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Effects of feed refreshing frequency on behavioural responses of Awassi lambs*

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Abstract: Sixty 2-month-old, male Awassi lambs were used in this study to investigate the effects of feed refreshing frequencies on behavioural responses of lambs. Treatments consisted of feed refreshing at intervals of 2 h (FR2), 4 h (FR4), 8 h (FR8), 12 h (FR12), and 24 h (FR24). Each lamb within each group kept individually was considered a replicate. All lambs were offered fresh feed ad libitum in each refreshing period for 56 days. Behavioural responses of the lambs were determined individually by monitoring the animals 2 days a week for 30 min at 10:00, 12:00, 14:00, 16:00, 18:00, 20:00, 22:00, 24:00, 02:00, 04:00, 06:00 and 08:00 at 5 min intervals. At the end of the study, 25.8%, 20.9%, 18.5%, 14.9%, and 14.6% eating behaviour; 9.6%, 11.5%, 12.3%, 12.8%, and 12.4% ruminating behaviour; 30.4%, 34.3%, 28.2%, 31.3%, and 36.6% standing behaviour; and 29.4%, 28%, 36.3%, 36.8%, and 32.1% resting behaviour were recorded as percentages of daily observed activities of lambs in the FR2, FR4, FR8, FR12, and FR24 groups, respectively. In conclusion, lambs that were offered fresh feed more frequently showed more eating behaviour but less ruminating and standing behaviour. It can be claimed that offering fresh feed 3 times a day will improve the welfare of lambs, with less standing and more resting behaviour.

Key words: Awassi, feed refreshing, behavioural responses

Yem tazeleme sıklığının İvesi kuzularında davranış özellikleri üzerine etkileri

Özet: Bu çalışmada kuzuların davranış özellikleri üzerine yem tazeleme sıklığının etkisini araştırmak için 60 baş erkek İvesi kuzusu kullanılmıştır. Gruplara 2 saat (FR2), 4 saat (FR4), 8 saat (FR8), 12 saat (FR12) ve 24 saat ara (FR24) ile yem tazeleme uygulanmıştır. Her grup içerisinde kuzular bireysel olarak yönetildiği için her kuzu bir tekerrürdür. Tüm kuzulara, 56 gün boyunca, belirtilen tazeleme sıklığı ile taze yem sunulmuştur. Davranış özelliklerini belirlemek için kuzular haftada 2 gün saat 10:00, 12:00, 14:00, 16:00, 18:00, 20:00, 22:00, 24:00, 02:00, 04:00, 06:00 ve 08:00'den başlayarak, yarım saat boyunca her 5 dakikada bireysel olarak gözlemlenmiştir. Çalışmanın sonunda, gözlemlenen davranış özellikleri olarak kuzuların, FR2, FR4, FR8, FR12 ve FR24 grupları için sırası ile % 25,8, % 20,9, % 18,5, % 14,9 ve % 14,6 oranında yem yeme davranışı; % 9,6, % 11,5, % 12,3, % 12,8 ve % 12,4 oranında geviş getirme davranışı; % 30,4, % 34,3, % 28,2, % 31,3 ve % 36,6 oranında ayakta durma davranışı; % 29,4, % 28,0, % 36,3, % 36,8 ve % 32,1 oranında dinlenme davranışı gösterdikleri belirlenmiştir. Sonuç olarak, daha sık taze yem verilen gruplarda yem yeme davranışı artmış, geviş getirme ve ayakta durma davranışı azalmıştır. Günde 3 defa taze yem sunulmasının, daha az ayakta durma ve daha çok dinlenme davranışı ile kuzuların refahını artırmış olabileceği söylenilebilir.

Anahtar sözcükler: İvesi, yem tazeleme, davranış özellikleri

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Introduction

Fattening performance of lambs is affected by genetic and environmental factors. One of the environmental factors is feeding systems such as meal feeding, ad libitum feeding, and choice feeding systems. Animals cannot completely show their genetic potential in terms of fattening with the meal system. The ad libitum feeding system seems to be more suitable for exploiting the genetic capacity of animals but it causes feed losses due to saliva and the animals become vulnerable to pathogenic contamination in the feeding unit.

