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# Carcass and Non-carcass Yield Characteristics of Horro Sheep Supplemented with Two Lablab purpureus Cultivars and Concentrate Mixture to a Basal Diet of Natural grass hay

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**Abstract**
The study was carried out using twenty five male yearling Horro sheep with average body weight (BW) of 18.5 $\pm$ 1.99 kg (Mean $\pm$ SD) to determine the supplementary value of Beresa-55 and Gebisa-17 Lablab purpureus cultivars and concentrate mixture to a basal diets of natural pasture hay on carcass and non-carcass yield characteristics. All lambs were stratified in to five groups according to their initial body weight in randomized complete block design and were assigned to the dietary treatments randomly. Experimental lambs had free access to a basal diet (natural grass hay) but, supplemental feeds were restricted considering 1.5 and 2% of their body weight in dry matter (DM) basis which is adjusted following regular weight measurements. Thus, the treatments were; ad-lib natural grass hay + concentrate mixture at 2% BW (T1), ad-lib natural grass hay + Gebisa-17 cultivar at 1.5% BW (T2), ad-lib natural grass hay + Gebisa-17 cultivar at 2% BW (T3), ad-lib natural grass hay + Beresa-55 cultivar at 1.5% BW (T4) and ad-lib natural grass hay + Beresa-55 cultivar at 2% BW (T5). All carcass parameters and most of the non carcass parameters were significantly affected by dietary treatments. Lambs fed diets T1 and T5 had performed better in most of the parameters measured such as SW, EBW, HCW, fore and Hind quarter. However, lambs in T2, T3 and T4 had intermediate value in these parameters. In general, lambs fed T1 and T5 enhanced comparable carcass and non carcass yield than in the other treatments. However, Supplementation with conventional feed resources (grains, cereals etc.) for animal production is scarce and highly expensive in many parts of the world. Hence, the use of forage legumes as alternative feed resources for ruminant livestock is becoming increasingly important in many parts of the tropics and sub-tropics because of its availability, abundance and relatively reduced cost. Therefore, it can be recommended that, T5 (ad-lib grass hay+Beresa-55 cultivars at 2% BW) can be used as a priority supplement in feeding of local sheep.
**Keywords:** Horro sheep, dressing percentage, hot carcass weight, *Lablab purpureus*

## 1. INTRODUCTION

Ethiopia has a diverse indigenous sheep population and their meat production is one of the most important in the country, and their socio-economic importance is also widely recognized (Adane and Girma, 2008; Solomon *et al*., 2013). However, Adugna *et al*. (2000) noted that, their production in East Africa and particularly in Ethiopia is characterized by low productivity levels in terms of growth rate, meat production and reproductive performance. Although there are various and complex constraints which contribute to these reduced productivity of sheep, inadequacy of feed in terms of both quality and quantity is considered to be the most important limiting factor (Adane and Girma, 2008). In under feeding conditions, animals take too long to reach optimum slaughter weight and the meat produced by such animals may not satisfy the desired quality attributes to fulfill the demand of the consumers. When the quality of the fodder is low, animals are not able to eat what is required to put on weight.

Supplementation with nutrient reach feed resources; mainly agro-industrial by products has been used in many developed countries for improving locally available poor quality feed resources (Xianjun *et al.*, 2012). Under smallholder livestock production systems however, the use of such supplements is usually limited due to their inaccessibility to farmers and unaffordable cost. As a result, there is limited prospect for using agro-industrial by products protein sources supplements such as oil seed cakes and wheat bran as a livestock feed by smallholder.

Hence, to improve the situation, identifying feed resources that are locally available and easily accessible to smallholder farmers for use as a supplement is crucial. FAO (2002) also suggested that, high quality feed for ruminants in developing countries can be achievable through intensive utilization of multipurpose trees and shrubs as they are easily produced and managed by livestock producers and have better nutritional quality nearly equivalent to grain based concentrates. In this regard, the use of leguminous forage crops such as *Lablab purpureus* capable of yielding quality herbage is urgently required. Although Gebisa-17 and Beresa-55 cultivars of *Lablab purpureus* was released as a new variety in 2014/15 for the study area as well as agro-ecologies similar to the study area, data on supplementary value of these cultivars on carcass characteristics of on local sheep was scarce. Therefore, the study was carried out to evaluate the carcass and non-carcass yield characteristics of Horro lambs supplemented with two *Lablab purpureus* cultivars and concentrate mixture in varied levels to basal diet of natural grass hay.

