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The Effect of Body Condition Scoring on Lamb Development in Akkaraman and Lalahan Genotypes

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ABSTRACT

The study was conducted at the International Livestock Research and Training Center Directorate and investigated the effects of ewes' body condition score (BCS) on certain body measurements of their lambs at birth and at 3 months of age in Akkaraman and Lalahan (Kıvırcık x Akkaraman G1 crossbred) sheep in Ankara province. The animal material consisted of 106 lambs (Akkaraman = 33, Lalahan = 73) at birth and 144 lambs (Akkaraman = 33, Lalahan = 111) at 3 months, along with their dams. The BCS values of the ewes were divided into three groups for analysis: low (≤2.5), medium (3.0), and high (≥3.5). The general means of BCS values of the ewes at birth and at 3 months were found to be 2.86 and 2.84, respectively. The effects of genotype and dam age on BCS were not significant in either period. The live weight (LW), wither height, rump height, chest depth, body length, and chest girth values of the lambs were 4.8 kg, 42.1 cm, 42.6 cm, 16.6 cm, 33.0 cm, and 38.5 cm at birth, and 24.0 kg, 62.2 cm, 63.0 cm, 27.8 cm, 58.8 cm, and 65.3 cm at 3 months of age, respectively. Ewes with high BCS had heavier LW lambs at both birth (low: 4.5 kg, medium: 4.8 kg, high: 4.9 kg; $P<0.05$) and 3 months (low: 24.3 kg, medium: 25.1 kg, high: 25.8 kg; $P>0.05$). A similar pattern was observed in the daily live weight gain (DLWG) of lambs (low: 0.205 kg, medium: 0.221 kg, high: 0.242 kg; $P<0.001$). In conclusion, it can be said that ewes with a high BCS adequately meet their nutritional needs during lactation, thereby providing better care for their lambs.

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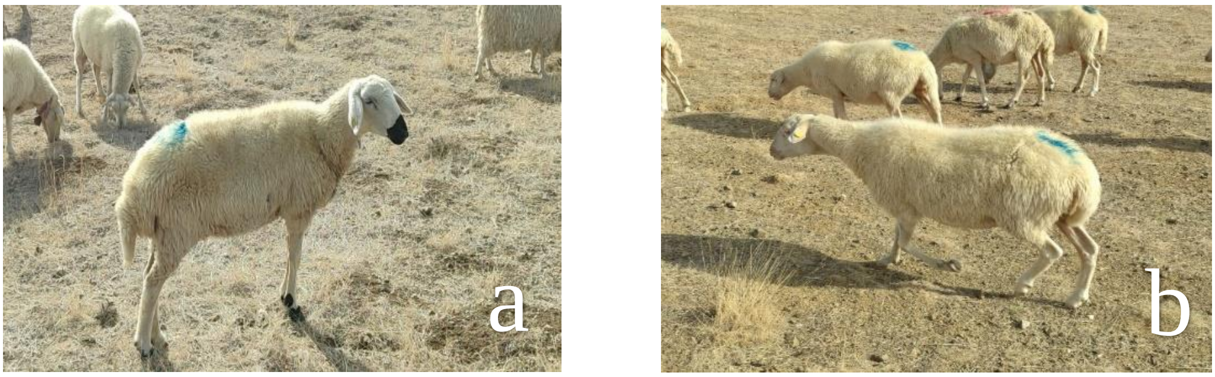
INTRODUCTION

In sheep breeding, knowing the body condition of sheep during different stages of the production cycle is crucial (Koyuncu et al., 2018). The condition affects the performance of animals at any stage, and body condition score (BCS) is a method used to rate the levels of fat deposition in the organism based on physical characteristics (Sarı et al., 2013). The fastest and cheapest way to determine the condition score is to assess the general state and some reference points (shoulder, buttocks, back, tail head, and chest) visually and by touch (Kor and Ertuğrul, 2000). There is an optimal BCS for each stage of the production cycle of sheep in the flock (Koyuncu et al., 2018). Sheep with different BCSs during periods such as reproduction, pregnancy, lambing, and lactation should be subjected to specific feeding regimens based on these scores (Şireli, 2019). The body condition during breeding and lambing directly affects the performance and productivity of both sheep and their lambs (Karakuş and Atmaca, 2016). During the lambing period, the critical lower limit of the condition score is around 2.5, and sheep above this score are less affected by nutritional deficiencies that may occur in the first weeks of lactation (Sarı et al., 2013).

