JOURNAL OF ANIMAL PRODUCTION
Hayvansal Üretim
ISSN 1301-9597
e-ISSN 2645-9043
Published by Ege Animal Science Association
www.journalofanimalproduction.com

Research Article

Received: 14.04.2024 Accepted: 31.05.2024 Final Version: 20.06.2024

Orhan KARACA[1], Nezih ATA[1], Kemal CANAZ[1], İbrahim CEMAL[1], Onur YILMAZ[1]*

[1] Aydın Adnan Menderes University Faculty of Agriculture, Department of Animal Science, Aydın, 09100, Türkiye

Investigation of Morphological Variations in Esme and Pırlak Sheep Raised in Breeder's Conditions#

ABSTRACT

Objective: The study was conducted to identify body measurements that can serve as selection criteria in breeding programs for Eşme and Pırlak sheep breeds. Additionally, the study aimed to investigate the phenotypic correlation between live weight and body measurements.

Material and Methods: The animal materials of both breeds were obtained from farms that are considered multiplier flocks in the breeding programs. The animal material used in this study consists of a total of 612 sheep, including 311 Eşme sheep from three breeders and 301 Pırlak sheep from three breeders, sourced from six farms in Uşak province. In the study, data were collected on various physical characteristics of the animals during the mating period, including their head measurement (such as forehead width, head length, and ear length), body measurement (such as chest width, rump height, withers height, back height, chest depth, chest girth, and body length), and weight at the time of measurement.

Results: The findings revealed that systematic environmental factors, such as breed, farm, gender, and age, have a statistically significant effect on the live weight and body measurements. On the other hand, positive correlation coefficients were obtained for live weight and body measurements.

Conclusion: The findings revealed that utilizing body measurements, particularly chest girth, as selection criteria in breeding programs aimed at improving growth characteristics can have a positive impact on the live weights of animals. The observation that the Eşme breed exhibited higher values than the Pırlak breed in terms of live weight and certain body measurements suggests that this breed holds significant potential for meat production in the region.

Keywords: Body measurement, live weight, western Anatolia, farmers

Yetistirici Kosullarında Yetistirilen Esme ve Pırlak Koyun Irklarının Morfolojik Özelliklerinin Arastırılması

ÖZ

Amaç: Çalışma, Eşme ve Pırlak koyun ırkları için saha ıslah çalışmalarında seleksiyon kriteri olarak kullanılabilecek vücut ölçülerinin belirlenmesi amacıyla yürütülmüştür. Ayrıca, çalışmada canlı ağırlık ve vücut ölçüleri arasındaki fenotipik korelasyonun araştırılması amaçlanmıştır.

Materyal ve Methot: Her iki ırka ait deneme materyali hayvanlar yürütülen ıslah programlarında ara elit olarak yer alan işletmelerde gerçekleştirilmiştir. Bu çalışmada kullanılan hayvan materyali, Uşak ilindeki altı çiftlikten üç yetiştiriciye ait 311 Eşme koyunu ve üç yetiştiriciye ait 301 Pırlak koyunu olmak üzere toplam 612 koyundan oluşmaktadır. Çalışmada, çiftleşme döneminde hayvanların baş ölçüleri (alın genişliği, baş uzunluğu ve kulak uzunluğu gibi), vücut ölçüleri (göğüs genişliği, sağrı yüksekliği, cidago yüksekliği, sırt yüksekliği, göğüs derinliği, göğüs çevresi ve vücut uzunluğu gibi) ve ölçüm anındaki ağırlıkları dahil olmak üzere çeşitli fiziksel özellikleri hakkında veriler toplanmıştır.

Bulgular: Elde edilen bulgular, ırk, işletme, cinsiyet ve yaş gibi sistematik çevresel faktörlerinin üzerinde durulan canlı ağırlık ve vücut ölçüleri üzerine istatistiksel olarak anlamlı bir etkisi olduğunu ortaya koymuştur. Öte yandan, canlı ağırlık ve vücut ölçümleri için pozitif korelasyon katsayıları elde edilmiştir.

Sonuç: Bu bulgular, gelişme özelliklerini hedef alan ıslah programlarında seçim kriteri olarak vücut ölçülerinin, özellikle göğüs çevresinin kullanılmasının, hayvanların canlı ağırlıklarını olumlu yönde etkileyebileceğini ortaya koymuştur. Eşme ırkının canlı ağırlık ve bazı vücut ölçüleri bakımından Pırlak ırkından daha yüksek değerler sergilemesi, bu ırkın bölgede et üretimi için önemli bir potansiyele sahip olduğunu göstermektedir.

Anahtar Kelimeler Vücut ölçüleri, canlı ağırlık, Batı Anadolu, yetiştirici

How to cite:

Karaca O, Ata N, Canaz K, Cemal İ , Yılmaz O. 2024. Investigation of Morphological Variations in Eşme and Pırlak Sheep Raised in Breeder's Conditions. Journal of Animal Production, Vol: 65 (1): 9-19, https://doi.org/10.29185/hayuretim.1467955

* Correspondence: oyilmaz@adu.edu.tr

INTRODUCTION

Foods of animal origin are important components of a healthy and balanced diet. Red meat, in particular, is a valuable source of exogenous amino acids and is known for its delicious taste and ability to quickly satisfy hunger (Kausar et al., 2019; Farvid et al., 2021). It is also satiating and contains vital nutrients in sufficient amounts, making it an important part of the diet for people of all ages (Pereira and Vicente 2013; Ye et al., 2020; Demirhan and Şahinler, 2022). Meeting the important need of human beings is possible by assessing the performance of livestock and implementing breeding plans that align with this yield direction in the field.

