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Effect of Feed Processing on the Fattening Performance and Carcass Traits of Awassi Ram Lambs

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ABSTRACT

The objective of this study was to investigate the effect of processing type of feed on the fattening performance and carcass traits of Awassi ram lambs. A total of 26, three month old Awassi ram lambs were used and randomly allocated into three groups (group 1, fed with ground feed, n = 8; group 2, fed with pellet feed, n = 9; group 3, fed with extruded pellet feed, n = 9). The results showed that total weight gain and Average Daily Gain (ADG) of ram lambs during the study were 12.8±1.1 kg and 180.9±17.7 g for group 1, 12.8±0.9 kg and 252.1±21.5 g for group 2 and 14.6±0.6 kg and 287.8±23.4 g for group 3, respectively. The difference of ADG among groups were significant ($p<0.01$). Lambs fed with extruded pellet feed (group 3) tend to have lower fattening period (19 d less) than group 1 ($p = 0.07$). Slaughter weight, warm and cold carcass weight, dressing percentage, fat thickness and Muscles Longissimus Dorsi (MLD) area were found not to be statistically significant ($p>0.05$). The results of the current study shows that feeding of Awassi ram lambs with extruded feed had positive effects on fattening performance, Feed Conversion Rate (FCR) and fattening period which are economically important for sheep farms.

Key words: Awassi lambs, carcass traits, extruded feed, fattening performance

INTRODUCTION

Sheep breeding is one of the most common farm animals. Awassi is the popular fat tailed sheep in Turkey. Awassi sheep are well adapted to conditions those related to the scarcity of feed availability and high environmental temperatures. Awassi also resistance to diseases and parasites, beside its high milk producing and growth abilities (Said *et al*., 1999; Galal *et al*., 2008).

In a sheep farm feedstuff expenses have a total 70% in all costs. A series of factors effect growth performance, thereby these factors effects cost of the farm (Kioumarsi *et al*., 2008). The reduction of this cost is very important for the management and profitability of the farm (Charray *et al*., 1992). Decreasing of this high amount is possible by increasing the genetic capacity, decreasing the feed conversion rate and shortening of fattening period. A small increase in lambs slaughter weight may result in higher productivity.

Feed processing can have either a negative or positive influence on subsequent animal performance and can certainly influence the profitability of a farm. (Lindahl and Davis, 1955; Konca *et al*., 2003). In last decade, feed industry has been developed several technological treatments such as extrusion, expansion and toasting which are effective in

improvement of digestibility of feed offered to the farm animals (Goelema *et al*., 1999). Since, the introduction of extruded feed in the late 1980s, the feed industry accepted this technique commonly throughout the world. Food extrusion is a process where a food material or a mixture of ingredients (called feed) is forced to low (under various conditions of mixing, heating and shear) through a die which is designed to form and /or puff-dry the extrudate. Extrusion cooking has become a common processing method in the cereal, snack and vegetable protein industries for converting starchy and proteinaceous raw materials into fabricated products (Rhee *et al*., 1999). High temperature, high pressure and high moisture heat treatments or dry treatments (toasting) are largely used in the feed industry to improve starch digestibility and reduce the rumen solubility and degradability of plant proteins (Peisker, 1992, 1994; Fancher *et al*., 1996; Goelema *et al*., 1999; Alonso *et al*., 2001; Aufrere *et al*., 2000, 2001) and also extrusion reduced the non digestible content of feed and partially increases the mineral absorption too (Alonso *et al*., 2001).

Several researches (Van der Poel *et al*., 1989, 1991; Herkelman *et al*., 1990; Hongtrakul *et al*., 1998) have studied the effect of feed extrusion in young pig, dairy cow diets (Francesco *et al*., 2006; Prestlokken and Harstad, 2001) and monogastric animals (Francesco *et al*., 2005) but there is a lack of studies on the effect of processing type of feedstuff on the fattening performance of lambs. The aim of this study was to investigate the effect of processing type of feedstuff on the fattening performance of Awassi ram lambs.

MATERIALS AND METHODS

This study was conducted at Animal Production Research and Application Center of Faculty of Veterinary Medicine in Bursa. A Total of 26 three month old Awassi ram lambs, with an average live weight of 29 kg were used and randomly allocated into three groups.

