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Feed Intake, Digestibility and Growth Performance of Horro Lambs Fed Natural Pasture Hay Supplemented Graded Level of *Vernonia Amygdalina* Leaves and Sorghum Grain Mixture

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Abstract

This study was undertaken with the objectives of evaluating the effect of dried and ground Vernonia (*V. amygdalina*) leaves and ground sorghum (*S. bicolor*) grain mixture supplementation on feed intake, digestibility, body weight change, feed conversion efficiency and of Horro lambs fed natural pasture hay. The feeding and digestibility trials were conducted using twenty male Horro lambs of similar yearling age and body weight (15.4±0.58kg). The lambs were randomly allocated to four dietary treatments independent of the blocks and replicated five times. Treatment 1 was fed on grass hay alone, while treatments 2, 3, and 4 received dried and ground Vernonia leaves (150, 300 and 450g, respectively) mixed with ground sorghum grain mixture on grass hay basal diet for 90 days. The dry matter intake (DMI) of the lambs for vernonia leaves and sorghum grain mixture was about 28%, 27% and 40% of the total DMI of treatment 2, 3 and 4; which was higher in T4 (p<0.01). Lambs fed hay only gained lower body weight, while those lambs supplemented with vernonia leaves and sorghum grain mixture gained higher body weights (p<0.01). The digestibilities of CP were highly significant in T4 (p<0.01). While DM and OM were higher (p<0.05) for lambs received T2 and T4 compared to T1 and T3. Correspondingly, the ADG of the lambs in T4 was higher than those in T3, T2, and T1 (p<0.01). Vernonia leaves and sorghum grain mixture were found to be good supplement to the hay diet; however, feeding vernonia leaves at T4 could increase the utilization of nutrients with higher growth performance of lambs compared to T3.

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INTRODUCTION

Ethiopia is known with a large diversity of farm animal species and genetic resources in the country (MoA, 1999) with capability to perform under different environments like cattle, sheep, and goat. Among these sheep is the second most populous and important livestock species in Ethiopia estimated to be 26 million (CSA, 2008). Sheep serve as a source of cash income to pay for school fees to children, and purchase of goods such as clothes, salt and sugar for family. They also serve as a source of quality protein, predominantly slaughtered during festive and religious occasions (Berhanu and Aynalem, 2009). Since sheep rearing in most production system takes short time to produce meat, farmers always aim to have sheep that can give the maximum possible lean meat in the shortest possible time. In this regard, Horro lambs have good merits for increased body weight gain post weaning (Kassahun, 2000). However, the existing natural pasture couldn't support these sheep to manifest their genetic potential to the optimum.

According to Ewenetu (1999) who indicated average daily live weight gain of 60.3±1.9 g when lambs grazing natural pasture were supplemented with 150-200 g/day of proteinaceous concentrate diets. This implies that protein supplementation plays important role in the growth performance, overall productivity, and profitability of the sheep flock, therefore, it is especially important to consider how indigenous browse species or herbages and

other agricultural products/concentrate supplements can be used to advance the performance of sheep so that the benefits of the farmers may be optimized both in quality meat production and income perspectives (Lester, 2006).

Tree and shrub legumes are important in producing large quantities of forage because of their deep-root systems and with correct management can produce green feed for much of the dry season. So indigenous multipurpose trees and legume forages such as *Vernonia amygdalina* can be used as an alternative protein supplement because of their green leaves and sustainability, but their potential as forage has been subject of little research (Aynalem and Taye, 2008). Foliage from this plant is commonly available from nurseries, gardens or backyard and farmlands.

Most conventional energy supplements are expensive and not readily available for livestock feeding as they are primarily used as human food. Sorghum grain is the energy source concentrates that can be used as human and animal feed. Feeding sorghum grain to lambs and kids improves growth performance of the animals and allows the producer to more easily monitor the health and condition of animals. In general, grain-fed livestock grow faster, become fleshier and tolerate the effects of internal parasites better (NRC, 1996).

