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Effect of parity and type of lambing on performance and udder traits of Bandirma ewes

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ABSTRACT

The objective of this study was to evaluate the effect of parity and lambing type on body condition score (BCS), live weight of ewes (LWE), daily milk yield (DMY), lambs growth performance and udder measurement of ewes during first 3 months of lactation in Bandirma ewes. Bandirma ewes (78) with healthy udders and their lambs (117 heads) were used. BCS of ewes was affected significantly by lambing types at first and third months of lactation, while lambing types were not significant in second month of lactation. Parity of ewes did not significantly affected BCS except third month of lactation which was significantly affected by parity. Effects of lambing types and parity of ewes were significant on BCS at first and third month of lactation. Live weight change of ewes was affected significantly by parity, while lambing types were not significant at first 3 months of lactation. There was a significant effect of parity on average daily milk yield at early lactation stage. Also lambing type had significant effect on DMY at first 2 months of lactation. DMY at third month of lactation were not affected by lambing types. Parity affected lambs growth performance in the first three months of lactation. No significant differences between lambing type and parity of ewes in udder measurement, except udder circumference (UC) measure which was significantly affected by parity and lambing types. The effects of parity of ewes were significant on udder circumference and udder width while the other udder traits were not significant. The effects of birth type of ewes were significant on udder width while the other udder traits were not significant. The positive and significant correlations were observed between udder circumference and udder width and daily milk yield in Bandirma sheep. Significant positive phenotypic correlations were determined between lambs live weight (LLW) and LWE, BCS and DMY, LLW and LWE, DMY and LWE. The results suggested that early stage of lactation of ewe's can be feed supplemented with high energy or high protein for increasing milk production. The control of these physiological stages of ewe may be improved BSC and DMY, also growth performance of lambs. Hence, we recommend that early stage of lactation performance and udder measurements of ewes are to be taken into consideration for selection programme of Bandirma sheep.

Key words: Body condition score, Correlation, Live weight, Milk yield, Sheep, Udder

The Bandirma sheep genotype was formed in 1999 in Turkey by crossing the German Black Head Mutton with the Kivircik breed (Ceyhan *et al.* 2011). Ceyhan *et al.* (2008) described the fattening and carcass characteristics of lambs. The udder characteristics do not belong to the most important traits of the milking sheep; however, they could have strong effects on the milk yield and composition (Ugarte and Gabina 2004). Studies about udder and teat measures and distance between teats were undertaken (Emediato *et al.* 2008). Knowledge of milk yield, milking time and udder conformation is necessary for optimal adaptation of the milking environment to the needs of the ewe (Altincekic and Koyuncu 2011). The relationships between morphological udder traits would permit to predict future correlated responses in milk-oriented selection schemes (Milerski *et al.* 2006). There was a high and significant correlation coefficient between daily milk yield during whole lactation period and live weight gains of lambs during pre-weaning period (Ünal *et al.* 2008).

Bandirma sheep, a breed for meat production and milk production, is to be used as breeding sheep. Determining the properties of sheep udder and milk yield, lambs, growth, fattening performance, slaughter and carcass characteristics and correlations between these features is important. The aim of this study was to investigate lambs growth performance, body condition score and live weight of ewes, the first three months daily milk yield, and udder measurement of crossbred Bandirma ewes.

MATERIALS AND METHODS

Animals and management: The study was conducted on 78 lactating ewes (2–6 years) of crossbred Bandirma sheep.

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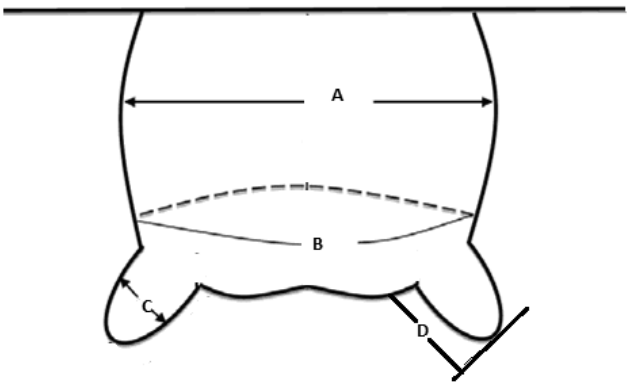

Fig. 1. Quantitative measurements of sheep udder. A. Udder width; B. Udder circumference above teats; C, Teat diameter; D, Teat length.

