GLOBAL JOURNAL OF ANIMAL SCIENTIFIC RESEARCH

G.J.A.S.R

Journal homepage: www.gjasr.com

Print ISSN:2345-4377 Online ISSN:2345-4385

Original Article

Effect of Gender on Body Conformation Traits in Lambs

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ABSTRACT

The aim of this study was to determine some body conformation traits of female and male Norduz lambs by using linear type evaluation scheme developed for sheep and to determine the effect of gender on conformation defects. The animal material of the study consisted of 40 female and 41 male lambs aged 5-7 months. Body weight and body measurements of lambs were determined. In the lambs, jaw alignment, pelvis slope, topline, gigot and legs were evaluated as body conformation traits. Correlations among body weight, body measurements and conformation traits were determined in female and male lambs. In the study, there found significant differences between the genders in favor of male lambs for body weight ($P<0.05$), withers height ($P<0.01$), body length ($P<0.05$) and chest depth ($P<0.01$). However, no significant differences were determined between female and male lambs in terms of body conformation defects except for the side view of the rear legs ($P<0.01$). By evaluating the conformation traits in different growth periods, it will be possible to detect defective animals in advance and to ensure the productivity of the herd. There is a need to develop linear type evaluation schemes that can be applied on different sheep breeds.

Keywords: Body measurements, conformation, gender, lamb.

INTRODUCTION

A proper body conformation positively affects the productive lifespan of livestock. Animals with outstanding conformation are valuable and their market value may be higher (Fuerst-Waltl ve Baumung, 2006). Fuerst-Waltl and Baumung (2006) reported that only type among the conformation traits (type, frame, form, feet and legs, and wool) had a significant effect on the auction price for rams and ewes.

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Cite this Article: Akdag, Ş., and Karakuş, F. (2020). Effect of gender on body conformation traits in lambs. *Global Journal of Animal Scientific Research,* 8(3), 60-71.
Retrieved from http://www.gjasr.com/index.php/GJASR/article/view/54

Article History: Received: 2020.09.16 Accepted: 2020.11.01

Animals with conformation defects can be low yielding and/or short-lived. However, although all conformation defects do not have a negative effect on performance, it allows hard culling of animals especially males in registered stock (Schoenian, 2016).

Defects in terms of overall color and body structure in animals can be easily understood. Except for very special cases, defective animals are excluded from breeding. Distorted jaw, asymmetrical / defective horn, crooked leg, abnormal ear structure, inconsistent color, and many other defects in livestock are the reasons for their exclusion from breeding (Karaca, 2014). Lambs with inherited jaw defects should be culled because jaw defects cause difficulty in suckling, eating and grazing (Sweiter *et al*., 2018). Sheep with weak foot conformation were found to be more likely to be lame (Kaler *et al*., 2010).

It has been reported that body conformation measurements must be included in breeding programs aimed at increasing the live weight of lambs (Holman *et al*., 2012). Body conformation is given more priority in selecting rams and sheep, especially by small-holder farmers (Yitayew *et al*., 2013). Amare *et al*. (2018) also reported that small-holder producers considered growth rate, body conformation, and weaning rate as the first three selection criteria to increase productivity in sheep. For Menz, Bonga, Horro, and Afar sheep breeds, appearance/conformation/size were reported by Giza as the main breeding objective traits.

A linear type evaluation scheme was developed by Janssens *et al*. (2004) to collect more useful and reliable information about the conformation traits of sheep in an objective way. The traits in the scheme were primarily based on their economic importance and potential to improve efficiency, and secondly on the possibility of being accurately measured or storable. Repeatability's of traits ranged from 0.28 to 0.93 with higher values for the traits determined by measurement.

Although quantitative data regarding the physiological characteristics of animals are evaluated in the selection programs, the share of morphological features which are the criteria of conformation cannot be denied. However, the linear evaluation of the conformation traits is mostly applied in dairy cattle and the applications in the sheep are very low. For this reason, evaluation methods should be developed to provide information about body conformation traits in sheep in a more reliable and objective way. The aim of this study was to determine some body conformation traits in female and male lambs by using the linear type assessment scheme developed for sheep and to reveal the effect of gender on conformation defects.

