

THE RELATIONSHIP BETWEEN BODY WEIGHT AND BODY CONDITION SCORE SOME INDIGENOUS SHEEP BREEDS IN TURKEY

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ABSTRACT

This study was carried out on Kivircik, Sakiz and Gokceada sheep bred at Marmara Livestock Research Institute. A total of 156 heads sheep from different age groups were used in the study. The relationships between Body Condition Scores (BCS) and Body Weights (BW) have been investigated in three different physiological periods such as breeding, lambing and weaning period of indigenous sheep breeds in Turkey. As a result of the analyses conducted, the relationship between body condition score and body weight were found to be $BW = 28.716 + 6.962 * BCS$; $BW = 39.977 + 6.771 * BCS$; $BW = 33.444 + 7.074 * BCS$ for the breeding, lambing and weaning periods respectively. Similarly, correlations (r) between them were found to be 0.817, 0.731, 0.746 respectively ($P < 0.01$). The regression coefficients of BCS on BW were 6.962 kg, 6.771 kg, 7.074 kg at breeding, lambing, weaning respectively and also significant ($P < 0.01$). The findings demonstrate that body condition score is a good indicator of changes in body weights in Kivircik, Sakiz and Gokceada indigenous sheep breeds and will assist sheep breeders with regard to the feeding program to be applied particularly before the breeding season.

Key words: Body condition score, body weight, Kivircik, Sakiz, Gokceada.

INTRODUCTION

Sheep breeding has an important role in animal production in Turkey. Sheep have the ability to transform poor grasslands, which are widespread in Turkey, into valuable products like meat, milk, wool and skin. The sheep population is about 97% of the indigenous breeds in Turkey (Kaymakçi and Sönmez 1996; Yılmaz *et al.*, 2003). They feed basically on natural grazing which is supported by fallow stubbles and grain stubbles in summer. In most sheep production systems applied under natural grazing conditions, the sheep mobilize their body reserves to overcome periods of feed shortage. Therefore, simple and reliable methods to assess animal nutrition status for all or some animals of a herd and to decide when and how to provide nutrition support are vital. One of these methods is body condition scoring (BCS). The body scoring is based on a subjective assessment of the fat level and muscle thickness on the backbone behind the last rib, according to a five-point scale described by Russel *et al.* (1969). Body condition score and its use are important in terms of achieving the desired performance in certain physiological periods in sheep breeding where extensive conditions are dominant. It is indicated that there can be differences in values obtained in various physiological periods for the genotypes bred in our country and that basic studies should be carried out to determine these values have to be carried out (Biçer, 1991).

In addition to limitations caused by physiological or metabolic factors, numerous problems result in insufficient nutrition intake by animals. Ability of the organism to overcome such insufficiencies is positively correlated to the metabolic weight of the respective period and the amount of stored nutrition that the organism can use by process of breakdown (Özder *et al.*, 1995).

In a study conducted using İvesi sheep, a positive correlation ($r=0.93$) was determined between the body condition score during the breeding period and the live weights of the sheep in lambing and shearing periods while a significant correlation ($r=0.55$) between the live weight and body condition scores in Lincoln Longwool sheep was determined and it was indicated that number of twin-borns increased in parallel to the increase in the body condition score (Beceril *et al.*, 1988; Barth and Neumann, 1991; Hossamo *et al.*, 1986).

In another study carried out using Manchega sheep, it was shown that age of sheep had a significant impact on the live weights during breeding, lambing and weaning while correlations between body condition score and body weight in breeding, lambing, weaning and dry periods for sheep lambing in May, September and January were found to be 0.92, 0.98, 0.91; 0.50, 0.45, 0.55; 0.79, 0.76, 0.56 and 0.92, 0.84, 0.92, respectively (Molina *et al.*, 1991a).

In a study on Kivircik sheep, a significant correlation coefficient ($r=0.248$) was observed between BCS and BW at breeding (Ada *et al.*, 2004). The

relationships between BW and BCS of Türkgeldi sheep were studied for different physiological periods. It was determined that each BCS unit is equivalent to the changes of 10.961kg, 10.376 kg, and 7.310 kg at breeding, lambing and weaning weights, respectively (Arik *et al.*, 1997).

The relationships between BCS, BW and internal fat weights of Manchega sheep were studied and significant correlation was calculated between live weight and omental, mesenteric, pelvic and total internal fat (0.72, 0.82, 0.67 and 0.92) correlation between the body condition score, and mesenteric, pelvic and total fat weight was found to be 0.58, 0.58 and 0.79 respectively (Molina *et al.*, 1991b).