Sheep play a significant role in meat production. They are known for their adaptability to various climates and environments. They can thrive in diverse geographic regions and harsh conditions where other livestock may struggle. This adaptability makes them valuable for meat production in different regions of the world (Teixeira et al., 2020). Sheep exhibit efficient characteristics for meat production. They have a relatively faster growth rate and can reach market weight quickly compared to larger livestock species. This efficiency translates into shorter production cycles and reduces the time and resources required to raise animals to the desired market weight. Sheep excel at efficiently utilizing grazing resources. They can graze on a wide range of vegetation types, including grasses, shrubs, and browse, which makes them valuable for pasture-based meat production systems. Their ability to convert forage into meat makes them a valuable asset in sustainable and resource-efficient agricultural practices. Sheep play a crucial role in small-scale and subsistence farming systems worldwide. They are often raised by farmers with limited resources who depend on them for meat production and to sustain their livelihoods (Cedden et al., 2020). Sheep breeding offers an opportunity for rural communities to generate income, improve food security, and enhance their resilience to economic challenges (Cedden et al., 2020; Alshamiry et al., 2023; Tunio et al., 2023).

Sheep breeding in Turkey is primarily conducted for lamb production. The country has a significant demand for lamb and mutton, both for domestic consumption and for export (Akbay and Boz, 2005). Many farmers engage in commercial sheep farming, raising animals for meat production. Therefore, in breeding programs implemented in the field, the main focus is on the birth weight, weaning weight, live weight at marketing, and average daily weight gain of animals. Live weight is a crucial parameter used not only to accurately determine the period when animals will be shipped to the market but also to assess the health status, fertility, and developmental characteristics of animals (Wishart et al., 2017; Posbergh and Huson, 2021; He et al., 2023; Bates et al., 2023; Canul-Solís et al., 2023).

Eşme and Pırlak sheep are native sheep breeds found in the Uşak province in the western part of Turkey. It is one of the important indigenous sheep breeds in the country. They are medium-sized animals with a well-developed body. They have a white fleece with dense and fine wool that is highly valued for its quality. The head is usually free of wool, and both rams and ewes typically have horns. They are well adapted to the local climatic conditions of the Uşak province, which include hot summers and cold winters. They have a good resistance to heat and can graze in arid and semi-arid areas with limited vegetation. The Eşme and Pırlak sheep breeds are primarily raised for meat production. They have good meat quality and provide a moderate carcass yield. Additionally, their wool is highly valued for its fineness and is used in textile production (Alarslan et al., 2021; Bozkurt et al., 2023; Yilmaz et al., 2022).

Accurately measuring live weights and body dimensions of farm animals is crucial for evaluating their performance and evaluation of intra-breed genetic variation within a breed. Accurate determination of live weight and developmental characteristics is crucial for livestock farms due to their economic significance (Yılmaz et al., 2013; Silva Souza et al., 2019; Posbergh and Huson, 2021). In addition, body measurements are another important parameter for determining whether animals possess distinct breed characteristics and for selection purposes. Since the identification of body measurements in livestock plays a crucial role in various areas such as feeding and management, disease detection, genetic evaluation, and reproductive evaluation, it is also of great significance in guiding animal breeding programs. Body measurements are also important in determining the selection criteria used in animal breeding. Determining the relationship between desired characteristics and body measurements contributes to making more accurate decisions in the selection of breeds. In addition, these measurements can reveal whether animals possess breed characteristics. And it is one of the important pieces of information for breed registration studies. They are a valuable tool used to define the morphological characteristics and physical structure in animals. Body measurements and live weight measurements are

commonly used as important criteria in scientific research and selection applications (Yılmaz et al., 2016; Silva Souza et al., 2019; Tahtali, 2019; Abebe et al., 2020; He et al., 2023; Bates et al., 2023; Canul-Solís et al., 2023).

Therefore, it is crucial to accurately present these parameters. Body measurements and live weight characteristics are quantitative traits that are influenced by various factors, including genotype, sex, birth type, feeding regime, age, birth season, and maternal age. Significant phenotypic correlation values have been reported between live weight and body measurements in various studies (Yilmaz et al., 2013; Canatan et al., 2014; Saraçoğlu et al., 2016; Yilmaz et al., 2016; Akay et al., 2018; Silva Souza et al., 2019; Tahtali, 2019; Huma and Iqbal, 2019; Salazar-Cuytun et al., 2022). Therefore, accurate identification and monitoring of body measurements in sheep are of great importance.

The study was conducted to determine body measurements that can serve as selection criteria in field breeding studies for two breeds, as well as to investigate the phenotypic correlation between body weight and body measurements. In this study, the objective is to determine the body characteristics and live weights of Eşme and Pırlak sheep breeds that are bred in Uşak, a significant lamb production center in the Aegean Region, during the mating period.

MATERIAL and METHODS

Animal Material

All animal procedures were conducted in accordance with EU Directive for animal experiments (European Union, 2010), ARRIVE guidelines (Kilkenny et al., 2010) and national regulation on the protection of experimental animals used for experimental and other scientific purposes (Anonymous, 2011).

