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Effect of grazing and feeding frequency on some productive characteristics and semen quality of Awassi lambs

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Abstract

Twenty Awassi male lambs aged 120 days were used in this study to evaluate the effect of grazing (GR) and feeding frequency (FF) on body weight and monthly body gain (BG), in addition to the effect of GR , FF and season (S) (autumn or summer) on semen quality. Animals were assigned to four experimental groups according to their initial weights. The 1st and 2nd groups (5 animals per group) were rationed once and twice *ad libitum*, respectively with 6 hrs grazing daily, whereas the 3rd and 4th groups (5 animals per group) rationed once and twice *ad libitum*, respectively daily without grazing. The BW and BG were recorded monthly. Semen samples from each ram were collected in October/2010 (autumn) and June /2011(summer). Semen ejaculates were evaluated for semen volume, ejaculate appearance, mass motility, individual motility %, live sperm %, abnormal sperm %, sperm concentration/ml and sperm concentration/ejaculate. The results showed a significant increase ($P<0.05$) in BW in the grazing group from the 4th month to the end of treatment, and in the group that rationed once a day at the 6th and 10th months of treatment, while the best weight was recorded in the interaction of T_1 at the 4th and 6th month of treatment. There was a significant increase in BG in the grazing group at the 4th, 8th and 10th months and in the group rationed twice daily at 8thmonth of treatment, while BG increased significantly ($P<0.05$) in T_1 as interaction effect at the 4th month, and in T_2 at 4th and 8th months and in T_3 in 10th month of treatment compared with T_1.. Grazing improved most of the semen characters significantly ($P<0.05$), while the twice rationed group daily improved live sperm% significantly. All semen parameters were better significantly ($P<0.05$) in 2nd season (summer) than in the 1st season (autumn). It was clear that the best interaction effects were in T_2 group (summer, grazing and rationed once daily) in improving the semen quality. Results of this study indicate that grazing has positive effect on BW, BG and semen parameters, while feeding frequency had no effect on semen quality.

Keywords: Awassi Lambs, Feeding Frequency, Grazing, Semen Characters

Introduction

Sheep form an important part of animal resources in Iraq (AOAD, 2009). The main breed of sheep in the Middle East is Awassi, which is well known for its good adaptability to the semi-dry and hot climate of the region (Lafi et al., 2009). It also possesses very desirable characteristics such as endurance to nutritional fluctuations, resistance to diseases and parasites and tolerance to extreme temperature. Besides its high milk production and growth abilities (Cursoy et al., 1993), fattening performance of lambs is affected by genetic and environmental factors. One of the environmental factors is feeding systems such as *ad libitum* feeding and choice feeding systems. Animals cannot completely show their genetic potential interims of fattening with the meal system. Feeding units using *ad libitum* systems use feed troughs that contain sufficient feed to meet the requirements of the animals for a few days. However, feed in troughs usually gets contaminated and wet with animal saliva which can cause the feed to harden leading to animals tending to resist feed (Keskin, 2010). For this reason, many livestock producers prefer the meal systems for finishing, however, the frequency of meals should be investigated based on animals' needs and welfare (Keskin, 2007). Keskin et al. (2004) observed that Awassi lambs increased their feed intake when they where offered fresh feed even when there was feed in the feed

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troughs. Feeding ruminants more than once daily might decrease the risk of acidosis by minimizing starch intake per meal and result in more stable ruminal conditions (Robles et al., 2007). Sutton et al. (1986) and Yang and Varga (1989) reported that increasing feeding frequency of concentrate in dairy cows decreases mean ruminal pH. The two major systems of small ruminant farming are pasture and indoor systems. Between these two farming systems, there is a wide scope of mixed systems such as summer pasture/winter indoors or alternatively indoors/outdoors subject to climatic differences. People consider more often pasture systems as more extensive than indoor systems. For each of these systems, the level of intensification is very variable, e.g., in pasture systems based on cultivated pasture versus poor rangelands. In regards to indoor systems, the level of intensification is tightly linked with the nutritive value of fodders, as well as, the quantity of distributed concentrates (Morand-Fehr et al., 2007). Reproductive wellbeing and performance of farm animals is largely dependent on their nutritional status. It is well documented that adequate nutritional management is crucial for successful mating in sheep flocks (Fernandez et al., 2004) and there is no doubt that protein deficient feeding can reduce semen quality and sexual activity (Fourie et al., 2004).