The research hypothesis is that indigenous multipurpose browse species such as *V. amygdalina* can serve as an alternative protein supplement because of their green fodder production capability, sustainability, low cost and accessibility. The main objective of the research is to study the effect of dried and ground Vernonia (*V. amygdalina*) leaves and ground sorghum (*Sorghum bicolor*) grain mixture on feed intake and body weight change of Horro lambs

MATERIALS AND METHODS

Description of the Study Area

The study was conducted at Nekemte town of East Wollega Zone, Oromiya National Regional State, located at 332km west of Addis Ababa. Nekemte is located at 9^0 6' N latitude and 37^0 9' E longitudes, with average altitude of 1950 m.a.s.l according to ADO (2010).

The area is characterized by a unimodal rainfall pattern and annual total rainfall of 1244 mm and the minimum and maximum air temperature of 15°C and 28°C, respectively. The rainy season occurs from April to September and maximum rain fall is received in the months of June, July and August (ADO, 2010). The Woreda has livestock population of 110,633 sheep and Goats, 51,274 cattle, 26,930 poultry and 5,028 equines and crops grown in the area are maize, sorghum, teff, noug, and beans.

Experimental Feed and Feeding Management

Natural pasture hay was bought from Holeta town and nearby markets which were produced by farmers of the area to feed the lambs *ad libitum* as a basal diet. It was regarded as low quality hay. Graded levels of green *Vernonia amygdalina* leaves (33%) and ground sorghum grain (67%) were used as supplements in the experiment. The *Vernonia* leaves were air dried and crushed into pieces by homemade mortar and pestle, commonly used by the community in the area, until it becomes powder to thoroughly mix with ground sorghum grain to minimize selection by the animals. Natural pasture hay was offered *ad libtum* for experimental sheep. The supplements, ground *Vernonia* leaves and sorghum grain mixture were offered in two equal portions at 10:00 h in the morning and 14:00 h in the afternoon local time. The experimental sheep had free access to drinking water.

Experimental Animals and their Management

Twenty yearlings male Horro lambs with initial average live weight 15.38±0.58 (mean±SD) were purchased from Nekemte livestock market. The age of the animals were estimated to be around one year depending on the dentition and information from the owners. The animals were acclimatized to the environment for one month and during this period they were de-wormed against internal parasites and sprayed against external parasites like lice, tick and fleas and vaccinated against pasteurellosis, the commonly observed animal diseases of the area. They were penned individually. During this period, the animals were offered *ad libtium* natural pasture hay and supplemented with dried *Vernonia amygdalina* leaves and ground sorghum grain mixture in small amount to familiarize them with experimental diet.

Experimental Design and Treatments

A randomized complete block design was used for the experiment. At the end of the acclimatization period, the animals were grouped into four blocks of five animals based on initial live-weight and body condition scoring and randomly assigned to treatment diets. The four treatments include:

Treatment 1 (control, no supplement);
Treatment 2 (hay *ad libitum*+150g/animal supplement);
Treatment 3 (hay *ad libitum* +300g/animal supplement)
Treatment 4 (hay *ad libitum*+450g//animal supplement).

The treatment diets were formulated on DM basis. One animal from each block was assigned to each treatment, which gives a total of five animals per treatment.

Measurement and Observation

Feed intake

Feed offered to the experimental animals and corresponding refusals were recorded daily throughout the experimental period to determine daily feed intake. Samples of feed offered are collected from each treatment while samples of refusal are taken from each sheep daily per treatment over the experimental period. Experimental sheep had free access to drinking water. This was pooled over the experimental period and sub-sampled for analysis. Daily feed was measured and recorded for each animal. Intake was calculated as the difference between feed offered and refused corrected for DM content. Generally, daily feed DM and nutrient intake for each animal was calculated as follows:

Natural pasture hay DM intake=

(Natural pasture hay offered X % DM) – (Natural pasture hay refused* % DM)

Supplement DM intake=

(Supplement Offered X % DM) - (Supplement Refused X % DM)

Daily total DM intake=

Basal Feed DM Intake + Supplement DM Intake

Daily OM, CP, NDF and ADF intake were also calculated by the same method.