Animal-derived foods play an important role in human nutrition, as they contain essential proteins, vitamins, and minerals necessary for human health (Oyan et al., 2024). Therefore, it is important to enhance fertility in sheep and support the healthy lives of lambs after birth. In most sheep production systems practiced under natural grazing conditions, sheep mobilize their body reserves to overcome periods of feed scarcity (Sezenler et al., 2011). Regular monitoring of the condition score ensures the maintenance of a healthy and productive flock and provides information about the animals' nutritional and health status (Koyuncu et al., 2018). Good body condition is particularly critical in late pregnancy and the lambing period for quality colostrum production and milk yield (Karakuş and Atmaca, 2016).

Sheep breeding is closely associated with the use of pasture and fallow lands, which are vital for nutrition, employment, rural development, and sociology worldwide. Sheep receive more attention than cattle due to their shorter gestation periods, higher twinning rates, lower slaughter age, and better utilization of roughage (Uysal et al., 2024). Sheep constitute a significant part of the livestock sector in Türkiye, making up about 60% of domestic animals (FAO, 2022). The majority of sheep bred in Türkiye are native breeds, with the Akkaraman breed, which accounts for 40-45% of the small ruminant population, being the most common in Central Anatolia (Şahin, 2023; Sakar, 2024). The Akkaraman sheep is a fat-tailed breed adapted to the region's harsh climatic conditions, raised for meat and milk production (Figure 1a). Lalahan sheep (Kıvırcık: 0.75 x Akkaraman:0.25, G1) is a genotype developed at the Lalahan International Livestock Research and Training Center (Ankara) for obtaining a new genotype suitable for steppe region conditions for lamb meat production (Erol et al., 2017). This type has a white fleece-covered body with black or brown spots on the head, face, and ears (Figure 1b).

Figure 1. Akkaraman sheep (a), Lalahan genotype (b)



This study aims to examine the effects of body condition scores of the Akkaraman and Lalahan genotype ewes during birth and 3 months of age on the growth and development of their lambs. The study evaluates the BCS of the dams at birth and at 3 months, aiming to reveal the relationship between these values and lamb birth weight as well as some body measurements.

MATERIAL and METHOD

Animal Material

The study was conducted at the International Livestock Research and Training Center Directorate (ILRTC). The animal material consisted of Akkaraman and Lalahan (Kıvırcık x Akkaraman G1) lambs born in February-March 2021, along with their dams. Body measurements were taken from a total of 106 lambs (Akkaraman: 33 head, Lalahan: 73 head) during the birth period and from 144 lambs (Akkaraman: 33 head, Lalahan: 111 head) at 3 months.

Mating was carried out in September and lasted about a month. Most births occurred in February. The animals were taken to pasture from April to October, with no additional feed provided during this period. During the winter, animals were given a diet of 40% roughage and 60% concentrate feed. Alfalfa hay and barley straw were provided as roughage. The ewes were supplemented with concentrate feed two weeks before the breeding season. In the last three weeks of pregnancy, the ewes were given 700 g/head/day of concentrate feed, and at the beginning of lactation, they received 400 g/head/day. Feeding was done twice daily at 08:30 a.m. and 4:30 p.m.

Lambs were kept with their dams in individual pens for 1-2 days after birth. They were allowed to suckle freely while remaining continuously with their dams. No weaning program was implemented during the suckling period. The animals were then taken to pasture with their dams, with no additional feeding provided during this period.