Ewes were maintained and fed indoors as commercial milk feed (14% crude proteins and 2,600 kcal ME) during the suckling period but for the rest of lactation, they grazed on natural pastures. Indoor daily ration was 1 kg common vetch hay (0.5 kg morning and 0.5 kg evening) and were supplemented with concentrate feed (1.5 kg/day). After weaning, ewes were grazed with flock during the day.

Data collection and statistical analysis: The ewe live weight (kg), body condition score (BCS), daily milk yield of ewe (g/day) and live weight of lambs (kg) were determined at first, second and third of month of lactation. The daily milk yield was recorded by hand milking twice daily (07:00 and 19:00 h) till lamb weaning age (90 day). Ewe and lamb body weights were measured, electronic scale that was sensitive to 10 g while for determining the BCS, the method developed by Khan *et al*. (1992) which uses evaluation groups with 0.5 point intervals between ranges of 0 to 5 was used.

The udder traits were determined lamb weaning age (90 day). Before lamb weaning time, the external udder measurements were performed as described by Iñiguez *et al.* (2009). These measurements (Fig. 1) included udder circumference (UC, cm) above teats. By using a caliper, right and left teat length (RTL and LTL, cm) was measured from attachment of teat with udder to the end of teats. Teat diameter (RTD and LRT, mm) was taken in the middle of teats, udder width (UW, cm) above teats at rear of udder. All measurements were taken before the ewes were milked.

General Linear Model was used to study the effect of parity of ewe and lambing type on daily milk yield, body condition score and ewe live weight, lambs live weight and udder measurement of Bandirma Sheep, assuming the following model:

$$y_{ijk} = \mu + X_i + Y_j + e_{ijk}$$

where:

y_{ijk}, observational value of animal; μ, overall mean; X_i, effect of parity (1, 2, 3, 4 and 5); Y_j, effect of lambing type (single and twin); and e_{ijk}, random error. Duncan multiple test was used to detect differences among least square means within each factor. Correlation coefficients among different milk traits as well as with udder measurements were computed by Pearson's correlation method.

RESULTS AND DISCUSSION

Body condition score (BCS), ewe live weight (ELW), daily milk yield (DMY), least square means and standard errors of crossbred Bandirma ewes are presented in Table 1. Lambing types had significant effect on BCS for the first and third months of lactation. However, parity had no significant effect on body condition score for the first and second months of lactation. But, lambing type had significant effect on BCS for the third month of lactation of ewes.

The BCS and live weight of the values has decrease the first month of the lactation in ewes according to second and third month's lactation in ewes. During the first three suckling mounts, average BCS changes for first to fifth parity ewes were –17.8%, –9.9%, –3.9%, –6.9% and –17.0% (P<0.01), respectively. On the other hand, average BCS change for twin and single lambing groups were –11.2% and –10.7% (P<0.01), respectively. Higher average results of BCS compared with our results by Köycü *et al.* (2008) Karacabey Merino mating, lambing and weaning BCS of (3.781, 3.354 and 2.279), respectively.

No differences were observed between lambing types all stages of lactation for the LWE. However, the effects of parity were significant (P<0.01) on the LWE.

During the first 3 suckling mounts, mean weight loss for first, third, fourth and fifth parity ewes were 4.9%, 5.6% 7.7% and 8.2%, respectively. But mean weight gain for second parity ewes was 3.4%. On the other hand, mean weight loss for twin and single lambing ewes were 6.4% and 7.3% (P<0.05), respectively. This results are general agreement with Benchohra *et al.* (2015).

Lower average results of live weight of ewes compared with results of Ceyhan *et al.* (2007) and Köycü *et al.* (2008). However, Ceyhan *et al.* (2011) found in 44.91 kg for GBM × K (F_1), 45.71 kg for Bandýrma-I and 42.22 kg for Bandýrma-II genotypes yearling weight. Köycü *et al.* (2008) Karacabey Merinos ewes at mating (71.357 kg), lambing (70.104 kg) and weaning time live weight (67.257 kg).