The present study was undertaken to assess the effects of feeding frequency and grazing on body weight, body gain and semen quality of Awassi lambs.

Materials and Methods

The study was carried out at the College of Agriculture and Forestry, University of Mosul. The experiment was conducted from May 2010 to August 2011 at the Animal Research and Practice Farm of the College. Twenty Awassi lamb aged 120 days with an average initial body weight of 22.27±0.55 kg were used in this study under natural photoperiod and temperature conditions. All these lambs were in good health. The animals were kept in open front barrens. Feed and water were available *ad libitum*. Lambs were divided into four treatments.

First group was rationed once daily with 6 hrs grazing. Second group was rationed twice daily with 6 hrs grazing. Third group was rationed once daily without grazing. Fourth group was rationed twice daily without grazing. The experimental diet was prepared as in Table 1, and all lambs had free access to fresh water. Animals were weighted on monthly basis.

Semen samples were collected by electro-ejaculator type (BAILY EJACULATOR-MOD 2). The 1st semen samples were collected in October 2010, when rams were 12 months old (1st season: autumn). The 2nd semen samples were collected in June 2011, when rams were 18 months old (2nd season: summer). Semen samples were evaluated as follows: The ejaculated semen volume was recorded immediately after collection in a graduated collection vial. The sperm mass motility was assessed according to Avdi et al. (2004) by placing a small drop of fresh semen on pre-warmed slide (37 ºC) by using a hot stage, and finally examining it under a microscope at magnifying power (10 x) within two minutes of collection, and performed on a scale of 0 (immotile) and five minutes (vigorous motility). (Ax et al., 2000). The percentage of individual motility was assessed by diluting a drop of semen in saline solution (2.9%), and transferring it to a warm slide, and then mounting it with a cover slip and examining it under a microscope at high magnification (40 x objectives). Sperm concentration was measured using spectrophotometer and calculated by the use of equation (y = 1027.4x - 183.31). The total number of spermatozoa per ejaculate was calculated by measuring the volume and sperm concentration.

Table1: Ingredients & chemical composition of basal diet

Ingredients	% of DM
Barley	79
Wheat bran	10
Soybean meal	10
Common Salt	0.5
$CaCo_3$	0.5
Calculated nutritive values	
Cp (%)	13.96
ME (Kcal /Kg/DM)	2624

Statistical analysis

Feeding frequency grazing data were subjected to statistical analysis using the GLM procedure of (SAS, 2002) according to the following model:

$Yijk = \mu + Fi + Gj + FGij + eijK$

Where: F and G are feeding frequency and grazing effect and FGij the interaction between feeding frequency and grazing (F × G), respectively. The μ is the overall mean and eijK experimental error. The semen characters were analyzed according to the following model:

$Yijkl = \mu + Gi + Fj + Sk + GFij + GSik + FSjk + GFSijk + eijkl$

Where: Sk is the season effect, GSik the interaction between G and S, FSik is the interaction between F and S, GFSijk is the interaction between F, G and S. The collected data, including body weight body gain and semen characteristics were expressed as standard errors. Simple correlations were calculated using CORR procedure of SAS (2002). The differences between means were tested using Duncan (Steel and Torrie, 1984).