Data Set

All animals were regularly recorded in the farm registry with information such as birth date, sex, dam number, and age. Additionally, lambs were recorded by attaching ear tags within 1-2 days after birth. Measurements were taken at birth (BM) and at 3 months (3M). During these two periods, the live weight (LW), withers height (WH), rump height (RH), chest depth (CD), body length (BL), and chest girth (CG) of the lambs were recorded. The weights were measured using a scale (Iconix FX41) with an accuracy of 50 g. Other measurements were taken using a measuring stick and tape measure. While the lambs' birth measurements were taken within the first 24 hours after birth, the 3-month measurements were taken within ±2 days of reaching 90 days of age. Additionally, the average daily weight gain (DWG) of lambs between birth and 3 months was calculated using the formula (kg/day): (3 months LW - birth weight) / (date of 3 months LW measurement - birth date).

In addition, the Body Condition Score (BCS) of the dams of the lambs was recorded during the birth and 3-month periods. BCS values of the ewes were measured shortly after birth. These values were recorded on a scale ranging from 1 to 5 points, in intervals of 0.5 (Russell et al., 1969). Two referees simultaneously scored the BCS values.

In the case of discrepancies between the referees, assistance was sought from a third expert, and the score given by that expert was considered the final score. If differences persisted in the independently determined BCS values, scoring continued until a consensus was reached among the referees. In the study, BCS values were divided into three groups: 1) low: ≤2.5, 2) medium: 3.0, and 3) high: ≥3.5 (Koyuncu et al., 2018).

Statistical Analysis

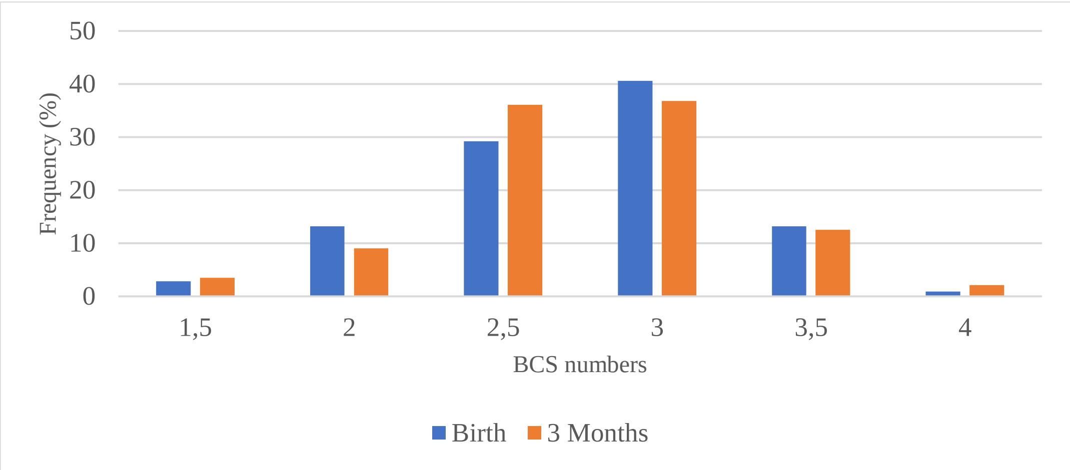
All body measurement values were analyzed using the General Linear Model (GLM) procedure. Average differences between groups were tested with Tukey's Multiple Comparisons. Data analysis was conducted using Minitab Statistical Software (Minitab, 2010). The GLM formula is as follows;

Yijklmn =μ + ai + bj + ck + dl + fm + eijklmn. Where; Yijklmn: observed data; μ: Overall mean; ai: i. effect of BCS (1: low (≤2.5), 2: medium (3.0), 3: high (≥3.5)); bj: j. effect of genotype (1: Akkaraman, 2: Lalahan); ck: k. effect of sex (1:female, 2: male); dl: l. effect of birth type (1:single, 2:twin); fm: m. effect of dam age (2-3, 4-6, 7+); eijklmn: random error.

RESULTS

In the study, examinations were conducted on 106 lambs at birth and 144 lambs at the 3-month period, along with their dams, from the Akkaraman and Lalahan genotypes. The percentage distribution of the BCS values observed in sheep at birth and 3 months is shown in Figure 2. In the study, BCS values below 1.5 and above 4 were not encountered in either period. At birth, the most common BCS value observed in sheep was 3 (40.6%), followed closely by a BCS score of 2.5 (29.2%). At 3 months, the most common BCS values were again 3 (36.8%) and 2.5 (36.1%), with these values being close to each other.

