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Carcass Characteristics of Menz Ram Lambs Fed Grass Hay Basal Diet and Supplemented Wheat Bran and Lentil Broken Screening

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Abstract

An experiment was conducted to evaluate carcass characteristics of Menz ram lambs fed grass hay basal diet and supplemented different combination of wheat bran and lentil broken screening. The treatments were T_1 (30 g wheat bran 133 g lentil broken screening), T_2 (235 g lentil broken screening only), T_3 (285 g wheat bran only), and T_4 (227 g wheat bran and 120 lentil broken screening). Twenty-four Menz ram lambs of 8 to 10 months of age were grouped into six blocks based on their initial body weight and treatments were randomly distributed to each block of four animals. Six animals per treatment were used for feed intake and body weight change evaluation. Five lambs from each treatment were randomly picked and slaughtered for carcass evaluation. Wheat bran and lentil screening combination affected ($P \le 0.01$) the daily total dry matter intake (TDMI), final body weight, total weight gain and average daily weight gain ($P \le 0.001$) of lambs with the highest value recorded from T_4 diet categories. The experimental lambs showed lower ($P \le 0.01$) feed conversion efficiency (0.06) for the diet containing 30 g wheat bran and 133 g lentil screening (T_1) than the values recorded from T_2, T_3 and T_4 groups. The slaughter body weight was lower ($P \le 0.001$) for those lambs were assigned in T_1 than in T_2, T_3 and T_4. The higher ($P \le 0.001$) empty body weight (19.56 g) was recorded for lambs assigned to T_4 diet than T_1 followed by T_2 and T_3 diet. The carcass yield of lambs was increased ($P \le 0.01$) at T_4 supplemented groups than at T_1 and T_2 diets. The concentrate combination effect was non-significant ($P \ge 0.05$) on dressing percentage, and proportions of carcass lean, fat and bone. Lambs assigned to T_4 diet had higher weight of kidney fat and ureo-genital tract ($P \le 0.01$) as well as respiratory tract and blood ($P \le 0.05$) than seen for other treatment categories. Except the dry matter percent of carcass fat ($P \le 0.001$), all carcass quality parameters were not affected ($P \ge 0.05$) by the concentrate diet combinations. Carcass yield and quality of Menz ram lambs was better at feeding plan of grass hay basal diet and 227 g wheat bran and 120 g lentil broken screening concentrate mixture supplementation.

Keywords: Carcass; Combinations; Lamb; Lentil screening; Sheep; Wheat bran

Introduction

Thought, sheep producers may not exactly explain animal nutrient requirement related factors that contribute to low productivity of the animals; scientific works put nutrition to be the major determinant factor affecting productivity. In many animal production systems, approximately two-thirds of improvements in livestock productivity can be attributed to improved nutrition [1]. According to McDonald et al. [2] and Olfaz et al. [3], feed types and nutritional levels are related to carcass yield, carcass quality, and fat tissue development and composition of the animals.

Moreover, excessive or scarce nutrient levels in the diet impair the feed conversion efficiency of lambs rather balanced feed can improve production and feed efficiency. Skunmun et al. [4] stated that dietary energy to protein ratio has implications on animal performance and can influences carcass and/or meat fatness and the muscle deposition. Appropriate supplementing animals with dietary energy and protein rich diets have proven to improve animal performance and profitability [5]. Thus, identifying the best combination of dietary energy and protein source feed supplement is important in practical feeding system to avoid under or over feeding of nutrients to the animals.

According to the survey work result conducted by wude et al. [6] wheat bran and lentil broken screening locally called "*ymiser kik bitari (Elet)*" are among the most predominant dietary energy and protein source concentrate supplements use for sheep fattening in and around Debre Berhan Town, where surroundings are the niches for Menz sheep breed. Thus, developing the best feed package from locally available feed resources where specific sheep breed found is preferable to recommend easily adoptable complete feed package. Proper and easily available feed package is among the major components for sustainable sheep production [7]. In Ethiopia different sheep fattening experiments undertaken by different researchers showed that dry matter, body weight change and carcass characteristics of sheep are affected by feed types [8,9]. However, information on dry matter intake, body weight change and carcass characteristics of Menz ram lambs fed grass hay basal diet and supplemented with wheat bran and lentil broken screening mixture was limited. Therefore, it was worthwhile to evaluate dry matter intake, body weight change and carcass characteristics of Menz ram lambs fed grass hay basal diet and different wheat bran and lentil broken screening mixtures supplementation.