In a study where the relationship between the live weight and body condition score and body fat composition and fat distribution was analyzed, it was found out that body condition score fails to determine in advance, the body fat storage and body fat composition in Churra sheep as it failed to do so in other breeds as well. Body weight index in itself seems to be an effective determinant, however, it is indicated that using body condition score together with body weight gives more definite results (Frutos *et al.*, 1997).

The present study was conducted in order to compare the relationship between BW and BCS in Kivircik, Sakiz and Gokceada sheep breeds for breeding, lambing, and weaning period.

MATERIALS AND METHODS

The animal material of the study comprises a total of 156 indigenous sheep breeds made up of 60 Kivircik, 53 Sakiz and 43 Gokceada breeds and ages of ewes between 2 to 6 years old. During the study, body condition scores of the sheep at breeding, lambing and weaning periods were determined.

Body weight and body condition scores were determined on the first day of the breeding, within the first ten days for the lambing period and on the 90th day on average for the period after lambing. Body weights were measured using electronic scale that is sensitive to 100 grams while for determining the body condition scores, 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.

At the research institute where the study was conducted, semi-intensive sheep breeding is carried out. While in general, additional feed support was provided to a certain extent before the breeding period, the sample used during this period was not given additional feed support. The animals were not given feed from the beginning of April until the beginning of September and they were allowed to make use of the pasture only. During December and January, they were given 600 grams of concentrated feed and 600 grams of forage

crops and were allowed to feed on the pasture to the extent weather conditions allowed to do so. And during February, the animals were given 700 grams of concentrated feed and 700 grams of forage crops. The concentrated feed mixture given to the animals contains 2613 ME kcal/kg, 15% CP. It contained 50% barley, 18% wheat 13.9% sunflower meal, 16% wheat bran, 1% marble dust, 1.0% salt and 0.1% mineral and vitamin mix.

The analysis of data was performed using General Linear Models (GLM) procedure with SAS software (SAS 1988). Duncan's multiple-range test was used to compare treatment means. The data which were obtained from this study were evaluated by the regression analysis method.

RESULTS AND DISCUSSION

Least-squares means of BW for different physiologic periods for breeds and age classes are given in Table 1. Likewise, based on the same reported as for the previous variables, we found that physiological state has a significant effect ($P<0.01$) on BW. At the beginning of breeding, the animals have a lower BW than the one they have after lambing. The overall means for BW averages in breeding, lambing and weaning periods were 52.378 kg, 55.913 kg, and 47.818 kg, respectively. It is clear that the body weight of Kivircik ewes were heavier than Gokceada and Sakiz ewes in breeding, lambing and weaning periods. The body weight (BW) of the animals studied covered a wide range from 42.032 to 61.018 kg for different ages (Table 1). Least-squares means of BSC obtained for different physiologic periods and age classes are presented in Table 2. The body condition score (BSC) of the breeds studied covered a wide range from 2.357 to 4.115 for different breeds and ages (Table 2). The overall means for BSC averages in breeding; lambing and weaning periods were 3.327, 2.993, and 2.05, respectively.

The BCS of Kivircik ewes were 4.115, 3.354, and 2.865 in breeding, lambing and weaning periods. The BCS between breeds in different physiological periods was statistically significant, ($P<0.01$). The average minimum BCS was observed in Gokceada ewes for all physiological periods. The average minimum BCS was observed in 2 years old ewes in breeding and weaning periods; and in 5 years old ewes in lambing period. Maximum BCS values were given for 6 years old ewes in breeding period, however for 4 years old ewes in lambing and for 5 years old ewes in weaning period.

The average values of BW and BCS changes (Table 1 and 2) were similar in comparison with the experiments on some Britain crossbreeds (Geisler and Fenlon, 1979) and Türkgeldi ewes (Arik *et al.*, 1997); higher results were obtained from the other experiments for Awassi ewes (Treacher and Filo, 1995) and Rasa

Aragonesa sheep (Teixera *et al.*, 1989). However, these results were low from the Karacabey Merino ewes (Köycü *et al.*, 2008). Data concerning the BCS and BW

for the studied periods and the result of regression analysis were summarized on Table 3, 4, 5 and in Fig- 1.

Table 1. Least-squares means of BW for different physiologic periods and age classes of sheep (kg).