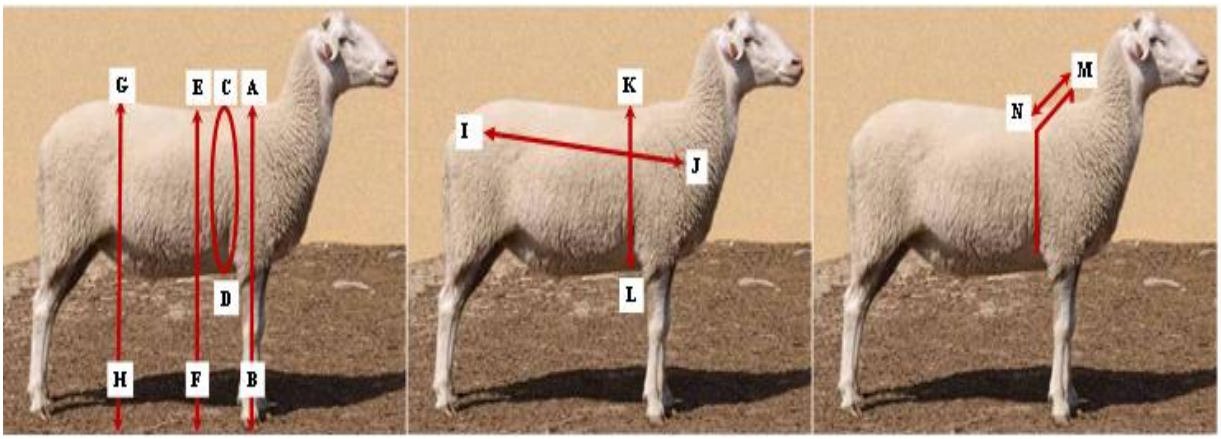
The study was carried out in the mating season of 2021, that is, in July, in Uşak, Turkey. The animal material used in this study consisted of 612 sheep, including 311 Eşme and 301 Pırlak sheep breeds from six different multiplier breeding farms. These farms were part of two sub-projects, namely "Uşak Eşme Sheep Breeding" and "Uşak Pırlak Sheep Breeding" which were implemented in the Uşak province as components of the "National Genetic Improvement Project for Small Ruminants at Breeders' Conditions" project supported by the General Directorate of Agricultural Research.

Body and Head Measurements

During the mating period, the body measurements and live weights of sheep on breeders' farms were recorded. The live weights of the sheep were determined using a digital scale with a precision of 50 g. Measurements of chest width (CW), rump height (RH), withers height (WH), back height (BH), chest depth (CD), chest girth (CG), and body length (BL) were obtained using a measuring stick (Figure 1).

Figure 1. Body measurements

Şekil 1. *Vücut ölçüleri*

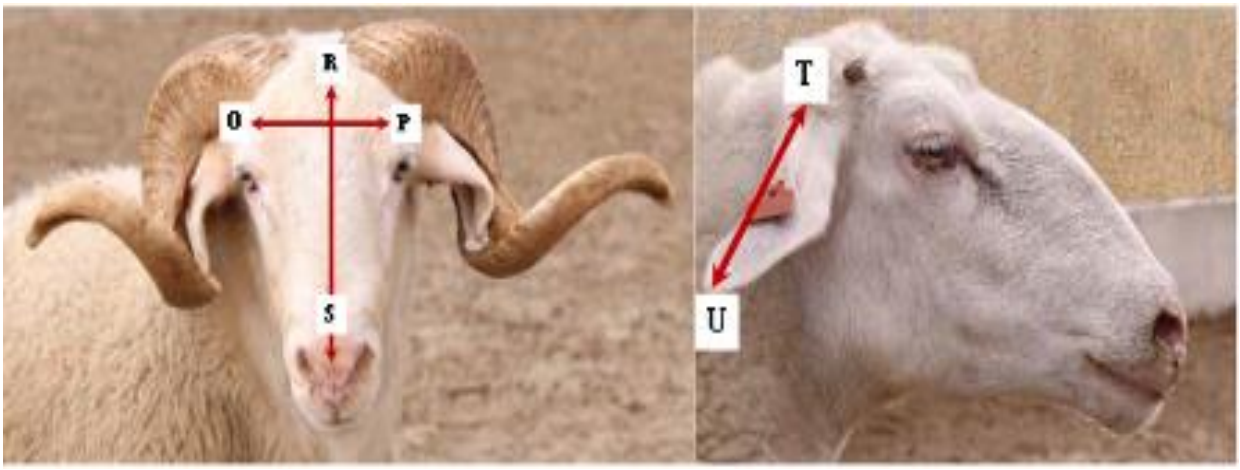


A-B: withers height; C-D: chest girth; E-F: back height; G-H: rump height; I-J: body lenght; K-L: chest depth; M-N chest width

Measurements of forehead width, head length, and ear length were obtained using a measuring strip (Figure 2).

Figure 2. Head measurements

Şekil 2. *Baş ölçüleri*



O-P: forehead width; R-S: head lenght, T-U: ear lenght

Statistical Analysis

Variance analysis was applied to the data to determine the influence of systematic environmental factors. The UNIVARIATE procedure of SAS statistical package (1999) statistical package program was used to check normality of the data. The result of this analysis showed that the data for all the measured characteristics were normally distributed. Afterwards, the General Linear Model (GLM) and CORR procedures in the SAS statistical package (1999) were used to analyze the variance of body and head characteristics and determine the Pearson phenotypic correlation coefficients. The mathematical model used in the GLM procedure for statistical analysis is as follows.