Results and Discussion

Table 2 shows that BW increased significantly in grazing group compared with non grazing group

Table 2: Mean ± SE of body weight, body gain (kg) in grazing and feeding frequency treated groups of Awassi lambs

Body weight (kg)

Treatment	Initial BW	M4	M6	M8	M10	M12
Grazing						
G	22.27±0.80	38.92±0.69^{a}	45.77±0.86^{a}	55.97^{a} ±0.7	67.37±0.83^{a}	80.72±0.92^{a}
W	22.27± 0.80	36.69±0.63^{b}	44.34±0.56^{b}	51.42±0.70^{b}	64.17±0.57^{b}	77.51±0.55^{b}
Feeding frequency						
O	22.24±0.92	37.95±1.01	45.63±0.91^{a}	53.73±1.39	66.73±1.11^{a}	39.78±1.19
T	22.30±0.66	37.66±0.34	44.48±0.52^{b}	53.66±0.51	64.81±0.39^{b}	78.45±0.46
Interaction between grazing and feeding frequency						
T_1	22.24±1.28	40.34±0.96^{a}	48.22±0.53^{a}	57.60±1.08	69.84±0.16	83.12±0.46
T_2	22.30±1.13	37.50±0.46^{b}	43.32±0.30^{c}	54.34±0.26	64.90±0.30	78.32±0.93
T_3	22.24±1.48	34.98±0.32^{c}	43.04±0.34^{c}	49.86±0.34	63.62±0.86	76.44±0.85
T_4	22.30±0.45	38.40±0.47^{b}	45.69±0.69^{b}	52.98±0.94	64.72±0.77	78.58±0.31

Body gain (kg)

Treatment	M4	M6	M8	M10	M12
Grazing					
G	4.25±0.43^{a}	3.87±0.40	6.54±0.60^{a}	5.45±0.32^{b}	7.06±0.49
W	2.41±0.27^{b}	4.43±0.31	4.16±0.33^{b}	6.53±0.31^{a}	6.94±0.28
Feeding frequency					
O	3.09±0.57	4.52±0.44	4.44±0.35^{b}	5.87±0.38	6.82±0.28
T	3.57±0.33	3.78±0.22	6.26±0.68^{a}	6.11±0.34	7.18±0.48
Interaction between grazing and feeding frequency					
T_1	4.12±0.86^{a}	3.88±0.75	5.02±0.58^{b}	4.88±0.08^{b}	6.50±0.27
T_2	4.38±0.29^{a}	3.86±0.38	3.86±0.25^{a}	6.02±0.55^{ab}	7.62±0.92
T_3	2.06±0.44^{b}	5.16±0.32	3.86±0.25^{b}	6.86±0.40^{a}	7.14±0.49
T_4	2.76±0.27^{b}	3.70±0.27	4.46±0.61^{b}	6.20±0.46^{ab}	6.74±0.31

M_4 - M_{12} : Fortnightly body weight of lambs in months 4,6,8,10,12 of treatment
G : Grazing
W : Without grazing
O : Once rationed daily
T : Twice rationed daily
T_1 : Grazing with once rationed
T_2 : Grazing with twice rationed
T_3 : Without grazing with once rationed
T_4 : Without grazing with twice rationed
Values in the same column with different superscripts differ significantly ($P \leq 0.05$)

from the 4th month to the end of treatment. In regard to the FF, there was a significant increase in BW in the group that rationed once daily at the 6th and 10th months of treatment compared with the group rationed twice daily, and for the effects of the interactions, the best weight was recorded in T_1 (Grazing and rationed once daily) at 4th and 6th months of treatment. Table 2 also reveals a significant increase in BW gain in grazing group at the 4th, 8th and 10th months of treatment compared with non-grazing group. There was a significant increase in BG in the group rationed twice daily at 8th month of treatment compared with group rationed once daily. For the effects of interaction, there was significant increase in BG in T_1 at the 4th month, and in T_2 at 4th and 8th months of treatment compared with other groups, and in T_3 in 10th month compared with T_1. Many previous researches revealed that sheep reared on concentrates gain (BW) better than those that depend on grazing only (Notter et al., 1991; Murphy et al., 1994; Santos–Silva et al., 2002; Munir et al., 2008). Also, other studies revealed that the enhancement of grazing with a limited quantity of concentrate rations prevents the body weight loss of sheep (Munir et al., 2007, 2008). In regard to this study, the result of grazing group was better significantly than non-grazing group, and it may be due to that the grazing group also consumed the concentrate *ad libitum*, which having a positive effects on the animal performance due to the increase in the available protein percentage for the animal (Taylor et al., 2002). The BW and WG in once rationed group animal, was better significantly during the 6th and 10th months of treatment. This may be attributed to the fact that increased FF tends to increase feed passage through the gastrointestinal tract (Forbes, 1995) and this will reduce digestibility and influence the animal performance. Bunting et al. (1987) suggested that increasing FF may result in the escape of degradable fibers from rumen, and this may reflected in reduction of digestibility and performance. The effect of grazing was more clear and affected more on the