Digestion Trial

The digestion trial was conducted during the last phase of the experiment. The animals were adapted to the fecal bags for three days, which was followed by seven consecutive days of fecal collection for each animal. Feces voided were collected daily per animal and weighed every morning before feed offer. About 20% of sample was taken from the feces collected daily for each animal and composited in container (airtight plastics) and stored at -20°C till the end of the collection period at Microbiology and Public Health Laboratory of Wollega University. At the end of the collection period, the feces were taken to the laboratory, thoroughly mixed for each animal and sub-sample was taken to determine the chemical composition of the feces. Feed intake was recorded daily and weight of each animal was recorded on the first and last day of the trial. The apparent digestibility of feed DM and nutrients were determined using the following equations:

Apparent DM/Nutrient Digestibility =

$$\frac{\text{DM(Nutrient intake)–DM(Nutrient in feces)}}{\text{DM (Nutrient Intake)}}$$

The metabolizable energy contents of the feeds were estimated from *in vitro* organic matter digestibility as described by (McDonald *et al.,* 2002).

ME (MJ/Kg) = 0.016 X DOMD

Where
DOMD= g digestible organic matter/kg dry matter

The feed conversion efficiency of the lambs was estimated from the feed conversion ratio as:

Feed conversion ratio = $\frac{\text{Daily dry matter intake (g)}}{\text{Daily weight gain (g)}}$

Body Weight Change

Data on live body weight change was taken every ten days starting from the day feeding adaptation was ended. The lambs were fasted for 12 h over night before weighing for data collection on BW. Assuring that all the animals were healthy and no other external factor dictated their weight change except the treatment diets, the average daily BW gain for each sheep was determined as a difference between the final and initial BW divided by the total number of actual feeding days. Feed conversion efficiency (FCE), which is the measure of feed utilization, was calculated as unit of body weight gain per unit of feed consumed.

Chemical Analysis

Representative samples of daily feed offered and refused were collected, weighed and separately stored for each animal in bags and kept in a room with adequate natural ventilation until the end of the experimental period. Then the feed samples were thoroughly mixed, sub sampled and taken to the Holleta Agricultural Research Center Nutrition Laboratory for chemical analysis. The dry matter (DM), organic matter (OM) and nitrogen (N), of sample of feed offered and refused and feces were analysed by AOAC (1990) and, neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) in the samples of feeds that were offered, and from refusals and feaces were determined by the method of Van Soest and Robertson (1985). The N was determined by Kjeldhal technique and the crude protein (CP) content was calculated by multiplying N content with 6.25. In vitro organic matter digestibility was determined using procedures out lined by (Tilley and Terry, 1963).

Soluble matter= 100-NDF;

Hemicelluloses= NDF-ADF;

Cellulose= ADF-(ADL+ADF-ash);

Soluble Carbohydrate (NFE) =

100 - (NDF + Ash + CP + CF + EE)

Statistical Analysis

The analyses of variance (ANOVA) on the experimental data (feed intake, digestibility and body weight change) was run using the General Linear Model procedure of Statistical Analysis System (SAS) (2004) for the randomized complete block design. The statistical model used for the experiment was as described below:

$Yijk = \mu + \alpha i + \beta j + eijk$

Yij = the observation in the ith treatment & jth block

μ = the overall mean

αi = the ith treatment effect

βj = the jth block effect

eijk = the random error associated with Yijk

RESULTS AND DISCUSSION

Chemical Composition of Treatment Diets

The chemical composition of treatment diets shows relatively higher NDF (76%) and lower CP (5.5%) content of natural pasture hay as shown in Table 1. This could be explained by the different factors affecting the nutritive value of natural pasture hay such as varietal differences, location or climate, fertility of the land, stage of maturity at harvest, morphological fractions (*e.g*. leaf to steam ratio), harvesting and transporting practices, length and condition of storage time (Archimede *et al*., 2000; Ru and Fortune, 1999; Preston and Leng, 1984).