Mathematical model used for body and head measurements;

$Y_{ijkl}=\mu+a_i+b_j+c_k+\beta(X_{ij}-\bar{X})+e_{ijkl}$

Mathematical model used for live weight;

$Y_{ijkl}=\mu+a_i+b_j+c_k+e_{ijkl}$

Where,

Yijkl = Observation of body and head measurements and live weight

μ= expected mean of the population

ai = Fixed effect of breed (i = Eşme, Pırlak)

bj = Fixed effect of sex (j = male, female)

ck= Fixed effect of age (k=2, 3, 4, 5, 6, 7)

β= Regression coefficient of live weight

Xij= Live weight of the animal

$\bar{X}$*= Means of live weight*

eijk = Random errors with the assumption of N (0, σ2)

RESULTS

With this study, body measurements of two different breeds were determined. Descriptive statistics for body and head measurements of Eşme and Pırlak sheep breeds are presented in Table 1.

Table 1. Descriptive statistics for body and head measurements and live weight, in the Eşme and Pırlak sheep breeds

Tablo 1. *Eşme ve Pırlak koyun ırklarında vücut, baş ölçüleri ve canlı ağırlığa ilişkin tanımlayıcı istatistikler*

Variable	Breed	Sex	$\bar{X}\pm S_{\bar{x}}$	CV (%)	Min	Max	Overall Mean
FW (cm)	Eşme	Male	13.67±1.732	12.67	11.00	16.00	10.37
		Female	10.27±0.586	5.70	9.00	12.00	
	Pırlak	Male	12.30±0.675	5.49	11.00	13.00	9.72
		Female	9.63±0.746	7.75	8.00	12.00	
HL (cm)	Eşme	Male	21.11±1.269	6.01	18.00	22.00	15.65
		Female	15.48±1.172	7.57	12.00	18.00	
	Pırlak	Male	17.40±1.506	8.65	16.00	20.00	15.08
		Female	15.00±1.436	9.58	12.00	19.00	
EL (cm)	Eşme	Male	18.56±0.726	3.92	18.00	20.00	15.45
		Female	15.36±1.509	9.83	11.00	20.00	
	Pırlak	Male	15.80±2.201	13.93	12.00	19.00	14.16
		Female	14.10±1.516	10.75	10.00	18.00	
CW (cm)	Eşme	Male	26.56±1.014	3.82	25.00	28.00	22.95
		Female	22.84±2.366	10.36	17.00	29.00	
	Pırlak	Male	24.70±2.627	10.63	21.00	30.00	22.85
		Female	22.79±2.353	10.32	16.00	32.00	
RH (cm)	Eşme	Male	85.56±2.555	2.99	83.00	90.00	76.69
		Female	76.43±3.209	4.20	70.00	87.00	
	Pırlak	Male	87.70±2.983	3.40	83.00	92.00	76.15
		Female	75.75±3.356	4.43	68.00	85.00	
WH (cm)	Eşme	Male	88.89±2.088	2.35	87.00	94.00	77.48
		Female	77.14±3.206	4.16	69.00	86.00	
	Pırlak	Male	87.90±3.28	3.73	83.00	94.00	75.65
		Female	75.23±3.112	4.14	68.00	83.00	
BH (cm)	Eşme	Male	87.11±1.453	1.67	84.00	89.00	75.55
		Female	75.21±3.207	4.26	65.00	84.00	
	Pırlak	Male	86.20±2.700	3.13	82.00	89.00	74.03
		Female	73.61±3.150	4.28	66.00	82.00	
CD (cm)	Eşme	Male	36.11±1.054	2.92	35.00	38.00	32.10
		Female	31.98±2.053	6.42	26.00	37.00	
	Pırlak	Male	36.50±2.415	6.62	33.00	40.00	32.93
		Female	32.80±2.130	6.49	28.00	40.00	
CG (cm)	Eşme	Male	116.44±2.01	1.72	113.00	119.00	104.66
		Female	104.31±5.82	5.58	85.00	117.00	
	Pırlak	Male	108.40±7.860	7.25	100.00	120.00	104.47
		Female	104.34±6.460	6.19	89.00	127.00	
BL (cm)	Eşme	Male	77.78±3.46	4.44	72.00	83.00	59.77
		Female	59.24±4.041	6.82	50.00	73.00	
	Pırlak	Male	71.90±5.570	7.74	64.00	83.00	59.24
		Female	58.80±4.555	7.75	46.00	72.00	
LW (kg)	Eşme	Male	114.44±8.85	7.73	100.80	129.10	73.78
		Female	72.57±9.114	12.56	43.70	99.40	
	Pırlak	Male	95.56±14.04	14.69	80.10	125.30	68.40
		Female	67.46±8.551	12.68	45.80	93.40	

FW: forehead width, HL: head lenght, EL: ear lenght, CW: chest width, RH: rump height, WH: withers height, BH: back height, CD: chest depth, CG: chest girth, BL: body lenght, LW: live weight

With this study, body measurements of two different breeds were determined. Descriptive statistics for body and head measurements of Eşme and Pırlak sheep breeds are presented in Table 1.

When evaluating the descriptive statistics of body measurements, differences in the discussed characteristics can be observed among breeds. The standard deviation, coefficient of variation, and change limits of live weight indicate that this feature exhibits significantly greater variation compared to body and head characteristics. These findings provide the most concrete evidence that body weight is the primary selection criterion used in breeding programs conducted in the field. Furthermore, male Pırlak breed individuals exhibited greater variation in live weight than females. Upon evaluating the descriptive statistics, it is evident that the FW and EL parameters, as well as the live weight values obtained from body measurements, exhibit the highest coefficients of variation. The criteria used to define the body structure of sheep has been evaluated, and the least squares means and standard errors are presented in Table 2.