The study was started after 7 days adoption of lambs to assess concentrate mixture (Table 1). All lambs were individually fed on the same concentrate mixture (lamb starter feed 10.47 MJ and alfalfa hay 8.62 MJ kg^{-1} ME) (Table 2) and water ad libitum for 43 kg of slaughter weight. Lambs in group 1; fed with mash feed (n = 8), lambs in group 2 fed with pellet fed (n = 9) and lambs in group 3 fed with extruded pellet feed (n = 9). Within the main group (group 1, 2 and 3) lambs were divided into three replicates (n = 3) and each replicate has been housed in a separate nearby pen. A lamb of the first group excluded from the research because of digestive problem. All feedstuffs were analyzed initially for dry matter and nutrient level nutrient analysis was conducted using standard procedures (AOAC, 1990). Daily rumen fluid samples with an amount of 0.5 l, were collected via the esophageal tube, 3 h after morning feeding. Later on all samples subjected to

Table 1: The component of concentrate lamb starter feed mixture

Ingredient	Conc. (%)
Corn	10.0
Barley	37.1
Sunflower meal	11.5
Soybean meal	6.0
Wheat bran	30.0
Rice bran	1.6
Limestone	2.7
Salt	0.4
Ammonium chloride (NH_4Cl)	0.7
Vit.-min premix	0.1

Table 2: Ingredients and chemical composition of Alfalfa hay and concentrate lamb starter feed mixture

	Alfalfa hay	Lamb starter feed
DM (%)	88.1	87.9
Metabolizable energy (MJ kg^{-1})	8.6	10.5
Crude protein (%)	18.9	19.9
Crude fiber (%)	26.7	8.6
Neutral detergent fiber (%)	46.7	31.5
Acid detergent fiber (%)	34.4	11.1
Ether extracts (%)	2.8	3.5
Ash (%)	10.2	9.1
Calcium (%)	1.3	1.3
Phosphor (%)	0.2	0.7

All compositions are on DM basis unless indicated

In vitro digestibility as described by Tilley and Terry (1963). *In vitro* organic matter digestibility was determined by the Tilley and Terry (1963) method and by 48 h incubation in buffered rumen fluid (DOM 46) as was used for the gas production incubations, after washing over a filter. Lamb starter feed's organic matter digestibility was determined with 3 replicates of this method.

Live Weight (LW) and feed consumption were recorded fortnightly. The study is adjusted to slaughter weight which was 43 kg. Nine lambs were chosen for control slaughter.

The animals were slaughtered after 12 h fasting. Slaughter live weight is recorded. Carcasses were weighted and chilled for 24 h at 5°C, weighed again and some carcass dimension were measured according to Kadim *et al.* (1989).

All carcass cuts were weighed, recorded and other measured characteristics were as follows: Musculus Longissimus Dorsi area (MLD) and fat thickness were determined between the 12th and 13th thoracic vertebra.

Statistical analysis: Statistical Analysis was performed with using PROC MIXED procedure of SAS (v9.1.3). The model included the effect of lamb as a random factor and the effect of feed type was determined as the main factor. Dependent variables were: fattening period, FCR, daily weight gain, final live weight and total live weight gain. Differences were significant at $p<0.05$ and $p<0.01$ and were shown.

RESULTS

The results on fattening performance of initial live weight, total weight gain and final live weight were presented in Table 3.

The initial live weight of lambs were similar ($p>0.05$) and were found 29.7±1.3, 29.9±1.1 and 28.9±0.8 for group 1, 2 and 3, respectively. Also at the end of fattening period the final live weights of lambs were similar ($p>0.05$). Total live weight gain during fattening period was found 12.8±1.1, 12.8±0.9 and 14.6±0.6 for group 1, 2 and 3, respectively. The differences were not statistically significant among groups ($p = 0.10$) but total live weight gain for group 3 was tend to be higher than the others. The difference of daily live weight gain was found statistically significant ($p<0.01$) and were found to be 180.9±17.7, 252.1±21.5 and 287.8±23.4 g, for group 1, 2 and 3, respectively.