Table 3: Mean ± SE of semen parameters in grazing, feeding frequency and season treated groups of Awassi lambs

Groups	Ejaculate Volume (ml)	Ejaculate Appearance	Mass motility	Individual motility %	Live Sperm %	Abnormal Sperm %	Sperm concentration $\times 10^9$ / ml	Sperm concentration $\times 10^9$ / ejaculate
Grazing								
G	1.29±0.05	3.10±0.16^{a}	3.45±0.11^{a}	68.90±1.68^{a}	65.75±1.37^{a}	1.64±0.10^{a}	1.71^{a}±0.04	2.22±0.12^{a}
W	1.24±0.08	2.45±0.11^{b}	2.80±0.11^{b}	53.50±1.99^{b}	56.80±1.17^{b}	1.01±0.18^{b}	1.56^{b}±0.03	1.94±0.13^{b}
Feeding frequency								
O	1.24±0.06	2.75±0.16	3.05±0.15	60.20±2.71	59.90±1.47^{b}	1.45±0.16	1.68±0.03	2.10±0.12
T	1.28±0.07	2.80±0.15	3.20±0.11	62.20±2.36	62.65±1.73^{a}	1.36±0.15	1.59±0.04	2.06±0.14
Season								
A	1.01±0.03^{b}	2.40±0.11^{b}	2.90±0.12^{b}	58.05±2.58^{b}	58.00±1.49^{b}	1.90±0.16^{a}	1.63±0.05	1.66±0.08^{b}
S	1.52±0.04^{a}	3.15±0.15^{a}	3.35±0.13^{a}	64.35±2.31^{a}	64.55±1.41^{a}	0.91±0.02^{b}	1.64±0.03	2.50±0.10^{a}
Interaction between grazing , feeding frequency and Season								
T_1 :	1.10±0.06^{b}	2.40±0.24^{bc}	3.00±0.00^{bcd}	65.60±2.33^{ab}	59.00±1.14^{c}	1.60±0.24^{b}	1.80±0.04^{a}	1.97±0.11^{bcd}
T_2 :	1.38±0.04^{a}	3.60±0.24^{a}	3.80±0.20^{a}	70.40±3.44^{a}	65.40±3.50^{b}	0.82±0.02^{c}	1.69±0.08^{a}	2.36±1.18^{ab}
T_3 :	1.09±0.06^{b}	2.80±0.20^{b}	3.40±0.24^{abc}	68.40±4.36^{ab}	67.40±1.16^{ab}	1.40±0.24^{bc}	1.61±0.12^{ab}	1.78±0.23^{cde}
T_4 :	1.59±0.09^{a}	3.60±0.24^{a}	3.60±0.24^{ab}	71.20±3.61^{a}	71.20±1.28^{a}	0.88±0.01^{c}	1.73±0.04^{a}	2.77±0.24^{a}
T_5 :	0.92±0.02^{b}	2.00±0.00^{c}	2.40±0.24^{d}	46.40±2.50^{d}	52.80±1.68^{d}	2.40±0.24^{a}	1.61±0.06^{ab}	1.48±0.09^{de}
T_6 :	1.58±0.11^{a}	3.00±0.00^{ab}	3.00±0.31^{bcd}	58.40±5.85^{bc}	62.40±1.72^{bc}	0.98±0.03^{bc}	1.63±0.05^{ab}	2.59±0.24^{a}
T_7 :	0.93±0.09^{b}	2.40±0.24^{bc}	2.80±0.20^{cd}	51.80±3.33^{cd}	52.80±1.15^{d}	2.20±0.37^{a}	1.52±0.08^{b}	1.40±0.12^{e}
T_8 :	1.54±0.05^{a}	2.40±0.24^{bc}	3.00±0.00^{bcd}	57.40±0.67^{bc}	59.20±1.35^{c}	0.97±0.05^{bc}	1.49±0.03^{ab}	2.30±0.05^{abc}

