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The Effects of Dietary Wheat Straw, Red Lentil Straw and Equal Mixtures of Straws as *ad libitum* on Intensive Fattening Performance, Some Serum Minerals and Economic Efficiency in Awassi Lambs

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Abstract: The objective of this study was to compare the effects of wheat and red lentil (*Lens esculenta*) straw on the growth performance, feed intake and its efficiency, serum minerals and economic efficiency in Awassi lambs. The project was carried out in the birth season of 2010 in the experimental unit of sanliurfa GAP Agricultural Research Institute with 30 male fat-tailed Awassi breed lambs in 3 groups after weaning period (approximately 3 months of age). Animals were grouped based on their initial live weights. Lambs, straws, concentrate lamb feed and remaining of both feeds were weighed for 14 days intervals. At the beginning, middle and end of the trial, blood samples were collected. Thirty Awassi lambs were randomly assigned to three experimental groups with three diets as follows; D1: Wheat Straw (WS-*ad libitum*) + Lamb Mixed Feed (LMF-*ad libitum*); D2: Red Lentil Straw (RLS-*ad libitum*) + Lamb Mixed Feed (LMF-*ad libitum*); D3: 50% wheat straw +50% red lentil straw (WRWS-*ad libitum*) + Lamb Mixed Feed (LMF-*ad libitum*). The result of the study indicated that the live weight, live weight gain and serum minerals of lambs were not different among the feeding groups. In conclusion red lentil straw or red lentil + wheat straw mixtures as *ad libitum* are used much successfully than that of wheat straw for economic lamb production of Awassi breed.

Key words: Feeding performance, lamb, red lentil straw, roughage, wheat straw

INTRODUCTION

Awassi is an important indigenous breed in South Eastern region of Turkey. In this region sheep breeding mostly depend on grazing in low quality pastures and agricultural wastes such as cereal straws and red lentil straw which commonly grown and its straw is abondent and cheaper. Red lentil straw have been using successfully as roughages in small ruminant diets without compromising animal performance in the region. Awassi is a triple purpose sheep breed raised for meat, milk and wool production due its well adaptation to harsh, semi-arid and arid environments and its resistance to diseases (Al-Jassim *et al*., 1999; Kaymakci *et al*., 2001; Soysal *et al*., 2005; Yurtseven *et al*., 2009). Awassi sheep has good milk production and growth abilities even in harsh conditions of the arid areas (Galal *et al*., 2008). The hardiness of Awassi breed allowed their members to be fully adapted to environmental stressors (i.e., hot weather, humidity, diseases and parasites) of the semiarid and arid regions (Epstein, 1985). Additionally, Awassi sheep have good ability to adapt to fluctuations in nutrition and management.

Increased profitability of lamb production is dependent on reducing input costs or increasing production output. Any reduction in feed intake or increase in feed efficiency without compromising growth rate or carcass quality can have a significant positive economic impact on lamb production (Snowder and Van Vleck, 2003). Increasing energy density in diets for lambs and kids showed improvement in feed efficiency and carcass characteristics (Haddad and Husein, 2004; Haddad, 2005).

Legume straws contain higher nutritional value than cereal straws due their higher nitrogen and lower fibre ingredients. Despite their greater lignification, legume straws are degraded in the rumen at a faster rate than cereal straws, leading to a higher extent of degradation and consequently, to higher dry matter digestibility (Lopez *et al*., 2005). Its crude protein content is approximately 14%. It can be used as roughage for nutrition of calves and lambs (Akyildiz, 1986).

Lentil traditionally produced in the Near East >8500 years and has spread to the Mediterranean, parts of Asia and was subsequently introduced into North America by the early 1900s. North America, specifically

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Canada and areas within Asia and the Middle East are responsible for the majority of lentil production and exportation (Roy *et al*., 2010).

Ewes in the Middle East countries commonly receive 20% of their Winter diet as lentil straw which includes broken branches, pod walls and leaflets (Erskine *et al*., 1990). Turkey has third row for lentil grain production in the World as 353.000 tonnes year^{-1} and lentil straw production is depending on harvest conditions, higher approximately one and half of grain production (Kalkan and Karabulut, 2002).

