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VARIATIONS IN SEXUAL BEHAVIOR CHARACTERISTICS OF NORDUZ RAM LAMBS BASED ON AGE*

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ABSTRACT: The aim of this study was to detect variations in several sexual behaviors of Norduz ram lambs based on age. A total of 32 approximately six-month-old Norduz ram lambs were subject to 13 sexual behavior tests performed at 14-day intervals and an additional test performed one month after the last bi-weekly test, 14 tests a total. Tests consisted of individually exposing lamb rams to 1-3 estrus ewes (stimulus female) for 15-minute periods. The basic statistics for the lip curl response, the anogenital sniffing, the raising of tail, the vocalization, the mount frequency (number of mounts) and the least square mean for mount duration were found to be 1.15±0.07, 4.41±0.18, 0.76±0.07, 8.08±0.44, 10.79±0.52 and 1.34±0.12 minutes, respectively. Findings indicated irregular variations in sexual behaviors of Norduz ram lambs based on age.
Key Words: Norduz, reproduction, sexual behavior, ram lambs

NORDUZ ERKEK TOKLULARINDA CİNSEL DAVRANIŞ ÖZELLİKLERİNİN YAŞA GÖRE DEĞİŞİMİ

ÖZET: Bu çalışmada cinsel davranış özelliklerinin yaş dönemlerine göre değişiminin saptanması amaçlanmıştır. Hayvan materyalini ortalama 6 aylık 32 baş Norduz erkek toklusu oluşturmuştur. Otuz iki Norduz erkek toklusu cinsel performans testlerine maruz bırakılmıştır. Cinsel performans testleri 14 günde bir tekrarlanmıştır. Ancak 12 ile 13 aylık yaş dönemleri arasında bir test yapılmıştır. Erkek toklular bireysel olarak 15 dk süreyle 1-3 kızgın koyunla test edilmiştir. Toplam 14 cinsel performans testi yapılmıştır. Norduz erkek toklularında flehmen, genital organları koklama, kuyruk kaldırma, ses çıkarma, biniş sayısına ilişkin tanımlayıcı değerler sırasıyla 1.15±0.07, 4.41±0.18, 0.76±0.07, 8.08±0.44, 10.79±0.52 ve biniş süresine ilişkin en küçük kareler ortalaması ise 1.34±0.12 dk olarak bulunmuştur. Bulgular, cinsel davranış özelliklerinin yaşa göre değişiminin son derece düzensiz olduğunu göstermektedir.
Anahtar Kelimeler: Norduz, üreme, cinsel davranış, erkek toklu

1. INTRODUCTION

Measurements of ram sexual behaviors can be used as a tool for predicting their reproductive activity (Katz et al, 1988; Price et al, 1994a,b; Price et al, 1996a,b; Price et al, 1998; Kridli and Said, 1999; Price et al, 1999; Price et al, 2000). Sexual behavior among rams varies greatly and is strongly affected by variations in herd management (Godfrey et al, 1988; Katz et al, 1988; Maina and Katz, 1997; Price et al, 1994a,b; Price et al, 2000; Price et al, 2001). Breeding programs should be designed to support rather than obstruct the sexual development of male lambs. Important studies have been carried out with different species in order to classify elements of sexual behavior and determine how these traits may be used as selection criteria (Kilgour, 1993; Perkins and Fitzgerald, 1994; Price et al, 2000; Bench et al, 2001; Kridli and Al-Yacoub, 2006).

The aim of the present study was to determine whether or not sexual behaviors in Norduz ram lambs varied according to age as an important first step in the widespread application of sexual behavior as a useful tool in animal breeding in Turkey.

2. MATERIALS AND METHODS

This study was conducted with 32 Norduz lamb rams born (22 single and 10 twins) over a 21-day period in March, 2003 and maintained at the Yüzüncü Yil University, Faculty of Agriculture's Research and Application Farm in Van, Turkey.

Norduz sheep are considered to be a variety of Akkaraman sheep. They have similar color characteristics; they are usually white, although they may be ash-grey, a mix of grey/white or brown/white, with black spots on several parts of their bodies, especially the head, chest and feet. Like Akkaraman sheep, Norduz sheep also have tails consisting of three distinct parts, with the central section being the largest of the three (Bingöl, 1998).

Sexual performance tests were initiated when the rams were approximately six months of age and were conducted on a bi-weekly basis. The study was initiated in September, 2003 and finished in March, 2004. Sexual behaviors were evaluated by placing

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each ram in a 5.40x5.00m^2 pen with 1-3 estrous ewes (stimulus female) for 15 minutes. Observations were recorded for each ram lamb throughout the 15-min period. The same pen was used for all tests, and the order of testing was determined by random selection in order to eliminate test time as a variable.