Milk yield had increased (P<0.05) in parity and lambing type of ewes (P<0.01) except for third month of lactation. Average daily milk yield in the first, second and third month were found 853.12, 622.91 and 618.99 g, respectively. Higher average results of 180 d daily milk production were compared with our results by Dag and Zülkadir (2004) Awassi sheep (716.18 ml) and Koncagül *et al.* (2012a) average daily milk yield, corrected to 180-day lactation length was 727 g/day (130.9±3.24 kg for Norduz ewes). Koncagül *et al.* (2012a) reported that overall means of daily milk yield was 770 for Zom sheep, and Reida *et al.* (2010) 1.57 kg/day for Awassi sheep. Significant effect of parity, type of lambing and lambing season on average milk yield was reported in Norduz sheep (Koncagül *et al.* (2012a), Zom sheep Koncagül *et al.* (2012a) and Awassi sheep (Reida *et al.* 2010).

Table 1. Least square means and standard errors of body condition score, live weight and daily milk yield in three months of lactation

Investigated factors		First month	Second month	Third month
		Body Condition Score		
		**	NS	**
	n	$\bar{X} \pm S\bar{x}$	$\bar{X} \pm S\bar{x}$	$\bar{X} \pm S\bar{x}$
Lambing type				
Twin	39	2.24±0.06	2.09±0.06	1.99±0.06
Single	39	2.61±0.09	2.14±0.08	2.33±0.08
Parity		NS	NS	**
1	16	2.19±0.11	1.92±0.11	1.80±0.11c
2	16	2.53±0.11	2.25±0.11	2.28±0.11ab
3	15	2.33±0.12	2.07±0.11	2.24±0.10ab
4	16	2.60±0.11	2.17±0.11	2.42±0.11a
5	15	2.47±0.12	2.15±0.11	2.05±0.11bc
Overall	78	2.42±0.05	2.11±0.05	2.16±0.05
		Ewe Live Weight (kg)		
Lambing type		NS	NS	NS
Twin	39	56.66±0.68	54.75±0.62	53.05±0.62
Single	39	57.15±0.96	53.53±0.87	52.96±0.86
Parity		**	**	**
1	16	50.77±1.236c	49.88±1.120c	48.26±1.11c
2	16	56.76±1.259b	53.53±1.141b	52.51±1.16b
3	15	55.97±1.267b	53.17±1.149b	52.84±1.14b
4	16	61.63±1.236a	58.82±1.120a	56.87±1.11a
5	15	59.37±1.284ab	55.32±1.164b	54.53±1.16ab
Overall	78	56.90±0.59	54.14±0.53	53.00±0.53
		Daily Milk Yield (g)		
Lambing type		**	**	N.S
Twin	39	905.88±29.50	647.73±17.38	646.76±18.30
Single	39	800.36±41.44	598.09±24.41	591.23±25.36
Parity		*	*	*
1	16	748.45±53.47b	483.81±31.50b	502.83±32.73b
2	16	808.72±54.49ab	632.92±32.09a	608.51±33.35a
3	15	851.96±54.84ab	675.51±32.31a	661.96±33.57a
4	16	947.20±53.47a	678.19±31.50a	624.47±34.02a
5	15	909.25±55.58ab	644.14±32.74a	697.20±34.02a
Overall	78	853.12±25.43	622.91±14.98	618.99±15.63

a, b, c, Means within the same columns followed by different letters significantly differ; NS, P>0.05; **, P<0.01; *, P<0.05.

During three suckling months, average DMY changes for first to fifth parity ewes were –35.9%, –24.8%, –22.3%, –34.1% and –23.3%, respectively. The great change of DMY was found in first parity ewe (–35.9%). Meanwhile, average BCS change for twin and single lambing ewes were –28.6% and –26.1%, respectively. Our finding are similar to Benchohra *et al.* (2015) finding that daily milk yield were 935, 644, 446 g for heavy weight group and 814, 596, 414 g for low weight group in the Algerian Rembi ewes, respectively, with 10.3% difference (P>0.05).