Factors Investigated	Breeding		Lambing		Weaning	
	n	$X \pm Sx$	n	$X \pm Sx$	n	$X \pm Sx$
Ages		**		**		**
2	29	42.032±1.358 d	28	50.632±1.545 d	24	44.070±1.410 c
3	41	51.205±1.064 c	40	53.278±1.211 cd	37	47.211±1.105 bc
4	34	54.638±1.191 b	33	56.905±1.355 b	29	48.159±1.236 ab
5	17	54.879±1.734 bc	17	57.735±1.972 abc	14	48.747±1.799 ab
6≥	35	59.136±1.148 a	34	61.018±1.306 a	31	50.904±1.191 a
Breeds		**		**		**
Kivircik	60	59.404±0.920 a	59	65.821±1.047 a	49	56.471±0.955 a
Sakiz	53	49.947±0.999 b	51	51.946±1.137 b	47	43.682±1.037 b
Gokceada	43	47.782±1.062 b	42	49.973±1.208 b	39	43.302±1.102 b
Mean	156	52.378±0.589	152	55.913±0.670	135	47.818±0.611

**P<0.01; a, b, c, d: Significant difference between the values of different letters on the same column.

Table 2. Least-squares means of BCS for different physiologic periods and age classes of sheep.

Factors Investigated	Breeding		Lambing		Weaning	
	n	$X \pm Sx$	n	$X \pm Sx$	n	$X \pm Sx$
Ages		**		NS		NS
2	29	2.638±0.162c	28	2.330±0.162	24	2.054±0.162
3	41	3.249±0.127b	40	2.231±0.127	37	2.137±0.127
4	34	3.622±0.142ab	33	2.508±0.142	29	2.060±0.142
5	17	3.467±0.207ab	17	2.122±0.206	14	2.074±0.207
6≥	35	3.661±0.137a	34	2.275±0.137	31	1.942±0.137
Breeds		**		**		**
Kivircik	60	4.115±0.110	59	3.354±0.110a	49	2.865±0.110a
Sakiz	53	3.509±0.119	51	2.260±0.119b	47	1.851±0.119b
Gokceada	43	2.357±0.127	42	1.266±0.126c	39	1.444±0.127c
Mean	156	3.327±0.070	152	2.293±0.070	135	2.053±0.070

**P<0.01; NS: No significant, a, b, c: Significant difference between the values of different letters on the same column.

Table 3. Relationship between body weight (BW) and body condition score (BCS) at breeding

Factors	n	R	Regression Equation	P
Ages	2	0.826	BW=26.998+5.953*BCS	P<0.01
	3	0.824	BW=27.639+6.826*BCS	P<0.01
	4	0.841	BW=31.784+6.193*BCS	P<0.01
	5	0.664	BW=37.412+5.364*BCS	P<0.01
	6≥	0.796	BW=36.538+5.916*BCS	P<0.01
Breeds	Kivircik	0.875	BW=20.396+9.179*BCS	P<0.01
	Sakiz	0.765	BW=30.927+5.591*BCS	P<0.01
	Gokceada	0.814	BW=27.785+8.443*BCS	P<0.01
Mean	156	0.817	BW=28.716+6.962*BCS	

Each BCS unit was equivalent to the BW changes of 6.962 kg, 6.771 kg, 6.774 kg in breeding, lambing and weaning periods respectively and these changes were statistically significant (P<0.01). Sanson *et*

al. (1993) found out that there is a high correlation between BCS and carcass lipid levels and thus BCS could be used for defining useful energy reserve in sheep.

For all three physiological periods, the relationship between BCS and BW is statically significant ($P<0.01$). The variation observed in BCS for defining BW changes from breeding to weaning are as follows; Breeding; $R=0.817$, Lambing; $R=0.731$, Weaning; $R=0.746$. When

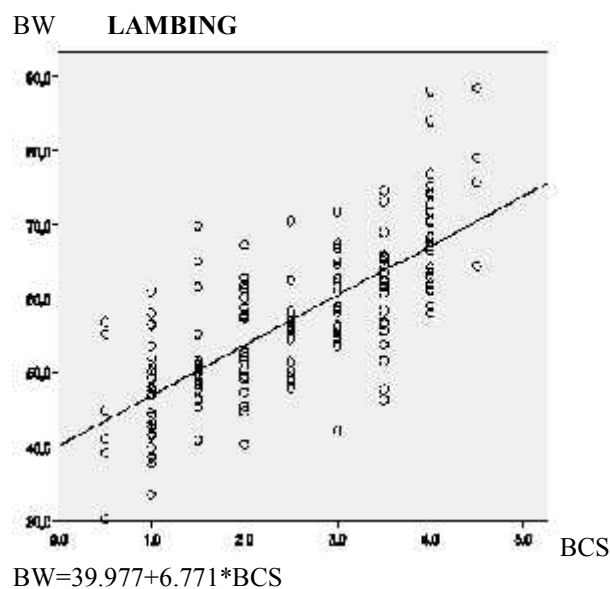
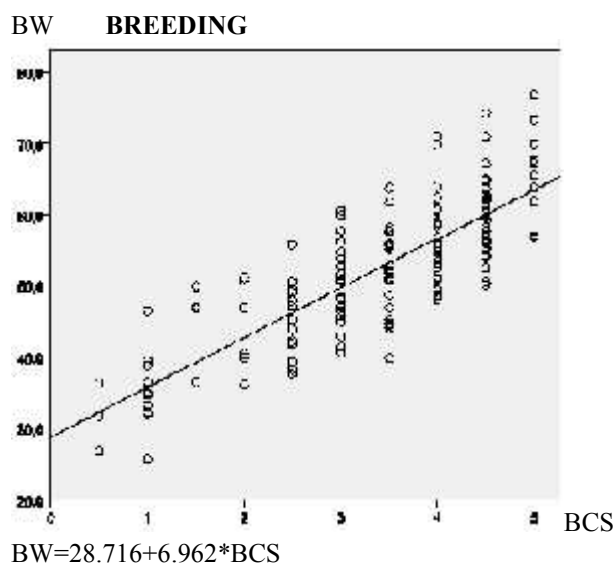
the regression analysis of BCS and BW was carried out on 5 years olds of three different breed ewes, a maximum regression coefficient ($r=0.882$) in weaning period, and a minimum regression coefficient ($r=0.598$) was observed in weaning period.