During the mating season, estrous ewes were identified by observing ram behavior, and those identified were immediately taken to the test pen for acclimation and for subsequent testing of lamb ram sexual behaviors. Outside the mating season, estrous was induced by treating 6-9 ewes with an intra-vaginal sponge for 12-14 days, followed by intramuscular injections of 500 IU PMSG. Sheep were screened for estrus within 24-72 hours of receiving the injections, and those showing signs of estrus were removed to the test pen for immediate testing of lamb ram sexual behaviors. The lip curl response, the anogenital sniffing, the raising of tail, the vocalization, the mount frequency and the mount duration as sexual behaviors were observed and recorded as described by Kridli and Said (1999) and Price (1993).

2.1. Statistical Analysis

Statistical analysis was conducted using the SAS (2005) program. Mount duration was analyzed using Least Mean Squares according to the following equation:

$$Y_{ijkl} = \mu + a_i + b_j + c_k + b_1 (x_{ijkl} - \bar{x}) + e_{ijkl}$$

where

Y_{ijkl} = mount duration of lambs,

μ = expected mean of population,

a_i = effect of dam age,

b_j = effect of birth type,

c_k = effect of age periods,

b_1 = mount duration regression based on body weight (kg),

x_{ijkl} = ram lamb body weight (kg),

$\bar{x}$ = mean body weight (kg), and

e_{ijkl} = normal, independent and random error.

Because the lip curl response, the anogenital sniffing, the raising of tail, the vocalization and the mount frequency exhibit discontinued variation (Frome and Morris, 1989), these traits were analyzed using GEE **(**Generalized Estimating Equations). Each sexual behavior was tested as a response dependent variable with the independent exponential variables dam age, birth type, ram lamb age and ram lamb weight in the following equation:

Log (response dependent variable)= $b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 (x_{ijkl} - \bar{x})$

Where

x_1 = dam age,

x_2 = birth type,

x_3 = age periods,

x_4 = lamb ram weight,

b_0 = expected mean of the population, and

b_1, b_2, b_3 and b_4 Indicate regressions for each sexual behavior based on dam age, birth type, ram lamb age at testing and live weight. In addition, the photoperiodic duration and daily average temperature were included models to detect its effects on examined sexual behavior characteristics. But then they were removed from models because of not important, statistically.

3. RESULTS

Table 1 shows the basic statistics for the lip curl response, the anogenital sniffing, the raising of tail, the vocalization, the mount frequency and the mount duration, which were 1.15±0.07, 4.41±0.18, 0.76±0.07, 8.08±0.44, 10.79±0.52 and 1.34±0.12 minutes, respectively.

Lip curl response was significantly affected by ram lamb age (P<0.05). Lip curl response in ram lambs at 222 and 264 days of age were similar and were significantly higher than ram lambs tested at other ages. Dam age and birth type did not significantly affect the lip curl response.

The anogenital sniffing was significantly affected by ram lamb age, birth type and dam age (P<0.05). The anogenital sniffing was highest among ram lambs at 264 days of age, ram lambs born twinned with a female lamb and ram lambs born of three-year-old dams.

The raising of tail was significantly affected by birth type and dam age (P<0.05). The raising of tail occurred more frequently among ram lambs born singly than among those born with a male or female twin and among those born of five-year-old dams than those born of four- or three-year-old dams. Although the raising of tail occurred more often among lambs at 278 days of age, this value was not significantly different from lambs tested at 250 and 292 days of age.

The vocalization was significantly affected by ram lamb age and dam age (P<0.05). Vocalization was highest at 264 days of age; this represented a significant difference between ram lambs at all other ages tested, with the exception of lambs at 222 days of age. Ram lambs born of five-year-old dams had significantly lower rates of vocalization than those born of three- and four-year-old dams. Birth type did not significantly affect the vocalization.