Figure 2. The frequency distribution of BCS in ewes



In the study, the BCS values obtained from the dams during the birth and 3-month periods are presented in Table 1. These values were 2.86 during the birth period and 2.84 during the 3-month period. The BCS values were found to be statistically not significant between genotypes and age groups of the dams in both the birth and 3-month periods.

Table 1. BCS values of the dam.

Factors	Birth		3 Months	
	n	BCS	n	BCS
Overall		2.86±0.051		2.84±0.049
Genotype		NS		NS
Akkaraman	33	2.91±0.083	33	2.85±0.085
Lalahan	73	2.82±0.058	111	2.84±0.047
Dam age		NS		NS
2-3	42	2.87±0.078	53	2.91±0.072
4-6	30	2.89±0.088	53	2.87±0.072
7+	34	2.83±0.087	38	2.74±0.085

NS: non-significant

The values of the body measurements taken from the lambs during the birth period, according to environmental factors are presented in Table 2. During the birth period, the values for BW, WH, RH, CD, BL, and CG were generally found to be 4.8 kg, 42.1 cm, 42.6 cm, 16.6 cm, 33.0 cm, and 38.5 cm, respectively. According to the BCS values of the dams, the BW, WH, and RH values were higher in lambs born from high-BCS dams, while CD, BL, and CG values were higher in lambs born from medium-BCS dams. The differences between the groups were significant (P<0.05) for BW, WH, RH and CD values, but not significant for the others. The measurement values for Akkaraman genotype lambs were higher than those for Lalahan genotype lambs in all parameters, with significant differences (P<0.05) in WH, RH, CD, and BL values, while the differences in BW and CG values were found to be not significant.

Table 2. The least squares mean and standard errors of body measurements in the birth period

Factors	n	LW (kg)	WH (cm)	RH (cm)	CD (cm)	BL (cm)	CG (cm)
Overall	106	4.8±0.108	42.1±0.271	42.6±0.295	16.6±0.593	33.0±0.293	38.5±0.324
Dam BCS		*	*	**	*	NS	NS
Low (≤2.5)	48	4.5±0.126^{b}	41.5±0.327^{b}	41.6±0.345^{b}	16.0±0.698^{b}	32.9±0.338	38.3±0.376
Medium(3.0)	43	4.8±0.126^{a}	42.1±0.337^{ab}	42.8±0.356^{ab}	17.8±0.704^{a}	33.5±0.352	38.7±0.389
High (≥3.5)	15	4.9±0.193^{a}	42.7±0.518^{a}	43.3±0.542^{a}	15.9±1.118^{b}	32.7±0.547	38.6±0.598
Genotype		NS	***	***	*	**	NS
Akkaraman	33	4.8±0.152	42.8±0.388^{a}	43.3±0.422^{a}	17.4±0.895^{a}	33.6±0.418^{a}	38.7±0.464
Lalahan	73	4.7±0.106	41.4±0.267^{b}	41.8±0.291^{b}	15.7±0.600^{b}	32.4±0.290^{b}	38.4±0.319
Sex		NS	**	**	NS	***	NS
Birth type		***	NS	NS	NS	NS	**
Dam age		*	NS	NS	NS	*	NS

^{a,b,c} Values within a column with different superscripts differ significantly at P<0.05. ***: P<0.001, **: P<0.01, *:P<0.05, NS:non-significant. LW: live weight, WH: withers height, RH: rump height, CD: chest depth, BL: body length, CG: chest girth

The values of the body measurements taken from the lambs at 3 months, according to environmental factors, are presented in Table 3. All values were found to be higher in lambs born to high-BCS dams, however, the differences between the groups were not significant for all measurements. Additionally, when differences by genotype were examined, BW, WH, and RH values were significant

(P<0.001), while the other values were found to be not significant. For all measurements, Akkaraman lambs were found to have higher values than Lalahan lambs.

