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Effect of feeding *Leucaena pallida* with concentrate and antihelmentic treatment on growth performance and nematode parasite infestation of Horro ewe lambs in Ethiopia

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The study was conducted to investigate the effect of supplementing *Leucaena pallida* in reducing gastrointestinal parasite load and to evaluate growth response of Horro ewe lambs to supplementation and antihelmentic treatment. A total of 32 Horro ewe lambs were randomly assigned to four treatments: Grazing, grazing + antihelmintics only, grazing + 500 g dried *Leucaena pallida* leaves + 200 g ground maize grain per head/day, and grazing + 200 g noug cake + 200 g ground maize grain per head/day with eight replicates. Feeding *L. pallida* leaves increased (P < 0.05) growth rates and reduced (P < 0.05) nematode parasite egg counts (Eggs per gram of faeces (EPG)) compared with un-supplemented Horro ewe lambs. Packed cell volume (PCV) was significantly increased (P < 0.05) in Horro ewe lambs supplemented with *L. pallida* and concentrate and treated with antihelmentic compared to the animals assigned to grazing alone. The results revealed that supplementation of *L. pallida* with concentrate have beneficial anti-parasitic properties and improved the growth performance of Horro ewe lambs.

Key words: Eggs per gram of faeces (EPG), packed cell volume (PCV), nematode, *Leucaena pallida*, Horro ewe lambs.

INTRODUCTION

Productivity of small ruminants in many tropical areas is often low and has been related to limitations caused by parasites, inadequate nutrition, unimproved genotypes and poor management (Devendra and Burns, 1983). About 80% of the national sheep population is reported to harbor varying degrees of infection with different species of nematode parasites. Parasitic infection has a significant effect in reducing productivity of sheep. Reduction in productivity can be expressed in terms of slow growth rate and mortality. Studies show that parasitism is one of the causes of mortality in sheep. For instance, out of the deaths in Horro sheep, 8.7% attributed to endo-parasitism (Markos et al., 2004a) and control of endo-parasites is among contributing factors in increasing sheep productivity. The interaction between the level of nutrition and the ability of animals to cope with internal parasites has long been recognized. Protein supplementation has shown to improve the resistance of lambs to endoparasites (Aynalem et al., 2002; Mukasa et al., 1991).

Parasitic nematodes of the digestive tract remain one of the main constraints to small ruminant production in tropical countries (Hoste et al., 2005). The usual mode of control of these gastrointestinal nematodes based on

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repeated use of antihelmintics is now strongly questioned because of the increasing development of resistance to chemical medicines (Waller and Chandrawathani 2005). The manipulation of host nutrition in order to improve the host resistance and/or resilience to parasite infections seems to represent one of the most promising options (Hoste et al., 2005). Small ruminants which are well nourished grow and reproduce faster and are better able to withstand the effects of worm infection than those given a low plane of nutrition (Peacock, 1996).

Drug resistance has become an important issue in small ruminant husbandry when antihelmintics are applied at high levels and at increasing frequency and with inappropriate doses (Pandey et al., 2001; Chartier et al., 1998). The use of natural substances is becoming preferable and may offer better control than using chemical compounds to treat parasitised animals (Chandrawathani et al., 2003).

Nowadays the impact of parasitism is becoming a serious problem in sheep production activity and as well contributing to sheep mortality. Thus, controlling gastrointestinal parasites is of a great importance in increasing sheep productivity. Control measures against internal parasites known to-date include the use of chemotherapy (antihelmentic), and/or controlled grazing, exploiting genetic variation in host resistance and improved nutrition to aid the development of immunity (Aynalem et al., 2002).

A chemical control program is the most widely used method for internal parasite control throughout the world (Jones and Bray, 1983). Many different commercial products are available to remove internal parasites from small ruminants in which the drugs are available and produced in several different physical forms and sold under various brand names. It is increasingly evident that gastrointestinal parasite (GIP) control programs based on de-wormers are failing because of increased de-wormer resistance; thus, alternative GIP control strategies are necessary. Recent studies have reported that anti-parasite agents extracted from plant materials for the control of parasites were successful (Nguyen et al., 2003). The research on effect of Cassava and Jack fruit leaves in diet on infection rates of intestinal nematodes and live weight gain of goats has been done. The results of counted strongyle eggs and coccidian oocyts were much lower with the goat fed foliage of Jackfruit and Cassava (Nguyen et al., 2003).

Previous studies showed that feeding cassava foliage hay to goats resulted in improved growth performance (Ngo et al., 2005; Phengvichith and Ledin, 2006). Apart from the nutritional benefit that has been obtained in ruminants fed on cassava foliages containing a moderate concentration of tannins, a reduction in the number of parasite eggs in the faeces has been also observed (Netpana et al., 2001; Seng and Preston, 2003; Ngo et al., 2005; Nguyen et al., 2005).