Haddad and Husein (2001) compared lentil, wheat, vicia straws and alfalfa hay in ewe diets and they found that final weights of ewes, dry mater digestibility, ruminal passage rate, forage intake, total dry matter intake and organic matter intake were higher in lentil straw than wheat straw. Haddad and Husein (2004) reported that increasing the concentrate level in fattening diet of Awassi lambs up to 85% improved growth performance, feed efficiency, slaughter characteristics and carcass weight. High concentrate diets in Awassi lambs should contain at least 10% wheat straw as roughage for good growth performance and carcass quality (Haddad and Ata, 2009). Cerci *et al*. (2011) stated that consumption of dried alfalfa as roughage instead of wheat straw in Akkaraman breed fattened lambs were improved the dry matter intake, daily weight gain and carcass characteristics.

In an earlier study, lentil straw, vetch hay, leaves from olive trees and Atriplex shrubs were compared with barley straw indicated that lentil straw has twice higher protein contents than barley, crude fiber content was two-third of barley straw, higher Ca content. At the same time, rumen degradability of lentil straw was higher than barley and caused higher intake of lentil straw. Lower crude fiber content was caused rapid passage of digesta from digestive tract. ME contents of lentil straw were higher than that of barley straw in both *in vivo* and *in vitro* methods of ME determinations in Awassi breed lambs (Abbeddou *et al*., 2011).

Lentil straw is higher in digestibility, protein, calcium and phosphorus compared with wheat straw. In addition, lentil straw tends to be more palatable than cereal straws. However, lentil crops tend to have little by product following harvest so, grazing animals may be the best method of salvaging any feed (Lardy and Anderson, 2009). Nutritive value (palatability, nutrient digestibility and weight gain) of lentil straw was close to alfalfa hay and better than vetch or wheat straw. As for vetch straw, the nutritive value was somewhat better than that of wheat straw (Awawdeh, 2011). Choice feeding or cafeteria feeding would give ruminants the opportunity to select their own diet. Sheep have the ability to select their diet from the available food to meet their nutritional requirements (Kyriazakis and Oldham, 1993; Arsenos and Kyriazakis, 1999). Recently, Gorgulu *et al*. (1996) reported that lambs successfully selected a diet among barley, wheat bran, cotton seed meal and alfalfa straw, surpassing their nutritional requirements as recommended by the NRC (1985).

Lambs can select a diet matching their presumed nutritional requirements from various feed ingredients and determine their priorities for protein and energy in response to growth and fattening without changing their performance in comparison to single mixed feed lambs (Sahin *et al*., 2003). Gultekin and Kaya (2009) have stated that roughage was given as *ad libitum*, 150-300 g concentrate feed for per lamb per day in Akkaraman breed fattening lambs. As a result, addition of 150 g concentrate feed increased growing performance and ruminal parameters positively, decreased ruminal fluid pH, especially with 300 g concentrate feed increased more daily live weight gain and rumen nitrogen.

The objective of this study was to compare the effects of wheat straw, red lentil (*Lens esculenta*) straw and high concentrate diets as *ad libitum* on growth performance, serum mineral contents and economic efficiency in Awassi lambs.

MATERIALS AND METHODS

Animals and treatments: This experiment was conducted at the experimental unit of Sanliurfa GAP Agricultural Research Institute in Turkey. Thirty Awassi weaner male lambs (average initial weight: 19.18±0.76 kg) were housed in 3 pens (4.35×3.60 m) and randomly assigned to 3 experimental diets (n = 10). In the trial, approximately 90 days old weaned lambs were fed for 56 days. After internal and external parasite medication, animals were allocated to groups considering their initial live weights. The amount of feed offered and refused was recorded for 14 days intervals. Fresh and clean drinking water was available in plastic buckets and pens were cleaned daily. Experimental diets were given seperately in order to determine seperate mixed feed and roughage intakes.

Feeds and feeding: Standard lamb fattening feed was used as concentrate. Wheat and red lentil straws were used as roughage. Nutrient contents of concentrated feed, wheat and red lentil straw were shown in Table 1. Wheat Straw (WS), Red Lentil Straw (RLS), 50% WS +50% RLS and Lamb Fattening Feed (LMF) were supplied as *ad libitum*.