Live weight of lambs (Table 3) had differ among lambing type and parity of ewes (*P*>0.01), except for third month of lactation. The average live weight of lambs at first, second and third months was 11.07, 23.78 and 32.00 kg, respectively.

Higher average results of third mount (weaning) weight compared with our results were found by Ünal *et al.* (2008) in the Bafra ewes (23.7 kg), and Sezenler *et al.* (2008) Merino (29.6 kg) but lower average results of weaning weight Ceyhan *et al.* (2011) in GBM × K (F1), Bandirma-I and Bandirma-II genotypes (34.11, 32.98, 33.18, and 30.29 kg), respectively. Sezenler *et al.* (2009) weaning weight 35.45 kg for Bandirma-I and 34.27 kg for Bandirma-II crossbred lambs and Ceyhan *et al.* (2007) at 38.17 kg for Kivircik, 29.25 kg for Gökceada and 30.82 kg Sakiz lambs. This difference or agreement with our results for Bandirma lamb could be attributed to the use of pastures areas and the management conditions of the lambs or to be affected by environmental factors such as the year of the birth, the type of breed, and the age of the ewe.

The least square mean of some udder and teat characteristics are given in Table 3. Significant differences were found among the lambing type and parity related to udder circumference width (P<0.05). The udder width was

Table 2. Least square means and standard errors of lambs live weight before weaning (kg).

Investigated factors	n	First month $\bar{X} \pm S\bar{x}$	Second month $\bar{X} \pm S\bar{x}$	Third month $\bar{X} \pm S\bar{x}$
Lambing type		**	**	**
Twin	78	9.52±0.21	20.84±0.43	28.90±0.54
Single	39	12.63±0.30	26.71±0.60	35.10±0.75
Parity		**	*	NS
1	24	9.94±0.39b	22.19±0.78b	30.16±0.96
2	23	11.15±0.40b	23.72±0.79ab	32.47±0.98
3	25	11.07±0.40b	23.43±0.80b	31.04±0.99
4	23	11.02±0.39b	23.96±0.78ab	32.27±0.98
5	22	12.20±0.40a	25.60±0.81a	34.05±1.00
Overall	117	11.07±0.19	23.78±0.37	32.00±0.46

a, b, c: Means within the same columns followed by different letters significantly differ NS: P>0.05, **: P<0.01, *: P<0.05.

Table 3. Some udder characteristics of Bandirma sheep

Investigated factors	n	UC (cm) $\bar{X} \pm S\bar{x}$	LTL (cm) $\bar{X} \pm S\bar{x}$	RTL (cm) $\bar{X} \pm S\bar{x}$	LTD (mm) $\bar{X} \pm S\bar{x}$	RTD (mm) $\bar{X} \pm S\bar{x}$	UW (cm) $\bar{X} \pm S\bar{x}$
		*	NS	NS	NS	NS	NS
Lambing type							
Twin	39	44.21±0.53^{b}	27.79±0.54	27.89±0.49	17.47±0.31	17.55±0.32	12.58±0.22
Single	39	46.21±0.55^{a}	27.22±0.55	27.42±0.67	17.38±0.30	17.21±0.31	12.89±0.27
Parity	*	NS	NS	NS	NS	*	
1	16	42.70±0.92^{c}	27.42±0.64	27.50±1.15	17.42±0.26	17.59±0.38	11.60±0.38^{b}
2	16	46.24±0.81^{a}	26.12±0.79	26.34±0.64	17.91±0.38	17.17±0.45	12.93±0.38^{ab}
3	15	45.63±0.90b	26.76±0.75	27.40±0.64	17.55±0.45	17.32±0.48	12.84±0.36^{ab}
4	16	45.40±0.78^{b}	29.06±1.11	28.71±0.97	17.12±0.64	17.56±0.67	13.00±0.31^{ab}
5	15	45.90±0.87^{a}	28.26±0.82	28.07±1.16	17.05±0.57	17.27±0.49	13.27±0.38^{a}
Overall	78	45.21±0.40	27.51±0.39	27.66±0.42	17.42±0.21	17.38±0.21	12.74±0.17

UC, Udder circumference; LTL, left teat length; RTL, right teat length; LTD, left teat diameter; RTD, right teat diameter; UW, udder width. a and b**,** Means within the same columns followed by different letters significantly differ; NS, nonsignificant; *, P<0.05.

significantly affected by parity. However, left and right teat length, udder width and right and left teat diameter were not effected by lambing type and parity of Bandirma ewes. The average udder circumference, left teat length, right teat length, left teat diameter, right teat diameter and udder width were measured 45.21, 27.51, 27.66, 17.42, 17.38 and 12.74 cm, respectively.