## 2. MATERIALS AND METHODS

### 2.1. Description of the Study Area

The study was conducted at Bako Agricultural Research Center (BARC) from June 2016 to February 2017. The area represents mid-altitude sub-humid maize growing agro-ecology of Ethiopia. The center is situated at latitude and longitude of 9°06'N and 37°09'E, respectively and it lies at an altitude of 1650 m above sea level with a mean monthly minimum and maximum temperatures of 11.23$^0$C and 31.74$^0$C, respectively and annual rainfall of about 1316.7 mm where the highest rain was received between May and September.

### 2.2. Experimental Feed Preparation and Feeding Procedures

Natural pasture grass was harvested manually from a naturally available grazing land found in the Center (Bako agricultural research center), sun dried for about 2 to 3 days and pilled under shade maintaining green color. Two recently released cultivars of *Lablab purpureus* labeled as Beresa-55 and Gebisa-17 were established on about 0.5 hectare of land at livestock farm site of the center in early June 2016 cropping season. It was harvested at 50% flowering, chopped with chopping machine to 3-5 cm in length to make more uniform and accessible to the animal, field-cured 2-3 days, baled and stored in a roofed hay barn. Whereas, wheat bran (WB) and Linseed Cake (LSC) sufficient for the entire experimental period were purchased and stored at Animal farm feed storage site. The crude protein content of experimental feeds was 19.93, 16.06, 29.43, 15.98 and 7.07% for Beresa-55, Gebisa-17, LSC, WB and natural grass, respectively. Similarly, Neutral detergent fiber (NDF) content ranged from the highest value of 52.82% obtained in natural grass to the lowest 34.56% (LSC). Experimental diets were offered as per the respective treatment in two equal portions at 0800 and 1600 h, respectively.

### 2.3. Experimental Design and Treatments

Randomized Complete Block Design was used for the study in which experimental lambs were blocked in to five groups each containing five lambs. Grouping of lamb in to the respective blocks were done based on their initial live weight taken in the morning before feeding and watering. They were housed in individual pens and the five experimental diets were randomly distributed to each lamb in the block. Natural grass hay was fed to all experimental lamb *ad-libitum* and supplemental feeds were offered on the body weight basis of the lambs restricted to 1.5 and 2% body weight on dry matter basis, which is adjusted following regular weight measurement taken every fifteen days. The composition of linseed cake (LSC) and wheat bran (WB) mixture was calculated based on their CP content obtained from laboratory analysis with the proportions (LSC 30%: WB 70%) chosen to provide CP content similar to that supplied by the highest CP level of Beresa-55 cultivar contained 19.93% CP. Therefore, the experimental treatments were:

- T1: *Ad-lib* natural grass hay + concentrate mixture at 2% BW
- T2: *Ad-lib* natural grass hay + Gebisa-17 cultivar hay at 1.5 % BW
- T3: *Ad-lib* natural grass hay + Gebisa-17 cultivar hay at 2 % BW
- T4: *Ad-lib* natural grass hay + Beresa-55 cultivar hay at 1.5 % BW
- T5: *Ad-lib* natural grass hay + Beresa-55 cultivar hay at 2 % BW

### 2.4. Experimental Animal and their Management

A total of twenty five (25) yearling Horro Lambs weighing initial body weight of 18.5 $\pm$ 1.99 kg (Mean $\pm$ Standard Deviation) were purchased in two rounds. While purchasing, age of the lambs were determined based on the information obtained from the owners and checking the dentition of lambs. All lambs were quarantined for ten (10) days before allocating them to the different experimental treatments. All lambs were ear tagged for ease of identification, de-wormed with antihelmintics (Fasionox 250 mg) to control internal parasites and sprayed with accaricides (Betazone diluted at 1.6 ml/liters of water) for external parasites control as prescribed by the manufacturer before the commencement of the trial up on their arrival at the center. At the end of the quarantine period, all lambs were tied in to their respective individual pens and offered with the experimental diet for 15 days to get them accustomed to the experimental feeds before commencing the actual feeding trial lasting for 90 days. Pen cleaning was done every morning before watering and feeding.