Upon examining Table 2, it was found that the impact of breed, sex, and age, which are considered fixed effects on head measurements, was statistically significant. However, the impact of breed on head length was considered insignificant. Males exhibited higher values than females in terms of both head and body measurements. It is noteworthy that the Eşme breed received higher values than the Pırlak breed in terms of body and head measurements. The impact of age on body and head measurements, except for chest width and chest girth, was determined to be statistically significant ($P < 0.01$).

Live weight and body measurements of farm animals are directly related to muscle development and bone structure. For this reason, live weight should be taken into account when evaluating the body measurements of animals. Therefore, when evaluating body measurements in the study, body weight was included as a covariate in the statistical model. The effect of live weight, which was considered as a covariate in the statistical model, on body and head measurements was found to be statistically very significant ($P < 0.001$). The impact of all the fixed effects discussed in the model on live weight was statistically significant.

The least square means for live weight were 91.04 kg and 84.67 kg for the Eşme and Pirlak breeds, respectively. On the other hand, the significant statistical difference in live weight between breeds is remarkable. The phenotypic correlation coefficients between body and head measures and live weights were found to be positive and very significant ($P<0.001$) (Table 3).

Considering the correlation coefficients between body measurements and live weight in the study, it can be concluded that the values obtained for other characteristics, except ear length, are moderately high. In the present study, the remarkably high level of correlation coefficient obtained between live weight and chest girth is noteworthy.

DİSCUSSİON and CONCLUSION

The reproductive efficiency of rams can be correlated with their weight during the mating period. It is important for the ram to have sufficient weight for successful mating. If the ram's weight is low, it may lead to a decrease in the fertilization rate and pregnancy rate of the females (Haslin et al., 2022; Pellicer-Rubio et al., 2023). In terms of body weight, which is an important factor in the selection of male animals, Eşme rams performed higher than Pırlak rams. The study also revealed that the Eşme breed outperformed the Pırlak breed in terms of live weight and body measurements.

It is expected to observe differences between these two breeds in terms of physical characteristics. Given that breeds can significantly affect body and head measurements, the results obtained in this study are consistent with our expectations. Similar findings have been reported in studies examining the relationship between breed and sex (Canatan et al., 2014; Yilmaz et al., 2016; Akay et al., 2018; Sabbioni et al., 2020; Whannou et al., 2021; Tırınk et al., 2022; Çakmakçı, 2022; Kutan and Keskin, 2022). It is possible to discuss uniformity within each breed, especially concerning the animals' body measurements. This indicates that herd uniformity is largely ensured in the studied breeds, and it is evident that the selection process has been successful.

Table 2. Least square means and standard errors regarding body measurements and live weights during the mating period in Eşme and Pırlak sheep breeds

Table 2. *Eşme ve Pırlak koyun ırklarında çiftleşme dönemindeki vücut ölçüleri ve canlı ağırlıklara ilişkin en küçük kareler ortalamaları ve standart hataları*

Factors	N	FW (cm)	HL (cm)	EL (cm)	CW (cm)	RH (cm)	WH (cm)	BH (cm)	CD (cm)	CG (cm)	BL (cm)	LW (kg)
Breed		**P=0.000**	**P=0.059**	**P=0.000**	**P=0.000**	**P=0.011**	**P=0.004**	**P=0.129**	**P=0.000**	**P=0.000**	**P=0.051**	**P=0.000**
Eşme	311	11.26±0.104	16.42±0.200	15.75±0.233	20.87±0.268	77.85±0.443	79.75±0.434	77.74±0.430	31.25±0.244	98.57±0.643	63.17±0.628	91.04±1.160
Pırlak	301	10.77±0.092	16.20±0.177	14.70±0.207	21.72±0.238	78.50±0.392	79.01±0.384	77.36±0.380	32.82±0.216	101.35±0.569	63.88±0.556	84.67±1.125
Sex		**P=0.000**	**P=0.000**	**P=0.012**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.010**	**P=0.000**	**P=0.000**	**P=0.000**
Male	19	12.07±0.186	17.35±0.357	15.76±0.416	19.57±0.479	80.09±0.791	82.38±0.774	80.48±0.766	31.46±0.435	94.94±1.146	67.85±1.120	105.63±2.098
Female	593	9.96±0.029	15.27±0.056	14.69±0.065	23.02±0.075	76.27±0.123	76.38±0.121	74.63±0.120	32.61±0.068	104.98±0.179	59.20±0.175	70.08±0.391
Age		**P=0.007**	**P=0.026**	**P=0.000**	**P=0.981**	**P=0.007**	**P=0.039**	**P=0.014**	**P=0.008**	**P=0.457**	**P=0.037**	**P=0.010**
2	120	11.10±0.101	16.50±0.193	15.55±0.225	21.19±0.259	78.38±0.428	79.50±0.419	77.63±0.414	31.58±0.235	100.00±0.620	63.75±0.605	86.43±1.215
3	110	11.11±0.104	16.57±0.200	15.57±0.234	21.23±0.269	78.90±0.444	80.07±0.435	78.24±0.430	31.91±0.244	100.00±0.644	64.31±0.629	85.87±1.285
4	139	10.91±0.110	16.14±0.211	15.17±0.247	21.34±0.284	77.76±0.469	78.89±0.459	76.90±0.454	31.89±0.258	99.64±0.679	62.93±0.663	89.84±1.288
5	102	11.10±0.113	16.32±0.216	15.52±0.253	21.35±0.290	77.84±0.480	79.21±0.470	77.50±0.465	32.17±0.264	99.30±0.695	63.23±0.679	87.85±1.372
6	44	10.77±0.138	15.93±0.264	14.47±0.308	21.34±0.354	77.54±0.585	79.10±0.573	77.36±0.567	32.38±0.322	100.57±0.848	62.75±0.829	89.46±1.713
7	97	11.10±0.114	16.38±0.219	15.08±0.256	21.32±0.294	78.63±0.486	79.51±0.475	77.70±0.471	32.28±0.267	100.25±0.704	64.18±0.687	87.66±1.396
Reg. Linear		**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	**P=0.000**	
LW		0.025±0.003	0.05±0.006	0.033±0.007	0.181±0.008	0.191±0.013	0.175±0.012	0.181±0.012	0.153±0.007	0.517±0.018	0.198±0.018	
General	**612**	**11.02±0.094**	**16.31±0.180**	**15.22±0.210**	**21.29±0.241**	**78.18±0.398**	**79.38±0.390**	**77.55±0.386**	**32.04±0.219**	**99.96±0.577**	**63.52±0.564**	**87.85±1.074**