The effect of using cassava leaves to control nematode parasite infestation in dairy cattle and buffaloes showed that the lowest level of eggs per gram of faeces (EPG) of nematode and the highest growth rate in animals fed with the plant (Netpana et al., 2001; Seng and Rodriguez, 2001). Sheep and goat grazing condensed tannin-containing legumes were shown to better tolerate internal parasite infections than those grazing non condensed tannin containing forages (Nguyen et al., 2003). Thus, the objectives of this study were to investigate the effect of supplementing *L. Pallida* in reducing gastrointestinal parasite load of Horro ewe lambs and to evaluate differential response of Horro ewe lambs to supplementation and antihelmentic treatment.

MATERIALS AND METHODS

Location and climate of experiment site

The experiment was conducted at Bako Agricultural Research Center which is located 250 Km west of Addis Ababa at an altitude of 1650 m above sea level. The center received mean annual rainfall of 1200 mm in a bimodal distribution, 80% of which falls from May to September. The area had a mean relative humidity of 59% and mean minimum and maximum temperatures of 13.5 and 27°C, respectively. The experiment was carried out for 90 days from the beginning up to the end of the wet season (June 20 to September 20, 2010).

Animal management and treatment

A total of 32 Horro ewe lambs were purchased from local Hareto market located at Jimma-Rare district, Horro Gudur zone. They were approximately one year old by looking teeth of ewe lambs (Vatta et al., 2006) and weighed 14.0±0.5 kg. The animals were kept on grazing pasture only (without any supplement) for quarantine period of two weeks and housed during the night in sheltered pens. All animals were drenched against nematodes with Fenbendazole (Panacur® Hoechst Ltd, UK) and against trematodes with Tricalbendazole (Fasinex ®CIBA-GEIGY, Switzerland) two weeks prior to the commencing of the actual experiment. They were vaccinated against ovine pasteurollosis and sheep pox. Individual animals were treated against any other infectious disease than for gastrointestinal parasites.

The animals were assigned in a completely randomized block design to four treatments with eight animals per treatment. The treatments were:

1. G = Grazing only,
2. GAH = Grazing +Antihelmintics treatment only,
3. GLCS = Grazing + 500 g dried Leucaena leaves+ 200 g ground maize per head/day,
4. GCS = Grazing +200 g noug cake + 200 g ground maize grain per head/day.

Horro ewe lambs assigned to antihelmentic treatment group were drenched against nematodes with Fenbendazole at a doze rate of 5 mg/kg live body weight (Tembely et al., 1996). The animals were managed in flock and grazed on natural pasture from 9:00 to 15:00 to give enough exposure time to natural infection. For the sun dried *Leucaena pallida*, the foliage was harvested and dried for about two days under shade and the sun-dried foliage stored in bags until needed. The feeds were offered two times per day in the morning at

Table 1. Mean values of change in live weight of Horro ewe lambs fed different supplements with *L. pallida*, concentrate and treated with antihelmentic.

Group	Change in live body weight			
	Initial weight (kg)	Final weight (kg)	Total weight gain (kg)	ADG (g)
G	20.29	22.35[b]	2.36[b]	26.22[b]
GAH	22.15	25.25[b]	3.10[b]	34.44[b]
GLCS	19.32	26.20[a]	6.88[a]	76.44[a]
GCS	22.13	30.07[a]	7.88[a]	87.56[a]
SE	±1.19	±1.93	±0.87	±0.01

G: grazing only; GAH: grazing + antihelmintics only; GLCS: grazing + 500 g dried Leucaena leaves+ 200 g ground maize per head/day; GCS: grazing +200 g noug cake + 200 g ground maize grain per head/day. [abc]Means within rows without common superscript differ significantly at P < 0.05.

8:00 am and in the afternoon at 4:00 pm. Water was provided *ad libitum*. The animals were allowed for one week adaptation period before starting the experiment to accustom the ewe lambs to the housing and the feeding systems.

Measurements/sample collection

The amounts of feed offered and refused were measured and recorded daily; separately for the basal diet and the supplements. Live weight was recorded at the beginning, fortnightly and at the end of the experiment before the animals released for grazing.

Blood samples for haematocrit values (PCV) were collected fortnightly from ear vein punctures in to heparinized capillary tubes. Fecal samples for parasite egg counts were collected fortnightly from the rectum of the experimental animals and counts were made using the modified McMaster method and expressed as egg per gram of faeces (EPG). The samples were analyzed following Schalm et al. (1975). To determine EPG, about 4 g of faecal samples were grinded and mixed with 56 ml of flotation fluid (a saturated sugar solution in water). After filtering through a “tea strainer”, a sub-sample was transferred to both compartments of a McMaster counting chamber and allowed to stand for 5 min. All parasite eggs were counted under a microscope at 10x10 magnifications and multiplied by 50 to yield the EPG of faeces (Hansen and Perry, 1994). At the end of the trial, necropsy was done on some randomly selected animals from each treatment group for worm counts. Two ewe lambs from each treatment were slaughtered to determine the total worm burden in the intestinal gut. The eggs in the faeces were cultured to identify the species of the infective larva using the faecal sample from the slaughtered animals.

