



Seasonal variation in sexual performance of Awassi rams

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Abstract

Six mature, sexually experienced Awassi rams were exposed to estrous ewes during the spring and autumn seasons to evaluate variations in sexual performance. During each season, body weight (BW) and scrotal circumference (SC) were evaluated. Additionally, during each season, rams were individually exposed to 2 estrous Awassi ewes for four 20-minute occasions, each 2 days apart. Sexual performance parameters were recorded during each exposure. No differences in BW were observed between the two seasons, while SC was greater ($P < 0.05$) during the autumn than the spring season. Leg kicking and anogenital sniffing frequencies were not affected by season. However, greater mounting frequency ($P < 0.01$), greater female tail-raising frequency ($P < 0.05$) and greater mating frequency ($P < 0.05$) were observed during the autumn than the spring season. Correlations existed between mounting and tail-raising frequencies ($r = 0.41$; $P < 0.05$) leg kicking and mating frequencies ($r = 0.78$; $P < 0.05$) and between tail-raising and mating frequencies ($r = 0.53$; $P < 0.001$). Mating efficiency (mounts per mating) was numerically lower during the spring than the autumn season. In conclusion, Awassi rams appear to have better sexual performance during the autumn than the spring season. Despite this fact, rams still had satisfactory sexual activity and performance during the spring and were capable of mating with fat-tailed ewes.

Keywords: sexual behavior, sheep, season.

Introduction

Ram sexual behavior can be influenced by many factors, including season of year, genetics, breed differences, hormonal influence, post-weaning management, temperature, and nutrition (Mickelsen *et al.*, 1982). Photoperiod is the main environmental factor affecting sheep reproduction (Chemineau *et al.*, 1992). Variations in the response of sheep breeds to photoperiodic stimuli appear to be influenced by the latitudes where animals are raised (Pelletier *et al.*, 1988); the further north in the northern hemisphere, the greater the seasonality (Pelletier *et al.*, 1988). Awassi sheep are considered to have a long breeding season, governed mainly by feed availability (Epstein, 1982). Awassi ewes can express estrus during the spring and autumn (Yavuzer, 2005). Despite this fact, scrotal

circumference (SC) and semen characteristics of Awassi rams appear to be better in the autumn (Gundogan, 2006).

Males are not normally influenced by photoperiod to the same degree as females although seasonal changes in semen characteristics (Langford *et al.*, 1998; Salhab *et al.*, 2003) and libido (Tulley and Burfening, 1983) have been reported in several breeds. Despite such changes, males continue to produce fertile spermatozoa and exhibit sexual behavior throughout the year. Avdi *et al.* (2004) reported a greater number of mounts in Chios rams during the autumn season, while Tulley and Burfening (1983) reported a greater number of services in rams subjected to short photoperiod. In both studies, the improvement in sexual performance in the autumn coincided with a similar increase in SC.

In previous studies, we evaluated sexual performance of Awassi males as influenced by age (Kridli and Said, 1999), sex composition group (male to female ratio) (Kridli and Al-Yacoub, 2006) and crossbreeding (Kridli *et al.*, 2006). To our knowledge, no definite reports on seasonal changes in reproductive behavior in the Awassi breed are present. Many sheep producers in Jordan introduce rams for breeding during the month of June, which may not be the time period for optimum male sexual activity. For this reason, this study was conducted to evaluate sexual performance of mature Awassi rams as influenced by photoperiodic changes between the spring and autumn seasons.

Materials and Methods

This experiment was conducted during the months of April/May (spring) and September/October (autumn) at the Center of Agricultural Research and Production at Jordan University of Science and Technology located in the northern part of Jordan at 32° 34' N and an altitude of 520 m above sea level. Average day lengths in April, September, and October are 13:05, 12:29, and 11:40 hours, respectively.

Six mature, sexually-experienced Awassi rams (4 to 5 years of age) were used in this study. All rams were used in at least 2 preceding breeding seasons. Rams were housed in open-front barns away from females prior to the start of the experiment. Water, shade, and mineral blocks were available *ad libitum*. Body weights (BW) and scrotal circumference (SC) were recorded for each ram on three occasions during the months of April and May and three other occasions during September and October. Two weeks separated the successive BW and SC recordings during each season.

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During each of the spring (April) and autumn (September/October) seasons, sexual performance of rams was recorded on four occasions. Two days separated the sexual performance tests. On the days of sexual performance testing, each ram was evaluated by being individually exposed to two estrous Awassi ewes for 20 minutes. Sexual performance parameters [bouts of leg kicking and anogenital sniffing, mounting frequency, frequency of raising the fat tail of females and mating (ejaculation) frequency] were recorded during these exposures. Sexual performance evaluations were conducted between the hours of 8:00 and 11:00 am.

