Carcass and Non-carcass Yield Characteristics of Horro Sheep Fed Elephant Grass (Pennisetum purpureum) Ensiled with Different Proportion of Dolichos Lablab (Lablab purpureus)

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Abstract

The study was conducted at Bako Agricultural Research Center with the aim to evaluate the effects of Elephant grass ensiled with different proportion of Dolichos lablab on carcass and non-carcass yield. Elephant grass was harvested after eight weeks of regrowth. While, Dolichos lablab at 50% blooming stage and they were chopped separately, mixed, added with 3% molasses and ensiled. A total of twenty intact male yearling Horro sheep were stratified into four groups based on initial body weight in RCBD and assigned to the dietary treatments randomly. Dietary treatments were arranged as T1, T2, T3 and T4 respectively for Elephant grass ensiled alone, with 10, 20 and 30% of Dolichos lablab. Lambs in all treatments were supplemented with wheat bran at 1.5% body weight. The study comprised 90 days of feeding trial and evaluation of carcass parameters. Increasing the inclusion levels of Dolichos lablab in the Elephant grass silage significantly increased slaughter weight (P<0.01), empty body weight, hot carcass weight (P<0.001), Hind and fore quarter, Dressing percentage on SW basis, EBW basis and REMA (P<0.05). The dietary treatments were significantly influenced (P<0.05) mean weight of tail, heart, liver with gall bladder, omasum-abomasum, large and small intestine, head with tongue and total edible offal components. Feeding of ensiled Elephant grass with different proportion of Dolichos lablab significantly affect weight values of Skin, gut contents and head without tongue of Horro lambs whereas, the rest parameters of non-edible offal components were not influenced. Lambs fed diets in T4 resulted in relatively higher feed cost, but, earns higher net return as compared to lambs in T1, T2 and T3 diet. Therefore, addition of 20-30% Dolichos lablab in Elephant grass silage enhanced the nutritive value of Elephant grass silage for better growth and carcass yields of Horro sheep.

Key words: *Carcass, Dolichos lablab, Elephant grass, Horro Sheep, Non-carcass, Silage*.

1. Introduction

Small ruminant production is a major component of the livestock sector in Ethiopia. According to CSA (2018) report, the total small ruminant population in Ethiopia is estimated to be about 64.04 million, out of which 31.3 million are sheep. At smallholder level, sheep are the major source of food security serving a diverse function including cash income, savings, cash for fertilizer purchase and sociocultural functions (Solomon et al., 2013). However, the productivity of sheep per head is low mainly because of inadequate year round nutrition, both in terms of quantity and quality, unimproved genetic potential and due to prevalence of diseases and parasites (Markos et al., 2006).

Nowadays most of natural pasturelands are put under intensified crop production due to the increasing human population pressure. The remaining land is heavily grazed and cannot meet the nutritional requirement of livestock, resulting in reduced growth rate, low production, poor fertility and high mortality particularly in the dry season (Solomon, 2004). Aftermath grazing and crop residue accounts for 60 to 70% of available basal diet in the highlands of Ethiopia. Such feeds are inherently low in nutritive value such as protein, digestible energy and minerals, which may result in sub-optimal rumen fermentation and lowered animal performance (Malede and Tekele, 2014). As a result, animals could not realize their genetic potential within the growth period for the breed.

To solve this problem, there are options like supplementing animals with agro-industrial by-products such as different oil seed cakes and brans from edible oil and flour processing industries. However, they are costly and not readily available everywhere. The other option of increasing livestock production can be achieved through cultivation of high-quality forages with high yielding ability that are adapted to biotic and abiotic environmental stresses (Muia et al., 2001; Tessema et al., 2010). Improved pasture crops have many advantages such as providing quality feed and improving soil fertility. The cost incurred for perennial pasture production is high only during the establishment year (Jφrgensen et al., 2010) but declined thereafter which could serve for the way forward in feed resources improvement strategies in Ethiopia at large. Amongst the promising forage species promoted in Ethiopia, Elephant grass could play an important role in providing a significant amount of high-quality forage to the livestock industry (Ndikumana, 1996; Tessema, 2005) both under the smallholder farmer and intensive livestock production systems with appropriate management practices (Alemayehu, 2004).