Values in the same column with different superscripts differ significantly (P≤0.05)

G,W,O,T As described in table 2

A,S Autumn and Summer season

T_1 : Autumn season with Grazing and rationed once daily

T_2 : Summer season with Grazing and rationed once daily

T_3 : Autumn season with Grazing and rationed twice daily

T_4 : Summer season with Grazing and rationed twice daily

T_5 : Autumn season without Grazing and rationed once daily

T_6 : Summer season without Grazing and rationed once daily

T_7 : Autumn season without Grazing and rationed twice daily

T_8 : Summer season without Grazing and rationed twice daily

interaction with FF. For the interaction of grazing and feeding frequency, it is clear that grazing effect was more prominent than the FF as observed in Table 2. Table 3 shows the mean values of the ram's semen characteristics. It is clear from Table 3 that grazing enhanced and improved most of the semen characters significantly compared with non-grazing group, where the twice rationed group a day significantly improved live sperm percentage compared with the once rationed group daily. In regard with the season effect, in the 2nd season (summer) all the semen parameters significantly improved compared with 1st season (autumn). For the interaction effects, it is clear from Table 3 that the best interaction effect was in T2 group (summer, grazing and rationed once daily). The benefit of grazing to improve the semen characters may attributed to the enhancement of the supplemented nutrients. Kheradmand et al. (2006) reported that improved dietary intake in Bakhtiary rams can improve reproductive performance in breeding season. Also, Brown (1994) and Fourie et al. (2004) reported that protein deficiency was associated with reduced sexual activity and semen quality in rams. In the present study, the combination of grazing and *ad libitum* feeding may have a positive effect on the animal performance due to the increase in the available protein percentage for the animal (Taylor et al ., 2002). Regarding FF, there were no differences except in the live sperm percentage that increased significantly in the twice rationed animals. This may be due to the increasing FF that reduced the fluctuation in ruminal environment (Shabi et al., 1998) and improve the microbial digestion and protein synthesis (Cecava et al., 1990). Therefore, it is suggested that this will enhance spermatogenesis and increase live sperm percentage. Metchell et al. (2003) reported that the deficient carbohydrate and protein will reduce the sexual behavior and spermatogenesis. On the other hand, in the 2nd reproductive season (summer), all the semen characters were improved compared with the 1st reproductive season (autumn). This may be attributed to the stimulation of reproduction during summer and autumn including semen volume, sperm concentration and motility (Al- Janabi et al., 2000).

Table 3 revealed that the best interaction effects were reported during the 2nd season and grazing groups regardless of FF, This may be related to the age effect as Toe et al. (1994) reported that age is one of the most contributing factors that affect semen quality. Also, Braun et al. (1980) revealed a positive correlation between BW and testis size and spermatogenesis.

Grazing has positive effect on animal performance due to increase in the available protein percentage for the animal (Taylor et al., 2002). This was in agreement with the finding of Fourie et al. (2004) who revealed that protein deficient was associated with reduced sexual activity and semen quality in rams. In conclusion, this study revealed that grazing with *ad libitum* feeding of concentrate (regardless of FF), will enhance productive and reproductive performance of Awassi rams, especially in the summer season.

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