As well as fattening performance, the behavioural responses of small ruminants may be expected to vary, depending upon the environmental factors such as climate, topography, availability or abundance of various plant species, genetic make-up of animals, prior experience or conditioning, prevailing nutritional and physiological state of animal, stocking rate, period of occupation, and supplementation with nutrients when they are kept in stalls (1). Lambs should consume sufficient amounts of feed and water in a certain period to show their genetic capacities. For the concept of animal welfare, animals should be free to reveal their natural feeding behaviour in pasture conditions in response to their physiology and environment (2,3). However, sheep and goats do not freely display their natural feeding behaviour when they are kept in stalls. These animals seek different feed resources in nature and graze freely under the control of different sense organs. This situation has been altered by domestication since domesticated animals are generally forced and accustomed to eat a certain type food in a certain time. Meal frequency depends on farm management rules rather than the availability of feed stuffs, usually without considering the welfare of sheep.

There have been limited studies exploiting the behavioural responses of sheep subjected to different feeding regimes or methods. Bermudez et al. (4) kept ewes in individual pens from the last month of pregnancy until the third week of weaning. In their study, feed intake was lower in the period of the day from 04:00 to 08:00 than during any of the 4-h periods between 08:00 and 24:00, with intermediate values between 24:00 and 04:00. The time of day had no effect on meal size or rate of eating. However, they did not investigate other behaviours such as playing, resting, or ruminating. Keskin et al. (5) investigated the effects of different feeding systems (single feeding system and cafeteria feeding system) on the behaviour and growth performance of Awassi lambs. They offered fresh feed to the lambs every day at 1200. They observed that the animals consumed most of the feed at this time. Their study gave a clue for the present study as to whether increasing meal frequency may affect the appetite, fattening performance, and behavioural responses of lambs.

Therefore, this study was carried out to determine behavioural responses of Awassi lambs subjected to different feed refreshing frequencies.

Materials and methods

Sixty, single born, fat-tailed male Awassi lambs were used in the present study at the Research and Training Farm of Mustafa Kemal University in Hatay.

All experimental animals were 2 months old and had an average live weight of 21.7 ± 0.41 kg at the beginning of the experiment. All lambs were vaccinated for enterotoxaemia before the experiment and injected with vitamins A, D, and E. After a 15-day training period, the lambs (n = 60) were numbered and equally (12 lambs per group) allocated into 5 groups with regard to statistically similar initial live weights. Feed refreshing was carried out in group FR2 at 2-h intervals, in FR4 at 4-h intervals, in FR8 at 8-h intervals, in FR12 at 12-h intervals, and in FR24 at 24-h intervals. Each lamb within each group was considered one replicate and housed individually within 100 × 120 × 120 cm sized pen in semi-open sheds. All lambs were offered fresh feed ad libitum in each refreshing period. Every 2 h, lambs in the FR2 group were offered fresh feed that had been weighed previously. At the end of each feeding, the remaining feed was weighed again and removed from the feeding box. The same procedures were done at 4-h intervals in the FR4 group, at 8-h intervals in the FR8 group, at 12-h intervals in the FR12 group, and at 24-h intervals in the FR24 group.

The experimental diet (Table 1) was prepared based on the nutritional requirements of lambs recommended by the NRC (6). All lambs had free access to fresh water throughout the day.

Table 1. Composition of the diet given to experimental lambs.