Uses of improved forage and tree legumes as supplementary options for livestock have been investigated in Ethiopia and elsewhere in Africa (Solomon et al., 2004; Ajebu et al., 2008 and Adegun, 2014). Improved forages could be fed to the animals by direct grazing, cut and carry, or stored and conserved as hay or silage. The potential of legumes for grazing is limited due to their susceptibility to trampling and the preferential grazing by livestock that adds pressure to legumes (Phelan et al., 2015). Additionally, fresh feeding of legumes is limited due to the seasonality of rain which reduces the independence from protein-rich feedstuffs during the dry season. Moreover, legumes feeding as hay restricted by high dry-matter losses occurring during drying, transport and storage furthermore, because of the practical implications of season and plant physiology that may prevent a timely harvest/drying at the optimal time for hay making (Titterton and Bareeba, 1999).

The limitations due to leaf shattering, harvest timing and availability in the dry season are minimized when forages are conserved as silage, making this probably the most suitable option to feed tropical legumes to ruminants. The development of small-scale intensive systems and the rising costs of concentrate feeds, made the conservation of forage crops an integral part of livestock production (Mapiye et al., 2007). Conserving high quality forages reduces the need to purchase concentrates for use in ruminant rations. Surplus and cultivated quality forages should be conserved during the wet season for use during the dry season. To this effect, silage-making is a common means of preserving surplus forage which could be fed to livestock during periods of scarcity. By conserving excess forage produced during the wet season to silage, the low production and productivity of livestock during the dry season due to scarcity of forage can be ameliorated (Wong, 2000). Conservation of cereals/grasses produces silages of high energy but low protein concentration (Mhere et al., 2002). On the other hand, legumes alone do not ensile well owing to their high moisture content and high buffering capacity, resulting in high effluent losses and unstable silage of high pH (Pahlow et al., 2002). Incorporation of legumes in cereal silage increases protein concentration improves silage intake and its nutritional quality thereby enhances ruminant animal performance (Ngongoni et al., 2008).

A number of Elephant grass and Dolichos lablab varieties are proved to produce high dry matter yield and adapted to a wide range of agro ecologies across the country. However, they contribute little to the much needed improvement of livestock production because data regarding the conservation of mixed grass-legume forages as silage was scarce. Similarly, feeding of silage in general and grass-legume mixed silage in particular for sheep as a basal diet is not practiced in the study area. Therefore, an alternative feed resources mainly conserved grass-legume mixed silage to enhance the productivity of small ruminants and determining the nutrient concentration of Elephant grass ensiled alone and with different proportion of Dolichos lablab is yet not investigated and exploited.

Thus, the study was undertaken with the objective to evaluate the effects of Elephant grass ensiled with different proportion of Dolichos lablab on carcass and non-carcass yield of Horro sheep.

2. Materials and methods

2.1. Description of the Study Area

The experiment was conducted at Bako Agricultural Research Center which is located in Oromia Regional State, West Shoa Zone at about 257 Km from the capital city Addis Ababa on the way to Nekemte town. The center is located at 8 km from Bako town. The altitude of the research center is 1650 m.a.s.l and lies at about 09°6'N latitude and 37°09'E longitude. The area has a warm sub-humid climate with annual mean minimum and maximum temperature of 13°C and 29.9°C, respectively. Mean monthly minimum and maximum temperatures are about 10.4°C and 33.6°C, respectively, with an average monthly temperature of 21°C. The daily mean minimum and maximum temperatures are 9.4°C and 31.3°C, respectively. The area is known by Unimodal types of rainfall and receives annual rainfall of 1431 mm mainly from May to September with maximum precipitation in the month of June to August. Sixty percent of the soil is reddish brown in color, and clay-loam in texture (Wakene, 2001).