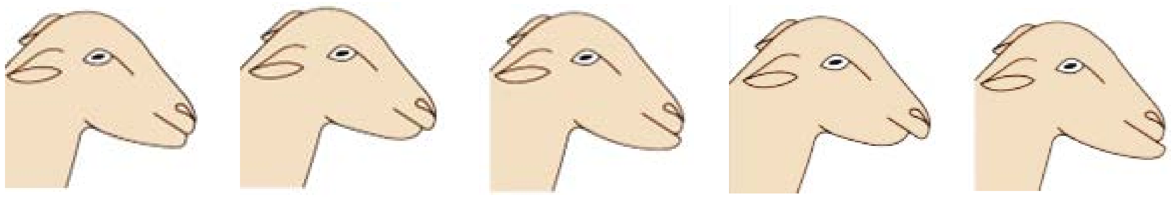
MATERIALS AND METHODS

The study was conducted at Research and Application Farm of Van Yuzuncu Yil University (Turkey), which is located at 38°34' N and 43°17' E and 1669 m above sea level. Animal material of the study consisted of 40 females and 41 male Norduz lambs at 5-7 months of age obtained in the 2018 lambing season. The lambs were weighed using a scale sensitive to 10 g. Body measurements taken on each lamb were as follows (Baenyi *et al*, 2018; Özen *et al*., 2019): withers height: the height from shoulder blades (the highest point of the withers) to the ground, body length: the distance from the tip of sternum to the base of the tail (tuber ischii), chest width: maximum intercostal diameter at the level of the 6th rib behind the articulatio humeri, chest depth: vertical distance from the top of the withers to the xyfoid process of the sternum, chest circumference: perimeter of the chest, and leg circumference: perimeter of the right leg.

Height, length, width and depth measurements were taken with a measuring stick, while a measuring tape was used for circumference measurements. During determining the body measurements, care was taken to ensure that the animals stand calmly on a flat surface. Udder condition in female lambs and presence of both testicles in male lambs were checked. Walking lambs were examined by making more than one observation for gait irregularity (scored as slightly, moderately and heavily irregular) (Janssens *et al*., 2004).

Jaw structure was examined, especially considering the alignment of the lower jaw and teeth relative to the upper jaw. Animals were scored as normal for Score 1, slight flaw (1-3 mm) for Score 3 and severe flaw (>3 mm) for Score 5 (Anonymous, 2013) (Figure 1).

Evaluations for pelvis slope, topline, gigot and legs/feet were made according to the linear assessment scheme reported by Janssens *et al*. (2004) for sheep (Figure 2). All evaluations were made jointly by two observers.



1	2	3	4	5
Normal	Slight flaw (1-3 mm)		Severe flaw (>3 mm)	

Figure 1. Jaw defects scheme (Anonymous, 2013; Schoenian, 2016)

Statistical Analyses

Data on live weight, body measurements and linear body conformation scores of the lambs were analyzed according to the Least Squares Method. Pearson's correlation analysis was used to determine the relationships between the examined traits. SAS package program (2005) was used for these analyzes.