### 2.5. Carcass Evaluation

All experimental lambs from each treatment were deprived off feed and water overnight and weighed before slaughter. Slaughtering was accomplished by severing the jugular vein and the carotid artery with knife for carcass evaluation. The head was placed on container to collect blood, and the blood as weighted and recorded.

 

The lams were suspended with head down. Skin was carefully flayed to avoid attachment of fat and muscle tissues to the skin and then weighted without head, feet and the feet below fetlock joints. Then, the non-edible offal components (head without tongue, skin and feet, spleen, genital organ, lung, trachea, gall bladder, pancreas, bladder and the gut fill) and the edible offal components (kidney fat, testes, genital fat, heart fat, liver, heart, kidney, esophagus, blood, abdominal fat, tongue, stomach and intestine, both small and large intestine) were weighed, recorded and documented separately.

Empty body weight (EBW), hot carcass weight (HCW), rib-eye muscle area (RIME) and dressing percentage (DP) were determined individually. EBW: was recorded as the difference between slaughter weight and gut contents. HCW: was estimated after removal of weight of head, skin, thoracic, abdominal and pelvic cavity contents as well as legs below the hock and knee joints. Whereas calculation of RIME was accomplished by tracing and drawing the $11^{th}$ and $13^{th}$ cross section using transparent paper. The value for rib-eye muscle area is the average of the right and left sides on $12^{th}$ rib (Torell and Suverly, 2004). Dressing percentage as proportions of hot carcass weight to slaughter weight and empty body weight was computed as follows:

$$\text{DP (Based on empty body weight)} = \frac{\text{Hot carcass weight (kg)}}{\text{Empty body weight (kg)}} \times 100$$

$$\text{DP (Based on slaughter weight)} = \frac{\text{Hot carcass weight (kg)}}{\text{Slaughter weight (kg)}} \times 100$$

### 2.6. Statistical Analysis

Analysis of variance (ANOVA) following the General Linear Model (GLM) procedure of SAS (SAS, 2002, version 9.1.3) was used to analyze the data. Significantly different means were separated by using least significant difference (LSD) test at 5% level of significance.

The model fitted for the experiment was:

$Y_{ij} = \mu + T_i + B_j + E_{ij}$

Where;

$Y_{ij}$ = response variable

$\mu$ = overall mean effect

$T_i$ = treatment effect

$B_j$ = block effect

$E_{ij}$ = random error

## 3. RESULTS AND DISCUSSIONS

### 3.1. Carcass Parameters

#### 3.1.1. Main carcass components

Supplementation of both *Lablab* cultivars and concentrate mixture to Horro lambs based on natural grass hay shows significant effect on all main carcass parameters indicated in Table 1. The values of slaughter weight (SW) and empty body weight (EBW) took almost similar trend to that observed in FBW. Lambs fed diets in T1 had higher SW ($P<0.05$) and EBW ($P<0.01$) as compared to those lambs in T2, T3 and T4, but comparable with lambs in T5 in both attributes. The higher EBW of lambs in T1 and T5 might be attributed to their higher SW. Except with T1, values of SW of lambs in T2, T3, T4 and T5 were comparable. In contrast, lambs fed diet in T2 performed least in EBW than lambs fed on other treatment groups indicating for greater gut content in T2 to account for part of the SW that make them to have similar SW with lambs in T3, T4 and T5. Similarly, significant difference ($P<0.0001$) was observed among treatments in HCW, fore and hind quarter measurements (T1=T5>T2=T3=T4) which could be attributed to variation in DM and digestible nutrient intake.

In line with the current finding, significant variation of SW, EBW and HCW was noted among *Begait* sheep supplemented with *tsara* (*Pterocarpus lucens*), pigeon pea (C*ajanus cajan*) leaves and concentrate mixture as reported by Abraham (2015). Similarly, Hunegnaw and Berhan (2016) reported that, average slaughter weight (SW) and empty body weight (EBW) were higher for lambs supplemented with 225 gm *Lablab* as compared to lambs supplemented with 260 gm cowpea, 243 gm pigeon pea and the control treatment fed basal diet with 200 gm wheat bran. In disagreement to the present study, Alem (2014) reported as there is no significant variation of main carcass parameters considered among dietary treatments fed to Arsi-bale sheep.