2.2. Forage Production and Preservation

Pre-existing Elephant grass accession (ILRI 14984) at Bako Agricultural Research Center (BARC) Forage production station was cut at about 50cm height above the ground in order to re-growth and later for silage making. In other fields, Dolichos lablab seeds was sown at recommended rate of 20 kg/ha under rain fed after ploughing and harrowing, then hand weeded and safeguarded from different wild animals. The removing (cutting) of Elephant grass was mainly to match its appropriate harvesting time with Dolichos lablab during silage making.

Elephant grass was harvested after eight weeks of re-growth, while the complete foliage of Dolichos Lablab was harvested at 50% blooming stage. The Elephant grass and Dolichos Lablab were separately chopped in to smaller pieces using machine chopper driven by tractor before ensiling to make it easy to compact silage and to remove inside air from the bags. Before ensiling plant materials were mixed according to treatment combinations. To improve fermentation quality of ensiling materials 3% sugar cane molasses was sprinkled uniformly to all treatments over the chopped fodders and thoroughly mixed. For the ease of application, the sugar cane molasses was diluted with water 3:1 ratio before use. The chopped and mixed fodders ready for ensiling were preserved in separate pit silos lined with polythene sheets. It was compacted by trampling with feet, covered with polythene sheets and heap the soil on the pit to maintain anaerobic conditions during storage. The silages was opened after 45 days and used in a feeding trial to evaluate the intake, digestibility and performance of sheep fed ad libitum Elephant grass and Dolichos lablab mixed silage.

2.3. Experimental Animals and Management

Before the commencement of actual experiment the experimental house, pens, feeding and watering trough were properly maintained, cleaned and disinfected. A total of twenty intact male yearling Horro sheep with initial body weight of 19.47±1.76 Kg (mean ± SD) used for this experiment were bought from local market. Age of the animals were determined by their dentition and information obtained from owners. The experimental animals were ear-tagged for identification, quarantined for fifteen days and vaccinated against common infectious diseases in the area. During the quarantine period animals were de-wormed against internal parasites using anthelmintic (Albendazole) and sprayed with accaricide (diazzinon 60%) against external parasites. Thereafter, the experimental animals were assigned into different treatments after which the animals were randomly put in to a separate well aerated pen having a feed trough.

2.4. Experimental Design and Treatments

A randomized complete block design (RCBD) were used. The experimental animals were grouped into five blocks of four animals each based on their initial body weight which was taken in the morning before feeding at the end of the acclimatization period. Animals in a block were assigned to one of the four treatments and uniformly supplemented with wheat bran 1.5% of their body weight across all the treatments.

The arrangement of dietary treatments were as follows;
T1: Elephant grass ensiled alone
T2: Elephant grass ensiled with 10% Dolichos Lablab
T3: Elephant grass ensiled with 20% Dolichos Lablab
T4: Elephant grass ensiled with 30% Dolichos Lablab

2.5. Carcass Analysis

At the end of digestibility trial, all the experimental animals were slaughtered after an overnight fasting. Experimental animals were slaughtered by severing the jugular vein using sharp knives. During slaughtering, the blood was drained and weighed. Weight of visceral organs like kidneys, liver with gall bladder, lungs with trachea, kidney fat, abdominal fat, omental fat, heart, spleen, genital organs, the entire alimentary canal (esophagus, reticulo-rumen, omasum-abomasum, small intestine and large intestine), full gut, empty gut, tail, tongue and head was recorded separately. The weight of the gut contents were measured by differences of full gut contents and empty gut contents. Empty body weight was determined by subtracting the gut fill from slaughter body weight. Hot carcass weight was computed by excluding contents of thoracic, abdominal and pelvic cavities, head, skin with feet (cut off at the proximal end of cannon bone) and tail of the animal. Dressing percentage was calculated as a ratio of hot carcass weight to slaughter weight and empty body weight multiplied by 100. The rib-eye muscle area of each animal was determined by tracing the cross sectional areas of the 12th and 13th ribs after cutting perpendicular to the back bone. The left and right rib-eye muscle areas were traced on a transparent water proof paper and the area was calculated as recommended by (Torell and Suverly, 2004). The value for rib-eye muscle area was the average of the right and left sides on 12th rib.