Twenty-four mature Awassi ewes were synchronized to exhibit estrus using 40 mg fluorogestone acetate sponges and equine chorionic gonadotropin (eCG; Ceva, France). Sponges were inserted for a period of 14 days. A 600-IU dose of eCG was administered to each ewe at the time of sponge removal. On each test day, 4 ewes were determined to be in estrus using a mature experienced Awassi ram. The estrous ewes were placed in two 6 x 6 m test pens (2 ewes/pen). A third similar pen, where the observers stood, separated the test pens. Two rams were tested simultaneously while the remaining rams were kept 20 to 30 m away, separated by visual barriers. The same procedure was repeated on all test days of both seasons.

Data were analyzed as a completely randomized design. The statistical analyses were conducted using the MIXED procedure of SAS (SAS, 1997). The effects of season on ram sexual performance

parameters were evaluated. Data were transformed by $\log(x + 1)$. However, because the $\log(x + 1)$ data are not meaningful in terms of showing the frequencies of various parameters, the actual sexual performance means are presented separately based on transformed data.

Results

Figure 1A shows the effect of season on BW and SC. Ram BW were not influenced by season, while SC were greater ($P < 0.05$) during the autumn than the spring. None of the sexual performance parameters were influenced by the day of testing during either season. The frequency of pre-copulatory behavior did not change (Fig. 1B) as the frequencies of leg kicking and anogenital sniffing bouts were similar between the spring and autumn seasons. The number of mounts per 20 min was influenced by season ($P < 0.01$), with a greater number occurring during the autumn than the spring (Fig. 1C). Similarly, the frequency of raising the females' fat tails was also greater ($P < 0.05$) during the autumn (Fig. 1C). Such improvement in sexual activity was reflected by the greater ($P < 0.05$) number of matings per 20 minutes during the autumn than the spring (Fig. 1D). A numerically greater mating efficiency (lower number of mounts per mating) was recorded during the spring (Fig. 1D). Positive correlations existed between mounting and tail-raising frequencies ($r = 0.41$; $P < 0.05$), leg kicking and mating frequencies ($r = 0.78$; $P < 0.05$), and between tail-raising and mating frequencies ($r = 0.53$; $P < 0.001$).