Table 1: Concentrate feed and roughages in groups

Feeds	D1	D2	D3
Wheat Straw (WS)	*Ad lib.*	-	50% (*Ad lib.*)
Red Lentil Straw (RLS)	-	*Ad lib.*	50% (*Ad lib.*)
Lamb Mixed Feed (LMF)	*Ad lib.*	*Ad lib.*	(*Ad lib.*)

Table 2: Nutrient contents of concentrate feed, red lentil and wheat straw

Feeds	Dry matter (%)	Ether extract (%)	Crude protein (%)	Crude fiber (%)	Crude ash (%)	OM (%)	ME (kcal kg^{-1}, OM)
Lamb Mixed Feed (LMF)	90.56	2.77	16.84	10.41	7.46	83.10	2743
Red Lentil Straw (RLS)	92.28	1.38	5.73	30.00	9.64	82.64	2026
Wheat Straw (WS)	93.5	2.41	1.52	39.43	9.50	84.00	1590

All animals were often controlled in order to prevent possible roughage/concentrate imbalances (low feed intake, apetite, growing and diare, etc.) for acidosis. There were no nutritional imbalances for acidosis at each group lambs during the trial. The nutritient contents of lamb fattening diet was 16.84% crude protein and 2743 kcal kg^{-1} ME. According to groups, experimental Diets (D) were as follows: D1:Wheat Straw (WS-*ad libitum*) + Lamb Mixed Feed (LMF-*ad libitum*); D2:Red Lentil Straw (RLS-*ad libitum*) + Lamb mixed feed (LMF-*ad libitum*); D3: 50% Wheat Straw +50% Red Lentil Straw (WSRLS-*ad libitum*) + Lamb mixed feed (LMF-*ad libitum*).

Determining of crude nutrients: Crude nutrient contents of feeds were shown in Table 2. Dry matter, crude protein, crude ash and ether extract analyses of the straws and lamb mixed diet samples were conducted according to AOAC (1995) method, crude fiber contents were determined according to Crampton and Maynard (1938). Metabolizable energy contents of straws and concentrate were calculated for ruminant animals by following equation considering their organic matter as kcal kg^{-1} (Anonymous, 1991):

$$ME\ (kcal\ kg^{-1}\ OM) = 3260+0.455\times CP-(4.037\times CF+3.517\times EE)$$

Where:
CP = Crude Protein (g kg^{-1} OM)
CF = Crude Fiber (g kg^{-1} OM)
EE = Ether Extract (g kg^{-1} OM)

Blood serum mineral contents: Blood samples were taken from vena jugularis into vacuum tubes in three times: at the begining, middle and end of the trial. Samples were centrifuged for 15 min and serum was seperated. Serum samples were kept at -20°C in deep freeze until they were analyzed. Ca, P, K, Na, Cl, Mg, Fe, Zn, Se and I contents in blood serum were determined in autoanalyzer (Pronto Evolution, Italy).

Slaughter: At the end of the feding period, all of the lambs (n:30) were weighted individually and slaughtered. Ruminal and intestinal acidity (pH) values were measured by digital pH-meter after slaughtering lambs. Calibrated pH-meter was kept in rumen fluid, until numbers in the screen been static. After each process, electrode was cleaned and calibrated.

Statistical analyses: The trial was arranged according to Randomised Plots Design with 3 groups and three replicates. In the statistical comparisons between the groups, the one-way Analysis of Variance (ANOVA) was used. All statistical analyses were performed by using the SPSS 17.0 (SPSS, 2011).

Economic analysis: In economic comparisions, Partial Budget Analysis Method was used (Aras, 1988). In this method, only changing costs for lamb production was considered and calculated. Three different feeding groups of animals were compared only for roughage and concentrate feed cost. Feeding cost in intensive ruminant animal production take place approximately 60% of total production cost. Therefore, feed costs reflect commonly total production cost. Another cost elements are not change for groups. Obtained total live weight gains are used as total income. In these comparisions, all of the data obtained from lambs were used. Lamb live weight current price was obtained from Meat and Fish Authority at the end of the study. At the same date, red lentil straw, wheat straw and concentrate lamb feed prices were used to calculate feeding cost of lambs.