Materials and Methods

Experimental site

The feeding and carcass evaluation trials were conducted at Debre-

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Zeit Agricultural Research Center located at about 45 km from Addis Ababa at an altitude of about 1900 meters above sea level. The mean annual rainfall and mean maximum and minimum temperatures for the area are 1100 mm, and 28.3°C and 8.9°C, respectively [10].

Experimental animals

Experimental animals were 24 Menz-sheep-breed ram lambs. The age range of lambs was from 8 to 10 months and the initial body weight was 17.97 ± 0.28 kg (mean ± SE). Age was estimated based on dentition and information obtained from the owners. Lambs were quarantined for 3 weeks during which they were treated against internal and external parasites with albendazole bolus and acarimic spray, respectively. Lambs were also vaccinated against pneumonia, sheep pox, blackleg, and anthrax diseases.

Feed ingredients and experimental diets

The feed ingredients used for feeding the experimental lambs were native pasture grass hay, wheat bran; lentil broken screening locally called "*ymiser kik bitari (Elet)"* and salt, which were among commonly available feed ingredients, where the experimental animals are predominantly found. Lentil broken screening is a mixture of high amount of broken lentil and very few lentil bran and lentil spur. Experimental diets were formulated by reviewing of different literatures about the energy and protein requirements of dietary energy and protein for growing lambs.

The combination of these dietary energy and protein source concentrates were determined based on nutrient recommendation guides for other breeds. Wheat bran and lentil broken screening combination was set (Table 1) the total offered feed to be contained around 8 to 9 MJ ME per kg DM and 10% to 12% CP considering the energy and protein the animals can also get from grass hay *ad libitum* feeding.

Experimental design and layout

Randomized complete block design (RCBD) was used to undertake the experimental study. Four dietary treatments from different wheat bran and lentil screening combinations were arranged as:

T_1=Diet containing 30 g wheat bran and 133 g lentil broken screening combinations

T_2=Diet containing 235 g lentil broken screening combinations

T_3=Diet containing 285 g wheat bran

T_4=Diet containing 227 g wheat bran and 120 lentil broken screening

The experimental lambs were grouped into six blocks of four lambs based on their initial body weight, which was determined two weighing average after overnight fasting at the end of the adaptation period of 15 days. Four treatment diets were randomly assigned to each lamb in the block, making six lambs per treatment.

Feeding of experimental lambs

Lambs were fed individually during the experimental period by offering grass hay basal diet *ad libitum* ensuring a refusal of 20%, based on previous day's intake. Concentrate supplements were offered twice a day in two equal portions at 08:00 and 16:00 hours. There was an adaptation period of 15 days to the experimental feeds before the commencement of data collection. Water was given ad libitum. Feed offered and refused was measured daily using 5 kg sensitive balance with one gram precision, and the difference between the daily total feed offered and the daily refused was considered as daily feed intake on DM basis.

Body weight change and feed conversion efficiency

On the first day of the commencement of the feeding trial, at the end of 15 days of adaptation period to treatment feeds the average of two weighing was taken as initial body weight of lambs. The daily feed and subsequent body weight measurements were taken at a ten-day interval after overnight fasting using a 100 kg Salter fixed balance with a sensitivity of 0.5 kg. The average daily body weight change was calculated as the difference between the initial and final live weight of the lambs divided by the number of experimental days. Feed conversion efficiency (FCE) of the lambs was determined as the proportion of daily body weight gain to the daily total DM intake [11].

