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Effects of Supplementary Feeding Levels During Mating Period on Reproductive Performance of Karakaş Ewes

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Abstract: A study was conducted with 80 Karakaş ewes and their lambs to investigate the effects of various feeding levels during mating period on the reproductive performance. Group 1 (control) was grazed only on pasture and Group 2, 3 and 4 were supplied with 200, 300, 600 g/head/day rolled barley, respectively, in addition to pasture. Supplementary feeding was initiated three weeks before mating and lasted for six weeks. There were increases ($P<0.01$) in live weights in Karakaş ewes in response to supplementary feeding during feeding period. While supplementary feeding reduced infertility rate ($P<0.05$), this treatment did not affect other reproductive traits. The effects of sex, birth type and birth weight of ewe on the lamb birth weight were significant ($P<0.01$). Birth type affected weaning weight, daily live weight gain and survivability at weaning ($P<0.05$). It was concluded that supplementary feeding in addition to pasture could be utilized to improve reproductive efficiency of Karakaş ewes, however, more detailed studies should be carried out to determine the appropriate supplementary feeding regimen and supplementary feeding period during mating period for this breed in regional conditions.

Key words: Karakaş ewes, supplementary feeding, reproductive performance, survival rate.

Introduction

Reproduction is one of the most important aspects determining productivity of animal farming. Feeding of ewes prior to breeding season (flushing) has been recognized for many years and this practice may have a profound influence on lamb production (Gordon, 1997). Better results were obtained from the studies in which supplementary feeding was initiated 3-4 weeks prior to introduction of ram in the flock and lasted for 2-3 weeks (Sönmez and Kaymakçi, 1987).

Several researchers reported increased twinning rate in the ewes subjected to supplementary feeding during breeding season (Gordon, 1997; Reese *et al.*, 1990 and El-Hag *et al.*, 1998), however, this practice did not affect lamb traits (Akmaz and Akçapinar, 1990). In ewes of many breeds body condition and level of feed intake affect ovulation rate (Gordon, 1997), however, in some breeds this rate is independent of body condition and level of feed intake (Doney and Gunn, 1973; Rhind and Schanbacher, 1991). In the ewes having similar genetic constitution live weight alone has been found to be a more accurate predictor of ovulation rate than body condition (Cumming, 1977). Ovulation rate and some reproductive traits of grazed Karakaş ewes have been determined (Ülker *et al.*, 2000), nevertheless, the effects of supplementary feeding in addition to grazing during breeding season on live weight and reproductive characteristics were not studied. Therefore the purpose of this study is to determine the effects of supplementary feeding in addition to grazing during breeding season on reproductive traits of Karakaş ewes, survival rate and live weight of their lambs at various periods.

Materials and Methods

80 Karakaş ewes raised in Yüzüncü Yil University, Faculty of Agriculture Sheep Facility (2-5≥ years old) were assigned in to four groups as one control (Group 1, $n=20$), and three supplement groups (Group 2, 3 and 4, $n=20$). Each group was designed to have equal numbers of ewes at the same age and weight. Supplement groups were fed with rolled barley for 6 weeks and this started 3 weeks before introduction of ram. Control group was grazed only on pasture and supplement groups were fed with 200, 400 or 600 g/day/animal rolled barley, respectively, in addition to pasture. Rams used in the study were supplemented with 600 g/day/animal rolled barley during mating period. Free mating system was applied and mating period lasted for three weeks. In order to determine mated ewes ram introduction was mediated at the facility twice a day. During the last 6 weeks of their pregnancy ewes in all groups were given 650 g barley, 1,5 kg chopped alfalfa hay; and from lambing until weaning they were given 600 g concentrate and 1,5 kg chopped alfalfa hay per animal at daily bases.

Table 1. Data recorded related to breeding season were initial body weight, body weight at the beginning and end of ram introduction. Lambing rate, twinning rate and lamb numbers per lambed and mated ewe, ewe weight at lambing and lamb birth weights were determined at lambing season.