Table 3. The least squares mean and standard errors of body measurements in the 3 months and DWG

Factors	n	LW (kg)	WH (cm)	RH (cm)	CD (cm)	BL (cm)	CG (cm)	DWG (kg)
Overall	144	24.0±0.453	62.2±0.450	63.0±0.507	27.8±0.318	58.8±0.555	65.3±0.587	0.222±0.0054
Dam BCS		NS	NS	NS	NS	NS	NS	***
Low (≤2.5)	70	24.3±0.495	61.7±0.486	62.6±0.547	27.6±0.343	58.5±0.597	64.3±0.635	0.205±0.0064[b]
Medium (3.0)	53	25.1±0.579	62.1 ±0.581	62.7±0.654	27.8±0.409	58.3±0.708	65.1±0.751	0.221±0.0064[ab]
High (≥3.5)	21	25.8±0.813	63.0±0.833	63.8±0.938	28.1±0.586	58.6±1.026	66.5±1.083	0.242±0.0093[a]
Genotype		***	***	***	NS	NS	NS	***
Akkaraman	33	26.7±0.536[a]	63.7±0.703[a]	64.5±0.792[a]	28.1±0.497[a]	58.9±0.867[a]	65.3±0.917[a]	0.239±0.0074[a]
Lalahan	111	23.4±0.544[b]	60.8±0.407[b]	61.5±0.458[b]	27.6±0.286[b]	58.7±0.498[b]	65.2±0.526[b]	0.206±0.0055[b]
Sex		***	***	***	NS	NS	NS	**
Birth type		***	***	***	***	***	***	***
Dam age		NS	NS	NS	NS	NS	NS	NS

[a,b,c] Values within a column with different superscripts differ significantly at P<0.05. ***: P<0.001, **: P<0.01, *:P<0.05, NS:non-significant. LW: live weight, WH: withers height, RH: rump height, CD: chest depth, BL: body length, CG: chest girth, DWG: average daily weight gain

The DWG values of the lambs between birth and 3 months are presented in Table 3. These values were generally found to be 0.222 kg. The effect of the dam's BCS at birth on the DWG values was found to be significant (P<0.001), with these values being 0.242 kg for the high group, 0.221 kg for the medium group, and 0.205 kg for the low group, in descending order. This value was also found to be higher in the Akkaraman genotype (0.239 kg) compared to the Lalahan genotype (0.206 kg) (P<0.001).

DISCUSSION

In the study, the BCS values obtained from the ewes at both periods (birth and 3 months) were found to be similar across genotypes and age groups (Table 1). This could be due to the uniform management practices on the farm, where all sheep are kept together and subjected to the same care, feeding, and grazing conditions. Similar BCS values were reported in the birth period for the Norduz breed at 2.9 (Karakuş and Atmaca, 2016), the Kıvırcık breed at 2.9 (Koyuncu et al., 2018), and the dairy breed Awassi at 2.64 (Şireli, 2019). The findings from this study were similar to those of meat or dual-purpose breeds but higher than those of dairy breeds.

While the birth weight averages of Akkaraman lambs with low, medium, and high dam BCS values at birth were determined as 4.5, 4.8, and 4.9 kg, respectively, the differences were found to be significant (P<0.05; Table 2). In Tuj sheep, the birth weights of lambs were 3.46, 3.76, and 3.85 kg in the ≤2, 2.5-3.5, and ≥4 dam BCS groups, respectively (P<0.01), with the effect of sex being not significant, but the effects of birth type and ewe age being significant (P<0.01) (Sarı et al., 2013). In a study with Karacabey Merino sheep, the average birth weights of lambs born to ewes with BCS values of ≤2, 3, and ≥4 at birth were found to be 4.38, 4.74, and 5.03 kg, respectively (P<0.05), with the effect of dam age also being significant (P<0.05) (Sezenler et al., 2008). In Kıvırcık sheep, the birth weights of lambs in the ≤2.5, 3, and ≥3.5 ewe BCS groups were reported as 4.0, 4.3, and 4.5 kg, respectively (P<0.01). The effects of sex and birth type on birth weight were also significant (P<0.01) (Koyuncu et al., 2018). In the Lori-Bakhtiari breed, the highest lamb birth weights were found in lambs from ewes with BCS values of 3.5, 3.0, 2.5, 4, 1, and 2, respectively (P<0.01), with the effect of sex also being significant (Vatankhah et al., 2012). In Sanjabi sheep, it was reported that the birth weight of lambs was significantly affected (P<0.05) by the ewe's BCS, with ewes having a BCS of 3 giving birth to lambs with higher live weights than those in other groups (Jalilian and Moeini, 2013). In Afshari sheep, it was reported that reproductive performance was better and lamb birth weight was higher in ewes with a BCS of 3 (Aliyari et al., 2012).