 

Table 1: Main carcass components of Horro lambs fed natural grass hay and supplemented with Gebisa-17 and Beresa-55 cultivars of *Lablab purpureus* and concentrate mixture

| | Treatments | | | | | | |
|---|---|---|---|---|---|---|---|
| Carcass components | T1 | T2 | T3 | T4 | T5 | SEM | SL |
| **Main carcass parameters** | | | | | | | |
| Slaughter weight (kg) | $24.80^{a}$ | $20.55^{b}$ | $21.58^{b}$ | $20.77^{b}$ | $22.57^{ab}$ | 0.797 | * |
| Empty body weight (kg) | $20.21^{a}$ | $14.53^{c}$ | $17.10^{b}$ | $16.51^{bc}$ | $17.91^{ab}$ | 0.807 | ** |
| Hot carcass weight (kg) | $10.63^{a}$ | $7.74^{b}$ | $8.04^{b}$ | $7.81^{b}$ | $9.75^{a}$ | 0.428 | *** |
| Fore quarter (kg) | $5.23^{a}$ | $3.62^{b}$ | $3.84^{b}$ | $3.73^{b}$ | $4.90^{a}$ | 0.211 | *** |
| Hind quarter (kg) | $5.26^{a}$ | $4.82^{b}$ | $4.86^{b}$ | $4.83^{b}$ | $5.10^{a}$ | 0.063 | *** |
| Rib-eye muscle area ($cm^2$) | $9.54^{a}$ | $7.04^{c}$ | $8.03^{b}$ | $7.73^{b}$ | $9.06^{a}$ | 0.177 | *** |
| Fat thickness (mm) | $5.20^{a}$ | $4.10^{b}$ | $4.50^{ab}$ | $4.00^{b}$ | $4.50^{ab}$ | 0.003 | * |
| **Dressing Percentage (%)** | | | | | | | |
| Slaughter weight basis | $42.89^{a}$ | $37.76^{b}$ | $37.17^{b}$ | $37.36^{b}$ | $43.26^{a}$ | 1.259 | ** |
| Empty body weight basis | $52.67^{ab}$ | $53.44^{a}$ | $47.18^{b}$ | $47.19^{b}$ | $54.60^{a}$ | 2.047 | * |

$^{a,b,c}$ Means within a row with different superscripts differ significantly ($P < 0.05$); * = ($P < 0.05$); ** = ($P < 0.01$); *** = ($P < 0.001$); SL: significance level; SEM (Mean $\pm$ SE) = standard error of means; T1 to T5 = treatments

The rib-eye muscle area (REMA) which is an indirect estimate of body musculature or leanness of meat or the muscular development of the lambs (Galal and Kassahun, 1981), is varied significantly (P<0.0001) among dietary treatments. Lambs assigned to T1 and T5 diets had higher values of REMA over the remaining treatment groups. Similarly, lambs in T1, T3 and T5 had comparable fat thickness but relatively higher than T2 and T4. The REMA values recorded in the current study varied from the highest records found in T1 (9.54 $cm^2$) and T5 (9.06 $cm^2$) to the lowest one in T2 (7.04 $cm^2$). Similarly, treatment diets significantly influenced (P<0.05) the fat thickness of experimental lambs. Lambs allocated to consume diet T1 (5.20 mm) better performed than other treatments where values of T2=T4 and T3=T5. According to Ryan *et al.* (2007), the higher fat thickness of lambs in T1 might be related to the higher metabolizable energy content of concentrate feeds, LSC (11.37 MJ $kg^{-1}$DM) and WB (12.28 MJ $kg^{-1}$DM), used in the current study and the relatively higher ME intake (7.69 MJ/day) for lambs in T1 leading to increased fat thickness.

The REMA (7.04 to 9.54 $cm^2$) and FT (4.00 to 5.2 mm) of the present study is found within the range of 4.2 to 10.7 $cm^2$ and 0.7 to 6.4 mm, respectively for Horro sheep fed vetch (*Lathyrus sativus*) haulm basal diet supplemented with wheat bran, *Acacia albida* leaf and their mixture reported by Takele and Getachew (2011). Dereje (2015) reported REMA ranging from 9.0 to 9.4 $cm^2$ for Arsi-Bale goats fed concentrate mix substituted with Mulbery leaves which was comparable to the REMA value of lambs in T1 (9.54 $cm^2$) and T5 (9.06 $cm^2$) of the present study. Yilkal *et al.* (2014) also found that, supplementation of different forms of processed Lupin (*Lupinus albus*) grain to Washera sheep based on natural pasture hay resulted in 7.43 to 10.27$cm^2$ rib eye muscle area, which was higher than the value obtained in the current study.