Carcass evaluation

Five experimental lambs from each treatment were weighed and slaughtered after overnight fasting. The hot carcass weight was measured after about one hour from slaughter. Then, the cold carcass weight was measured after overnight chilling. The weights of different non-carcass components were measured immediately after slaughter. The blood and full reticulo-rumen were weighed using plastic buckets. The un-dissected and dissected carcass was measured for carcass yield and quality parameters.

The pH and color values of carcass were measured as described by Mitchell. The pH value was measured twice (at 1 and 24 hour, after slaughter), using a pH meter equipped with a penetrating electrode (Hanna Instruments, HI–9025), which was manually inserted into the *longissimus dorsi muscle.* Then, at insertion the muscle pH was read from the equipment. In addition to calibration, ionized water was used to rinse the pH meter before and after inserting in to the muscle of another lamb. Color was measured from *longissimus dorsi muscle* using a Minolta CM-2002 colorimeter, defining color as a set of three variables: L^* for brightness, a^* for redness and b^* for yellowness.

According to Mitchell, the carcass was split along the dorsal middle line with a band saw after removing the tail.

Thus, components of the carcass were estimated as:

Total lean=Constant × Weight of lean from left half carcass,

Total fat=Constant × Weight of fat from left half carcass, and

Treatment	Experimental feed ingredients (g)			Total (g)	Nutrients	
	Wheat bran	Lentil broken screening	Salt		ME (MJ/kg DM)	CP (%)
T_1	30	133	5	168	10.5	25.73
T_2	0	235	5	240	10.4	27.73
T_3	285	0	5	290	11.7	18.23
T_4	227	120	5	352	11.3	21.62

Table 1: Concentrate feed ingredients used to formulate treatment diets.

Total bone=Constant × weight of bone from left carcass,

Where, constant is determined as proportion of cold whole carcass to cold left half carcass.

Samples from lean meat and from visible fat were collected from the left half carcass and were retained for laboratory chemical analysis of ether extract and crude protein.

Laboratory analysis

The partially dried representatives of feed samples were milled using laboratory mill to pass through 1 mm sieve screen and analyzed for DM and ash according to the procedure of AOAC [12]. The two-stage method outlined by Tilley and Terry [13] was followed to determine IVOMD and then metabolizable energy (ME) content was estimated using the equation: ME (MJ/kg DM)=0.16 × IVOMD [2]. Nitrogen (N) was analyzed according to Kjeldhal procedure, and CP was determined as N × 6.25. Samples of meat and fat were dried at 60°C for 48 h in a forced draft oven and ground to pass through a 1 mm sieve screen and analyzed for DM, CP and EE as per AOAC [12].

Data analysis

The data was analyzed using SAS software [14]. Mean comparison was done using Duncan's multiple range test and significant differences between the treatment groups were considered at $P \leq 0.05$).

The model fitted to calculate the different response variables were:

$Y_{ij} = \mu + a_i + e_i$

Where:

Y_i = Response variables

μ = Over all mean

a_i = i^{th} Effect of wheat bran and lentil broken screening combinations

e_i = Effect of the i^{th} random error

Results

Dry matter intake and body weight change

The effects of different combinations of wheat bran and lentil broken screening on the average daily dry matter and body weight of ram lambs is presented in Table 2. Wheat bran and lentil broken screening combinations affected ($P \leq 0.05$) the total dry matter intake (TDMI). Lambs assigned for 227 g wheat bran and 120 g lentil screening combination (T_4) showed highest TDMI than T_1, T_2 and T_3 diet groups.

The initial body weight of the experimental animals was similar ($P \geq 0.05$) between the dietary treatment groups. Final body weight (FW) of the animals was higher ($P \leq 0.01$) for those animals fed 227 g wheat bran and 120 g lentil screening concentrate (T_4). Total body weight gain (BWG) and daily body weight gain (DBWG) of those animals allocated to T_4 were higher ($P \leq 0.001$) than recorded for lambs were in T_1 followed by T_2 and T_3 diet group.