In contrast to the literature information reported above, there are also studies indicating that dam BCS does not affect lamb birth weight. In a study with Türkgeldi sheep, it was reported that the effects of ewe condition score groups and birth type on lamb birth weight were not significant, while the effects of sex and dam age were significant (P<0.01; P<0.05) (Özder et al., 1997). In Norduz sheep, lamb birth weights from ewes with BCS values of 2.5, 3.0, and 3.5 were reported as 4.77, 4.92, and 5.18 kg, respectively (P>0.05), with ewe age and sex also having no effect, while birth type had a significant effect (P<0.01) (Karakuş and Atmaca, 2016). In Fat-tailed Barbarine sheep, it was determined that the BCS of ewes at lambing did not affect lamb birth weight (P>0.05), with values of 3.8, 3.8, and 3.9 kg for the lean, medium, and fat groups, respectively (Yagoubi and Atti, 2020). Consistent with other studies, this study found that lambs from ewes with high BCS had significantly higher birth weights. However, in this study, the birth weight of lambs according to dam BCS and other environmental conditions was similar to some literature results but different from others. These differences are thought to be due to variations in genotype, the climatic and topographical geography of the region where the sheep are reared, and especially the nutrition of the ewe during pregnancy.

At 3 months old, inter-group differences in body measurement values of lambs based on dam BCS were found to be not significant; however, all values were higher in lambs born to high-BCS ewes. Condition scoring of ewes at lambing time and adjusting their nutrition based on their condition during the lamb-rearing period is beneficial for the development of lambs until weaning (Mathias-Davis et al., 2013). In Türkgeldi sheep, although significant differences were not found among the average weaning weights of the condition score groups determined during the lambing period, extreme values (1.5 and 3.5) were reported to have a negative effect on weaning weight (Özder et al., 1997). In Tuj sheep, the 90-day LW values of lambs were found in descending order for those in lambs born to ewes with ≥4 (20.37 kg), 2.5-3.5 (20.18 kg), and ≤2 (18.78 kg) BCS, respectively (P>0.05), although the effect of birth type on this value was significant (P<0.001), the effects of sex and ewe age were found to be not significant. (Sarı et al., 2013). In Norduz sheep, the 90-day LW values of lambs were found to be 26.16 kg, 24.45 kg, and 23.73 kg for ewes with BCS of 3.5, 3.0, and 2.5, respectively (P>0.05), the effects of dam age (2, 3, 4), sex, and birth type on this value were also found to be not significant (Karakuş and Atmaca, 2016). In Kıvırcık sheep, the weaning weight of lambs born to ewes with BCS ≤2.5, 3, and ≥3.5 was reported as 22.3, 23.0, and 23.1 kg, respectively (P>0.05), the effects of sex and birth type on this value were significant (P<0.05; P<0.01) (Koyuncu et al., 2018). In this study, it was generally consistent with the literature findings that lambs with higher dam BCS at 90 days of age (or weaning age) had higher live weights.

In Sanjabi sheep, the effect of dam BCS on lamb weaning weight was found to be significant (P<0.05), with the highest values reported in lambs from ewes with a BCS of 3 (24.2 kg) and >3.5 (Jalilian and Moeini, 2013). Discrepancies in these values in the literature are reported to be due to differences in scoring timing, variations in the BCS scale, as well as differences in nutrition during the mid to late pregnancy and lactation periods (Karakuş and Atmaca, 2016). Although there was no significant difference in body measurements at 3 months, generally higher values were observed in lambs with high BCS, indicating better dam care. Higher BCS scores in ewes are associated with improved lamb growth, as reflected in other studies.