In general, the natural pasture hay had low CP and high fiber content whereas the Vernonia-Sorghum mixture (VSM) had high fiber content. The high CP content of the feed supplements (Vernonia leaves=22.6%), suggests that there is a potential for supplementing the low quality feeds by locally available protein rich tree leaves to improve animal performance.

Table 1: Chemical composition and *in vitro* OM digestibility of treatment feeds.

Chemical Composition	Treatments Feeds			
	Hay	Vernonia	Sorghum	VSM (33%:67%)
DM (g/kg)	928.9	917.4	884.5	895.4
Ash (g/kg DM)	25.9	47.9	4.6	18.9
OM(g/kg DM)	903.0	869.5	879.9	876.5
CP(g/kg DM)	54.8	226.4	102.6	142.0
NDF(g/kg DM)	762.6	386.8	136.3	218.9
ADF(g/kg DM)	396.7	220.2	77.0	134.3
ADL(g/kg DM)	77.8	50.6	20.1	39.2
Hemicelluloses(g/kg DM)	365.9	166.6	59.3	84.6
Cellulose(g/kg DM)	346.1	142.4	56.9	95.1
EME (MJ/kg DM)	8.47	11.99	14.8	13.87
IVOMD (g/kg DM)	529.6	749.9	925.0	867.22

EME =estimated metabolizable energy, IVOMD=invitro organic matter digestibility, VSM= Vernonia Sorghum mixture

Generally, natural pasture hay in this experiment was found to have low CP (5.48%) and high NDF (76.26%), ADF (39.67%) and ADL (7.78%) contents which require supplementary protein sources. The CP contents of the supplementary diets, namely, Vernonia leaves and ground Sorghum grain were 22.64% and 10.26, respectively. These CP contents were similar with CP of Vernonia foliage and Maize grain, 23.9% and 9.9% respectively. The OM content of Vernonia and Sorghum mixtures in this experiment (87.65%) was higher than the result of Vernonia foliage-maize grain mixtures (81.8%) as reported by Amensisa (2010). The NDF contents of Vernonia leaves and Sorghum grain (38.68%) and (13.63%) in this study and ADF (20.02%) and (7.7%) were lower than the values of NDF (44.8%) and (20.6%), Vernonia foliage and maize grain respectively reported by Amensissa (2010), and ADF contents of 36.7% and 9.5% in Vernonia foliage and Sorghum grain by the same author.

According to Lonsdale (1989), feeds that have <120, 120 - 200 and >200g CP/kg DM and <9, 9 - 12 and >12 MJ ME/kg DM are classified as low, medium and high protein and energy sources, respectively. The basal diet, natural pasture hay, used in this experiment with CP content of 54.8 g/kg DM and 8.47 MJ EME/kg DM could be considered as low protein and energy feed source.

Dry Matter and Nutrient Intake

The mean daily DM and nutrient intake of lambs fed natural pasture hay alone or supplemented with mixtures of Vernonia leaves and ground sorghum

grain is presented in Table 2. The total daily DM intake was significantly highest (p<0.001) for T3 followed by T4 and T2.The least DM intake was recorded for the lambs kept on natural pasture hay (T1). This was probably due to the low fiber fraction in VSM, which increased the basal diet intake and thereby resulted in better total DMI (T4). Generally, the results indicated that supplementation of natural pasture hay with VSM significantly improved (p<0.001) total DMI. This could be attributed to high fermentable protein content which might have enhanced the efficiency of rumen micro-organisms that increase fiber degradability and digestibility thereby improved feed intake (McDonald *et al.,* 2002).

Table 2: Daily dry matter and nutrient intakes of Horro lambs fed natural pasture hay alone or supplemented with mixtures of ground Vernonnia leaves and ground sorghum grain at different proportions.