Tablo 1. The basic statistics regarding with discrete sexual behavior characteristics and the Least Square Means for the mount duration in Norduz ram lambs

	Lip curl response		Anogenital sniffing		Raising of tail		Vocalization		Mount frequency		Mount duration	
Factors	n	$\bar{X} \pm S_{\bar{X}}$	n	$\bar{X} \pm S_{\bar{X}}$	n	$\bar{X} \pm S_{\bar{X}}$	n	$\bar{X} \pm S_{\bar{X}}$	n	$\bar{X} \pm S_{\bar{X}}$	n	$\bar{X} \pm S_{\bar{X}}$
General	427	1.15±0.07	363	4.41±0.18	426	0.76±0.07	363	8.08±0.44	427	10.79±0.52	363	1.34±0.12
The age periods												
180	32	0.72±0.20^{de}	.	.	32	0.03±0.03^{g}	.	.	32	5.94±1.63^{h}	18	1.60±0.15^{a}
194	32	1.09±0.20^{cd}	.	.	32	0.13±0.04^{fg}	.	.	32	6.34±1.26^{h}	20	1.44±0.14^{ab}
208	32	0.91±0.24^{de}	32	3.50±0.50^{cd}	32	0.56±0.20^{de}	32	7.81±1.06^{d}	32	19.06±1.98^{a}	32	1.43±0.11^{ab}
222	32	1.97±0.35^{a}	32	1.97±0.35^{f}	32	0.81±0.25^{cd}	32	10.44±1.36^{bc}	32	10.78±1.73^{f}	30	1.59±0.11^{a}
236	32	1.34±0.26^{bc}	32	6.84±0.72^{a}	32	0.94±0.22^{bc}	32	12.09±1.49^{b}	32	13.56±1.61^{cd}	29	1.58±0.11^{a}
250	32	1.28±0.24^{bcd}	32	6.09±0.55^{a}	31	1.32±0.47^{ab}	32	11.34±1.41^{b}	32	15.28±2.37^{bc}	31	1.46±0.10^{a}
264	31	1.68±0.34^{ab}	31	7.00±0.92^{a}	31	0.90±0.38^{bc}	31	15.55±2.18^{a}	31	11.00±2.61^{ef}	29	1.29±0.11^{abcd}
278	32	1.13±0.36^{cd}	32	3.78±0.54^{bc}	32	1.66±0.34^{a}	32	10.25±1.68^{c}	32	16.75±2.36^{ab}	29	1.09±0.11^{d}
292	31	1.13±0.21^{cd}	31	4.94±0.58^{b}	31	1.55±0.29^{ab}	31	5.35±1.30^{f}	31	12.87±1.69^{d}	28	1.10±0.11^{cd}
306	30	1.17±0.23^{cd}	30	2.93±0.29^{e}	30	0.57±0.17^{de}	30	6.17±1.42^{e}	30	9.60±1.73^{fg}	27	1.17±0.11^{bcd}
320	29	1.07±0.23^{cd}	29	2.72±0.34^{e}	29	0.45±0.16^{def}	29	4.72±1.06^{f}	29	8.14±1.44^{g}	25	1.05±0.12^{d}
334	28	1.07±0.18^{cd}	28	2.93±0.38^{de}	28	0.36±0.11^{ef}	28	2.39±0.32^{g}	28	4.36±0.91^{i}	20	1.41±0.13^{abc}
348	30	0.50±0.16^{e}	30	3.63±0.47^{cd}	30	0.83±0.21^{cd}	30	5.47±1.41^{f}	30	10.77±1.74^{f}	27	1.09±0.12^{d}
378	24	0.96±0.35^{de}	24	1.67±0.39^{f}	24	0.42±0.13^{ef}	24	2.86±0.66^{g}	24	3.83±0.95^{i}	18	1.00±0.14^{d}
Birth type												
Single	295	1.18±0.09	251	4.37±0.23^{b}	294	0.87±0.09^{a}	251	8.34±0.57	295	11.84±0.69^{a}	248	1.15±0.04^{b}
Twin (M-F)	80	1.01±0.13	68	4.99±0.32^{a}	80	0.48±0.12^{b}	68	6.88±0.86	80	7.40±0.87^{b}	65	1.54±0.08^{a}
Twin (M-M)	52	1.21±0.17	44	3.75±0.42^{b}	52	0.56±0.10^{b}	44	8.43±1.11	52	10.03±1.03^{c}	50	1.22±0.08^{b}
Dam age												
3	95	1.08±0.16	81	4.68±0.39^{a}	95	0.83±0.12^{ab}	81	9.14±1.11^{a}	95	13.49±1.23^{a}	83	1.39±0.04^{a}
4	188	1.14±0.11	160	4.56±0.29^{ab}	187	0.62±0.07^{b}	160	9.28±0.67^{a}	188	10.50±0.64^{b}	168	1.21±0.04^{b}
5	144	1.21±0.17	122	4.05±0.28^{b}	144	0.90±0.16^{a}	122	5.80±0.62^{b}	144	9.39±1.01^{c}	112	1.32±0.06^{ab}

The mount frequency was significantly affected by birth type and dam age (P<0.05). Ram lambs born singly had significantly higher mounting frequency than those born with a male or female twin, and those born of three-year-old dams had significantly higher mounting frequency than those born of four- and five-year-old dams. Although mount frequency was highest among lambs at 208 days of age, this did not represent a significant difference between ram lambs at other ages.