The feed conversion rate was found 8.2±0.5, 6.9±0.4 and 6.5±0.3 for group 1, 2 and 3, respectively and the differences were statistically significant ($p<0.05$). The differences among groups in the terms of fattening period were not found statistically significant but in group 3

Table 3: Fattening performance, feed consumption, organic matter digestibility of lamb starter feed for groups and feed consumption ratio of Awassi ram lambs

Parameters	Group 1 (n = 8)	Group 2 (n = 9)	Group 3 (n = 9)	p-value
Initial live weight (kg)	29.7±1.3	29.9±1.1	28.9±0.8	ns
Total weight gain (kg)	12.8±1.1	12.8±0.9	14.6±0.6	ns
Final live weight (kg)	43.6±0.3	43.8±0.3	44.1±0.3	ns
Total roughage consumption (kg)	37.0±2.0	30.8±4.3	31.9±3.0	ns
Total concentrate feed consumption (kg)	63.7±2.6	57.2±3.6	62.7±5.5	ns
Fattening period (day)	72.8±5.5^{b}	54.9±7.2^{a}	53.8±5.4^{a}	*
Feed conversion rate	8.2±0.5^{b}	6.9±0.4^{ab}	6.5±0.3^{a}	*
Average daily weight gain (g)	180.9±17.7^{a}	252.1±21.5^{ab}	287.8±23.4^{b}	**
Digestibility of lamb starter feed (%)	81.4±1.0^{a}	84.8±0.3^{b}	84.8±0.5^{b}	*

ns: Non significant at p>0.05, *p<0.05, **p<0.01, Means within a row and class not followed by the same letter are significantly different

Table 4: Average weights of by-products of slaughtered ram lambs

Parameters	Group 1 (n = 3)	Group 2 (n = 3)	Group 3 (n = 3)	p-value
Live weight after fasting (kg)	43.6±0.3	43.8±0.3	44.1±0.3	ns
Warm carcass weight (kg)	19.0±0.4	18.4±0.4	18.1±0.3	ns
Carcass weight in cold condition (kg)	18.2±0.3	17.7±0.3	17.5±0.4	ns
Dressing percentage in warm condition (%)	50.6±0.8	49.2±1.0	48.5±0.1	ns
Dressing percentage in cold condition (%)	48.8±0.4	47.5±0.7	47.2±1.1	ns
Fat tail weight in warm condition (kg)	3.1±0.1	3.2±0.2	3.4±0.3	ns
Fat tail weight in cold condition (kg)	3.1±0.1	3.1±0.2	3.3±0.3	ns
M. longissimus dorsi area (mm^{2})	1146.0±95.0	1292.5±23.5	1218.0±98.0	ns
Fat thickness (mm)	6.0±1.0	6.5±1.5	6.5±1.0	ns

ns: Non significant at p>0.05

average total fattening period was 19 d less than group 1 (P = 0.07). Lambs fed with extruded pellet feed (group 3) tend to have lower fattening period than fed with ground feed (group 1). Total forage and concentrate feed consumption among groups were found to be similar (p>0.05).

Digestibility of organic matter was found 81.4±1.0, 84.8±0.3 and 84.8±0.5 for group 1, 2 and 3, respectively. The differences were statistically significant (p<0.05) among group 1 and group 2, group 3.

The results of by product weights of slaughtered lambs and average measurements of carcass were given in Table 4. Slaughter weight, warm carcass weight, dressing percentage, fat tail weight, cold carcass weight, cold fat tail weight, M. longissimus dorsi area and fat thickness were found not to be statistically significant among groups (p>0.05). In fine, shortest fattening period has been found for group 3 (53.78±5.43 d) and lowest feed conversion rate was found in group 3 (6.451±0.31).

At the end of research daily weight gain and feed conversion rate were found statistically significant despite fattening period and feed consumption were not found statistically significant (p>0.05). But the shortest fattening period was found for group 3 which was 19 days less.

DISCUSSION

In feeding lamb, shortest fattening period and highest feed conversion rate were preferred. In this research, the best daily weight gain and feed conversion rate were found in group 3 but

fattening period and feed consumption were not found statistically significant ($p>0.05$). Group 3 have 21.1 and 6.5% lower feed conversion rate than group 1 and group 2, respectively. Average daily weight gain of group 3 was 13.9% higher than group 2. So that, excess of total roughage and concentrate feed consumption could be connected to this increased average daily weight gain for group 3. Also the fattening period of group 3 was 26.1 and 2.0% less than group 1 and 2, respectively.