Parameters	Treatments					
	T1	T2	T3	T4	SEM	SL
Dry Matter Intake						
Natural Pasture Hay (g/d)	190.1^{d}	334.4^{c}	606.8^{a}	519.1^{b}	26.79	***
Supplemented (g/d)	0^{d}	130. 9^{c}	236.6^{b}	351.8^{a}	7.69	***
Total DM (g/d)	190.1^{c}	465.3^{b}	883.3^{a}	870.9^{a}	37.6	***
Total DM (%BW)	3.27^{b}	4.1^{a}	2.8^{c}	2.4^{c}	0.15	***
Nutrient Intake (g/d)						
Total OM	184.8^{c}	453.2^{b}	825.5^{a}	849.0^{a}	35.6	***
Total CP	11.2^{d}	40.5^{c}	74.0^{b}	86.4^{a}	2.5	***
Total NDF	156.0^{c}	306.6^{b}	512.1^{a}	557.0^{a}	29	***
Total ADF	81.2^{c}	162. 5^{b}	295.2^{a}	274.4^{a}	15.14	***
Total ADL	10.4^{c}	24.0^{b}	45.2^{a}	43.68^{a}	2.26	***

a, b, c, =means with different superscripts in a row are significantly different. * = (p<0.05); ** = (p<0.01); ***= (p<0.001); ADF=acid detergent fiber; ADL=acid detergent lignin; CP=crude protein; DM=dry matter; NDF=neutral detergent fiber, OM =organic matter; V=Vernonia; S=Sorghum; SEM=standard error of mean; SL=significance level; T1= control (Natural pasture hay sole); T2= Natural pasture hay + 150 g (33%V:67% S); T3= Natural pasture hay + 300 g (33%V:67% S); T4= Natural pasture hay + 450 g (33%V:67% S)

The results agreed with the findings of Yoseph, (1999) that showed supplementation of concentrate diets (atella) to sheep maintained on hay basal diet, increased the total and basal DM intake as compared to pulse hull supplemented ones. In the current study, the lower NDF and ADF contents of VSM might be the major factors contributing to increase intakes of the supplement diets by reducing gut fill and optimizing rate of passage (Amensisa, 2010). Dietary protein supplementation is known to improve intake by increasing the supply of nitrogen to the rumen microbes. This has positive effect on increasing rumen microbial population and efficiency, thus enabling them to increase the rate of breakdown of the digesta. When the rate of breakdown of digesta increases, feed intake is accordingly increased (Van Soest, 1982). On the other hand, Grovum and Williams (1977) reported that if the ingested feed is retained longer in the rumen, it is expected that the animal would consume less feed, because of the occupied space or 'gut fill'. On the other way, rate of passage would be quicker as intake increases leaving less time for feed to be digested in the rumen. Supplementary diets in this study improved the total DMI by 81.2, 62.8 and 60.9 percent over non-supplemented natural pasture hay for T4, T3 and T2 respectively.

Dry Matter and Nutrient Digestibility

The digestibility of DM and nutrients by sheep fed natural pasture hay basal diet and supplemented with mixtures of VSM is presented in Table 3. Supplementation significantly improved (p<0.001) the DM, OM, CP and fiber components digestibility of the total mixed diet. Mulat (2006) indicated that digestibility of DM, OM, CP, NDF and ADF for sheep fed on finger millet straw basal diet supplemented with different protein sources were improved. But NDF content above 55% can limit DM intake (Van Soest, 1967). Digestibility also decreases with increased NDF content and increased lignifications of the fiber (McDonald *et al*., 2002). In this experiment the chemical analysis results indicate that VSM had soluble matter content

of 781.1 g/kg DM. Mengistu (2001) and Tikabo (2004) reported similar results (389 and 366 g/kg DM, respectively). As the amount of nitrogen required by the rumen micro flora is related to the amount of fermentable energy potentially available, Vernonia could also serve as a complementary diet for feeds which are high in readily fermentable energy sources for their efficient utilization of nitrogen by rumen microbes to serve microbial protein synthesis.

Table 3: Daily dry matter and nutrient digestibility of Horro lambs fed natural pasture hay alone or supplemented with mixtures of ground vernonia leaves and ground sorghum grain at different proportions.