The udder characteristics and their effects on the milk production traits were evaluated differently by the various authors. Many of them took the udder measurements concerning different sheep breeds from the udder using cm scale, which needed time and extra labour. Genotype had a strong effect on udder characteristics, but the size effect had the same trend in each genotype (Kukovics *et al.* 2006). Altincekic and Koyuncu (2011) suggest that the udder measurements may be suitable selection markers to improve Tahirova, Kivircik and Karacabey Merino sheep breeds milking ability. Udder circumference had strong, positive estimates of phenotypic correlation with udder width, udder length, and teat angle and udder volume in ewes. In the near future, udder scoring will be extended to the entire registered population to conduct a more accurate and efficient genetic evaluation.

Lower average results of udder circumference compared with our results were found by Sari *et al.* (2015) 34.33cm for Tuj ewes, Ünal *et al.* (2008) 34.7 to 36.5 cm for Bafra sheep two and three age of ewes, and Dag and Zülkadir (2004) 33.2 cm for Awassi sheep.

The left and right teat diameter finding higher than Sari *et al.* (2015) 1.17 cm for Tuj ewes, Ünal *et al.* (2008) reported that the left teat diameter (1.4–1.4 cm), right teat diameter (1.3–1.3 cm) reported for Bafra sheep in lactation 98 days.

Mc Kusick *et al.* (2000) measured higher average udder depth for multiparous East-Friesian ewes (19.7 cm). Udder width of Bandirma sheep value is different form results Sari *et al.* (2015) 10.89 cm for Tuj ewes, Ünal *et al.* (2008) 10.4–10.6 cm udder a width for Bandirma sheep and Dag and Zülkadir (2004) 15.59 cm for Awassi sheep. The udder depth measurements in Tsigai, improved Walachian and Lacaune dairy sheep breeds were 4.2, 4.5 and 6.0 cm.

Higher average results of teat length compared with our results were found by Sari *et al.* (2015) 2.41 cm for Tuj ewes, Emediato *et al.* (2008) in the Bergamasc ewes (2.86

Table 4. Phenotypic correlation coefficients among udder characteristics [a]

Measurements	UC	LTL	RTL	LTD	RTD	UW
LTL	0.06^{NS}					
RTL	0.03 ^{NS}	0.72**				
LTD	0.03 ^{NS}	0.25 $^{N.S}$	0.35**			
RTD	0.07 ^{NS}	0.46**	0.64**	0.70**		
UW	0.59**	0.12 ^{NS}	0.06 ^{NS}	–0.08 ^{NS}	–0.03 ^{NS}	
DMY	0.43**	0.21 ^{NS}	0.26 ^{NS}	–0.03 ^{NS}	0.09 ^{NS}	0.42**

NS, nonsignificant; **, P<0.01; DMY, daily milk yield.
[a]: For traits abbreviations see footnote of Table 3.

Table 5. Phenotypic correlation coefficients among live weight, body condition score and daily milk yield

Lactation months		ELW	BCS	DMY
	LLW	0.24*	0.19 **	0.05 ^{NS}
First	ELW		0.60**	0.29**
	BCS			–0.02 ^{NS}
		ELW	BCS	DMY
	LLW	0.22*	0.09 ^{NS}	–0.01 ^{NS}
Second	ELW		0.49**	0.40**
	BCS			0.02 ^{NS}
		ELW	BCS	DMY
Third	LLW	0.21 **	0.09 ^{NS}	0.14^{NS}
	ELW		0.60**	0.46 **
	BCS			0.15 ^{NS}