FW: forehead width, HL: head lenght, EL: ear lenght, CW: chest width, RH: rump height, WH: withers height, BH: back height, CD: chest depth, CG: chest girth, BL: body lenght, LW: live weight

Table 3. Pearson phenotypic correlation coefficients between mating period live weight and body measurements in Eşme and Pırlak breed sheep

Table 3. *Eşme ve Pırlak ırkı koyunlarda çiftleşme dönemi canlı ağırlığı ve vücut ölçüleri arasındaki Pearson fenotipik korelasyon katsayıları*

	LW	FW	HL	EL	CW	RH	WH	BH	CD	CC
FW	0.570***									
HL	0.509***	0.573***								
EL	0.350***	0.474***	0.427***							
CW	0.663***	0.278***	0.278***	0.058ns						
RH	0.636***	0.498***	0.498***	0.365***	0.387***					
WH	0.665***	0.563***	0.530***	0.383***	0.374***	0.875***				
BH	0.671***	0.551***	0.510***	0.400***	0.390***	0.910***	0.939***			
CD	0.622***	0.237***	0.280***	0.027ns	0.572***	0.472***	0.457***	0.472***		
CC	0.714***	0.354***	0.374***	0.128**	0.721***	0.461***	0.421***	0.439***	0.652***	
BL	0.568***	0.454***	0.522***	0.196***	0.315***	0.542***	0.569***	0.558***	0.427***	0.405***

*FW: forehead width, HL: head lenght, EL: ear lenght, CW: chest width, RH: rump height, WH: withers height, BH: back height, CD: chest depth, CC: chest circumference, BL: body lenght, LW: live weight, ***:P<0.001, **:P<0.01, *: P<0.05, ns:non-significant*

In contrast to previous studies (Yilmaz et al., 2013; Faraz et al., 2021) on the subject, obtained findings suggest that body measurements change with age. The statistical distinction in terms of live weights can be accepted as an important indicator of breed differences in the present study. When these values are examined, it indicates that the Eşme breed outperforms the Pirlak breed in terms of live weight. Previous studies have also shown that factors such as farms, breed, age, and sex have a significant effect on live weight (Yilmaz et al., 2013; Canatan et al., 2014; Saraçoğlu et al., 2016; Yilmaz et al., 2016; Akay et al., 2018; Silva Souza et al., 2019; Tırınk et al., 2022; Çakmakçı, 2022; Kutan and Keskin, 2022; Salimovich et al., 2022). In this context, it can be said that the breed differences revealed in the presented study are an expected finding.

It can be concluded that the high level of positive phenotypic correlation coefficients obtained between body weight and body measurements in the study is consistent with the existing literature (Yilmaz et al., 2013; Yilmaz et al., 2016; Salazar-Cuytun et al., 2020). A high level of phenotypic correlation coefficients between chest girth and body weight has been reported in almost all studies (Yilmaz et al., 2013; Yilmaz et al., 2016; Tırınk et al., 2022; Çakmakçı, 2022; Kutan and Keskin, 2022; Salimovich et al., 2022). In the present study, the highest phenotypic correlation coefficients were found between body weight and chest girth, which is consistent with previous literature (Yilmaz et al., 2013; Salazar-Cuytun et al., 2020; Salimovich et al., 2022).

In conclusion, long-term breeding programs targeting growth and development characteristics are carried out in both of the studied breeds. In this context, the findings on the variation and systematic environmental factors affecting body measurements and body weights during the mating period in the sheep breeds examined are important. These findings provide valuable information about enhancing growth and development characteristics, which are the primary objectives of the Uşak Eşme Sheep Breeding and "Uşak Pırlak Sheep Breeding" programs. In this study, the results show high phenotypic correlation coefficients between certain body measurements, such as chest girth and live weight. These findings reveal the potential of using certain body measurements, particularly traits that show high phenotypic correlation coefficients with body weight, like chest girth, as selection criteria in breeding programs conducted under breeder conditions. In the study, the observation that the Eşme breed exhibited higher values than the Prılak breed in terms of live weight and certain body measurements suggests that this breed holds significant potential for meat production in the region.