Significant variation among treatments was observed in dressing percentage (DP) as a proportion of slaughter weight (SW) (P<0.01) and empty body weight (EBW) (P<0.05) basis. DP values on the EBW basis were higher than SW basis, implying the influences of digesta (gut fill) on dressing percentage. Lambs in T1 and T5 had higher DP on SW (P<0.01) basis followed by T2=T4=T3. However, DP on EBW basis was not significantly varied (P>0.05) among lambs in T1, T2 and T5 and, the same thing is true for T3=T4. Yilkal *et al.,* (2014) reported dressing percentage on SW and EBW basis in the range of 32.73 to 48.51% and 44.54 to 58.2%, respectively for Washera sheep supplemented different forms of processed Lupin (*Lupinus albus*) grain, which is in line to the present study result. Similarly, Mulugeta and Gebrehiwot (2013) reported DP ranging from 35.29 to 45.03 and 44.2 to 55.39% as a proportion of SW and EBW basis, respectively for indigenous (koraro) sheep. However, Abadi *et al.* (2014) reported DP of Afar sheep fed on natural grass hay and supplemented with Faba Bean (*Vicia faba L.*) as a substitute for wheat bran in the range of 41.96 to 45.56 (slaughter weight base) and 52.32 to 60.36 (empty body weight base), which is higher than the value obtained in the current study.

### 3.2. Non Carcass Parameters

#### 3.2.1. Edible Offal Components

The values of blood, Omasum-abomasum, diaphragm and tongue were not significantly influenced (P>0.05) by dietary treatments whereas, the rest parameters indicated (Table 2) were influenced significantly. Berhanu *et al.* (2014) who fed Washera sheep with *Millettia ferruginea* (Birbra) foliage as a supplemental diet also reported that; liver, blood, heart, kidney, small intestine and kidney fat were significantly affected by treatment and the rest offal components such as tongue, omasum, abomasums, Reticulo-rumen, large intestine and omental fats were not significantly influenced by treatment diets which is somewhat consistent with the current study result.

Lambs fed diets in T1 had resulted significantly different (P<0.05) tail weight as compared to those lambs in T2, T3 and T4 but not significantly different with lambs fed diets in T5 (P>0.05). However, values of tail weight of lambs in T5 was comparable (P>0.05) with those lambs in T2, T3 and T4. The weight of tail in lambs fed T1 was heavier by 351.88, 330.36 and 390.48 g over those lambs in T2, T3 and T4, respectively. On the other hand, heart (P<0.05) and heart fat (P<0.01) were also significantly affected by treatment diets. Statistically similar values of heart (P>0.05) and heart fat (>0.01) were recorded in lambs in T1 and T5. Likewise, the rest lambs in T2, T3 and T4 had also almost similar values in their heart (P>0.05) and heart fat (P>0.01) weight records.

Liver, liver with bladder, kidney, kidney fats and abdominal fat significantly varied among dietary treatments. With the exception of liver with bladder which is heavier in T1 than in T5; liver, abdominal fat, kidney and kidney fat did not significantly (P>0.01) differ between lambs in T1 and T5. Similarly, no significant (P>0.01) difference was also observed among lambs in T2, T3 and T4 in those parameters indicated above. Liver weight in T1 and T5 were higher than in T2, T3 and T4 by 102.06, 111.19, 99.63 and 63.18, 72.31, 60.75 g, respectively. In consistent to the present study, increasing trend of liver weight was reported by Gebregziabher *et al*. (2003) who conducted research on Horro rams. According to Lawerance (1989), the increase in liver weight with increasing supplementation level might be related with the storage of reserve substance such as glycogen.