Statistical analysis

Data were analyzed using the General linear model of Statistical Analysis System (SAS, 2003). During analysis, treatment was considered as independent variables whereas average daily weight gain, PCV and EPG considered as dependent variables.

RESULTS AND DISCUSSION

Feed intake and live weight gain of Horro ewe lambs

Almost all concentrate and *L. pallida* supplements were consumed by treatment animals so that the feed refusals of the supplements were nil in this experiment. Average daily live weight gain (ADG) was higher ($P < 0.05$) for Horro ewe lambs supplemented with *L. pallida* and concentrate compared with the un-supplemented control and antihelmentic treatments (Table 1). The faster growth rates in supplement treatments probably relate to the growth potential of Horro sheep breed and the higher protein content of the supplements. These results are in agreement with Solomon et al. (1996) who reported Horro lambs given no supplementary feed and grazed on natural pasture in the dry season lost weight while the supplemented lambs gained weight. Galal (1983) made a similar observation for the same sheep breed kept on cultivated pasture in the dry season when the stocking rate was high. There was no significant difference in growth rate between control and drenched Horro ewe lambs treatments due to the fact that drenching with antihelmentic did not result in better growth if the nutritional level was not improved. Similar results were reported by Pralomkarn et al. (2001).

Parasite infestation

Eggs per gram of faeces (EPG) were significant reduced ($P < 0.05$) in Horro ewe lambs supplemented with *L. pallida* and treated with antihelmentic treatment compared to the grazing alone (Tables 2 and 3). EPG was also lower ($P < 0.05$) for Horro ewe lambs drenched with antihelmentic compared to supplementation with *L. pallida* and concentrate. A reduction in nematode infestation in ewe lambs supplemented with *L. pallida* leaves, compared with ewe lambs graze alone, as evidenced by lower EPG values in faeces, was reported by Seng and Rodriguez (2001); Seng and Preston (2003). In more detailed studies (Seng et al., 2009) it was shown that goats fed both cassava foliage had reduced worm fecundity (reduced EPG) beneficial effects of the improved protein status on the health of the goats fed cassava foliage could also be expected as it has been shown that protein supplementation of infected sheep or goats helped them to mount an effective immunological

Table 2. Mean values for EPG (eggs per gram of faeces) of the Horro ewe lambs supplemented with *L. pallida* concentrate and treated with antihelmentic.

Group	Overall EPG for the group	Eggs per gram of faeces (EPG)			
		June	July	August	September
G	2715.32[c]	2531.25[c]	3382.5[c]	2635[c]	2312.5[c]
GAH	447.5[a]	96.25[a]	443.75[a]	406.25[a]	443.75[a]
GLCS	1165.63[b]	918.75[b]	981.25[b]	1325[b]	1437.5[b]
GCS	1150[b]	862.5[b]	1131.3[b]	1337.5[b]	1268.75[b]
Overall	1369.61	1102.19[b]	1484.69[b]	1525.94[b]	1365.63[b]
SE	±146.94	±290.98	±290.98	±290.98	±290.98

G: grazing only; GAH: grazing + antihelmintics only; GLCS: grazing + 500 g dried Leucaena leaves+ 200 g ground maize per head/day; GCS: grazing +200g noug cake + 200 g ground maize grain per head/day. [abc]Means within rows without common superscript differ significantly at P < 0.05.

Table 3. Mean values for EPG parasite (Fasciola, Paramphistomum, Haemonchus, Coccidia, Trichuris and Nematodes) of Horro ewe lambs supplemented with *L. pallida* and treated with antihelmentic.

Group	EPG parasite					
	Fasciola	Paramphistomum	Haemonchus	Coccidia	Trichuris	Nematodes
G	1410.72[c]	330[c]	905.58[b]	207.14[c]	315.95[b]	533[a]
GAH	235.63[a]	75[a]	268.01[a]	50[a]	127[a]	
GLCS	382.15[b]	115[b]	421.21[a]	133.33[a]	135.42[a]	--
GCS	423.36[b]	230[b]	455.58[a]	50[a]	174.82[a]	250[b]
SE	±113.07	±102.58	±77.85	±73.23	±50.36	±47.14

[abc]Means within rows without common superscript differ significantly at P < 0.05.

response to the infection (Hoste et al., 2005). The data for worm egg counts support the earlier findings of Seng and Rodríguez (2001), with much lower EPG on the cassava supplement in experiment. The difference was that the degree of infestation was much less in this experiment than in the study of Seng and Rodríguez (2001), who reported that the EPG counts were high on the grazing alone treatment and showed a steady decline during the experiment from about 4000 to 5000 in the first 30 days to about 1500 after 70 days.