Parameters	Treatments					
	T1	T2	T3	T4	SEM	SL
Digestibility %						
DM	69^{b}	81^{a}	71^{b}	89^{a}	0.03	*
OM	72.6^{b}	83.8^{a}	73.4^{b}	90.2^{a}	0.026	*
CP	35.6^{c}	39.6^{b}	59.4^{b}	86.8^{a}	0.15	***
NDF	73.4^{bc}	80.8^{ab}	67.4^{c}	87^{a}	0.03	*
ADF	60.8	64.4	55.4	58.2	0.15	Ns
Digestible Nutrient Intake (g/d)						
DM	132.3^{c}	386.4^{b}	637.19^{a}	773.38^{a}	45.41	***
OM	135.7^{c}	384.5^{b}	662^{a}	765.6^{a}	39.79	***
CP	4.23^{d}	28.53^{c}	44.54^{b}	75.01^{a}	4	***
NDF	115.5^{b}	351.4^{a}	383.9^{a}	445^{a}	62	Ns
ADF	50.09^{b}	109.5^{b}	208.3^{a}	220.22^{a}	22.29	*

a, b, c, =means with different superscripts in a row are significantly different. ***= (p<0.001); **= (p<0.01); * (p<0.05).

The digestibility of DM increased by 59.8, 50.2 and 44.4% in response to supplementation for T2, T3 and T4, respectively, over non-supplemented diets. The lower apparent digestibility of nutrients in non-supplemented groups compared with the supplemented ones could be associated with the lower CP in the feeds offered for control group (Table, 3). Fecal CP losses as a percentage of CP intakes for supplemented treatments were 34.5, 35.7 and 34.7% for T2, T3, and T4 respectively. In this study, the digestible DM, OM, CP, NDF and ADF intakes were higher (p<0.001) for supplemented than non-supplemented lambs (Table 3). In addition to this, digestible dry matter and organic matter intake was significantly (p<0.001) higher for supplemented treatment.

However, digestibility of DM, OM, NDF and ADF was only numerically higher in Vernonia and lower in sorghum than their mixture. On the other hand, there was a significant difference (p<0.05) in the digestibility of CP among VSM and Natural pasture hay. Thus, T2 and T3 had significantly lower (p<0.05) digestibility than T4. Generally, VSM had the highest digestibility as compared to natural pasture hay, which could be attributed to its higher fiber (ADF) and ADL contents. As could be observed from digestibility figures, VSM used in this experiment had the potential to improve the digestibility of the basal diet.

Body Weight Gain of Horro Lambs

The body weight (BW) change of experimental sheep on the different treatment feeds is given in Table 4. The average daily BW gain of sheep supplemented with ground Vernonia leaves and ground Sorghum grain mixture at 450 (T4) and 300 (T3) g/d was significantly different (p<0.001) from T2, which in turn varied from T1. The non-supplemented sheep had got significantly lower (p<0.001) daily BW gain than those supplemented with 450, 300 and 150g/d. Based on the lower nutrient intake and digestibility for lambs that were not supplemented, such differences are expected. The higher (p<0.001) average daily BW gain of 40.00, 81.25 and 93.75 g/lamb/d was recorded for lambs in T2, T3, and T4 as compared to non-supplemented groups, respectively, and the BW gain tended to increase for the higher CP intakes. Vernonia and sorghum mixture (T2) supplemented treatment had significantly lower (p<0.001) daily BW gain, and final BW as compared to T3 and T4. This could be due to the lower CP content of Vernonia leaves and Sorghum grain mixture offered, and consequently lowers digestible CP intakes of the lambs as compared to other supplemented treatments (T3 and T4). The results of this study were higher than the values, 63.8 g/d BW gain reported by Tesfaye (2007) when sheep fed teff straw basal diet were supplemented with 350g concentrate mixture and 22.7 g/d BW gain reported

by Mulat (2006) when sheep fed finger millet straw basal diet were supplemented with 24% NSC. The higher daily BW gain of supplemented experimental lambs in the present study might be due to the high CP intakes of lambs.