Ingredients	%
Barley (890 g DM, 2937 Kcal ME, 110.4 g CP, and 49 g CF kg^{-1})	48
Wheat bran (910 g DM, 2548 Kcal ME, 130 CP, and 76 CF kg^{-1})	18
Cotton seed meal (900 g DM, 2025 Kcal ME, 319.5 g CP, and 129.6 g CF kg^{-1})	22
Alfalfa straw (850 g DM, 1530 Kcal ME, 150 g CP, and 290 g CF kg^{-1})	10
Salt	1
Vitamin & mineral mixture (obtained from a commercial source)	1
Calculated composition per kg fresh diet	
Metabolisable energy (Kcal)	2467
Dry matter (DM), g	887
Crude protein (CP), g	161
Crude fibre (CF), g	95
Ash, g	64
Ca, g	8
P, g	6
Na, g	7

The pens were lit and ambient temperatures ranged from 19.1 °C at night to 35.3 °C during the day. To determine the effects of treatments on behavioural responses of lambs, each lamb was monitored individually 2 days a week for 30 min at 10:00, 12:00, 14:00, 16:00, 18:00, 20:00, 22:00, 24:00, 02:00, 04:00, 06:00, and 08:00 with 5 min intervals. The first observed activity was recorded as behavioural response. The recorded activities were eating (act of feed eating), ruminating, standing, resting (sleeping or lying down), and others (urinating, drinking, and defecation). The method of behavioural observation was based on the method of "time sampling" with some modification (7).

Statistical analyses for the main effect of feed refreshing frequency on behavioural characteristics were done using the chi-square test based on the count of activities for each 30 min observation (Windows version of SPSS, release 10.1). The presented proportional (%) behavioural activities were calculated by dividing the count of each activity in each time period by the number of total observations in that time period.

Results

Effects of different feed refreshing frequency on behaviour responses of lambs are given in Table 2, and Figures 1 and 2, respectively.

Discussion

The behavioural responses of lambs were significantly affected by feed refreshing frequency, except for the other behaviours (urinating, drinking, and defecation) (Table 2).

Lambs in the FR2 group showed a higher percentage (25.8%) of eating behaviour than the other groups (FR4, FR8, FR12, and FR24). As expected, more frequent fresh feed offering motivated eating behaviour. Rumination behaviour was, however, observed in the lowest percentage (9.6%) in this group. Similarly, increasing the meal number prolonged the period spent eating, enhanced saliva production, and increased the amount of food consumed by sheep (8).

Demirören (9) reported that sheep usually spend approximately 50% of the day eating, 40%-45%

Table 2. Effects of feed refreshing frequency on behavioural responses of Awassi lambs.

Groups	Behavioural elements (%)				
	Eating	Ruminating	Standing	Resting	Other behaviours
FR2	25.8[a]	9.6[c]	30.4[c]	29.4[c]	4.8
FR4	20.9[b]	11.5[b]	34.3[b]	28.0[c]	5.3
FR8	18.5[c]	12.3[ab]	28.2[d]	36.3[a]	4.7
FR12	14.9[d]	12.8[a]	31.3[c]	36.8[a]	4.2
FR24	14.6[e]	12.4[ab]	36.6[a]	32.1[b]	4.3
SED	0.25	0.21	0.27	0.32	0.08
P	***	**	***	***	NS

P, statistical significance; **, P < 0.01; ***, P < 0.001; NS, non-significant; different superscript in the same column shows statistical significance