Lambs received only milk of their mothers during the first 15 days after lambing and then they were made accustomed to concentrate and chopped alfalfa hay. Accordingly, 130 g concentrate and 150 g chopped alfalfa hay were supplied to the suckling lambs at a daily basis. Lambs were weighed at lambing and then at 15, 30, 45,

Table 1: Nutrient contents of the feed used in the study (%)

	Rolled barley	Concentrate for ewes	Concentrate for lambs	Chopped alfalfa hay
Dry matter	90.65	90.67	90.07	90.42
Organic matter	97.25	84.45	89.08	91.26
Crude protein	9.81	12.28	12.86	10.40
Crude fat	1.82	2.43	2.41	1.89
Crude ash	2.75	15.55	10.92	8.24
ADF	8.22	19.00	15.75	47.88
NDF	50.40	44.55	49.67	55.25

60 and 75 th day of age following a 12 hours fasting period. All lambs were weaned at 75 days of age. Feed was analysed for dry matter, crude protein, fat and ash content (Akyildiz, 1974) as well as ADF and NDF content (Van Soest *et al.*, 1991).

Live weights of ewes and lambs were analysed using following model

$$y_{ijklm} = \mu + G_i + A_j + B_k + S_l + b(X_{ijklm} - \overline{X}_{ijklm}) + e_{ij\ klm}$$

where μ is population mean, G, A, B and S are the effects of group, age, birth type and sex of the animals, respectively; b is regression for initial ewe weight and lamb birth weight for ewe weights, and lamb weights at various ages, respectively; e_{ijklm} is the experimental error; X and $\overline{X}$ are birth weight and average birth weight, respectively.

Solution of this equation was analysed least square technique. Least square analysis were mediated in SAS/GLM procedure. Duncan test was utilised for determining differences among the means. Since distribution of discrete data such as reproductive traits and survivability is binomial, SAS/GENMOD was utilised in the evaluation of the effects of supplement groups and ewe age on these traits (SAS, 1998).

Results and Discussion

Live weights and reproductive traits of Karakaş ewes during breeding season were given in Table 2. The effects of supplementary feeding on live weight at the beginning and at the end of ram introduction were significant ($P<0.01$), however, the effect of ewe age on these traits was not significant. Ewes subjected to increased amount of supplementary feeding had higher live weight at the end of ram introduction indicating that Karakaş ewes respond positively to supplementary feeding during breeding season that corroborate earlier findings in other breeds (Akmaz and Akçapinar, 1990; Reese *et al.*, 1990; Rhind and Schanbacher, 1991; Gordon 1997 and El-Hag *et al.*, 1998). The effect of initial weight on live weight at the beginning and end of ram introduction was significant ($P<0.01$). This indicates that using the initial weight as a regression factor is important in such studies.

Table 2. While supplementary feeding reduced infertility rate ($P<0.05$), this treatment did not affect other reproductive traits. Although some investigators reported that supplementary feeding did not affect reproductive efficiency (Doney and Gunn, 1973; Akmaz and Akçapinar, 1990; Rhind and Schanbacher, 1991 and Özder *et al.*, 1998), others reported that depending on some factors such as the amount and quality of supplementary feeding, duration of feeding, condition and age of ewe, this practice reduced infertility rate (Filya *et al.*, 1996), increased twinning rate, lamb number per mated and lambed ewe (Baş *et al.*, 1986; Reese *et al.*, 1990; Yoder *et al.*, 1990; Molle *et al.*, 1997 and El-Hag *et al.*, 1998). The ability of nutrition to improve reproductive traits may be related to cell entry rate of glucose, which involves in follicle recruitment and consequently increases in ovulation rate. On the other hand, feed intake in sheep can influence the concentration of progesterone. This hormone, through its negative feedback effects, can affect LH pulse frequency, which is thought to play an important role in oocyte maturation and early development. Beside that, peripheral concentration of progesterone on days 0 and 1 after LH peak are important for embryo survival (Boland *et al.*, 2001). In a previous study in which ovulation number and lamb number per lambed ewe were compared in Karakaş ewes it was concluded that lamb number per lambed ewe could be considered as an indication for ovulation rate in this breed (Ülker *et al.*, 2000). The positive response of Karakaş ewes to supplementary feeding in terms of increases in live weights, but not ovulation rate, was determined in present study, however, based on the conclusion from previous study, it could be speculated that ovulation rate in Karakaş ewes is independent of level of feed intake. Nevertheless, more detailed studies should be carried out to support this phenomena.