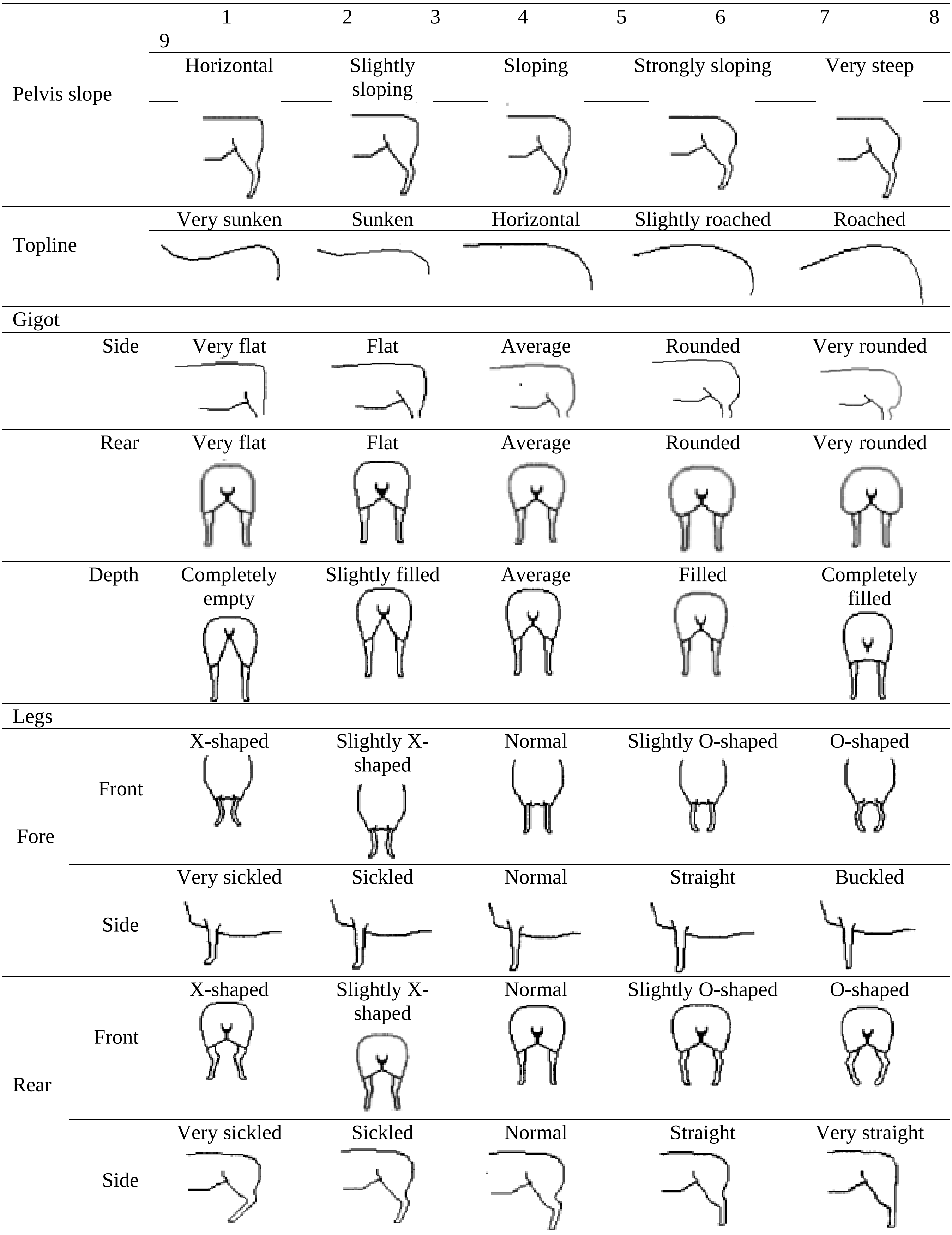


Figure 2. Scored traits in the linear assessment scheme (Janssens *et al*., 2004)

RESULTS AND DISCUSSION

Live weight values of Norduz female and male lambs at 5-7 months of age were determined as 28.41 kg and 32.17 kg, respectively (P<0.05, Table 1). Similar to the findings of this study, male lambs have been reported to be significantly heavier than female lambs at 5-6 months of age by Sarı *et al*. (2014) (P<0.01, P<0.001) and Mirderikvandi *et al*. (2016) (P<0.0001).