The wheat bran and lentil screening concentrate combination effect was significant ($P \leq 0.01$) on FCE in terms of kg body gain per kg dry matter intake. The experimental sheep showed superior feed conversion efficiency (0.08) on the diet containing 227 g wheat bran and 120 g (T_4) lentil screening concentrate than those offered a diet containing 30 g wheat bran and 133 g lentil screening (T_1).

Carcass evaluation

The effect of wheat bran and lentil screening combinations on carcass yield is presented in Table 3. The slaughter and empty body weight, and cold carcass weight of finishing ram lambs varied ($P \leq 0.001$) between wheat bran and lentil screening combinations. The hot carcass weight was also affected ($P \leq 0.01$) by wheat bran and lentil screening combinations. The dressing percentage and carcass lean, fat and bone proportion of lambs were similar ($P \geq 0.05$) between the treatment diets groups.

The higher slaughter and empty body weight was recorded for lambs assigned to T_4 diet categories than were in T_1, T_2 and T_3 ones. The carcass yield of lambs was increased at concentrate supplement of 227 g wheat bran and 120 g lentil screening mixture (T_4) than at T_1 diet. Lambs assigned to T_4 diet numerically had higher dressing percentage in terms of slaughter weight than the lambs fed T_1, T_2 and T_3 diets. A bit higher fat percentage also was recorded for lambs assigned to a T_4

Treatment	Measured variables					
	TDMI	IBW (kg)	FW (kg)	TWG (kg)	DWG (g)	FCE
T1	716.06^a	18.08	21.42^a	3.33^a	37.04^a	0.06^a
T2	760.17^a	17.79	22.58^{abc}	4.79^b	53.24^b	0.07^b
T3	775.11^a	18.08	23.25^b	5.17^b	57.41^b	0.07^b
T4	814.47^b	17.92	24.13^c	6.21^c	68.98^c	0.08^b
Sig.	*	NS	**	***	***	**

Note: DMI=Dry Matter Intake; IBW=Initial Body Weight; FW=Final Body Weight; TWG=Total Body Weight Gain; DWG=Daily Body Weight Gain; FCE=Feed Conversion Efficiency (BWG/DMI); **=P ≤ 0.01; ***=P ≤ 0.001; NS=Non-Significant; Sig.=Significance.

Table 2: Dry matter intake and body weight change of lambs as affected by wheat bran and lentil broken screening combinations (g).

Treatments	Measured variables								
	SW (kg)	EBW (kg)	Carcass wt. (kg)		Dressing %		Carcass proportion (%)		
			Hot	Cold	SW basis	EBW basis	Lean	Fat	Bone
T1	19.20^a	15.48^a	7.88^a	7.34^a	41.2	50.17	57.69	10.78	27.83
T2	21.40^b	18.00^b	9.32^b	8.77^b	43.48	51.76	60.08	11.84	25.12
T3	22.20^b	18.76^b	9.40^b	8.89^{bc}	42.42	50.17	56.93	11.04	24.93
T4	22.60^b	19.56^c	10.06^b	9.65^c	44.61	51.64	58.62	12.28	26.31
Sig.	***	***	**	***	NS	NS	NS	NS	NS

Note: SW=Slaughter Weight; EBW=Empty Body Weight; **=P ≤ 0.01; ***=P ≤ 0.001; NS=Non-Significant; Sig.=Significance
^{abc}The same column with different superscripts differ significantly.

Table 3: The carcass yield parameters as affected by wheat bran and lentil screening combinations.

than T_1 followed by T_2 then T_3 group. The carcass lean proportion from lambs was better at T_2 than T_4 then followed by T_1 and T_3 categories.

Non-carcass components

The effect of wheat bran and lentil screening combinations on non-carcass body components are presented in Table 4. Wheat bran and lentil screening combinations effect was significant ($P \leq 0.01$) on kidney fat and ureo-genital tract (UGT) of the experimental lambs. Respiratory tract and blood weights were different ($P \leq 0.05$) between the treatment diet groups.