There were no significant differences in EPG between the months (Table 2). On the unsupplemented control treatment, the parasite infection increased almost inconsistely for 90 days close to three thousand EPG. On the *L. pallida* treatment, the EPG counts increased inconsistely over time but to a much lesser extent than on the control or grazing treatment. From this result, it would appear that *L. pallida* foliage contains compounds (presumably the condensed mimosine) that have an antihelmentic effect against nematode parasites in ewe lambs. In this respect, there are many reports in the literature that describe such an action to the presence of condensed tannins and mimosine (Granum et al., 2003; Butter et al., 2000; Kabasa et al., 2000; Molan et al., 2002; Kahn and Diaz., 2001).

Other indirect effects of *L. pallida* foliage could be the higher level of protein as compared to grass and the expectation that the mimosine and tannins present in Leucaena and cassava foliage will enhance the supply of essential amino acids to the small intestine (Wanapat, 2003). The importance of the protein nutrition of the host animal as a factor enabling it to overcome parasitism has been emphasized by many authors (Coop and Kyriazakis, 2001; Aynalem et al., 2002; Nolan, 1999). A high level of protein nutrition is also important in developing natural immunity against nematode parasites (Nolan, 1999).

Examination of the larvae cultured from the eggs in the faeces samples showed that the parasite or worms were almost entirely of the *Haemonchus contortus and Strongylus* species (Table 3). Sokerya et al. (2007) also reported that *H. contortus* was the most abundant species, accounting for more than 50% of the worm burdens in tropics.

Packed cell volume (PCV) was significantly increased (P < 0.05) in Horro ewe lambs supplemented with *L. pallida* and concentrate and treated with antihelmentic compared to the animals assigned to grazing alone (Table 4). This might be related to the fact that the burdens of parasites were significantly reduced with *L. pallida* and antihelmentic treatments so that worms suckling the blood of animals and share the nutrients might be reduced. However, there was no significant (P >0.05) difference in PCV between ewe lambs treated with

Table 4. PCV (least square means ± SE) from Horro ewe lambs supplemented with *L. pallida*, concentrate and treated with antihelmentic during different months.

Group	Overall PCV for the group	Packed cell volume (PCV) in %			
		June	July	August	September
G	20.05[b]	20.94[b]	21.63[b]	19.69[b]	17.94[b]
GAH	25.21[a]	24.3[a]	25.31[a]	25.32[a]	25.89[a]
GLCS	26.08[a]	25.63[a]	24.82[a]	26.19[a]	27.69[a]
GCS	26.97[a]	27.13[a]	26.75[a]	27.00[a]	27.0[a]
SE	±2.07	±1.99	±1.98	±1.95	±2.36

G: grazing only; GAH: grazing + antihelmintics only; GLCS: grazing + 500 g dried Leucaena leaves+ 200 g ground maize per head/day; GCS: grazing +200 g noug cake + 200 g ground maize grain per head/day. [ab]Means within rows without common superscript differ significantly at P < 0.05.

antihelmentic and supplemented with concentrate containing *L. pallida*. PCV was not significantly different over the period of months. These results are similar to the result from the study by Nguyen et al. (2003). Sokerya et al. (2007) also reported that during the time that egg counts were rapidly increasing, there were correspondingly decreasing trajectories of PCV in all groups.

CONCLUSIONS AND RECOMMENDATION

The objectives of this study were to investigate the effect of supplementing *L. pallida* in reducing gastrointestinal parasite load and to evaluate differential response of Horro ewe lambs to supplementation and antihelmentic treatment. Average daily live weight gain was higher ($P < 0.05$) for Horro ewe lambs supplemented with *L. pallida* and concentrate compared with the un-supplemented control and antihelmentic treatment. EPG counts (eggs per gram of faces) were significantly reduced ($P < 0.05$) in Horro ewe lambs supplemented with *L. pallida* and treated with antihelmentic treatment compared to the grazing alone. EPG was also lower (P < 0.05) for Horro ewe lambs drenched with antihelmentic compared to supplementation with *L. pallida* and concentrate treatments. Packed cell volume (PCV) was significantly increased (P < 0.05) in Horro ewe lambs supplemented with *L. pallida* and concentrate and treated with antihelmentic compared to the animals assigned to grazing alone. Supplementation of *L. pallida* had improved growth rate, reduced level of EPG of nematode in controlling parasite infestation and increased the level of PCV in Horro ewe lambs. Therefore, it can be suggested that *L. pallida* supplementation could be used as control method for internal parasite in addition to providing higher protein content for Horro ewe lambs.

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