Table 1. Means (±SE) for body weight (kg) and body measurements (cm) of female and male lambs

Traits	Gender	n	Means (±SE)	Min. – Max.
Body weight			*	
	Female	40	28.41±1.13	12.40-46.20
	Male	41	32.17±1.18	18.80-49.50
	Overall	81	30.31±0.84	
Withers height			**	
	Female	40	59.04±0.76	50.00-69.00
	Male	41	61.58±0.63	53.00-69.00
	Overall	81	60.32±0.51	
Body length			*	
	Female	40	55.14±0.68	43.00-64.70
	Male	41	57.41±0.71	47.20-65.10
	Overall	81	56.29±0.50	
Chest width				
	Female	40	14.57±0.32	10.60-18.60
	Male	41	14.89±0.35	9.70-19.60
	Overall	81	14.73±0.24	
Chest depth			**	
	Female	40	22.79±0.37	17.10-27.10
	Male	41	24.14±0.35	19.60-27.70
	Overall	81	23.47±0.26	
Chest circumference				
	Female	40	75.45±1.25	58.00-93.00
	Male	41	76.17±1.10	62.00-93.00
	Overall	81	75.81±0.83	
Leg circumference				
	Female	40	43.43±0.72	35.00-55.00
	Male	41	44.46±0.71	37.00-56.00
	Overall	81	43.95±0.50	

SE: Standard error; n: Number of animals; *: P<0.05; **: P<0.01

In the study, withers height, body length and chest depth were 59.04 and 61.58 cm (P<0.01), 55.14 and 57.41 cm (P<0.05), and 22.79 and 24.14 cm (P<0.01), respectively, in female and male lambs. However, there was no significant effect of gender on chest width, chest circumference and leg circumference. Iqbal *et al*. (2014) reported non-significant differences in withers height, body length and heart girth of female and male Kajli lambs in age groups 4-6 and 7-9 months. Similar to the study findings, Alarslan and Aygün (2019) found statistically significant effect of lamb gender on withers height (P<0.05) and body length (P<0.05) in Kıvırcık lambs at 5-

and 6-months age, but the significant differences was not found in chest depth, chest width and chest circumference.

Least squares means of linear body conformation traits in Norduz lambs are given in Table 2. According to the evaluation made in terms of jaw defects, only 2 female and 2 male lambs had slight defects and scoring was made as 1.10 for both sexes. The pelvis in the female and male lambs was scored as 5.45 and 5.34 points, respectively, considered to be sloping (P>0.05). In the evaluation of pelvis, Janssens *et al*. (2004) scored in the category of slightly sloping in Hampshire (HAMP) and Suffolk (SUFF) breeds, sloping in Houtlander (HOUT), Bleu du Maine (BLEU), Mergellandschaap (MERG), Entre Sambre et Meuse (ESME), Cambridge (CAMB), Ile de France (IDEF), Vlaams Kuddeschaap (VLKU), Rouge de L'Ouest (ROUE), Voskop (VOSK) breeds, and strongly sloping in Texel (TEXL) breed.

The mean scores for topline in both female and male lambs were determined in the horizontal class, respectively 4.93 and 4.95 (P>0.05). Janssens *et al*. (2004) reported scores between 3.9 and 5.1 (from sunken to horizontal) for topline in different sheep breeds.

Scores for gigot side and rear views were determined as 4.85 and 4.45 for female lambs, 4.95 and 4.49 for male lambs, respectively. These values were lower than the 6.9 value reported by Janssens *et al*. (2004) for both traits in TEXL breed, but higher than the values reported for HOUT, BLEU, MERG, ESME, CAMB, IDEF, VLKU, and VOSK sheep breeds ranging from 1.0-2.8.

In the study, it was determined that female and male lambs had an average gigot depth. Janssens *et al*. (2004) found that HAMP and TEXL sheep breeds had a full gigot depth, but in other breeds, gigot depth varied from completely empty to slightly filled.

The general averages of the front and side views of the forelegs in Norduz lambs were 4.86 and 4.94, respectively, in the normal category, and no significant differences were found between the female and male lambs. Similarly, Janssens *et al*. (2004) scored the front and side views of the forelegs in different sheep breeds generally in the normal category.