RESULTS AND DISCUSSION

There were no significant differences among treatment groups for live weight, live weight gain, ruminal and intestinal acidity and serum mineral contents ($p>0.05$). However, researchers can not statistically compare groups for feed intake, feed efficiency and economic efficieny because of group feding of lambs.

Live weight: According to groups, live weights of lambs for 14 days intervals were shown in Table 3, Fig. 1. The highest final lamb live weight was obtained in Group II (with red lentil straw) as 36.43 kg. This was followed by Group III (wheat + red lentil straw mixtures) as 36.41 kg and Group I (wheat straw) as 35.7 kg. The final live weight results are not in similar line with the findings of Haddad and Husein (2001) that they stated red lentil straw lead to better results than wheat straw. But the results are consisted with the findings of Kyriazakis and Oldham (1993), Arsenos and Kyriazakis (1999), Gorgulu *et al.* (1996) and Sahin *et al.* (2003) that they stated lambs can prefer feedstuffs to obtain their nutritional requirements succesfully in *ad libitum*.

Live weight gain: Average daily live weight gains of lambs for 14 days intervals and total live weight gains were shown in Table 3, Fig. 1. The highest final daily lamb live weight gains were obtained in Group II (with red lentil straw) as 0.320 kg. This was followed by Group III (wheat + red lentil straw mixtures) as 0.310 kg and Group I (wheat straw) as 0.298 kg. The final live weight results are not in similar line with the findings of Haddad and Husein (2001) that they stated red lentil straw lead to better results than wheat straw. But the results are consisted with the findings of Kyriazakis and Oldham (1993), Arsenos and Kyriazakis (1999), Gorgulu *et al.* (1996) and Sahin *et al.* (2003) that they stated lambs can prefer feedstuffs to obtain their nutritional requirements succesfully in *ad libitum*. The average daily live weight gain values were higher than that of Gultekin and Kaya (2009) who stated with only grass hay (*ad libitum*) and grass hay (*ad libitum*) + 300 g concentrate for lamb changed between 118-215.3 g; Cerci *et al.* (2011) who pointed out the values were 198.05 g for wheat straw + concentrate and 250.05 g for dry alfalfa + concentrate as *ad libitum* feeding of Akkaraman breed lambs (Fig. 2).

Table 3: Live weight and live weight gain of lambs in different growing stages

Days	Group I (WS+LMF) X±Sx	Group II (RLS+LMF) X±Sx	Group III (WS+RLS+LMF) X±Sx
Live weight (kg)			
Initial	19.38±1.400	18.82±1.310	19.34±1.350
14	21.86±1.730	23.16±1.510	23.17±1.770
28	25.72±2.150	27.23±1.640	28.26±1.970
42	31.01±2.380	31.87±1.650	32.12±2.350
56	35.76±2.480	36.43±1.610	36.41±2.400
Live weight gain (kg)			
0-14	0.191±0.034	0.333±0.063	0.295±0.040
15-28	0.275±0.037	0.291±0.018	0.364±0.058
29-42	0.378±0.022	0.332±0.011	0.276±0.078
43-56	0.339±0.019	0.325±0.021	0.306±0.021
0-28	0.235±0.033	0.311±0.033	0.331±0.033
0-42	0.284±0.028	0.318±0.023	0.312±0.026
0-56	0.298±0.022	0.320±0.018	0.310±0.020

Feed intake: Average roughage and concentrate feed intake of lambs for 14 days intervals and total feed intakes were shown in Table 4. The highest roughage, concentrate and total feed intake values were obtaied from Group II (as 9.40, 76.36 vs. 85.76 kg), respectively. This was followed by Group III (as 8.12, 73.83 vs. 81.95 kg) and Group I (as 5.80, 75.62 vs. 81.41 kg). Roughage intake