The effect of dam BCS on lamb DWG values was found to be significant (P<0.001), with lambs from high BCS ewes having the highest DWG values (Table 2). DWG90 values in Karacabey Merino sheep were reported to be highest in lambs with a dam BCS of 3 (0.269 kg) (P<0.05), along with significant effects ($P<0.05$) of ewe age and sex (Sezenler et al., 2008). The BCS of Barbarine ewes at birth affected the live weight at 30 days, live weight at 70 days, and DWG of lambs ($P<0.01$), with better results reported from lambs born to ewes with a fat BCS (Yagoubi and Atti, 2020). In Tuj sheep, the highest value was found in lambs with a BCS of 2.5-3.5 (228.87 g) ($P>0.05$), while the effect of sex and birth type on this value was found to be significant ($P<0.01$; $P<0.05$), and ewe age had no significant effect (Sarı et al., 2013). A study with Kıvırcık sheep reported that higher live weight and condition values positively affected lamb development, with lambs from ewes with a BCS ≥3.5 having the highest DWG90 value ($P>0.05$), and significant effects ($P<0.05$; $P<0.01$) of sex and birth type (Koyuncu et al., 2018). It has been explained that ewes with higher BCS can utilize body reserves to meet energy requirements for sustaining high milk production levels to nurse their lambs, even under inadequate nutrition conditions (Yagoubi and Atti, 2020). The differences between the findings of this study and some literature reports may arise from variations in breed, origin, ewe age, and differences in care and feeding practices. According to the findings obtained in this study, it can be said that high BCS ewes meet their nutritional needs during lactation adequately, thereby increasing both the quality and quantity of milk they provide to their offspring.

CONCLUSION

In this study, the relationship between the BCS of Akkaraman and Lalahan genotype ewes during the lambing and at 3 months, and the body measurements and DWG values of their lambs were investigated. It was found that lambs born to ewes with higher BCS had higher birth weights, and these differences were significant. Although no significant differences were found among groups in body measurements at 3 months, lambs born to ewes with generally higher BCS tended to have higher values. In terms of DWG values, lambs born to ewes with higher BCS showed better performance, suggesting that meeting the nutritional needs of ewes during lactation results in providing their offspring with higher quality and quantity of milk. Consequently, it was determined that the BCS of ewes during lambing and at 3 months has a significant impact on the growth and development of lambs. Therefore, closely monitoring the body condition scores of ewes and adjusting feeding strategies accordingly would be beneficial.

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27/08/2021 dated and numbered 192 was given by International Center for Livestock Research and Training ethics committee.

Authors Contributions

Research Design (CRediT 1) Author 1 (%40) - Author 2 (%30) - Author 5 (%30)
Data Collection (CRediT 2) Author 1 (%25) – Author 2 (%25) - Author 3 (%25) - Author 4 (%25)
Research - Data analysis - Validation (CRediT 3-4-6-11) Author 1 (%25) – Author 2 (%25) - Author 3 (%25) - Author 4 (%25)
Writing the Article (CRediT 12-13) Author 1 (%50) - Author 2 (%50)
Revision and Improvement of the Text (CRediT 14) Author 5 (%100)

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Conflict of Interest

The authors declare that there is no conflict of interest.

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REFERENCES

Aliyari, D., Moeini, M.M., Shahir, M.H., & Sirjani, M.A. (2012). Effect of body condition score, live weight and age reproductive performance of Afshari ewes. *Asian Journal of Animal and Veterinary Advances*, 7, 904-909.

Erol, H., Akçapınar, H., Özbeyaz, C., Özdemir, P., & Ünal, N. (2017). Investigation of fertility and some morphological characteristics in Lalahan Sheep (Kıvırcık x Akkaraman G1). *Journal of Lalahan Livestock Research Institute*, 57(2), 69-76.

FAO, 2022. Number of sheep in the World. https://www.fao.org/faostat/en/#data/QCL. (accessed 15 December 2023).

Jalilian, M.T., & Moeini, M.M. (2013). The effect of body condition score and body weight of Sanjabi ewes on immune system, productive and reproductive performance. *Acta Agriculturae Slovenica*, 102(2), 99-106. doi:10.2478/acas-2013-0033

Karakuş, F., & Atmaca, M. (2016). The effect of ewe body condition at lambing on growth of lambs and colostral specific gravity. *Archives Animal Breeding*, 59, 107-112. doi:10.5194/aab-59-107-2016.