In the study, the scores regarding the rear view of rear legs was determined as 4.25 and 4.48 in female and male lambs, respectively (P>0.05). On the other hand, the side view of rear legs in female and male lambs was scored as 4.05 and 4.41, respectively, and the difference was found to be statistically significant (P<0.01). Rear legs scores determined in the study were similar with the values reported for MERG, but higher than those in HOUT and VOSK breeds (Janssens *et al*., 2004). According to the evaluations made, it was concluded that the linear assessment scheme developed by Janssens *et al*. (2004) allowed comparison of different sheep breeds in terms of many body conformation traits.

The health status of udder in the female animals and the testicles in the male animals are important conformation traits that should be considered in selection. The presence of two teats was normal in all female lambs in the study (Table 3). On the other hand, while the condition of the testicles was normal in 27 (65.85%) male lambs, 5 (12.20%) of them were determined to be cryptorchids, 2 unilateral and 3 bilateral. Also, in the palpation examination for testicular hypoplasia, it was found that testicular development rate was below normal in 9 (21.95%) male lambs. Çiftçi *et al*.

(1996) reported lower rates of cryptorchid (5.9%) and testicular hypoplasia (5.8%) in Merino male lambs than the findings of this study. Smith *et al*. (2012), who performed external examination for cryptorchidism in young male lambs, determined a total of 29 cases of cryptorchidism (0.56%), 86% of cases were unilateral. The reason for the higher rates of cryptorchid and testicular hypoplasia in male lambs in this study might be the incomplete sexual maturity of all lambs.

Table 2. Means (±SE) for body conformation traits in female and male lambs

Traits		Gender	n	Means (±SE)	Min. – Max.
Jaw		Female	40	1.10±0.07	1.00-3.00
		Male	41	1.10±0.07	1.00-3.00
		Overall	81	1.10±0.05	
Pelvis slope		Female	40	5.45±0.09	4.00-6.00
		Male	41	5.34±0.11	4.00-8.00
		Overall	81	5.40±0.07	
Topline		Female	40	4.93±0.04	4.00-500
		Male	41	4.95±0.10	3.00-7.00
		Overall	81	4.94±0.06	
Gigot	Side	Female	40	4.85±0.11	4.00-6.00
		Male	41	4.95±0.12	3.00-7.00
		Overall	81	4.90±0.08	
	Rear	Female	40	4.45±0.09	4.00-6.00
		Male	41	4.49±0.10	3.00-6.00
		Overall	81	4.47±0.07	
	Depth	Female	40	4.40±0.08	4.00-5.00
		Male	41	4.46±0.09	3.00-6.00
		Overall	81	4.43±0.06	
Forelegs	Front	Female	40	4.88±0.05	4.00-5.00
		Male	41	4.85±0.06	4.00-5.00
		Overall	81	4.86±0.04	
	Side	Female	40	4.90±0.05	4.00-5.00
		Male	41	4.98±0.02	4.00-5.00
		Overall	81	4.94±0.03	
Rear legs	Front	Female	40	4.25±0.08	3.00-5.00
		Male	41	4.48±0.09	3.00-5.00
		Overall	81	4.36±0.06	
	Side			**	
		Female	40	4.05±0.06	3.00-5.00
		Male	41	4.41±0.09	3.00-5.00
		Overall	81	4.23±0.06	

SE: Standard error; n: Number of animals; **: P<0.01

Table 3. Frequency table for teat in female lambs and testicular condition in male lambs

Trait		n	%
Teat condition	Normal	40	100
Testis condition	Normal	27	65.85
	Cryptorchid	5	12.20
	testicular hypoplasia	9	21.95
	Overall	41	100

n: Number of animals

Correlations between body weight and body measurements in female and male lambs are given in Tables 4 and 5. Higher correlation coefficients between body weight and body measurements were obtained in female lambs compared to male lambs. The highest correlation coefficient in female lambs was determined between body weight and body length (r = 0.914, P<0.001), and between body weight and chest depth in male lambs (r = 0.876, P<0.001). Similar to the study findings, Şahin *et al*. (2018) reported significant correlations between body weight and body measurements in Anatolian Merino male lambs (P<0.01). Also, Cam *et al*. (2010) and Tahtalı *et al*. (2012) reported significant correlations between body measurements.