Live weights of dams and lambs were given in Table 3. Live weights of 2 and 3 years old ewes at lambing were lower than 4 and 5≥ years old ewes. Ewes' lambing weight affected lamb birth weight ($P<0.01$). These findings

Table 2: Mean (±SEM) Live weights (kg) and some reproductive traits in Karakaş ewes subjected to various levels of supplementary feeding during mating season

	N	Initial live weight	Live wt at the begin. Of ram introduction	Live wt at the end of ram introduction	Infertility rate (%)	Lamb number per mated ewe	N	Lamb number per lambed ewe	Twinning rate (%)
General	80	58.46±1.49	57.40±0.60	57.21±0.39	12.50±0.37	1.06±0.06	70	1.21±0.05	20.00±0.48
Feeding groups			**	** *					
Group 1	20	58.04±1.46	55.30±0.58b	57.79±0.49b	10.00±0.68b	1.20±0.16	18	1.33±0.14	27.78±0.11
Group 2	20	58.12±1.50	58.53±0.60a	58.40±0.51ab	15.00±0.82b	0.95±0.11	17	1.12±0.08	11.76±0.81
Group 3	20	58.97±1.50	59.32±0.60a	59.19±0.51a	25.00±0.99b	0.90±0.14	15	1.20±0.10	20.00±0.11
Group 4	20	58.72±1.51	56.45±0.60b	60.10±0.51a	0.00±0.00a	1.20±0.09	20	1.20±0.09	20.00±0.92
Dam age groups		**				**		**	**
2 Years	28	48.34±1.17c	57.22±0.58	58.51±0.49	17.86±0.74	0.82±0.07b	23	1.00±0.00b	0.00±0.00b
3 Years	26	56.86±1.22b	57.90±0.47	58.90±0.41	11.54±0.64	1.04±0.10a	23	1.17±0.08a	17.39±0.81a
4 Years	21	63.25±1.36a	57.27±0.63	58.85±0.53	9.52±0.66	1.29±0.16a	19	1.42±0.14a	36.84±0.11a
5≥ Years	5	65.38±2.79a	57.21±1.17	59.23±0.39	0.00±0.00	1.60±0.24a	5	1.60±0.25a	60.00±0.24a
Initial live wt regres.			0.92±0.05**	0.92±0.04**					

*p<0.05. **p<0.01

a,b,c: Means with different letters within the same column were different

Table 3: Mean (±SEM) lambing weights (kg) of Karakaş ewes and their lambs' live weights (kg) at various periods

	N	Ewe lamb. weight	Lamb birth weight	N	Live wt at 15 days of age	N	Live wt at 30 days of age	Live wt at 45 days of age	N	Live wt at 60 days of age	N	Live wt at 75 days of age
General	84	66.91±1.69	4.44±0.17	79	8.31±0.24	81	11.56±0.37	14.59±0.49	80	17.63±0.62	76	19.99±0.81
Feeding groups							*					*
Group 1	24	66.90±1.56	4.32±0.16	24	8.62±0.21	24	11.80±0.34a	14.55±0.45	24	17.45±0.56	24	19.19±0.71b
Group 2	18	66.53±1.85	4.51±0.19	18	8.45±0.25	18	11.70±0.40ab	14.11±0.53	18	17.88±0.66	18	20.10±0.84ab
Group 3	18	67.13±1.83	4.66±0.19	14	7.93±0.29	15	12.07±0.44a	15.39±0.58	15	17.90±0.72	13	21.44±0.99a
Group 4	24	67.04±1.58	4.33±0.16	23	8.11±0.22	24	10.89±0.35b	14.49±0.45	23	17.44±0.57	21	19.91±0.78ab
Dam ages groups		**			*							
2 Years	23	55.08±1.80c	4.28±0.22	22	8.00±0.26ab	23	10.85±0.41	13.76±0.54	23	17.14±0.54	20	20.13±0.88
3 Years	27	64.21±1.45b	4.60±0.15	26	8.22±0.20ab	27	11.21±0.32	14.90±0.42	27	17.93±0.42	27	20.92±0.65
4 Years	28	71.32±1.40a	4.34±0.16	25	7.98±0.21b	25	11.83±0.33	14.89±0.44	24	17.52±0.44	24	19.65±0.70
5 ≥ Years	6	76.99±2.97a	4.61±0.33	6	8.91±0.42a	6	12.57±0.66	15.00±0.86	6	18.08±1.07	5	19.94±1.47
Sex			**									
Male	35	67.57±1.37	4.65±0.14	32	8.29±0.20	34	11.74±0.31	14.56±0.40	34	17.79±0.40	32	20.23±0.68
Female	49	66.29±1.19	4.26±0.12	47	8.26±0.17	47	11.49±0.27	14.72±0.36	46	17.55±0.36	44	20.09±0.58
Birth type		*	**				**	**		**		*
Single	55	68.84±1.26	4.80±0.13	52	8.45±0.19	54	12.50±0.30	15.88±0.39	53	18.94±0.49	50	21.32±0.64
Twin	29	64.97±1.55	4.11±0.16	27	8.10±0.23	27	10.73±0.36	13.40±0.47	27	16.40±0.59	26	19.00±0.77
Lamb birth wt regr.					0.96±0.16**		0.29±0.25	0.50±0.32		0.53±0.40		0.38±0.52
Dam lamb wt regres.			0.02±0.01**									