Carcass quality parameters

Carcass quality parameters as affected by wheat bran and lentil screening combinations are shown in Table 5. Wheat bran and lentil screening combinations effect was non-significant ($P \geq 0.05$) on all carcass quality parameters except on DM content of carcass fat. The DM% of carcass fat was higher ($P \leq 0.001$) for lambs from the diet contained 227 g wheat bran and 120 g lentil screening (T_4) than T_1 and T_2 diet. Animals assigned to T_2 diet had numerically greater value (8.59) of cold carcass b^* value than 8.59, 8.11 and 7.08 recorded from T_3, T_1 and T_4 diet groups. The CP% in carcass lean of lambs was numerically higher for $T_1>T_3>T_2$ diet. The values of cold carcass brightness (L^*) was a bit higher from lambs assigned for T_4 diet.

Discussion

Dry matter intake and body weight change

The present study showed that dry matter intake and body weight change were statistically affected by energy and protein source concentrate combinations. In T_4 and T_3 diet groups, which were the higher energy contained concentrate ones, the dry matter intake of lambs was higher than T_1 and T_2 groups. It was associated with more concentrate offered for the animals assigned to higher energy contained diets. In agreement with the present findings, Sultan et al. [15] reported that dietary energy levels influenced the dry matter intake of lambs. Similarly with the present study, Haddad and Husein [16] reported that finishing Awassi lambs on high energy diet improves DMI better than on low energy diet.

The total DMI (814.47 g) observed from T_4 diet was in agreement with 802 ± 9.35 g reported by Kassahun [17] from one year old Menz lambs fed on hay ad libtum and 400 g concentrate supplement. Anindo et al. [18] reported 568 ± 11 g daily DM intake from 5-7 month-old Menz ram lambs on grazing and supplemented with 80 g molasses-urea-block, which was less than the DMI recorded in the present study. It could be due to the experimental animals' age and feed composition differences.

Measured variables	Treatments				
	T_1	T_2	T_3	T4	Sig.
Full gut (kg)	5.32	5.12	5.16	4.8	NS
Empty gut (kg)	1.6	1.72	1.76	1.8	NS
Kidney (g)	57.62	60.76	59.26	62.94	NS
Kidney fat (g)	29.68^a	48.30^{bc}	37.92^{ab}	51.62^c	**
Spleen (g)	43.74	44.46	49.26	49.64	NS
RT (g)	0.28^a	0.35^b	0.31^{ab}	0.37^b	*
Heart (g)	0.12	0.13	0.12	0.13	NS
Liver^a (g)	0.33	0.38	0.35	0.39	NS
Blood (kg)	0.78^a	0.85^a	0.84^b	0.96^c	*
Skin (kg)	1.95^a	2.33^{ab}	2.23^{ab}	2.70^b	NS
Head (kg)	1.64	1.91	1.82	1.83	NS
Testicles (g)	0.19	0.21	0.19	0.24	NS
UGT (g)	62.82^a	94.14^b	74.78^{ab}	125^c	**

Note: UGT=Ureo-Genital Tract; RT=Lung with Trachea; *=P ≤ 0.05; **=P ≤ 0.01; NS=Non-Significant; Sig.=Significance
^{abc}The same column with different superscripts differ significantly.

Table 4: Non-carcass body components as affected by wheat bran and lentil screening combinations.

Measured variables		Treatments				
		T1	T2	T3	T4	Sig.
DM%	lean	29.08	28.7	30.8	32.96	NS
	Fat	50.86^a	53.30^b	55.12^c	55.66^c	***
Lean meat CP %		61.58	60.5	60.58	58	NS
EE %	lean	6.39	7.14	8.49	8.84	NS
	fat	90.26	80.49	83.44	90.55	NS
Carcass pH	Hot	6.61	6.86	6.91	6.68	NS
	Cold	5.68	5.71	5.94	5.8	NS
Hot	L^*	33.53	33.74	32.93	31.5	NS
Carcass color	a^*	7.83	7.17	6.99	6.85	NS
	b^*	7.42	7.26	6.63	6.56	NS
Cold	L^*	34.53	34.21	32.94	34.6	NS
Carcass color	a^*	11.33	12.04	9.96	10.26	NS
	b^*	8.11	9.97	8.59	7.08	NS

Note: DM=Dry Matter; CP=Crude Protein; EE=Ether Extract; L^*=Bright, A^*=Red And B^*=Yellow; ^{abc}The same column with different superscripts differ significantly; ***=P ≤ 0.001; NS=Non Significant; Sig.=Significance Level

Table 5: Carcass quality as affected by wheat bran and lentil screening combinations.