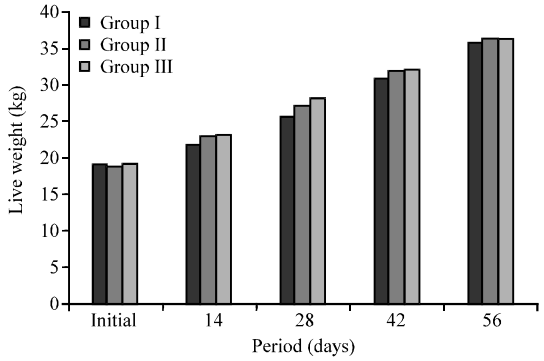

Fig. 1: Average live weights of lambs in different growing periods

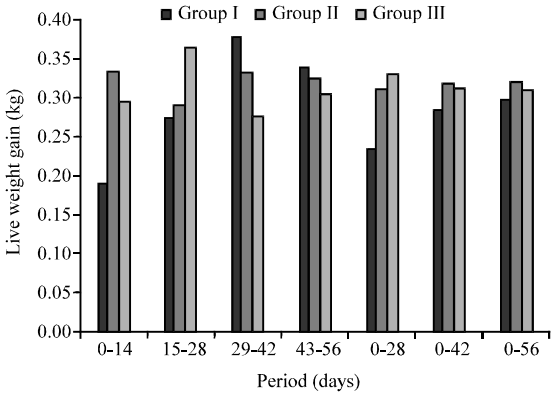

Fig. 2: Average live weights gain of lambs in different growing periods

Table 4: Roughage, concentrate and total feed intake and roughage/concentrate ratios

Days	Group I (WS+CMF) X			Group II (RLS+CMF) X			Group III (WS+RLS+CMF) X		
	WS	CMF	Total	RLS	CMF	Total	WS+RLS	CMF	Total
Roughage, concentrate and total feed intake (kg/lamb/14 days)									
0-14	0.953	11.270	12.223	1.825	12.500	14.325	1.363	12.020	13.383
15-28	1.095	13.585	14.680	2.118	13.280	15.398	1.930	12.425	14.355
29-42	2.045	23.930	25.975	2.933	23.605	26.538	3.186	24.505	27.691
43-56	1.705	26.830	28.535	2.600	26.305	28.905	1.645	24.875	26.520
0-56	5.798	75.615	81.413	9.476	75.690	85.166	8.124	73.825	81.949
Roughage/concentrate intake ratios (%)									
0-14	7.800	92.200	100.000	12.740	87.260	100.000	10.180	89.820	100.000
15-28	7.460	92.540	100.000	13.760	86.240	100.000	13.440	86.560	100.000
29-42	7.870	92.130	100.000	11.050	88.950	100.000	11.510	88.490	100.000
43-56	5.980	94.020	100.000	8.990	91.010	100.000	6.200	93.800	100.000
0-56	7.120	92.880	100.000	11.130	88.870	100.000	9.910	90.090	100.000

Table 5: Feed conversion ratios and gastro-intestinal pH values

	Group I (WS+CMF) X			Group II (RLS+CMF) X			Group III (WS+RLS+CMF) X		
Days	CMF	WS	Total	CMF	RLS	Total	CMF	WS+RLS	Total
Feed conversion ratios (kg/lamb/14 days)									
0-14	4.54	0.38	4.92	2.88	0.42	3.30	3.14	0.36	3.50
15-28	3.51	0.28	3.79	3.26	0.52	3.78	2.44	0.38	2.82
29-42	4.52	0.39	4.91	5.08	0.63	5.71	6.35	0.83	7.18
43-56	5.65	0.36	6.01	5.77	0.57	6.34	5.80	0.38	6.18
0-56	4.62	0.35	4.97	4.34	0.53	4.87	4.32	0.48	4.80
Gastro-intestinal pH values									
Rumen	6.27±0.049			6.35±0.025			6.39±0.100		
Intestine	6.57±0.234			6.70±0.204			7.26±0.135		

ratios in total feed intake were changed for wheat straw group as 7.12%, straw mixtures as 9.91% and red lentil straw as 11.13%. Lambs were fed as group feeding. Individual feed intakes were not determined. Thus, statistical analysis were not done for feed intake and feed efficiency parameters. The average total feed intake values were higher than that of Gultekin and Kaya (2009) who stated that with fattened Akkaraman breed lambs, daily total feed intake (with grass hay-*ad libitum*, 300 g concentrate + grass hay-*ad libitum*) for each lamb changed between 904.10-1051.60 g, respectively. However, the results were lower than that the findings of Cerci *et al*. (2011) who pointed out daily DM intake values were 1157.94 g for wheat straw + concentrate and 1480.22 g for dry alfalfa + concentrate.