*p<0.05. **p<0.01. a, b, c: Means with different letters within the same column were different

Table 4: Mean (±SEM) daily weight gain (g), live weight changes (g) and survivability rates (%) of Karakaş lambs.

	N	Daily wt gain	N	Live wt changes	N	Survivability rate
General	76	0.207±0.01	76	15.51±0.81	85	98.82±0.12
Feeding groups		*		*		
Group 1	24	0.196±0.01b	24	14.71±0.71b	24	100.00±0.00
Group 2	18	0.208±0.01ab	18	15.61±0.84ab	19	100.00±0.00
Group 3	13	0.226±0.01a	13	16.96±0.99a	18	94.44±0.56
Group 4	21	0.206±0.01ab	21	15.43±0.78ab	24	100.00±0.00
Dam ages groups						
2 Years	20	0.209±0.01	20	15.65±0.88	23	100.00±0.00
3 Years	27	0.219±0.01	27	16.44±0.65	27	100.00±0.00
4 Years	24	0.202±0.01	24	15.17±0.70	29	96.55±0.34
5 ≥ Years	5	0.206±0.02	5	15.46±1.47	6	100.00±0.00
Sex						
Male	32	0.210±0.01	32	15.75±0.68	35	97.14±0.29
Female	44	0.208±0.01	44	15.61±0.58	50	100.00±0.00
Birth type		*		*		*
Single	50	0.224±0.01	50	16.84±0.64	56	98.21±0.18
Twin	26	0.194±0.01	26	14.52±0.77	29	100.00±0.00
Lamb birth wt regres.		-0.008±0.007		-0.624±0.518		

*p<0.05. **p<0.01 a, b: Means with different letters within the same column were different

have similarities with previous reports that live weights of 2 years old ewes at lambing were lower than 3, 4, and 5≥ years old ewes (Karaca *et al.*, 1993; Aygün and Bingöl, 1999 and Gökdal *et al.*, 2000). Male and single lambs

were superior to female and twin lambs, respectively, at birth weight ($P<0.01$). This is in agreement with pervious findings in Karakaş lambs (Karaca *et al.*, 1993; Aygün and Bingöl, 1999 and Gökdal *et al.*, 2000). Supplementary feeding and birth type affected weaning weight ($P<0.05$). This is the first study to report the effect of supplementary feeding on weaning weight in this breed.

Table 3. Lambs' daily weight gains, live weights changes and survivability rates were given in Table 4. The effects of feeding groups and birth type on average daily live weight increase were significant ($P<0.05$). Similar results were reported by various researchers (Reese *et al.*, 1990 and Esen and Yildiz, 2000). Live weights changes of Karakaş lambs were affected from supplementary feeding but not from dam age in the present study, however, some other studies reported that lambs born by 5≥ years old ewes had higher live weight changes (Baş *et al.*, 1986 and Filya *et al.*, 1996). Feeding groups, dam age and sex did not affect survival rate. This may be an indication that maintenance conditions play more effective role in this trait as observed in other studies (Akmaz and Akçapinar, 1990; Baş *et al.*, 1986 and Filya *et al.*, 1996).

Table 4. In conclusion, supplementary feeding in addition to grazing during breeding season increased live weight and decreased infertility rate in Karakaş ewes, however, did not affect twinning rate, lamb number per mated and lambed ewe. While supplementary feeding did not affect survivability of the lambs, it affected weaning weight and daily live weight increases in Karakaş lambs. Since Karakaş ewes respond supplementary feeding positively, a region wide practice will make significant contribution to reproductive efficiency of the ewes and variety of lamb yield traits, however, more detailed studies related to the level and period of supplementary feeding and ewe body condition during mating season are needed to be performed.

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