The present study confirmed that FW, TWG, and DWG of lambs assigned to 227 g wheat bran and 120 g lentil screening mixture (T_4) were higher than those fed on T_1, T_2 and T_3 diet. Similarly, the wheat bran and lentil screening combination effect was significant on FCE. Lambs assigned to a diet containing 227 g wheat bran and 120 g lentil screening showed higher FCE than were seen for T_1 diet groups. In agreement with the present study, Moharrery et al. [19] and Yagoub and Babiker [20] reported that daily body weight gain improved at a higher dietary energy than at a lower energy level. The final body weight of the lambs fed a diet containing 2.90 Mcal/kg DM was higher than lambs fed a diet with 2.40 Mcal/kg DM [21], which was in similar trend with the present finding. The FCE was higher in a diet containing a higher ME and CP level [22]. Similarly, Yagoub and Babiker [19] stated that increased dietary energy level improved FCE. Hosseini [23] also indicated that dietary energy density has effect on performance of lambs and it is the major dietary element responsible for the variation in the utilization of nutrients.

Kassahun [17] reported that Menz ram lambs attained 19.12 ± 0.47 kg body weights at their 12 month of age with DWG of 50.62 ± 2.20 g. The 5-7 months old Menz ram lambs resulted in 4 kg extra body weight after 6 months of grazing and supplemented with 80 g molasses-urea-block [18]. Indoor feeding g with 227 g wheat bran and 120 g lentil screening mixed diet supplementation could be for better final body weight during the 3 months feeding period seemed to be acceptable to obtain best body weight of fattening Menz ram lambs. Almost in all treatment groups, the body weight change trend was increasing with slower rate at the beginning of experimental weeks then increased at a higher rate followed by slower rate towards the last week indicated that the three months lambs fattening time with the same age and initial body weight group and diet could be enough.

Carcass evaluation

The concentrated diet supplement combination affected the slaughter body, empty body, hot and cold carcass weights and these parameters were higher at T_4 than were at T_1, T_2 and T_3 diets. The dressing percentage and carcass proportion were not affected by energy and protein source concentrate feed combinations. Ríos-Rincón et al. [24] also observed insignificant effect of dietary protein level on lamb carcass parameters.

In the present study, the dressing percentage recorded from all treatment groups disagreed with Kassahun who reported 49.1% dressing percentage, 10.78-12.36% fat, 24.93-26.48% carcass bone and 19.5% fat proportion from the same breed slaughtered at about 17 months of age and attained 32 kg live body weight. Ewnetu et al. [25] also found higher pre-slaughter weight (25 kg), empty body weight (20.4 kg) and carcass weight (10 kg), lower fat (9%) and bone (23%) proportion from 17-month-old Menz ram lambs. The difference on carcass measurements observed between the previous and the current study could be due to age and nutrition composition differences. In line with this, different scholars such as, Santos-Silva et al. [26]; Ruzic-Muslic et al. [27] and Muhammad et al. [28] stated that plane of nutrition as a factor of environment has a vital role to determine carcass characteristics of lambs.

The proportion of carcass lean was better from lambs supplemented 235 g lentil screening (T_2) than the rest of treatment groups. The proportion of carcass lean was also higher than the previous reports [17,25]. This level of supplementation can be considered as best for finishing of Menz lambs, if leaner meat is the first preference. The characteristics of a superior lamb carcass are a high proportion of muscle (lean), a low proportion of bone and an optimal level of fat cover [17]. However, during festivities, lambs and withers with high fat cover may be more worth. Accordingly, a supplement diet containing 227 g wheat bran and 120 g lentil screening may be used for feeding lambs for better carcass fat cover. A slower growth rate at a lower energy diet produced a slightly higher leaner carcass and a lower dressing percentage. In relation to this, Beauchemin et al. [29] reported that to improve carcass leanness, reducing the energy content of diets fed to feedlot lambs is not an economically sound production strategy.