Kor, A., & Ertuğrul, M. (2000). Estimation methods of carcass composition in living animals. *Journal of Animal Production*, 41, 91-101.

Koyuncu, M., Öziş Altınçekiç, Ş., Duru, S., & Duymaz Karaca, M. (2018). The effect of live weight and body condition score of ewe on growth of lamb at lambing period. *Journal of Kahramanmaraş Sütçü İmam University Natural Sciences*, 21(6), 916-925. https://doi.org/10.18016/ksutarimdoga.vi.420321

Mathias-Davis, H.C., Shackell, G.H., Greer, G.J., Bryant, A.I., & Everett-Hincks, J.M. (2013). Ewe body condition score and the effect on lamb growth rate. *Proceedings of the New Zealand Society of Animal Production*. 73, 131-135.

Minitab. (2010). Minitab 16.1.1 for Windows. State College, PA, USA: Minitab Inc.

Oyan, O., Şenyüz, H.H., & Arköse, C.Ç. (2024). Comparison of carcass weight and carcass characteristics in some cattle breeds. *Research and Practice in Veterinary and Animal Science* (REPVAS), 1(1), 1-8.

Özder, M., Arık, İ.Z., Yurtman, İ.Y., & Özdüven, M.L. (1997). Effects of condition score, age and live weight on some performance characteristics in Türkgeldi sheep. *Journal of Akdeniz University Faculty of Agriculture*, 10, 119-128.

Russel, A.J.F., Doney, J.M., & Gunn, R.G. (1969). Subjective assessment of body fat in live sheep. *Journal of Agricultural Science*, 72, 451-454. https://doi.org/10.1017/S0021859600024874

Sakar, Ç.M. (2024). The effect of climate index on growth values from birth to breeding in Akkaraman sheep. *Tropical Animal Health and Production*, 56(2), 1-11. https://doi.org/10.1007/s11250-024-03901-7

Sarı, M., Önk, K., Aksoy, A.R., & Tilki, M. (2013). The effect of body condition score in Tuj sheep at lambing on the lamb growth traits and liveability. *Journal of Fırat University Health Sciences Veterinary*, 27(3), 149-154.

Sezenler, T., Köycü, E., & Özder, M. (2008). The effect of body condition score in Karacabey Merino at lambing on the lamb growth. *Journal of Tekirdag Agricultural Faculty*, 5(1), 45-53.

Sezenler, T., Özder, M., Yıldırır, M., Ceyhan, A., & Yüksel, M.A. (2011). The relationship between body weight and body condition score some indigenous sheep breeds in Turkey. *The Journal of Animal & Plant Sciences*, 21(3), 443-447

Şahin, Ö. (2023). Distribution of births of Bafra sheep reared in the Mediterranean region during the day. *Black Sea Journal of Agriculture*, 6(2), 197-203. https://doi.org/10.47115/bsagriculture.1239664

Şireli, H.D. (2019). Determination of effect of sheep birth weights and body condition score on lamb birth weight in Awassi sheep. *Journal of Dicle University Faculty of Veterinary Medicine*, 12(1), 20-24.

Uysal, S., Uysal, A., Öz, C., Yörük, M.A., & Ölmez, M. (2024). Evaluation of sheep colostrums according to time after lambing by brix refractometer method and color scoring. *Research and Practice in Veterinary and Animal Science (REPVAS)*, 1(1), 27-35.

Vatankhah, M., Talebi, M.A., & Zamani, F. (2012). Relationship between ewe body condition score (BCS) at mating and reproductive and productive traits in Lori-Bakhtiari sheep. *Small Ruminant Research,* 106(2-3), 105-109. doi:10.1016/j.smallrumres.2012.02.004

Yagoubi, Y., & Atti, N. (2020). Effects of the fat-tailed ewes body condition scores at lambing on their metabolic profile and offspring growth. *Archives Animal Breeding*, 63, 183-191. https://doi.org/10.5194/aab-63-183-2020