Total edible offal (TEO) components were taken as the sum of blood, testicles, liver, kidney, kidney fat, heart, omental fat, tongue, reticulo-rumen, omasum-abomasum, large and small intestine and tail. Total non-edible offal components (TNEO) were computed as the sum of spleen, pancreas, skin and feet with hooves, penis, head without tongue, lung with trachea and gut contents. Total useable products (TUP) were taken as the sum of hot carcass weight, TEO and skin.

2.6. Statistical Data Analysis

The data generated during the experimental period were subjected to statistical analysis of variance (ANOVA) following the General Linear Model (GLM) procedure of SAS version 9.0 (SAS, 2002). Significant means ($P<0.05$) were separated by Duncan's multiple range tests.

The model used for data analysis was:

$Y_{ij} = \mu + t_i + b_j + e_{ij}$

Where;

Y_{ij} = response variable, μ = overall mean, t_i = treatment effect, b_j = block effect, e_{ij} = random error

3. Results and discussion

3.1. Chemical Composition of Experimental Feeds

The nutrient composition of the feeds used in the current study was presented in Table 1. The dry matter, crude protein and digestible organic matter in dry matter content of the silage increased as the proportion of Dolichos lablab in the mixture increased. On the contrary, Ash, NDF, ADF and ADL of the ensiled mixtures were reduced with increasing inclusion level of Dolichos lablab, showing that addition of Dolichos lablab was effective in improving nutritional values of the Elephant grass silage. However, organic matter of the experimental feed was almost similar.

Table 1. Chemical composition of experimental feeds

Feed Samples	DM%	Chemical Composition, (% DM)						
		Ash	CP	OM	NDF	ADF	ADL	IVDOMD
T1	30.14	10.86	8.75	89.14	72.14	42.23	8.77	55.1
T2	32.40	8.64	10.19	91.36	63.00	40.89	4.56	56.24
T3	34.70	8.21	11.06	91.79	61.11	38.86	4.02	56.55
T4	35.34	7.83	12.38	92.17	61.21	36.19	4.32	58.87
Wheat Bran (WB)	90.76	6.09	17.37	93.91	37.36	15.21	3.88	78.61
Refusal								
T1	30.08	13.1	6.48	86.9	70.86	42.51	9.32	36.65
T2	30.83	12.58	6.87	87.42	72.82	41.68	4.63	38.19
T3	31.44	12.52	7.13	87.48	71.64	40.86	4.59	39.81
T4	31.92	11.23	7.25	88.77	71.6	40.79	4.59	40.43

DM= dry matter; OM= organic matter; NDF=neutral detergent fiber; ADF=acid detergent fiber; ADL= acid detergent lignin; CP= crude protein; IVDOMD= In vitro digestible organic matter in dry matter; NG= Elephant grass; DL= Dolichos lablab; WB = wheat bran; T1=Elephant grass ensiled alone; T2= Elephant grass ensiled with 10% Dolichos Lablab; T3=Elephant grass ensiled with 20% Dolichos Lablab; T4=Elephant grass ensiled with 30% Dolichos Lablab.

T4 contained 14.7 and 29.32% more DM and CP respectively than T1 However, it contained 15.15, 14.30 and 50.70% lower NDF, ADF and ADL concentration, respectively. The ideal level of DM in silage described by McDonald et al. (1991) is approximately 280–350 g/kg. In consistent to present study, Ferreira et al. (2017) reported that inclusion of 40% dehydrated barley in the murandu grass silage increased proportion of dry matter content from 24.13 to 43.9%. But, in the present study the DM content was slightly higher than the report of Olusola (2011) which was the DM of Elephant grass silage increased from 18 to 30% with addition of 50% cassava peel in the mixture.