Table 4. Correlations between body weight and body measurements in female lambs

	BW	WH	BL	CW	CD	CC
WH	0.873***					
BL	0.914***	0.873***				
CW	0.848***	0.724***	0.754***			
CD	0.879***	0.835***	0.815***	0.747***		
CC	0.896***	0.829***	0.844***	0.865***	0.801***	
LC	0.866***	0.812***	0.799***	0.736***	0.767***	0.732***

BW: Body weight; WH: Withers height; BL: Body length; CW: Chest width; CD: Chest depth; CC: Chest circumference; LC: Leg circumference; ***: P<0.001.

Table 5. Correlations between body weight and body measurements in male lambs

	BW	**WH**	**BL**	**CW**	**CD**	**CC**
WH	0.851***					
BL	0.751***	0.692***				
CW	0.736***	0.663***	0.481**			
CD	0.876***	0.824***	0.704***	0.647***		
CC	0.864***	0.736***	0.681***	0.788***	0.760***	
LC	0.733***	0.500***	0.560***	0.582***	0.600***	0.743***

BW: Body weight; WH: Withers height; BL: Body length; CW: Chest width; CD: Chest depth; CC: Chest circumference; LC: Leg circumference; **: P<0.01; ***: P<0.001

Table 6. Correlations between body weight, body measurements and conformation traits in female lambs

	JAW	PELVIS	TOPLINE	GISIDE	GIREAR	GIDEPTH	FLFRONT	FLSIDE	RLFRONT	RLSIDE
BW	0.162	0.329*	0.306*	0.578***	0.516***	0.397**	-0.047	0.272	0.042	-0.128
WH	0.144	0.381**	0.263	0.560***	0.507***	0.447**	-0.205	0.073	0.094	-0.152
BL	0.136	0.195	0.407**	0.546***	0.495***	0.444**	-0.123	0.226	0.071	-0.101
CW	0.089	0.329*	0.310*	0.396**	0.426**	0.236	-0.036	0.354*	0.018	-0.056
CD	0.157	0.425**	0.268	0.593***	0.519***	0.428**	-0.142	0.290	0.221	-0.127
CC	0.207	0.246	0.381**	0.526***	0.434**	0.286	-0.114	0.275	0.135	-0.041
LC	0.081	0.280	0.345*	0.505***	0.515***	0.412**	-0.099	0.236	-0.117	-0.245

BW: Body weight; WH: Withers height; BL: Body length; CW: Chest width; CD: Chest depth; CC: Chest circumference; LC: Leg circumference; GISIDE: Gigot side view; GIREAR: Gigot rear view; GIDEPTH: Gigot depth; FLFRONT: Forelegs front view; FLSIDE: Forelegs side view; RLFRONT: Rear legs front view; RLSIDE: Rear legs side view; *: P<0.05; **: P<0.01; ***: P<0.001.

Table 7. Correlations between body weight, body measurements and conformational characteristics in male lambs

	JAW	PELVIS	TOPLINE	GISIDE	GIREAR	GIDEPTH	FLFRONT	FLSIDE	RLFRONT	RLSIDE
BW	-0.139	0.497***	-0.062	0.461**	0.205	0.183	0.053	0.276	0.348*	0.323*
WH	-0.033	0.279	-0.035	0.417**	0.154	0.171	0.129	0.340*	0.454**	0.243
BL	-0.135	0.265	-0.211	0.448**	0.299	0.255	-0.138	0.227	0.138	0.279
CW	-0.029	0.369*	-0.151	0.359*	0.177	0.159	0.102	0.303*	0.363*	0.349*
CD	-0.035	0.347*	-0.109	0.375*	0.160	0.146	-0.095	0.297	0.311*	0.288
CC	-0.152	0.432**	-0.158	0.525***	0.343*	0.327*	0.030	0.163	0.248	0.170
LC	-0.149	0.533***	-0.157	0.535***	0.507***	0.473**	0.043	0.192	0.200	0.052