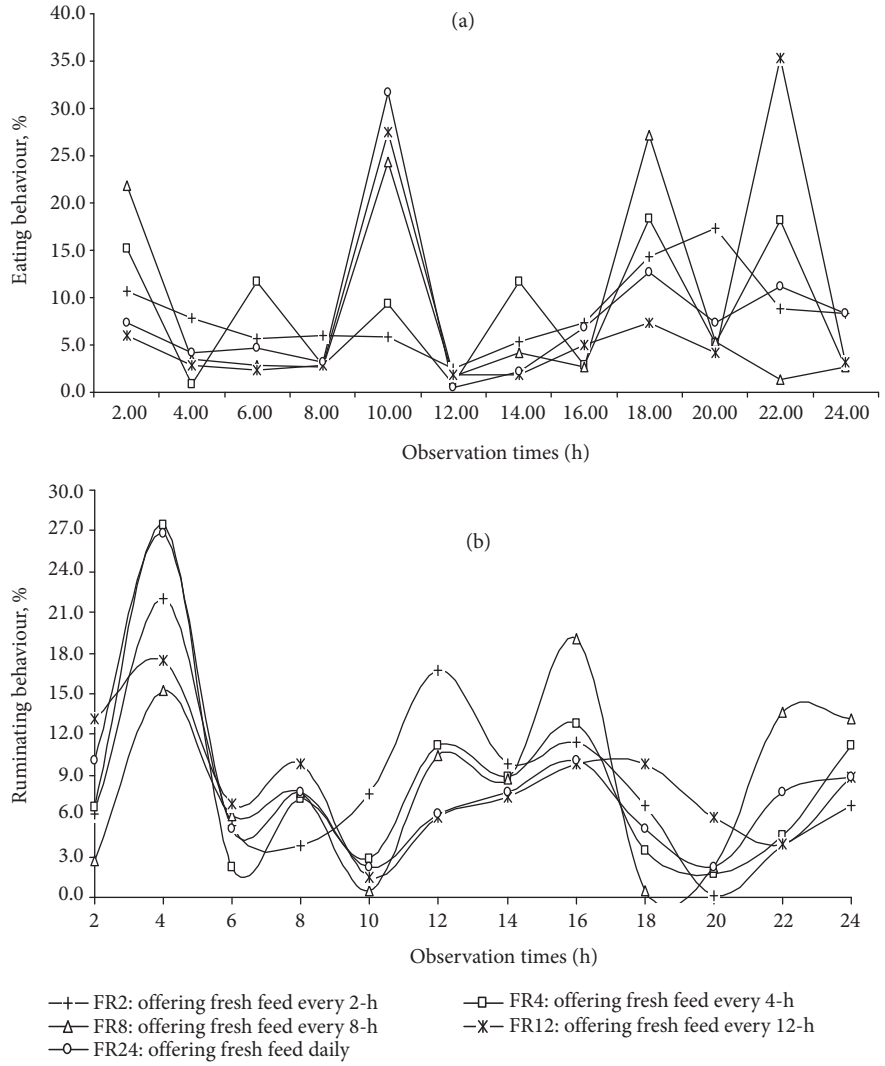


Figure 1. Eating (a) and ruminating (b) behaviours of experimental lambs during the day.