The CP content of silage used in the present study ranged from 8.75 to 12.38 % was above the 7% CP required for microbial protein synthesis in the rumen that can support at least the maintenance requirement of ruminants (Van Soest, 1994). The result obtained in the present study was comparable with Mbuthia et al. (2003) and Conteras-Govea et al. (2009) that reported the CP content of the Elephant grass silage increased from 9.7% to 11.2% with the addition of 20% Dolichos lablab. Furthermore, silage with a high level of CP is beneficial because it allows for increased proteolysis, which results in a buffering effect that hinders the reduction of the pH to levels that are optimum for fermentation (Napasirth et al., 2015).

The CP content of wheat bran was higher than results of 16.1, 14.48, 13 and 15.98% reported by Wondwesen (2010); Radia et al. (2013); Teklu (2016) and Abuye et al. (2018a) respectively. However, it was comparable with results of 17.19, 16.9, 17.77, 18 and 17.46% reported by Getnet (1998); Yenesew et al. (2013); Hunegnaw (2015); Mekonnen et al. (2016) and Firaol (2017). But it was relatively lower than the CP value of 20.10 and 23.08% reported by Simret (2005) and Awet and Solomon (2009). The wheat feed nutrient composition varies depending on variety of wheat being milled and the processing method used (McDonald, 2002). Regarding feed refusal, the CP and DOMD content was reduced and that of NDF, ADF and ADL were increased with the increasing inclusion level of Dolichos lablab in the mixed silage as compared to the feed offered, indicating selectivity by animals is common for nutritious parts of the feed.

3.2. Carcass Characteristics

3.2.1. Main carcass components

There were significant effects in relation to increasing the levels of Dolichos lablab inclusion in the Elephant grass silage on slaughter weight (SW) ($P<0.01$), empty body weight (EBW), hot carcass weight (HCW) ($P<0.001$), Hind quarter, fore quarter, dressing percentage both on slaughter and empty body weight basis and rib eye muscle area (REMA) ($P<0.05$) all showed increased with increasing inclusion levels of Dolichos lablab in the Elephant grass silage. Different studies have showed that supplementation had significant effect on slaughter weight, empty body weight, hot carcass weight, rib-eye muscle area (Abebe, 2006; Matiwos et al., 2008; Wondesen, 2008; Tewodros, 2011; Mulugeta and Gebrehiwot, 2013). Similarly, Mekonnen et al., (2017) reported that Horro lambs fed Cynodon dactylon hay with nitrogen rich leguminous forage has significantly improved the parameters indicated. The present study result for dressing percentage on slaughter and empty body weight basis was comparable with the values noted by Assefu (2012) for Horro sheep weighing 21.2 to 24.7 Kg at slaughter ranged from 35 to 36.2% and 42.2 to 44%, by Mekonnen et al. (2017) for the same breed of 22.2 to 27.5 Kg slaughter weight ranged from 34.2 to 37.5% and 46 to 47.5% respectively.

Table 2. Carcass components of Horro lambs fed Elephant grass ensiled with different proportion of Dolichos lablab

Parameters	Treatments					
	T1	T2	T3	T4	SEM	SL
Slaughter Weight (Kg)	22.92^{b}	24.96^{ab}	25.96^{a}	27.68^{a}	0.6108	**
Empty Body Weight (Kg)	18.58^{c}	20.24^{bc}	21.57^{ab}	22.24^{a}	0.3890	***
Hot Carcass Weight (Kg)	7.78^{b}	8.37^{b}	9.96^{a}	10.89^{a}	0.3948	***
Fore Quarter (Kg)	3.96^{b}	4.64^{ab}	5.22^{ab}	5.83^{a}	0.2887	**
Hind Quarter (Kg)	3.48^{b}	4.22^{ab}	4.94^{ab}	5.04^{a}	0.3603	*
Rib-eye area (cm^2)	6.4^{b}	7.53^{b}	7.90^{ab}	9.93^{a}	0.7581	*
Dressing Percentage on						
Slaughter Weight basis	33.94^{b}	33.54^{b}	38.36^{a}	39.23^{a}	1.509	*
Empty Body Weight basis	41.70^{b}	41.41^{b}	46.19^{ab}	48.89^{a}	1.618	*