The mount duration was significantly affected by lamb ram age (P<0.05), birth type and dam age. Mounting duration was longest in lambs born twinned with a female lamb and lambs born of three-year-old dams. Live weight was also found to have a significant effect on mount duration (P<0.05).

3.1. Poisson Parameter Estimation Values for Sexual Behavior Characteristics

Table 2 shows predicted values for the sexual behaviors tested. Because GEE models employ each level of a discontinued independent variable as a reference, information regarding each level of dam age, birth type and age of ram lamb tested is provided as a reference.

Table 2. The parameter predicted values and their standard errors obtained Poisson regression for sexual behavior characteristics

		Lip curl response		Anogenital sniffing		Raising of tail		Vocalization		Mount frequency	
Factors	DF	PV	SE	PV	SE	PV	SE	PV	SE	PV	SE
General	1	-0.924	0.46*	0.737	0.28**	-2.577	0.61**	-1.181	0.21**	1.172	0.17**
Dam age											
3	1	-0.104	0.13	0.226	0.07	-0.175	0.15	0.510	0.10	0.280	0.04**
4	1	0.018	0.10	0.146	0.06	-0.263	0.13*	0.564	0.10	0.159	0.04**
Birth type											
1	1	0.014	0.14	0.099	0.09	0.431	0.20**	-0.047	0.10**	0.099	0.05*
2	1	0.079	0.18	0.393	0.10**	0.038	0.25	0.005	0.10**	-0.337	0.06**
Age periods											
180	1	0.100	0.33	.	.	-1.989	1.07*	.	.	0.481	0.14**
194	1	0.482	0.30	.	.	-0.669	0.62	.	.	0.481	0.13**
208	1	0.257	0.31	0.955	0.20**	0.769	0.42	1.632	0.15**	1.593	0.12**
222	1	0.996	0.27**	1.523	0.19**	1.071	0.39**	1.827	0.14**	1.062	0.12**
236	1	0.580	0.28	1.628	0.18**	1.120	0.38**	1.910	0.14**	1.295	0.12**
250	1	0.485	0.28	1.497	0.18**	1.453	0.37**	1.808	0.14**	1.395	0.12**
264	1	0.751	0.27**	1.628	0.18**	1.051	0.38**	2.118	0.14**	1.070	0.12**
278	1	0.322	0.28	0.981	0.19**	1.609	0.36**	1.637	0.14**	1.487	0.12**
292	1	0.294	0.28	1.204	0.18**	1.478	0.35**	0.914	0.15**	1.219	0.12**
306	1	0.296	0.28	0.647	0.19**	0.415	0.40	0.994	0.15**	0.928	0.12**
320	1	0.190	0.28	0.550	0.20**	0.144	0.42	0.695	0.15**	0.767	0.12**
334	1	0.165	0.28	0.605	0.20**	-0.098	0.45	-0.039	0.17	0.159	0.14
348	1	-0.528	0.34	0.793	0.19**	0.735	0.37*	0.759	0.14**	1.064	0.12**
Live weight	1	0.015	0.006*	0.017	0.003*	0.025	0.008**	0.030	0.003**	0.0001	0.0002**

*P<0.05 **P<0.01, PV: Predicted value, SE: Standard errors

Predicted values for lip curl response were found to be positive and significant (P<0.01) for lambs at 222 and 264 days of age. This is an indication of a marked increase in lip curl response frequency at these ages. Predicted values for lip curl response for dam age and birth type were insignificant. Predicted values for lip curl response were also positive and significant (P<0.05) for live weight.

Predicted values for the anogenital sniffing were found to be positive and significant (P<0.01) for all ages tested and for birth type (males twinned with females). Predicted values for the anogenital sniffing for dam age were insignificant.

Predicted values for raising of tail were positive and significant (P<0.01) for ram lambs at 222, 236, 250, 264, 278 and 292 days of age, positive and significant (P<0.05) for lambs at 348 days, negative and significant at 180 days and negative but insignificant at 334 days. Predicted values for raising of tail were negative and significant (P<0.05) for lambs born of four-year-old dams and negative but insignificant for those born of three-year-old dams. Predicted values for raising of tail were positive and significant (P<0.05) for live weight.