Feed conversion ratio: Feed Conversion Ratio (FCR) values were calculated with average intakes of straw, concentrate and total feed for 1 kg live weight gain. FCR values for 14 days intervals and total were shown in Table 5. Total FCR values were obtained from Group I (as 4.97) followed by Group II (4.87) and Group III (4.80). Because of group feeding, analysis of variance was not applied for FCR values. The results were lower than that of Gultekin and Kaya (2009) who stated total feed conversion ratio (with grass hay-*ad libitum*, 300 g concentrate + grass hay-*ad libitum*) for each lamb changed between 7.70-5.20, respectively. But the results were in similar line with the findings of Cerci *et al*. (2011) who pointed out FCR values were 5.85 for wheat straw + concentrate and 5.91 for dry alfalfa + concentrate.

Gastro-intestinal pH values: After slaughtering of lambs, ruminal and intestinal fluid were taken in a cup as soon as possible and pH values were determined by a digital pH-meter (Table 5). There were no enough literature on gastro-intestinal acidity in order to compare the results. However, the ruminal pH walues were lower than that of Dehority and Tirabasso (2001) as 6.68. Gultekin and Kaya (2009) stated that adding of grass hay as *ad libitum* for fattened Akkaraman breed lambs increasing levels of concentrated feed decreased ruminal pH (as 6.28-6.54, similar line with the results). The ruminal pH values were higher than Kaya and Yalcin (2000) which they measured ruminal pH between 5.22-5.85 with 13% barley straw +87% concentrate feed in Karaman x Dorset Down G1 crossbreed male lambs.

Table 6: Some serum mineral contents of lambs at different growing stages in groups

Minerals	Group I (WS+CMF) X±Sx	Group II (RLS+CMF) X±Sx	Group III (WS+RLS+CMF) X±Sx
At the beginning of the trial			
Ca (mg dL^{-1})	9.47±0.12	9.36±0.18	9.39 ±0.08
P (mg dL^{-1})	8.20±0.13	8.40±0.16	8.80±0.59
Na (mg dL^{-1})	134.06±1.71	137.45±1.84	138.09±1.36
Cl (mg dL^{-1})	95.40±1.16	98.65±1.71	101.39±1.60
K (mg dL^{-1})	5.18±0.32	4.93±0.11	4.67±0.10
Mg (mg dL^{-1})	4.90±0.31	5.00±0.33	5.6±0.27
Fe (mcg dL^{-1})	300.9±29.0	220.2±29.1	266.0±22.5
Zn (mg dL^{-1})	1729.1±10.6	1725.7±8.62	1696.5±19.7
Se (mcg lt^{-1})	91.52±6.88	83.45±6.42	80.92±4.70
I (µg/100 mL)	693.0±158.0	905.0±229.0	848.0±222.0
At the middle of the trial			
Ca (mg dL^{-1})	11.10±0.11	10.22±0.30	10.69 ±0.07
P (mg dL^{-1})	6.67±0.24	6.80±0.25	7.20±0.33
Na (mg dL^{-1})	142.36±1.38	139.75±1.90	142.23±0.76
Cl (mcg dL^{-1})	95.55±1.09	95.89±1.23	96.83 ±0.65
K (mg dL^{-1})	3.76±0.07	4.04±0.07	4.07±0.06
Mg (mg dL^{-1})	6.00±0.823	6.00±0.278	6.00±0.141
Fe (mcg dL^{-1})	234.7±12.3	222.4±16.1	224.8±7.51
Zn (mg dL^{-1})	126.56±1.83	295±166.0	285±153.0
Se (mcg lt^{-1})	73.92±8.35	73.23±5.31	71.29±6.10
I (µg/100 mL)	1036.0±206.0	955.0±176.0	1236.0±141.0
At the end of the trial			
Ca (mg dL^{-1})	9.24±0.32	8.80±0.26	9.02 ±0.36
P (mg dL)	20.10±6.80	17.30±5.31	14.00±5.10
Na (mg dL^{-1})	131.50±1.65	130.50±1.46	131.33±2.03
Cl (mcg dL^{-1})	91.10±1.27	91.35±1.27	92.52 ±1.71
K (mg dL^{-1})	4.03±0.06	3.95±0.04	4.22±0.07
Mg (mg dL^{-1})	8.90±2.51	7.60±0.85	6.70±0.47
Fe (mcg dL^{-1})	210.17±7.46	238.8±12.1	163.4±21.9
Zn (mg dL^{-1})	1933.0±247.0	1624.0±341.0	1850.0±119.0
Se (mcg lt^{-1})	117.4±15.3	71.9±8.02	90.56±9.79
I (µg/100 mL)	2032.0±219.0	621.0±191.0	1033.0±197.0