Table 2: Edible offal components of Horro lambs fed natural grass hay and supplemented with Gebisa-17 and Beresa-55 cultivars of *Lablab purpureus* and concentrate mixture

| | Treatments | | | | | | |
|---|---|---|---|---|---|---|---|
| Edible offal (gm) | T1 | T2 | T3 | T4 | T5 | SEM | SL |
| Blood | 1009.60 | 810.40 | 1003.40 | 909.60 | 1088.00 | 80.12 | Ns |
| Tail | 650.22$^{a}$ | 398.34$^{b}$ | 419.86$^{b}$ | 359.74$^{b}$ | 528.12$^{ab}$ | 65.47 | * |
| Heart | 119.96$^{a}$ | 94.22$^{b}$ | 91.38$^{b}$ | 90.44$^{b}$ | 111.58$^{ab}$ | 7.66 | * |
| Heart fat | 22.34$^{a}$ | 14.18$^{bc}$ | 12.42$^{c}$ | 8.76$^{c}$ | 19.60$^{ab}$ | 2.37 | ** |
| Liver | 415.06$^{a}$ | 313.00$^{b}$ | 303.87$^{b}$ | 315.43$^{b}$ | 376.18$^{a}$ | 14.83 | ** |
| Liver with- bladder | 439.74$^{a}$ | 321.90$^{c}$ | 320.30$^{c}$ | 316.38$^{c}$ | 382.00$^{b}$ | 16.44 | ** |
| Kidneys | 39.70$^{a}$ | 35.57$^{b}$ | 32.46$^{b}$ | 35.93$^{b}$ | 42.16$^{a}$ | 1.20 | ** |
| Kidneys fat | 26.89$^{a}$ | 13.42$^{c}$ | 18.68$^{bc}$ | 13.84$^{c}$ | 24.06$^{ab}$ | 2.00 | ** |
| Abdominal fat | 80.45$^{a}$ | 55.60$^{bc}$ | 59.36$^{bc}$ | 52.58$^{c}$ | 70.33$^{ab}$ | 7.84 | ** |
| Small & large intestine | 889.96$^{a}$ | 755.26$^{ab}$ | 651.00$^{b}$ | 723.60$^{ab}$ | 882.20$^{a}$ | 56.23 | * |
| Reticulo-rumen | 648.22$^{a}$ | 600.00$^{ab}$ | 502.00$^{c}$ | 512.00$^{bc}$ | 594.00$^{ab}$ | 29.59 | * |
| Omasum-abomasum | 230.95 | 207.20 | 195.50 | 217.73 | 215.20 | 17.37 | Ns |
| Omental fat | 32.73$^{a}$ | 26.69$^{bc}$ | 26.93$^{bc}$ | 24.20$^{c}$ | 28.44$^{b}$ | 1.4 | ** |
| Diaphragm | 102.68 | 88.84 | 95.26 | 84.38 | 97.48 | 5.98 | Ns |
| Tongue | 89.64 | 93.76 | 86.95 | 89.08 | 92.39 | 2.06 | Ns |
| Total Edible Offal (kg) | 4.89$^{a}$ | 3.83$^{b}$ | 3.82$^{b}$ | 3.75$^{b}$ | 4.55$^{a}$ | 0.17 | ** |

$^{a,b,c}$ Means within a row with different superscripts differ significantly (P < 0.05); * = (P < 0.05); ** = (P < 0.01); *** = (P < 0.001); SL: significance level; SEM (Mean ± SE) = standard error of means; ns = non significant; T1 to T5 = treatments

Lambs fed diets in T1, T2, T4 and T5 had shown no significant difference (P>0.05) in their small and large intestine weight but different from lambs in T3 (P<0.05). Similarly, significant variation in reticulo-rumen (P<0.05) and omental fat (P<0.01) was also seen among treatments. However, no clear trend was observed among dietary treatment. On the other side, total edible offal (TEO) was also significantly affected by dietary treatments. Lambs in T1 and T5 had similar values (P>0.05) in their TEO followed by T2=T3=T4. Significantly increased TEO with increasing level of supplementation for Adilo sheep fed sweet potato tuber and haricot bean screenings as a supplemental diets was reported by Biru (2008). The author further reported that, TEO values ranging from 2.9 to 4.5 kg which agrees with value obtained in the current study (3.75 to 4.89 kg). Heavier TEO values ranging from 9.3 to 9.9 kg for Arsi-Bale sheep compared to the current study was reported by Teklu (2016). This difference might be due to the difference in sheep breed and basal feed types used unlike in the current study.