Non-carcass components

The effect of wheat bran and lentil screening combination was insignificant on all non-carcass body component weights except for kidney fat, blood, respiratory and ureo-genital tract weights. Higher kidney fat, blood, respiratory and ureo-genital tract weights recorded from lambs assigned to T_4 diet. In agreement with the present study, Ríos-Rincón et al. [24] reported more kidney-pelvic fat percentage in the high-energy diet. The weights of heart, head, kidney and testicles recorded from all treatments were similar with the reports of Abadi, et al. [30] heart (118-123 g), head (1662-1760 g), kidney (185-212 g), and testicles (240-254 g) weight of Afar sheep. The higher blood, kidney fat and liver weights were reported in the present study as compared with reported for Washera sheep fed grass hay supplemented with *Millettia ferruginea* leaf hay [31].

Carcass quality parameters

The higher lean and fat DM% value at T_4 diet group indicated that lambs fed a diet containing 227 g wheat bran and 120 g lentil screening resulted in a carcass yield with higher DM content as compared to that of T_1, T_2 and T_3 diet. Numerically, the protein content of lean carcass was higher from lambs supplemented 285 g wheat bran (T_3) than the rest treatment groups. According to FAO [32], the content of fat and CP in lamb`s lean meat was 9.5% and 28.5%, respectively was disagreed with the present study for all diet groups. It could be due to differences in breed, feed and age of lambs.

The higher EE of lean carcass in the present study from lambs assigned in T_4 indicated that 227 g wheat bran and 120 g lentil screening mixture diet was better to get high carcass fat cover than for other combination diet. A higher ether extract value (22.4%) was reported by Kasahun [17] from lean carcass of Menz lambs, compared to the EE recorded from the present study. The EE values variation between the present and the previous ones might be a higher proportion of intra muscular fat from older lambs than young ones. The nutrient concentration could also be the reason for EE value differences between the previous and present studies. Energy to protein ratio influences muscle deposition and meat quality [4]. According to Kasahun [17], Iason and Mantecon [33] and Cantón et al. [34] reports, breed, management, environmental conditions, and nutritional level can affect carcass yield and quality, fat tissue development and composition.

Thought, the effect of concentrate combinations was non-significant on color and pH values, the higher hot carcass yellowness (b^*) numerical value for T_1 diet was in agreement with Maiorano et al. [35], yellowish muscles developed in animals assigned to lower ME diets than were at higher one. The pH levels of 5.8 or less after 24 hour of slaughter are recommended to avoid meat quality deteriorated [36]. Croker and Watt [37] also reported that pH around 5.5 is desirable for carcass. Thus, the pH values recorded for cold carcass in the present study from all diet groups were within the recommended ranges.

Conclusion

The study was conducted to evaluate dry matter intake, growth performances and carcass characteristics of fattening Menz ram lambs fed grass hay basal diet and different mixtures of wheat bran and lentil broken screening supplement. Final body weight, TWG, DWG, FCE and nutrient utilization were significantly affected by the concentrate feed combinations with the higher values recorded for the lambs assigned to T_4 diet. The concentrate feed combinations affected the slaughter body, empty body, hot and cold carcass weights and the values of these parameters were higher at T_4 than were at T_1, T_2 and T_3 diets. Except more value of kidney fat, blood, respiratory and ureo-genital tract weights recorded from the animals assigned to T_4 than to other diet groups, the effect of wheat bran and lentil split screening combinations was non-significant for all non-carcass components. The wheat bran and lentil split screening combinations effects were non-significant for all carcass quality parameters except for carcass fat DM%. It could be concluded that as one of feed package option, 227 g wheat bran and 120 g lentil screening mixture supplement on grass hay basal diet can be considered as the best for fattening of Menz ram lambs with better dry matter intake, body weight, and carcass yield with acceptable carcass fat cover.

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