^{a,b,c,d} =Means within a row not bearing a common superscript differ significantly; *=(P<0.05); **=(P<0.01); ***=(P<0.001); SEM=standard error of means; SL= significance level; T1 to T4= treatments..

Rib-eye muscle area is mostly used as a tool to indicate the proportion of carcass muscling (Wolf et al., 1980). In the present study, Rib-eye muscle area was significantly (P<0.05) influenced by dietary treatment. According to the report of Wolf et al. (1980), greater rib-eye muscle area is associated with a higher production of lean in the carcass and higher lean to bone ratio. Lambs assigned to T4 diet showed relatively higher REMA, which is a reflection of increase in lean meat. In the current study slightly higher rib-eye muscle area ranged from 6.4 to 9.93cm^2 was obtained as compared to 7.4 to 8.9 cm^2 reported by (Assefu, 2012). Comparable values for rib-eye muscle area 6.0 to 9.5cm^2 were reported by Mekonnen et al. (2017) for the same breed of sheep fed Cynodon dactylon hay alone or supplemented with Cajanus cajan, Lablab purpureus or their mixture. Similarly, Abuye et al. (2018b) noted rib eye area ranged from 7.04-9.54 cm^2 for the same breed of sheep fed natural grass hay and supplemented with Gebisa-17 and Beresa-55 cultivars of Lablab purpureus and concentrate mixture.

3.2.2. Non carcass parameters

Offal components are edible or non-edible based on tradition, religion, culture and differences in norms and preferences of the people and is more or less subjective.

3.2.2.1. Edible offal components

The mean weight of blood, kidneys, heart fat, reticulo-rumen and tongue of lambs fed Elephant grass ensiled with different proportion of Dolichos lablab were not affected Table 6. The weight mean values of tail, heart, liver with gall bladder, omasum-abomasum, omental fat, kidney fat, testicles, Large and small intestine, and total edible offal components (TEOC) were significantly influenced (P<0.05) by dietary treatments. Similar to the present study, Mekonnen et al. (2017) reported that the weight of carcass offal such as heart, liver with gall bladder, intestines and tail is significantly improved by supplementation in Horro lambs fed Cynodon dactylon hay supplemented with Cajanus cajan, Lablab purpureus or their mixture. The values of large and small intestine, heart and tail weight was significantly higher (P<0.05) for lambs fed T4 diet as compared to T1, but it is not significantly different (P>0.05) from those fed diets in T2 and T_3. In the present study the value of liver with gall bladder weight was significantly higher (P<0.05) for lambs fed diets in T4 as compared to those in T1 and T2 but had values similar (P>0.05) with those in T3 group. Various studies Tewodros (2011); Mekonnen et al. (2017) and Abuye et al. (2018b) reported an increasing trend in weight of liver with increase in the supplementary diets and suggested that this phenomenon could happen due to the storage of more reserve substances such as glycogen in the liver. Gebregziabher et al. (2003) also reported higher liver weight in Horro sheep fed with sesbania forage compared to those fed ground maize grain and grass hay, which supports the present result.

Similarly, the weight of omasum-abomasum, testicles and total edible offal component was significantly different (P<0.01) among dietary treatments. Lower weight of testicles, omasum-abomasum and total edible offal for sheep fed T1 diet as compared to those fed T4, T3 and T2 diet. While, significantly higher (P<0.001) values of omental fat and kidneys fat weight was observed for sheep fed T4 diet as compared to those in other group. In general, increasing level of Dolichos lablab inclusion in Elephant grass silage affected positively the omental fat and other edible offal components production. This might be due to the high energy content of legume enriched silage feed which promoted higher internal fat deposition. Gemeda et al. (2002) reported that testis weight differences between the animals in the different treatments may reflect the body weight differences among the different treatments.