On the other hand, the study revealed that traits with high phenotypic correlation coefficients between live weight and body measurements can be used in regression models to estimate live weight. It is noteworthy that chest circumference is the most suitable parameter for estimating body weight in these breeds, especially among the body measurements examined. By utilizing the information gathered from this study in the future, it will be feasible to create body weight estimation models with high accuracy that are suitable for various regions and breeds.

Acknowledgements: We would like to thank our General Directorate of Agricultural Research and Policies for providing us with the necessary animal material. As well as, we would also like to thank our breeders who participated in the Eşme Sheep Breeding and Pırlak Sheep Breeding projects.

Data availability: Data will be made available upon reasonable request.

Author contributions*: conception and design of the study: OK, NA, KC, İC, OY; sample collection: NA, KC; analysis and interpretation of data: OK, İC, OY; statistical analysis: OY; visualization: OK, NA, KC; writing manuscript: OK, İC, OY, NA

Competing interests.: There is no conflict of interest between the authors in this study

Ethical statement: All researchers declared it that "all animal procedures were conducted in accordance with EU Directive for animal experiments (European Union, 2010), ARRIVE guidelines (Kilkenny et al., 2010) and national regulation on the protection of experimental animals used for experimental "

Financial support.: This study was financially supported by Adnan Menderes University Scientific Research Projects Coordination (BAP, Project No; ZRF-14027). The authors thank the financial support.

Article description: This article was edited by Editor Çağrı KANDEMİR.

REFERENCES

Abebe AS, Alemayehu K, Johansson AM, Gizaw S. 2020. Breeding practices and trait preferences of smallholder farmers for indigenous sheep in the northwest highlands of Ethiopia: Inputs to design a breeding program. PloS One 15(5):e0233040.

Akay N, Canatan T, Yılmaz O. 2018. Live weight estimation based on linear body measurements of South Karaman sheep breeds. International Agricultural Science Congress, 09-12 May 2018, Van Yüzüncü Yıl University, Van, s.146.

Akbay C, Boz I. 2005. Turkey's livestock sector: Production, consumption and policies. Livestock Research for Rural Development 17(9):1-11.

Alarslan E, Ata N, Yilmaz O, Öner Y, Kaptan C, Savaş T, Yilmaz A. 2021. Genetic identification and characterisation of some Turkish sheep. Small Ruminant Research 202:106455.

Alshamiry FA, Alharthi AS, Al-Baadani HH, Aljumaah RS, Alhidary IA. 2023. Growth rates, carcass traits, meat yield, and fatty acid composition in growing lambs under different feeding regimes. Life, 13(2):409-421.

Anonymous 2011. Regulation on the welfare and protection of animals used for experimental and other scientific purposes. Legal Gazette (T.C. Resmi Gazete): 28141.

Bates H, Pottie D, Taylor D, Benter A. 2023. Automatic multi-weigh-station for assessing sheep liveweight in small flocks. Computers and Electronics in Agriculture 205:107631.

Bozkurt Z, Hacan ÖG, Koçak S, Çelikeloğlu K, Tekerli M, Erdoğan M. 2023. Impact of farm-scale on animal management practices in Pırlak sheep enterprises. Kocatepe Veteriner Dergisi 16(1):57-69.

Canatan T, Kan M, Kırbaş M, Akay N, Yilmaz O. 2014. Adult live weight estimates of Hasmer and Hasak sheep with their some body measurements. Balkan Agriculture Congress, 08-10 September 2014, Trakya University, Edirne, s.338.

Canul-Solís JR, Portillo-Salgado R, García-Herrera RA, Castillo-Gallegos E, Castillo-Sanchez LE, Camacho-Perez E, Chaves-Gurgel AL, Marques-Costa C, Bezerra-Fernandes P, Chay-Canul AJ. 2023. Comparison of mathematical models to estimate live weight from heart girth in growing Pelibuey sheep. Revista Colombiana de Ciencias Pecuarias 36(2):89-97.

Cedden F, Cemal I, Daşkıran I, Esenbuğa N, Gül S, Kandemir Ç, Karaca O, Kaymakçı M, Keskin M, Koluman N, Koşum N, Koyuncu M, Köycü E, Özder M, Savaş T, Taşkın T, Tölü C, Ulutaş Z, Yılmaz O, Yurtman, Yİ. 2020. Türkiye küçükbaş hayvancılığında mevcut durum ve gelecek. Türkiye Ziraat Mühendisliği IX. Teknik Kongresi, 13-17 January 2020, Ankara, s.133-152.

Çakmakçı C. 2022. Live weight prediction in Norduz sheep using machine learning algorithms. Turkish Journal of Agriculture - Food Science and Technology 10(4):587-594.

Demirhan SA, Şahinler N. 2022. The importance of some animal products for nutrition and health. Turkish Journal of Agriculture - Food Science and Technology 10(sp1):2696-2700.

European Union (2010). European Union Directive 2010/63/EU of the European parliament and of the council of 22 September 2010 on the protection of animals used for scientific purposes. Official Journal of the European Union Legislation, 276:33–79.

Faraz A, Tirink C, Eyduran E, Waheed A, Tauqir NA, Nabeel MS, Tariq MM. 2021. Prediction of live body weight based on body measurements in Thalli sheep under tropical conditions of Pakistan using CART and MARS. Tropical Animal Health and Production 53:1-12.

Farvid MS, Sidahmed E, Spence ND, Mante Angua K, Rosner BA, Barnett JB. 2021. Consumption of red meat and processed meat and cancer incidence: a systematic review and meta-analysis of prospective studies. European Journal of Epidemiology 36:937-951.