BW: Body weight; WH: Withers height; BL: Body length; CW: Chest width; CD: Chest depth; CC: Chest circumference; LC: Leg circumference; GISIDE: Gigot side view; GIREAR: Gigot rear view; GIDEPTH: Gigot depth; FLFRONT: Forelegs front view; FLSIDE: Forelegs side view; RLFRONT: Rear legs front view; RLSIDE: Rear legs side view; *: P<0.05; **: P<0.01; ***: P<0.001.

As seen in Table 6, moderately significant correlations of body weight were determined with pelvis slope (P<0.05), topline (P<0.05) and gigot region traits (P<0.01, P<0.001) in female lambs. Correlations of pelvis slope with withers height, chest width and chest depth were found as 0.381 (P<0.01), 0.329 (P<0.05) and 0.425 (P<0.01), respectively. Topline conformation trait showed moderate and significant (P<0.05, P<0.01) relationships with all body measurements except withers height and chest depth. Also, moderate and statistically significant (P<0.01, P<0.001) correlations were found between all body measurements and the side (0.396-0.593) and rear view (0.426-0.519) of the gigot. Among the leg conformation traits, a statistically significant correlation (r= 0.354, P<0.05) was found between only the side view of the forelegs and chest width.

Correlations between body weight, body measurements and linear conformation traits in male lambs are given in Table 7. Significant relationships were found between body weight and pelvis slope (P<0.001), gigot side view (P<0.01), rear legs front (P<0.05) and side view (P<0.05) traits in male lambs. There were moderate and significant relationships between pelvis slope and all body measurements (P<0.05, P<0.01, P<0.001) except withers height and body length. Similar to the female lambs, the side view of the gigot in male lambs showed statistically significant (P<0.05, P<0.01, P<0.001) correlations between 0.359 and 0.535 with all body measurements examined. On the other hand, only the correlations between the chest circumference and leg circumference measurements with the gigot rear view and gigot depth were found to be statistically significant (P<0.05, P<0.01, P<0.001). Also, the correlation coefficients of forelegs side view with withers height and chest width were determined as 0.340 (P<0.05) and 0.303 (P<0.05), respectively. While the conformation trait of rear legs front view showed statistically significant correlations with withers height (P<0.01), chest width (P<0.05), and chest depth (P<0.05), a significant relationship was found only between the side view trait and chest width (P<0.05).

A direct comparison could not be made since no studies have been performed regarding the correlations among body weight, body measurements and linear body conformation traits.

The study material was examined in terms of gait irregularity by making more than one observation. As a result of the observations made, no walking irregularity was observed in Norduz female and male lambs.

CONCLUSION

A well-structured body is crucial to the longevity of rams and ewes, as any conformation defects in breeding animals will continue to be passed down through generations. By evaluating the conformation traits in different growth periods, it will be possible to detect defective animals in advance and to ensure the productivity of the herd.

In this study, no significant differences were found between female and male lambs, except for the side view of the rear legs, according to the evaluation made in terms of conformation defects including jaw, pelvis slope, topline, gigot side and rear view, gigot depth, front and side views of fore and rear legs.

As a result, it was determined that the linear type evaluation scheme developed by Janssens *et al.* (2004) could be used to evaluate some body conformation traits in lambs. However, there is a need to develop linear type evaluation schemes that can be applied on different sheep breeds.

ACKNOWLEDGEMENT

The authors thank Mehmet Nur Ciftsüren, who contributed to the statistical analysis of the study data.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest. This study is based on the first author's master's thesis.

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