Significantly increased TEO with increasing level of supplementation for Horro sheep fed natural grass hay and supplemented with Gebisa-17 and Beresa-55 cultivars of Lablab purpureus and concentrate mixture was reported by (Abuye et al., 2018b). The author further reported that, TEO values ranging from 3.75 to 4.89 Kg which agrees with value obtained in the current study (4.175 to 5.194 Kg. Similarly, Comparable TEO values ranged from 3.08 to 4.9 Kg for the same breed was reported by (Girma and Mengistu, 2017). However, Assefu (2012) was reported the values of TEO weight ranged from 3.68 to 4.55 Kg which was slightly lower than the present values of TEO weight. Higher weight of TEO ranged between 4.3 and 5.8 Kg was reported by (Mekonnen et al., 2017) for the same breed.

Table 3. Edible offal of Horro lambs fed Elephant grass ensiled with different proportion of Dolichos lablab

Edible Offal Components (g)	Treatments					
	T1	T2	T3	T4	SEM	SL
Blood	1070	1040	1234	1150	62.007	NS
Tail	422^{b}	654^{ab}	694.4^{ab}	806^{a}	83.317	*
Heart	99.2^{b}	104.46^{ab}	117.4^{ab}	134.8^{a}	8.1304	*
Heart fat	50.12	43.32	52.58	50.2	3.4505	NS
Liver with gall bladder	388.38^{c}	406.84^{bc}	447.86^{ab}	461.76^{a}	14.887	*
Kidneys	127.8	117.86	119.28	129.36	8.8129	NS
Kidneys fat	37.72^{c}	42.46^{bc}	49.64^{b}	59.40^{a}	2.3676	***
Large and Small Intestine	830^{b}	992^{ab}	1196^{a}	1092^{a}	74.030	*
Reticulo-rumen	592.2	682	604	568	36.270	NS
Omasum-abomasum	208^{c}	360^{a}	270^{bc}	286^{b}	21.726	**
Omental fat	24.80^{c}	27.70^{bc}	30.06^{b}	34.54^{a}	1.2572	***
Testicles	236.2^{b}	221.98^{a}	261.4^{a}	329.6^{a}	19.107	**
Tongue	88.80	87.12	95.92	92.48	3.5334	NS
Total Edible offal	4175.22^{b}	4779.74^{ab}	5172.54^{a}	5194.14^{a}	171.16	**

^{a,b,c,d} =Means within a row not bearing a common superscript differ significantly; *=(P<0.05); **=(P<0.01); ***=(P< 0.001); SEM=standard error of means; SL= significance level; T1 to T4= treatments.

3.2.2.2. Non-edible offal components

The values of Skin, gut contents and head without tongue were significantly influenced by feeding of ensiled Elephant grass with different proportion of Dolichos lablab. Whereas, the rest parameters indicated in (Table 7) were not influenced. In the present study, lambs assigned to diets in T1 had lighter (P<0.05) skin and head without tongue as compared to lambs in other treatment group. Whereas, lambs fed diet in T2, T3 and T4 had almost similar (P>0.05) value in their skin and head without tongue weight even though, lambs fed diet in T2 was not significantly different (P>0.05) from T1. The relatively higher skin weight obtained by lambs fed diets in T4 and T3 might be associated to their higher ME intake of T4 (9.99 MJ/day) and T3 (9.41 MJ/day), which might have resulted in better subcutaneous layer fat deposition in these groups. The highest value of gut contents weight were recorded for lambs assigned to fed T1 and T2 diet. The heaviest gut content of lambs fed T1 and T2 diet may be due to the higher roughage or relatively poor quality feed used. This was agreed with the views of VanSoest (1994) and pond et al. (1995) in that non supplement animals fill their gut with less digestible roughage, which would retain in the gut for longer time to be degraded by rumen microbes. Total usable products showed highly significant (P<0.001) variations among dietary treatments. It was significantly higher for lambs fed T4 and T3 diet as compared to those fed T1 and T2 diets.