Table 4: Body weight change of Horro lambs fed natural pasture hay supplemented with different levels of ground Vernonia leaves and ground sorghum grain mixtures.

Digestibility %	Treatments					
	T1	T2	T3	T4	SEM	SL
Initial weight (kg)	15.0	15.1	15.6	15.8	0.26	Ns
Final weight (kg)	15.6^{c}	18.3^{b}	22.1^{a}	23.3^{a}	0.81	***
ADG (g)	7.55^{c}	40.00^{b}	81.25^{a}	93.75^{a}	8.9	***
Weight change (kg)	0.6^{c}	3^{b}	7^{a}	8^{a}	0.71	***
FCR (g DMI/g BWG)	-5.6	10	12	12.6	6.18	Ns
FCE (g BWG/ g DMI)	0.05	0.09	0.01	0.11	0.02	Ns

a,b,c Means with different superscripts in the same row are significantly different (p<0.05); *** (p<0.001); ** (p<0.01); * (P<0.05); ns: not significant; SEM: standard error of mean; DMI: dry matter intake; FCR: feed conversion ratio; ADG: average daily body weight gain.

The daily BW gain among supplemented sheep in T3, and T4 was similar. This result reflected that the supplements were comparable in their potential to supply nutrients for improving the weight gains of lambs. Lambs in the three treatment diets (T2, T3 & T4) had significantly different (p>0.05) in digestible CP intake as compared to the control groups.

The lambs maintained on T4 had significantly (p<0.001) highest final BW and average daily BW gain at the end of the experiment than the other VSM supplemented lambs and those maintained on natural pasture hay. This implies that all the lambs supplemented with Vernonia and Sorghum mix obtained CP above their maintenance requirements. The minimum protein level required for maintenance is about 8% CP in the DM (CTA, 1991). Mulat, (2006) reported a weight loss of 24.9 g/d in sheep fed sole finger millet straw, and ascribed the weight loss to low protein and energy intake, which was reported to be below the maintenance requirements of the sheep. It might be also possibly associated with higher NDF, ADF and ADL contents of natural pasture hay.

Those which had higher body weight could consume larger amount of hay to get maintenance energy while the others consumed less due to gut fill. (Kaitho, 1997) indicated that because of low nitrogen, high cell wall and slow digestion and low intake of hay, animals fed on straw or hay as sole diet may not be able to maintain their nitrogen balance, and growing animals could lose body weight.

Feed Conversion Efficiency

The Feed conversion efficiency (FCE) of lambs supplemented with mixtures Vernonia leaves and ground sorghum grain is presented in Table 4. The FCE was significantly improved (p<0.001) for supplemented groups relative to the non-supplemented ones. It was significantly highest (p<0.001) for the lambs fed on T4 followed by T3 as compared to T2 and T1. The improved FCE seemed to be related to higher nutrient concentration of the supplements and the consequent increase in BW gain (Table, 4). This showed that treatments fed higher mixture have greater potential in effectively supplying more nutrients required for body weight gain of the lambs. Therefore, supplementation improved both feed conversion efficiency in the present study which in turn resulted in daily body weight gain.

CONCLUSION

This study investigated the effect of supplementing finely crushed Vernonia leaves and ground sorghum grain mixtures on feed intake, digestibility, body weight gain and feed conversion efficiency of Horro lambs fed natural pasture hay basal diet. The chemical analysis of feed showed that the supplemented diets had potentially highest nutrient concentration than the non-supplemented ones. Accordingly, the total daily DM and other nutrient intake was significantly higher (p<0.001) for T3 and T4. However, supplementation of Natural pasture hay with VSM significantly improved (p<0.001) total DMI without affecting the intake of the basal diet. The Supplementation of Horro lambs with Vernonia leaves and ground sorghum grain mixture at 450 (T4) and 300 (T3) g per day on DM bais improves apparent nutrient digestibility, final BW gain, average daily WG, and FCE.

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