Serum mineral contents: At the beginning, middle and end of the trial, blood samples were collected; serum mineral contents were shown in Table 6. The highest serum levels of Ca, P, Na, Mg, Zn, Se and I were measured in Group I; Fe in Group II; Cl and K in Group III. At the

Table 7: Economic efficiency in groups (total live weight gain income/lamb)

	Group I (WS+CMF)			Group II (RLS+CMF)			Group III (WS+RLS+CMF)		
Cost, incomes (TL)	CMF	WS	Total	CMF	RLS	Total	CMF	WS+LS	Total
WS	-	0.72	-	-	-	-	-	0.51	-
RLS	-	-	-	-	2.37	-	-	1.02	-
CMF	45.38	-	-	45.41	-	-	44.30	1.53	-
Total cost	-	-	46.10	-	-	47.78	-	-	45.82
TLWG	-	-	16.69	-	-	17.92	-	-	17.36
LWGI	-	-	150.21	-	-	161.28	-	-	156.24
Net incomes	-	-	104.11	-	-	113.50	-	-	110.42

TL: Turkish Lira, TLWG: Total Live Weight Gain, TLWI: Total Live Weight Income; 1 USA $ = 1.59 TL (June 2011)

end of the experiment, serum mineral levels were ranged from highest to lowest for Ca (9.24-8.80), P (20.10-14.00), Mg (8.90-6.70), Na (131.50-130.50), Cl (92.52-91.10), K (4.22-3.95), Fe (238.80-163.40), Zn (1933-1624), Se (117.4-71.9) and I (2032-621), respectively. Serum mineral contents of different animal species are quite constant. Minerals are deposits in animal body, released in deficiencies and balance in serum levels. In literature findings, serum mineral contents were not affected by dietary applications such as Baran *et al.* (2008) using sorghum in stead of wheat in beef cattle diets; Demirel *et al.* (2011) dietary clinoptilolite in rat diets.

Economic efficiency: At the time of finishing the trial, at June 2011, concentrate feed, wheat straw, lentil straw and live weight prices were as follows: 0.60, 0.125, 0.25 and 9 TL kg^{-1} (Table 7). According to economic analysis results of the study; the highest live weight income per lamb was obtained from Group II (as 113.50 TL) and this was followed by Group III (110.42 TL) and Group I (104.11 TL). Average live weight incomes could not compare statistically because of group feeding. When researchers compare groups, considering live weight incomes straw misture groups have higher live weight income than wheat straw group as 6.07%, red lentil group have higher income as 9.03% and red lentil group have higher income as 2.79% than wheat straw group.

CONCLUSION

Legume straws generally have a higher concentration of crude protein and digestible energy but lower crude fiber content than cereal straws. Legume straws despite higher levels of lignifications, dry matter content is easily degrade in rumen and pass through digestive system. However, the nutrient contents of lentil straw likewise many agricultural by products vary depending on some factors such as variety, soil, climate conditions, sowing time, weed struggle, fertilisation, harvest type, storage conditions, etc.

When fattened Awassi beed lambs fed as *ad libitum* straw and concentrated feed, lambs can arrange their nutrient requirements without negatively effecting their growth performance. Despite rather high expectation of acidosis, animals were able to arrange their feed preferences. Although, roughage/concentrate ratio was decrease in to 7.12-92.88%, there were not any health problems. The major result from the study is red lentil straw or mixture of it can be used succesfully in economic lamb meat production, lowering the cost of roughage and concentrate feed. When it bought and stored in harvest season, red lentil straw is a serious potantial for semi-intensive or intensive production of lamb meat production in Turkey.

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