LLW, Lamb Live weight, ELW, Ewe Live weight, EBSC, Ewe Body Condition Score, DMY, Daily milk yield. NS, non-significant, *: P<0.05, **: P<0.01.

to 2.91 cm), Rovai *et al.* (2008) in Manchega (42.7 mm) and Lacaune breed at (32.7 mm) and Iñiguez *et al.* (2009) found in Awassi average teat length 3.4 cm. Dag and Zülkadir (2004) 3.76– 3.85cm for Awassi sheep. Also the teat lengths (mm) were 35.3, 36.5, 33.6, respectively (Milerski *et al.* 2006). Makovický *et al.* (2013) reported that a greater teat length (36.61 mm) was observed in crosses Tsigai (T) × specialized dairy breeds (SDB) (25% SDB) compared to purebreds Lacaune ewes (33.94 mm). The lowest average teat length (32.68 mm) was found in crosses T × SDB (50% SDB).

Lower average results of teat length compared with our results were found by Kahtuei *et al.* (2008) in Kermani (2.64 cm), respectively and Ayadi *et al.* (2011) at Sicilo-Sarde (18.5 mm) and Ünal *et al.* (2008) left teat length (2.4–2.4 cm), right teat length (2.3–2.5 cm) Bafra sheep.

Values in accordance with ours were found by Sadeghi et al. (2013) in the Lori Bakhtiari ewes from 2.32 to 3.25 cm and by Altinçekiç and Koyuncu (2011) in Kivircik, Tahirova and Karacabey ranged from 2.68 to 2.88 cm. This difference or agreement with our results for Bandirma ewes could be attributed to be affected by environmental factors such as the year of the birth, the type of breed, and the age of the ewe.

The positive and significant (P<0.01) correlations were observed between udder circumference and udder width and DMY in Bandirma sheep. In the present study, udder circumference was positively and significantly (P<0.01) correlated with average daily milk and udder width in Bandirma sheep. A significant correlation (P<0.01) was also found between right teat length and left teat length (Table 4). Similarly, the average daily milk was significantly (P<0.01) correlated with udder width. Therefore, selection to improve any one of these traits might lead to an improvement of the others. Dag and Zülkadir (2004) reported phenotypic correlation among average daily milk yield with UC (0.38) and ADMY with LTL and RTL (0.17). Also Ünal *et al.* (2008) found positive and significant correlations between average daily milk production and udder circumference, udder a width traits. However, Milerski *et al.* (2006) could not find significant correlation coefficients between udder depth and teat length in Tsigai, Walachian and Lacaune dairy ewes.

A significant correlation between udder circumference, udder shape, udder depth, udder attachment with daily milk yield was found highly correlated with daily milk yield. But insignificant correlation between udder circumference and teat length was found in the Lori Bakhtiari ewes (Sadeghi *et al.* 2013). Also Sari *et al.* (2015) reported that significant positive correlations (P<0.05, P<0.001) were found between udder circumference and udder depth, udder circumference and teat diameter, udder circumference and udder width, udder depth and teat diameter, udder depth and udder width, teat length and teat diameter, teat diameter and udder width, udder bottom height and udder upper height, udder upper height and udder width at the 70th and 100th days of lactation.

Phenotypic correlation coefficients among live weight, body condition score and daily milk yield are presented in Table 4. Significant positive phenotypic correlations were determined between lambs live weight and ewe live weight (0.24) for first month of lactation. The correlations were not observed between LLW and BCS, DMY. However, significant positive phenotypic correlations were determined between lambs live weight (LLW) and ewe live weight (ELW) (0.22), ewe live weight (ELW) and daily milk yield (0.40) and BCS (0.49) for the second month of lactation. Also, significant positive phenotypic correlations were established between BCS and ELW (0.60) and ELW and DMY (0.46) for third month of lactation.

Our results indicated that the twin lambing ewes produce more milk than single lambing ewes. Also, their BCS changes were higher than single lambing ewes. However, live weight changes were similar with single and twin lambing ewes. It could be suggested that control of BCS ewes for the different stage of lactation, before mating and gestation status may increase milk production and help better flock management for reducing reserve mobilization.

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