Haslin E, Corner-Thomas RA, Kenyon PR, Pettigrew EJ, Hickson RE, Morris ST, Blair HT. 2022. Effects of heavier live weight of ewe lambs at mating on fertility, lambing percentage, subsequent live weight and the performance of their progeny. New Zealand Journal of Agricultural Research 65(2-3):114-128.

He C, Qiao Y, Mao R, Li M, Wang, M. 2023. Enhanced LiteHRNet based sheep weight estimation using RGB-D images. Computers and Electronics in Agriculture 206:107667.

Huma ZE, Iqbal F. 2019. Predicting the body weight of Balochi sheep using a machine learning approach. Turkish Journal of Veterinary and Animal Sciences 43(4):500-506.

Kausar T, Hanan E, Ayob O, Praween B, Azad Z. 2019. A review on functional ingredients in red meat products. Bioinformation 15(5):358-362.

Kilkenny C, Browne WJ, Cuthill IC, Emerson M, Altman DG. 2010. Improving bioscience research reporting: the ARRIVE guidelines for reporting animal research. Journal of Pharmacology and Pharmacotherapeutics 1(2):94-99.

Kutan P, Keskin M. 2022. Lamb development traits and phenotypic correlations between different body measurements and fattening performance characteristics in Awassi sheep. Mustafa Kemal Üniversitesi Tarım Bilimleri Dergisi 27(1):109-114.

Pellicer-Rubio MT, Laignel G, Thomas Y, Prache S, Benoit M, Tournadre H. 2023. Reproductive performance in two organic sheep farming systems differing by the number of mating sessions in and out of the breeding season. Theriogenology 195:238-248.

Pereira PMDC, Vicente AFDRB. 2013. Meat nutritional composition and nutritive role in the human diet. Meat Science 93(3):586-592.

Posbergh CJ, Huson HJ. 2021. All sheeps and sizes: a genetic investigation of mature body size across sheep breeds reveals a polygenic nature. Animal Genetics 52(1):99-107.

Sabbioni A, Beretti V, Superchi P, Ablondi M. 2020. Body weight estimation from body measures in Cornigliese sheep breed. Italian Journal of Animal Science 19(1):25-30.

Salazar-Cuytun ER, Sarmiento-Franco LA, Aguilar-Caballero AJ, Fonseca MA, Tedeschi LO. 2020. Body mass index and body chemical components in Pelibuey ewes. Ecosistemas y Recursos Agropecuarios 7(2):e2515.

Salimovich MB, Vafoevna AM. 2022. The Relationship of body length and width of Karakul lambs. Texas Journal of Agriculture and Biological Sciences 9:41-42.

Saraçoğlu T, Yılmaz O, Ata N. 2016. Comparison of digital and manuel measurements of some body dimensions in Karya sheep. Journal of Agricultural Faculty of Bursa Uludag University 30:269-273.

SAS 1999. The SAS System. Version 8. Copyright (c) 1999 by SAS Institute Inc., Cary, NC, USA.

Silva Souza JD, do Santos Difante G, Neto JVE, Lana ÂMQ, da Silva Roberto FF, Ribeiro PHC. 2019. Biometric measurements of Santa Inês meat sheep reared on Brachiaria brizantha pastures in Northeast Brazil. PloS One 14(7):e0219343.

Tahtali Y. 2019. Use of factor scores in multiple regression analysis for estimation of body weight by certain body measurements in Romanov lambs. The Journal of Life and Environment 7:e7434.

Teixeira A, Silva S, Guedes C, Rodrigues S. 2020. Sheep and goat meat processed products quality: A review. Foods 9(7):960-981.

Tırınk C, Tosun R, Saftan M, Kaya E, Atalay Aİ. 2022. Prediction of birth weight from body measurements with the CART algorithm in Morkaraman lambs. Large Animal Review 28(4):187-192.

Tunio SA, Naeem M, Behan AA, Kaka A. 2023. Effect of different management systems on growth and carcass traits of post weaned male Kachhi lambs. Journal of Animal Health and Production 11(1):14-19.

Whannou HRV, Afatondji CU, Ahozonlin MC, Spanoghe M, Lanterbecq D, Demblon D, Houinato MRB, Dossa, LH. 2021. Morphological variability within the indigenous sheep population of Benin. PloS One 16(10):e0258761.

Wishart H, Morgan-Davies C, Stott A, Wilson R, Waterhouse T. 2017. Live weight loss associated with handling and weighing of grazing sheep. Small Ruminant Research 153: 163-170.

Ye Y, Eyres GT, Reis MG, Schreur, NM, Silcock P, Agnew MP, Johnson PL, Maclean P, Realini CE. 2020. Fatty acid composition and volatile profile of m. longissimus thoracis from commercial lambs reared in different forage systems. Foods 9(12):1885.

Yilmaz O, Kizilaslan M, Arzik Y, Behrem S, Ata N, Karaca O, Elmaci C, Cemal I. 2022. Genome-wide association studies of preweaning growth and in vivo carcass composition traits in Eşme sheep. Journal of Animal Breeding and Genetics 139(1):26-39.

Yilmaz O, Cemal I, Karaca O. 2013. Estimation of mature live weight using some body measurements in Karya sheep. Tropical Animal Health and Production 45(2):397-403.

Yılmaz O, Ocak S, Ogun S. 2016. Ultrasonic carcass assessment of Dorper and Dorper x Merino lambs using MLD and body measurements. Turkish Journal of Agriculture - Food Science and Technology 4(5):395-400.