Table 4. Non Edible offal of Horro lambs fed Elephant grass ensiled with different proportion of Dolichos lablab

Non-Edible Offal Components (g)	Treatments					
	T1	T2	T3	T4	SEM	SL
Skin	1976^{b}	2150^{ab}	2280^{a}	2414^{a}	76.875	*
Gut contents	4985.2^{a}	4482^{a}	3912^{b}	3770^{b}	192.93	**
Head without Tongue	1210^{b}	1384^{ab}	1420^{a}	1550^{a}	71.366	*
Lung with trachea	290.64	317.6	310.6	313.72	14.333	NS
Spleen	45.3	43.72	49.62	46.46	2.4067	NS
Pancreas	30.06	32	35.74	34.36	1.9877	NS
Penis	45.76	52.38	53.1	46.26	3.0244	NS
Feet with hooves	472	484	500	517.6	14.324	NS
Total Non-Edible offal	9055	8945	8561.1	8692.4	287.32	NS
Total Usable Products (Kg)	13.95^{b}	15.25^{b}	17.43^{a}	18.49^{a}	0.4537	***

^{a,b,c,d} =Means within a row not bearing a common superscript differ significantly; *=(P<0.05); **=(P<0.01); ***=(P< 0.001); SEM=standard error of means; SL= significance level; T1 to T4= treatments.

4. Conclusion

The experiment was conducted at Bako Agricultural Research Center from July 2018 to April 2019 using intact male yearling Horro lambs with initial body weight of 19.47±1.76 kg. The objectives of the study was to to evaluate the effects of Elephant grass ensiled with different proportion of Dolichos lablab on carcass and non-carcass yield of Horro sheep. A randomized completely block design (RCBD) with four treatments and five replications were used. The experimental animals were grouped into five blocks of four animals each based on their initial body weight. Animals in a blocks were assigned to one of the four treatments. Dietary treatments were arranged as T1, T2, T3 and T4 respectively for Elephant grass ensiled alone, with 10, 20 and 30% of Dolichos lablab. The experimental animals in all treatments were free access to clean water, mineralized salt block and supplemented with wheat bran of 1.5% body weight. At the end of the digestibility trial, all experimental animals were slaughtered for carcass characteristics evaluation.

Variations among experimental diets were observed in chemical composition. Dry matter and crude protein content of the silage increased as the proportion of Dolichos lablab in the mixture increased. On the contrary, Ash, NDF, ADF and ADL of the ensiled mixtures reduced showing that addition of Dolichos lablab was effective in improving nutrient values of the Elephant grass silage.

The mean weight of blood, kidneys, heart fat, reticulo-rumen and tongue of lambs fed Elephant grass ensiled with different proportion of Dolichos lablab were not affected. The weight mean values of tail, heart, liver with gall bladder, omasum-abomasum, Large and small intestine, head with tongue and total edible offal components (TEOC) were significantly influenced (P<0.05) by dietary treatments. The weight values of Skin, gut contents and head without tongue of Horro lambs were significantly influenced by feeding of ensiled Elephant grass with different proportion of Dolichos lablab whereas, the rest parameters including lung with trachea, spleen, pancreas, penis and feet with hooves were not influenced. In general, based on the result, it can be concluded that mixing Dolichos lablab with Elephant grass had beneficial effects on silage properties and carcass yield of Horro lamb. Therefore, it is recommended that addition of 20-30% Dolichos lablab in Elephant grass silage enhance the nutritive value of Elephant grass silage thereby, increasing the growth and carcass yield of sheep.

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