Predicted values for vocalization were positive and significant (P<0.01) for ram lambs at 208, 222, 236, 250, 264, 278, 292, 306, 320, and 348 days of age, but insignificant for lambs at 334 days of age. Predicted values for vocalization were negative and significant (P<0.01) for lambs born without a twin, insignificant

for dam age and positive and significant (P<0.01) for live weight.

Predicted values for mount frequency were significant and positive (P<0.01) for ram lambs at all ages except at 334 days. Predicted values for mount frequency were significant and positive (P<0.05) for singly-born lambs and significant and negative (P<0.01) for those born with a female twin. Predicted values for mount frequency were insignificant for dam age, but were significant and positive (P<0.01) for live weight.

4. DISCUSSION AND CONCLUSION

The mean value (1.15) for lip curl response of Norduz ram lambs in this study was lower than the values reported for St. Croix White, Barbados Blackbelly, Kıvırcık, and Dağlıç sheep, which were reported to be 4.5, 3.6, 3.4 and 2.1, respectively (Godfrey et al, 1988; Taşkın, 1995). However, the value in the present study was similar to the value of 0.8 reported for Dorset sheep (Maina and Katz, 1997).

The mean anogenital sniffing value of 4.41 found in this study was lower than the values reported for Dorset, St. Croix White, Kıvırcık, Barbados and Awassi sheep, which were 6.20, 8.80, 9.60, 12.00 and 9.40, respectively (Godfrey et al, 1988; Taşkın, 1995; Maina and Katz, 1997; Kridli and Said, 1999). It was also lower than the value of 41.04 obtained by Price et al (Price et al, 1996b), who compared the sexual performance of rams exposed to ovariectomized and intact estrous ewes. However, the value in the present study was higher than the value of 1.4 reported by Taşkın (1995).

The mean raising of tail value of 0.76 reported in this study was lower than the values reported for one- and two-year-old Awassi sheep, which were 4.9 and 6.6, respectively (Kridli and Said, 1999).

The mean the vocalization value of 8.08 found in this study was higher than the values reported by Taşkın for Kıvırcık and Dağlıç sheep, which were 2.8 and 1.3, respectively (Taşkın, 1995).

The mean mount frequency value of 10.79 reported in this study was lower than the 21.40 reported by Katz et al (1988), who studied the effects of post-weaning exposure to females on the subsequent sexual performance of young rams. Our value was also lower than the 17.40 reported by Price et al (Price et al, 1988), who investigated variations in lamb ram sexual behaviors according to age, as well as the values reported by Godfrey et al (1988), Kridli and Said (1999), Price et al (1994b; 1999; 2000; 2001) and Maina and Katz (1997). However, our value was higher than those reported for Kıvırcık and Dağlıç sheep (Taşkın, 1995), which were 3.2 and 2.5, respectively, and the 5.6 reported in another study by Price et al (1998) that examined the effects of sexual stimulation in male sheep and goats.

The mean mount duration of the Norduz ram lambs in this study was 1.34 minutes. This value is lower than those values reported for Merinos and Ossimi (Davidson, 1977), Targhee (Price et al, 1991), FinnxTarghee (Perkins et al, 1992) and Kıvırcık (Taşkın, 1995), but similar to the value reported for Dağlıç sheep (Taşkın, 1995).

Single, male-female and male-male twin ram lambs were compared to respect with examined sexual behaviors. It was observed that the effect of type of birth varies based on sexual behavior characteristics. Generally, Single ram lams were higher the anogenital sniffing, the raising of tail, the vocalization and mount frequency than twin ram lambs in examined sexual behaviors, statistically (P<0.05-P<0.01; table 2). However, Price et al (2000) reported that selecting of single or twin ram lambs was not important for the selection productivity. At the same time, regarding with age of dam there were a variation among ram lambs regarding sexual behavior characteristics investigated (Table 2). This variation changes according to the sexual behavior characteristics. Especially ram lambs' of the 5-year old dams were higher the raising of tail those of the 3 and 4- year old dams. Ability to raise fat tail for native sheep is a significant property and this must be development with testing during herd management (Kridli ve Said, 1999).

In general, age-related variations in the traits examined were irregular; therefore, evaluating the various traits as a whole should prove more useful than selecting any one trait for improving the productivity of selection.

The effects of environmental factors vary according to the specific trait of sexual behavior studied. Other studies have noted the important effects of a number of environmental factors, especially management practices, on sexual behavior (Katz et al, 1988; Price et al, 1993).

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