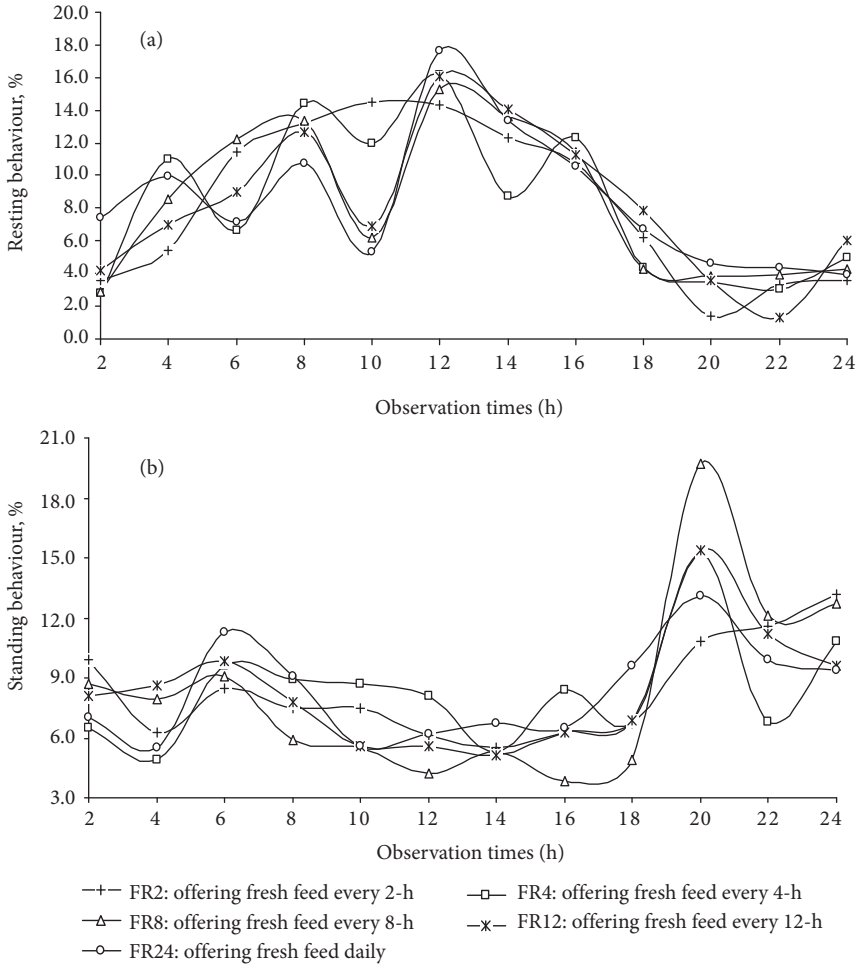


Figure 2. Resting (a) and standing (b) behaviours of experimental lambs during the day.

ruminating, and about 5%-10% resting. The differences between our report and Demirören's (9) regarding eating and rumination behaviours arose from the fact that the lambs in our study were not grazed. In our study, since the feed was always available to the lambs, they did not have to search for feed sources. Therefore, they showed higher eating but lower rumination behaviour.

According to Shabi et al. (10), higher feeding frequency (4 versus 2 meals) of dairy cows increases postruminal digestion of organic matter by 28%. It could be speculated that the same procedure in the digestive system could have occurred in the present study since increasing the feeding frequency may reduce ruminal discomfort by decreasing diurnal variation in ruminal pH, ruminal ammonia, and plasma urea. Since the present lambs were kept under continuous lighting, this may also increase dry matter intake and improve postruminal organic matter digestibility as reported previously (10).

In all groups, eating behaviour of lambs decreased at 12:00, 14:00, and 16:00 when the temperature was higher than the rest of the day (Figure 1). In previous studies, feeding behaviours of animals were reported to be affected by environmental temperature. Sheep tend to graze when the temperature is low (mostly morning and evening) and to ruminate in the middle of the day when the environmental temperature is higher (11,12).

FR24 lambs showed the highest eating behaviour at 10:00 when the fresh feed was available, while FR12 lambs showed the highest eating behaviour at 22:00. This was in line with the results reported by Keskin et al. (5). Lambs showed more eating behaviour by extending the interval between 2 subsequent feed refreshings as a result of an increment in hunger; similar observations were also reported by Welch and Hooper (13).

Animals can consume diet voluntarily if the opportunity is given during the day in order to sustain their metabolic comfort (5,12). Normally, small ruminants have a tendency to eat during the day and to ruminate during the night (9,14). In our study, the lighting in pens for 24 h may have caused some fluctuations in eating behaviour, especially at 04:00 and 12:00, when more rumination was observed (Figure 1).

This study indicated that different feed refreshing frequencies had a significant effect on ruminating behaviour during the day ($P < 0.01$). The literature also reports different animal species showing different responses to feeding frequency. For example, increasing feeding frequency (6 times a day) has no effect on carbohydrate digestion or ruminal parameters in dairy cows (15).

Lambs offered fresh feed 3 times (FR8) a day showed less standing and more resting behaviour than the other groups (Figure 2). This result may indicate that FR8 lambs were more comfortable than the other groups. Resting behaviour for this group reached its highest level at 12:00, 14:00, and 16:00, when temperature was higher than the other observation times. Standing behaviour reached its maximum level at 20:00, irrespective of treatments.

In conclusion, Awassi lambs that were offered fresh feed more frequently showed more eating but less ruminating and standing behaviours, improving the welfare of lambs. Taking into consideration all 5 groups, it is recommended that the feed should be offered to lambs 3 times a day depending on feed availability and feeding conditions.

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