Table 4. Relationship between body weight (BW) and body condition score (BCS) at lambing

Factors		n	R	Regression Equation	P
Ages	2	28	0.845	$BW=33.707+7.513*BCS$	$P<0.01$
	3	40	0.730	$BW=38.497+6.309*BCS$	$P<0.01$
	4	33	0.783	$BW=39.207+6.903*BCS$	$P<0.01$
	5	17	0.804	$BW=42.457+7.463*BCS$	$P<0.01$
	≥ 6	34	0.746	$BW=46.331+6.169*BCS$	$P<0.01$
Breeds	Kivircik	59	0.592	$BW=42.739+6.409*BCS$	$P<0.01$
	Sakiz	51	0.653	$BW=40.499+5.207*BCS$	$P<0.01$
	Gokceada	42	0.535	$BW=39.100+8.550*BCS$	$P<0.01$
Mean		152	0.731	$BW=39.977+6.771*BCS$	

Table 5. Relationship between body weight (BW) and body condition score (BCS) at weaning

Factors		n	R	Regression Equation	P
Ages	2	24	0.598	$BW=32.385+6.364*BCS$	$P<0.01$
	3	37	0.817	$BW=29.880+7.933*BCS$	$P<0.01$
	4	29	0.693	$BW=33.417+6.954*BCS$	$P<0.01$
	5	14	0.882	$BW=34.570+7.227*BCS$	$P<0.01$
	≥ 6	31	0.834	$BW=37.039+7.095*BCS$	$P<0.01$
Breeds	Kivircik	49	0.720	$BW=34.9922+7.409*BCS$	$P<0.01$
	Sakiz	47	0.663	$BW=33.820+5.582*BCS$	$P<0.01$
	Gokceada	39	0.337	$BW=39.099+2.956*BCS$	$P<0.05$
Mean		135	0.746	$BW=33.444+7.074*BCS$	



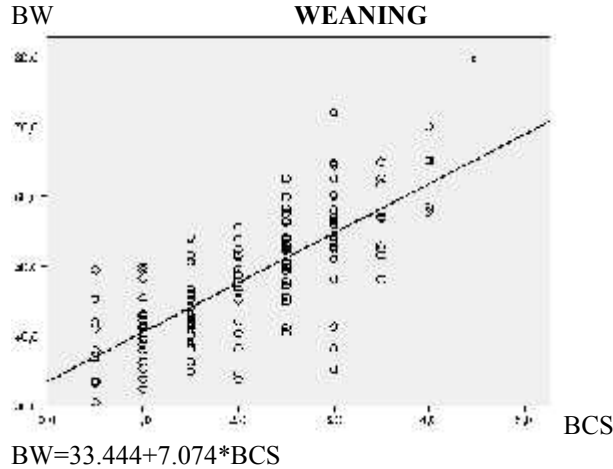


Figure 1. Relationship between body weight (BW) and body condition score (BCS) at different physiologic periods.

Conclusion: It is important to have information about BCS in all physiological periods in terms of determining the feeding programs to be applied in order to increase lamb production by indigenous sheep breeds. It is known that quality of grazing sources is not adequate for an economical level of production. BCS should be used in order to allow sheep to feed with balanced ration in different physiological periods. The results of this study suggest that, based on the conditions which prevail in our region, BCS is a good estimator of BW modifications in Kivircik, Sakiz and Gokceada ewes. It would be the right method to choose in the management of commercial flocks. These recommendations constitute targets for farmers who weeks before introducing the rams into their flocks, must adapt, and eventually improve their range management or feeding policy in order to reach suitable body condition score of ewes early at the beginning of the breeding period.

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