**3.2.2. Non-edible offal Components**

In the current study, significant variation among treatments was noticed only for skin, gall bladder, testicle and penis whereas, no significant difference (P>0.05) was observed for the rest parameters indicated in Table 3. Lambs in T1 and T5 had higher (P<0.01) skin weight compared to lambs in T2, T3 and T4. Whereas, lambs fed diet T2, T3 and T4 had almost similar (P>0.01) value in their skin weight even though lambs fed T4 had slightly lower value. Gall-bladder also significantly varied (P<0.05) among dietary treatments where the higher value was gained by lambs in T5 followed by T1=T3>T4=T2.

The relatively higher skin weight obtained by lambs fed diets in T1 and T5 might be associated to their higher ME intake, T1 (7.69 MJ/d) and T5 (6.02 MJ/d), which might have resulted in better subcutaneous layer fat deposition in these groups. Testicles and penis weight had also shown significant variation (P<0.05) among treatments where, lambs in T1 had almost similar (P>0.05) value in testicles weight with lambs in T5 and T2 followed by T3=T4. Similarly, higher values in penis weight were obtained from lambs in T1 however, T2 had the lower value and, T3, T4 and T5 had intermediate result.

Table 3: Non-edible offal components of Horro lambs fed natural grass hay and supplemented with Gebisa-17 and Beresa-55 cultivars of *Lablab purpureus* and concentrate mixture

| | Treatments | | | | | | |
|---|---|---|---|---|---|---|---|
| Non-edible offal | T1 | T2 | T3 | T4 | T5 | SEM | SL |
| Lung with trachea (gm) | 366.56 | 297.86 | 342.08 | 285.84 | 330.04 | 24.74 | Ns |
| Skin (kg) | $2.58^{a}$ | $2.18^{bc}$ | $2.16^{bc}$ | $2.11^{c}$ | $2.42^{ab}$ | 0.09 | ** |
| Gall-bladder (gm) | $17.75^{ab}$ | $12.30^{b}$ | $16.43^{ab}$ | $15.09^{b}$ | $20.97^{a}$ | 1.84 | * |
| Gut-content (kg) | 4.59 | 6.02 | 4.48 | 4.26 | 4.66 | 0.49 | Ns |
| Spleen (gm) | 76.56 | 51.30 | 52.64 | 63.66 | 64.48 | 7.38 | Ns |
| Pancreas (gm) | 33.33 | 32.79 | 31.52 | 31.90 | 33.58 | 1.41 | Ns |
| Head (kg) | 1.20 | 1.23 | 1.21 | 1.20 | 1.29 | 0.04 | Ns |
| Testicles (gm) | $148.69^{a}$ | $131.15^{ab}$ | $124.24^{b}$ | $125.97^{b}$ | $147.50^{a}$ | 6.34 | * |
| Penis (gm) | $48.73^{a}$ | $41.25^{c}$ | $44.23^{bc}$ | $43.6^{bc}$ | $46.88^{ab}$ | 2.59 | * |
| Feet with hooves (gm) | 282.46 | 244.13 | 264.56 | 253.15 | 269.11 | 13.48 | Ns |
| Total non-edible offal (kg) | 9.35 | 10.24 | 8.73 | 8.39 | 9.29 | 0.47 | Ns |

[a,b,c] Means within a row with different superscripts differ significantly ($P < 0.05$); * = ($P < 0.05$); ** = ($P < 0.01$); SL: significance level; SEM (Mean $\pm$ SE) = standard error of means; ns = non significant; T1 to T5 = treatments

## 4. Conclusion

In general, despite their variability in magnitude, which in turn depends on their levels of supplementation, both Gebisa-17 and Beresa-55 cultivars and concentrate supplements had positively influenced the carcass and non carcass parameters under consideration. However, Lambs fed concentrate mixture (T1) and Beresa-55 cultivar (T5) diets had shown almost comparable and better performance in their main carcass parameters as well as non carcass parameters, especially edible offal components, as compared to the other treatment groups. Under smallholder livestock production systems however, the use of commercial concentrate supplements is usually limited due to their inaccessibility to farmers and unaffordable cost. As a result, there is limited prospect for using agro-industrial by products protein sources supplements such as oil seed cakes and wheat bran as a livestock feed by smallholder. Therefore, it can be concluded that supplementation of Beresa-55 cultivars (T5) at 2% body weight could be used as a priority supplement for low quality roughage in feeding of local sheep.

## 5. Acknowledgment

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