2.28	66.55±3.54
	SGPT (IU/L)		
NC	13.91±0.38	24.45±0.33	19.14±0.73
C	13.25±0.23	23.14±0.39	18.15±0.65
T	13.38±0.10	23.46±0.20	18.60±0.68

The normal serum glucose (mg/dl) levels in treatment and control groups observed in the present study indicated no physiological stress upon experimental lambs. Similar findings were reported by Dey *et al*. (2008) in lambs fed with *Ficus infectoria* leaves and Pathak *et al.* (2012) in*Haemonchus contortus* infected kids fed with different tanniferous diets.

The mean serum cholesterol (mg/dl) values (Table:4) did not differ significantly irrespective of the different feeding treatments and the values were found to be within the normal physiological range of sheep (Kaneko, 1997). Though within the normal physiological range, the cholesterol (mg/dl) levels gradually increased with the advancement of the feeding experiment. Similar findings were reported by Pathak *et al.* (2016) in the lambs supplemented with *Ficus infectoria* and *Psidium guajava* leaf meal mixture. The results of the present study indicated that feeding of diets containing CT at3% did not have any effect on the serum glucose and cholesterol (mg/dl) levels in lambs.

Table 4: Effect of feeding TLMM incorporated TMR on serum biochemical profile in lambs

Treatment	Day 1	120 Day	Mean
	Serum creatinine (mg/dl)		
NC	0.69±0.04	1.23±0.03	0.93±0.04
C	0.83±0.10	1.27±0.03	1.04±0.04
T	0.75±0.03	1.13±0.06	0.93±0.03
	Serum urea (mg/dl)		
NC	39.63±0.45	$39.76±0.46^{c}$	$39.90±0.20^{b}$
C	39.8±0.52	$40.16±0.34^{c}$	$40.04±0.17^{b}$
T	39.78±0.62	$27.32±0.42^{a}$	$32.69±0.88^{a}$
	Serum glucose (mg/dl)		
NC	48.08±1.94	48.39±1.52	48.83±0.60
C	46.83±3.75	49.08±1.21	47.62±0.93
T	49.75±3.98	49.85±1.58	49.58±1.12
Serum cholesterol (mg/dl)			
NC	38.78±0.87	65.97±0.80	50.82±2.00
C	38.76±0.69	63.3±0.52	49.48±1.76
T	40.41±0.30	65.14±1.09	51.25±1.65

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

The lower levels of serum urea in TLMM incorporated TMR fed group may be attributed to the reduced rumen protein breakdown and increased essential amino acid absorption (Waghorn *et al.,* 1990). Similar to the present results, lower serum urea levels in lambs supplemented with CTs through *Ficus infectoria* and *Psidium guajava* leaf meal mixture were reported by Pathak *et al*. (2016). Similar findings were also reported by Dey *et al*. (2008) in lambs fed on diets containing *Ficus infectoria* leaves at 1.5 – 2% and Bhatta *et al.,* 2002 in kids fed leaves of *Prosopis cineraria.* The fall in serum urea (mg/dl) in the present study could be attributed to the reduced rumen protein breakdown after CT supplementation due to bypass of the dietary protein to the lower gut (McAllister *et al.,* 1994) resulting into low concentration of urea. The serum Ca, P and Cu (mg/dl) values (Table 5) did not differ significantly (P<0.05) among different experimental groups and the values were found to be within the normal physiological range for sheep (Boyd, 1984). Similar values for serum Ca and P (mg/dl) were reported by Pathak *et al.* (2016) in the lambs supplemented *Ficus infectoria* and *Psidium guajava* leaf meal mixture. The results obtained from the present study indicate that feeding CTs in the diet up to 3% did not have any effect on serum Ca, P and Cu (mg/dl) levels in lambs.

Table 5: Effect of feeding TLMM incorporated TMR on serum mineral profile in lambs

Treatment	Day 1	120 Day	Mean
	Serum calcium (mg/dl)		
NC	9.69±0.31	10.04±0.24	9.99±0.10
C	10.34±0.26	10.45±0.15	10.29±0.09
T	10.12±0.07	10.24±0.22	10.20±0.11
Serum phosphorous (mg/dl)			
NC	5.43±0.13	5.17±0.13	5.38±0.06
C	5.67±0.17	5.27±0.25	5.56±0.08
T	5.38±0.10	5.47±0.09	5.41±0.05
Serum copper (mg/dl)			
NC	0.49±.04	0.47±0.04	0.52±0.03
C	0.59±.07	0.48±0.04	0.53±0.06
T	0.57±.02	0.47±0.02	0.53±0.05

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

Effect of feeding TLMM incorporated TMR on cost per kg weight gain in Nellore brown lambs

The cost of feeding (₹) per kg weight gain (Table 6) was significantly (P<0.05) lower in treatment (T) group and was significantly (P<0.05) higher in C group compared to other groups.The feeding cost per kg live weight gain was 38% less in treatment (T) group, as compared to control. In consistent with the present findings, Dey *et al.* (2007) reported that the cost of per kg body gain was reduced by ₹8/- in lambs fed with diets containing CT at 1.5% level compared to the control. Similar findings were reported by Dey and De.(2014) in a study conducted on cows, where feeding cost per kg milk production was reduced (₹ 11.24 vs 9.7) in cows fed FBLM diet as compared to control.

Reduction in the cost per kg weight gain in lambs fed with CT based TMR might be due to replacement of conventional feed ingredients with unconventional feed ingredients (Adegbola and Okonkwo, 2000) along with the beneficial effects exerted by moderate level of CT inclusion in the diets of lambs. Yashim (2016) reported significant (P>0.05) decline in cost of feeding the rams as the inclusion level of *F. sycomorus* leaf meal increased from 0% (505.31/ram) to 15% (439.10/ram).

Table 6: Effect of feeding TLMM incorporated TMR on growth performance and cost of feeding per kg weight gain in Nellore brown lambs

Parameter	NC	C	T
Initial body weight (kg)	12.12 ± 0.81	12.08 ± 0.88	12.08 ± 0.80
Final body weight (kg)	23.82 ± 0.82 ^{b}	20.97 ± 0.80 ^{a}	25.80 ± 0.27 ^{c}
Total weight gain (kg)	11.7 ± 0.22 ^{b}	8.8 ± 0.19 ^{a}	13.7 ± 0.58 ^{c}
Average daily weight gain (g)	97.50 ± 2.46 ^{b}	74.03 ± 2.19 ^{a}	114.31± 3.66 ^{c}
Feed consumed (g/day)	784.00 ± 11.16^{a}	736.25 ± 26.32^{b}	785.25 ± 6.60^{a}
FCR (kg feed/kg weight gain)	8.23 ± 0.27^{b}	10.23 ± 0.28^{c}	7.20 ± 0.44^{a}
Mean cost of feeding per lamb for 120 days(₹)	1377.33 ±19.61^{ab}	1293.45 ±46.24^{a}	1327.70 ±11.17^{ab}
Cost of feeding / kg weight gain	117.90±2.53^{b}	145.52±3.58^{c}	97.63±4.01^{a}

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

CONCLUSION

The present study concluded that dietary supplementation CT at 3% of the diet through locally available tanniferous LMM has positive effect on haematology and also decreases cost per kg weight gain. Hence TLMM can be included in the diet of sheep at 3% CT level without any adverse effect on health.

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