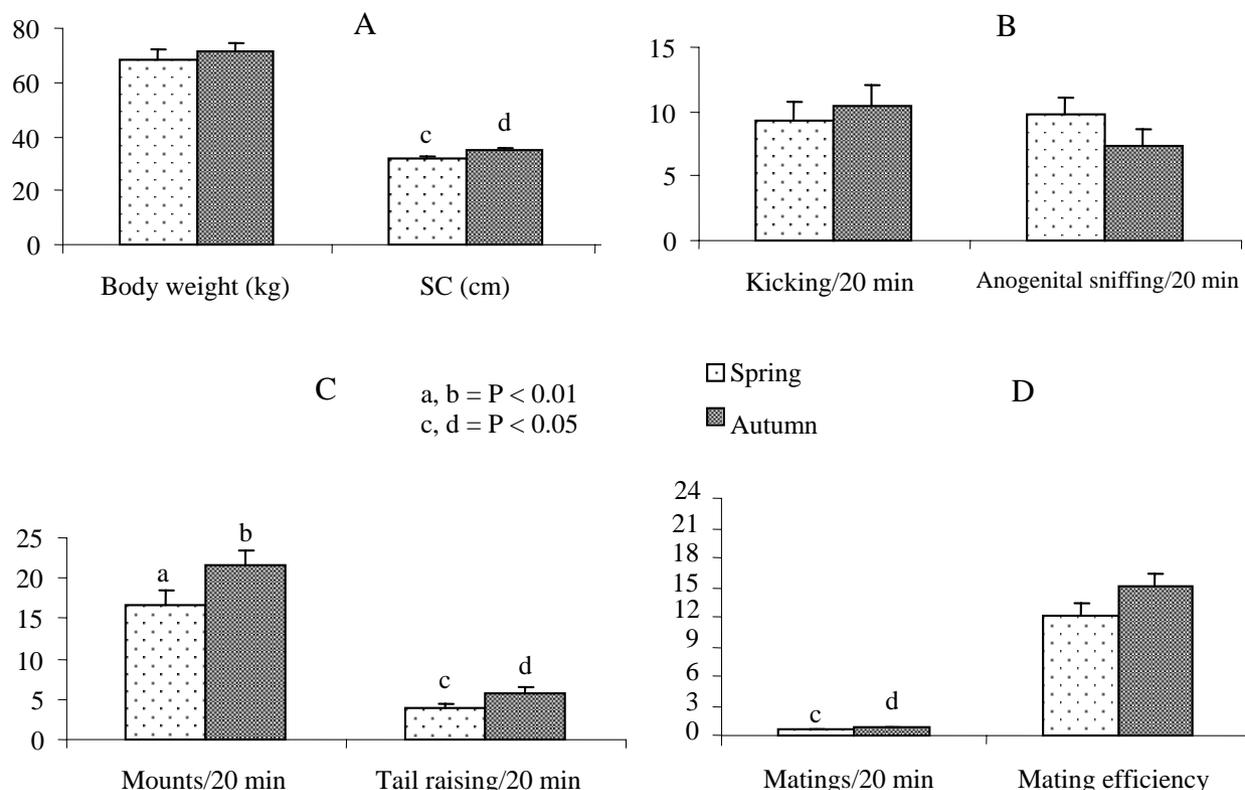


Figure 1. Body weight, scrotal circumference (SC), and sexual behavior parameters of Awassi rams and female (tail raising) recorded during the spring and autumn seasons.



Discussion

Awassi is the predominant sheep breed in Jordan, raised primarily for meat and milk. Epstein (1982) reported that the Awassi breeding season lasts from late June/early July through December (peaking between August and September). Most sheep producers in Jordan tend to breed their ewes during the summer months (June through September) to lamb between November and February.

Because rams in the present study were sexually experienced, no improvements in performance were detected during the successive test days of both seasons. Ram mounting and female tail-raising activities were observed during both seasons. The frequencies of mounting and tail-raising increased during the autumn compared with the spring. A similar increase in mounting was observed by Avdi *et al.* (2004). The number of mounts and matings per 20 minutes obtained in the present study were similar to those reported by our previous study (Kridli *et al.*, 2006). However, Price *et al.* (1992) reported a lower number of mounts per 30 minutes. The reason for such contradiction is that Price *et al.* (1992) used docked females which make it easier for mating to occur (in a lower number of mounts) compared with the fat-tailed Awassi ewes. On average, the fat tail of Awassi ewes is 18 cm long and 15 to 16 cm wide and weighing around 6 kg (Epstein, 1982). At the time of mating, the ram must stand behind the ewe and slightly to the side to improve the ability of raising the fat tail as he mounts (Kridli *et al.*, 2006). In the present study, as the mounting activity increased, the frequency of lifting the fat tail increased.

The greater female tail-raising frequency during the autumn resulted in a greater mating frequency compared with the spring season. A similar trend for improved number of services during the autumn was reported by Tulley and Burfening (1983). Successful mating (ejaculation) is usually followed by short periods of sexual inactivity (Price *et al.*, 1992). This means that higher mating frequency may reduce the frequency of other sexual activities. Despite the greater mating frequency in the autumn, rams still maintained a higher level of sexual activity than during the spring indicating greater libido. This could be due to the effect of short photoperiod on hormonal secretions. The number of matings in the present study was lower than that reported by Price *et al.* (1992), which is probably due to their use of docked females compared with the fat-tailed ewes in the present study. Even though the mating frequency was low during the spring, it was improved when compared to what we have reported in previous studies (Kridli and Said, 1999; Kridli *et al.*, 2006). Such differences may be due to the level of ram experience among the various studies. A numerically better mating efficiency (lower number of mounts per mating) was observed during the spring, which can be attributed to the greater number of mounts

recorded during the autumn.

The precopulatory sexual behavior (leg kicking and anogenital sniffing) was not affected by season. Such behaviors may be affected by lower libido during the spring and greater mating incidence during the autumn; both of which decrease the incidence of precopulatory behavior. The values reported for both the leg kicking and anogenital sniffing bouts were in the same range reported by previous studies (Price *et al.*, 1992; Kridli *et al.*, 2006). The incidence of leg kicking was positively correlated with mating frequency during both seasons. A similar correlation was observed in a previous study (Kridli *et al.*, 2006). According to Price *et al.* (1992), such pre-copulatory behavior reflects the rams' sexual motivation to mate with the estrous ewes.

Body weights were not affected by season although they were numerically higher during the autumn. Seasonal changes in BW may vary according to breed and feed availability. Kafi *et al.* (2004) reported no monthly variations in BW of Persian Karakul rams throughout the year, while Avdi *et al.* (2004) reported monthly variation in BW of Chios and Serres rams. Scrotal circumferences were greater during the autumn than the spring. Similarly, Taha *et al.* (2000) reported greater SC and testosterone concentrations in Awassi rams during the late summer months. Seasonal changes in SC are probably regulated by the melatonin action on gonadotropin release during declining photoperiod (Lincoln *et al.*, 1990). The greater SC observed during the autumn is probably the reason behind the improved sexual performance during that period.

This study evaluated variations in sexual performance of Awassi rams during the spring and autumn seasons. Results show that Awassi rams appear to have better sexual activity during the autumn. Despite this fact, rams still had satisfactory sexual activity and performance during the spring and were capable of mating with fat-tailed ewes. Such information should be of importance to sheep producers who introduce rams for mating during the month of June.

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