Our results of average daily weight gain similar with the findings of those reported by Shaker *et al.* (2003) but lower result was obtained for total weight gain. this difference could be resulted from long of fattening period. In addition, our results of feed conversion were higher than those reported by Shaker *et al.* (2003).

Average total weight gain in this research similar with Rihawi *et al.* (2010) 1st trial (on-farm). However, average daily gain results in this study lower than 1st trial (on-farm) but higher than 2nd trial's (on station) results reported by Rihawi *et al.* (2010).

Extruded feed ration improved daily weight gain and reduced FCR of lambs in group 3. These results are similar with the findings of Madhavi *et al.* (2006) but better than the findings of Titi *et al.* (2008).

Keskin *et al.* (2007) obtained 193.6 g daily gain and 6.1 FCR with feed refreshing at 2 h, this daily gain result was higher than our first group but lower than our second and third group. However, FCR results are lower than in this research.

The results of Total Weight Gain (TWG) in group 1 and 2 were similar with the findings of Shaker *et al.* (2002) but TWG results in group 3 was better than those reported by Shaker *et al.* (2002). So extrude pellet affected TWG positively in group 3. Our results of average daily gain and FCR were better than the others (Karim *et al.*, 2002; Shaker *et al.*, 2002; Madhavi *et al.*, 2006; Titi *et al.*, 2008; Rihawi *et al.*, 2010) study on Awassi ram lambs.

In this study the highest FCR results in group 3 in accordance with; Al-Ani *et al.* (1991) who used dried date pulp (barley) in diet at 45% levels, Al-Jassim *et al.* (1998) and Obeidat *et al.* (2008) but opposite with Al-Ani *et al.* (1991) who used dried date pulp (barley) in diet at 15% levels, Omar (2002) and Awawdeh *et al.* (2009).

Organic matter digestibility results agree with the findings of those reported by Madhavi *et al.* (2006). Organic matter digestibility higher in fed with pellet groups because pelletization of complete feed, improved digestibility of nutrients (Reddy and Reddy, 1984, 1994; Reddy *et al.*, 2003).

For lamb meat production both the final weight before slaughter and the dressing percentage have an importance (Shaker *et al.*, 2002).

In this study Carcass characteristics (specially dressing percentage and carcass weight) in Awassi ram lambs did not affect from different processing feedstuffs. This result the same with some other research that presentation Obeidat *et al.* (2008, 2009), Abdullah *et al.* (2010), Obeidat and Aloqaily (2010), Awawdeh (2011), Obeidat *et al.* (2011a, b). Dressing percentage in warm condition (%) found similar with Karim *et al.* (2002) and Shaker *et al.* (2002) but less than Madhavi *et al.* (2006), Titi *et al.* (2008) for control Awassi group. However, dressing percentage in warm condition (%) results high than Keskin *et al.* (2007).

The difference in MLD area and fat thickness were not statistically significant between the groups. The average MLD area found in this study were 1146±95.0, 1292.5±23.5 and 1218.0±98.0 mm^2 in carcasses of group 1, 2 and 3, respectively. However, the differences between individual groups were not significant ($p>0.05$). Some researchers were found smaller MLD area than ours (Karim *et al.*, 2002; Shaker *et al.*, 2002, 2003). The average fat thickness

over MLD obtained in this study was 6.0±1.0, 6.5±1.5 and 6.5±1.0 mm in group 1, 2 and 3, respectively. However, differences between the groups were not statically significant ($p>0.05$). The results of fat thickness were lesser than Shaker *et al.* (2002) but higher than Shaker *et al.* (2003). Bayindir (1980) suggested that fat thickness over MLD was significantly and positively correlated with slaughter weight and it increased as slaughter weight increased.

As important criteria which influence the economy of fattening performance are feed conversion rate (Table 3) and fattening period which were better for group 3. Lowest feed conversion rate was found in group 3 which is quite higher than the results reported by Shaker *et al.* (2003).

CONCLUSION

Awassi lambs fed with extruded pellet feed had better fattening performance. The ram lambs have better feed conversion and shorter fattening period when fed with extruded pellet. It can be concluded that Awassi ram lambs could be fattened to slaughter weight in the short time and more economically.

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