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Effects of Some Environmental Factors on Morphological Characteristics of Yalova Genotype

Yalova Genotipinin Morfolojik Özellikleri Üzerine Bazı Çevre Faktörlerinin Etkileri

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Keywords: Body measurements, indigenous breed, live weight, Yalova sheep.

ABSTRACT

Objective: This study aimed to determine the live weight, the body measurements and their morphological features, and the effect of some environmental factors on morphological characteristics of Yalova sheep.

Materials and Methods: The research material was consisted of 1-5≤ year old 250 ewes from 5 flocks and 1-4 year old 70 rams from 13 flocks. Live weight, withers height, back height, rump height, body length, tail length, rump width, chest width, chest depth, chest girth, thigh circumstances, cannon bone girth, head length, head width, forehead width, ear length and ear width of Yalova genotype was measured.

Results: The average live weight of Yalova genotype was found as 55.63 and 85.75 kg for ewes and rams, respectively. Overall means of some characters of ewes were found as withers height, back height, rump width, body length, rump width, chest width, chest depth, chest girth and tail length 71.30, 70.40, 71.21, 71.43, 22.70, 21.53, 32.72, 93.41 and 20.50 cm, respectively. The effect of flock factor for ewes were found to be statistically significant on rump height ($p<0.05$) and body length, ($p<0.01$), and on all of the other examined features ($p<0.001$). For ewes, the age factor was statistically significant on live weight, chest depth, chest girth, head length ($p<0.001$) and ear length ($p<0.05$).

Conclusion: Yalova genotype was revealed morphological characteristics different from pure Kıvırcık sheep. Besides Yalova genotype is different from other indigenous breeds due to its short tail with low fleece or no naked tail.

Anahtar Kelimeler: Canlı ağırlık, vücut ölçüleri, Yalova koyunu, yerli ırklar.

ÖZ

Amaç: Bu çalışmanın amacı, Yalova koyunlarının canlı ağırlık ve vücut ölçülerini tespit etmek ve bu koyunların morfolojik özelliklerini etkileyen bazı çevre faktörlerini belirlemektir.

Materyal ve Yöntem: Araştırma materyalini 5 işletmeden 1-5≤ yaşlı 250 dişi ve 13 işletmeden 1-4 yaşlı 70 baş Yalova koçu oluşturmuştur. Yalova koyunlarının canlı ağırlık, cidago yüksekliği, sırt yüksekliği, sağrı yüksekliği, vücut uzunluğu, kuyruk uzunluğu, sağrı genişliği, göğüs genişliği, göğüs derinliği, göğüs çevresi, but çevresi, incik çevresi, baş uzunluğu, baş genişliği, alın genişliği, kulak uzunluğu ve kulak genişliği ölçüleri alınmıştır.

Bulgular: Yalova koyunlarında ortalama canlı ağırlık koyun ve koçlarda sırasıyla 55.63 ve 85.75 kg olarak bulunmuştur. Koyunların cidago yüksekliği, sırt yüksekliği, sağrı yüksekliği, vücut uzunluğu, kuyruk uzunluğu, sağrı genişliği, göğüs genişliği, göğüs derinliği, göğüs çevresi, but çevresi, incik çevresi, baş uzunluğu, baş genişliği, alın genişliği, kulak uzunluğu ve kulak genişliği gibi bazı vücut özelliklerinin genel ortalamaları sırasıyla 71.30, 70.40, 71.21, 71.43, 22.70, 21.53, 32.72, 93.41±0.34 ve 20.50 cm olarak bulunmuştur. Sürü faktörünün etkisi sağrı yüksekliği ($p<0.05$), vücut uzunluğu üzerine ($p<0.01$) diğer incelenen özelliklerin hepsi üzerinde $p<0.001$ düzeyinde istatistik olarak önemli bulunmuştur. Dişiler için yaş faktörü canlı ağırlık, göğüs derinliği, göğüs çevresi, baş uzunluğu ($p<0.001$) ve kulak uzunluğu ($p<0.05$) üzerinde istatistik olarak önemli bulunmuştur.

Sonuç: Yalova genotipi koyunların, saf Kıvırcık koyunlarından morfolojik özellikler bakımından farklı olduğu ortaya çıkmıştır. Aynı zamanda Yalova koyunu, kısa yapılı kuyruğunun az yapağılı veya yapağısız olması ile diğer yerli ırklardan da farklılık göstermektedir.

INTRODUCTION

Turkey is one of the world's leading countries in terms of the presence of sheep population, having 37.276 million heads of the sheep. In Turkey, sheep are reared under various traditional farming systems, generally extensive and the majority of sheep population is composed of indigenous breeds and varieties that have not to yield but well adapted to their region (TUIK, 2019).

Turkey hosts a wide range of biodiversity due to its biogeographic location. This situation also causes to rear different indigenous sheep breeds and varieties in Turkey. Indigenous sheep breeds in Turkey show many genetic variations even within a breed. It is also known that new ecotypes well adapted to the region are rearing as a result of controlled or uncontrolled crossbreeding.

The morphological characteristics of Yalova sheep resemble Kıvırcık sheep. Kıvırcık sheep is one of the Turkish sheep breeds and raised in the western Anatolion. Kıvırcık is thin tailed and known with its meat quality and high palatability. Variation of Turkish sheep breeds has been researched in recent years. Environmental factors are known to cause some morphological differences even within the same breed. Some studies are suggesting that Kıvırcık sheep in Yalova is a subtype/variety of Kıvırcık breed (Kaymakçı, 2010; Alarslan and Aygün, 2019a; Alarslan and Aygün, 2019b). However, with the genetic diversity analysis, it was revealed that the Yalova genotype was genetically separated from Kıvırcık, Tahirova and Eşme sheep (Anonymous, 2020).

The Yalova sheep has white body, head and feet. Black spots can be rarely seen on the head and feet. The ewes are generally hornless (small horns can be found), whereas rams have spiral horns that extend sideways. The nose is convex. Yalova genotype has a lower distribution of fleece on the dorsal and dorsolateral, bare chest and abdomen, a short tail with low fleece or no naked tail (Alarslan and Aygün, 2019a; Alarslan and Aygün, 2019b).

External structure features of sheep are important to define breeds and varieties, to determine their characteristics, to reveal similarities and differences, and to follow growth and development. It also helps to maintain conservation and breeding programs more effectively.

This study aimed to determine the live weight, the body measurements and their morphological features, and the effect of some environmental factors on morphological characteristics of Yalova genotype.

This research is a descriptive study.

MATERIALS and METHODS

The study was carried out in Yalova province under extensive conditions in 2019. The research material was consisted of 1-5≤ year old 250 ewes from 5 flocks and 1-4 year old 70 rams from 13 flocks. The sheep were weighed on a 100 g sensitive bascule to determine live weight (LW) after 12 hours of starvation. Body measurements of sheep measured with a measuring stick and a tape measure as taking by Ertuğrul (1991), Karaca et al. (2012) and Fao (2012) after the sheep were sheared and put on a normal standing position on a flat surface.

Body measurements were determined as below.

Withers height (WH): The vertical distance between the highest point of the withers and the ground. Back height (BH): The vertical distance between the highest point of the last dorsal protrusion and the ground. Rump height (RH): The vertical distance between the highest point of the sacrum and the ground. Body length (BL): The horizontal distance between caput humeri and tuber ischii. Tail length (TL): The distance from the bottom to the tip of the tail. Rump width (RW): The horizontal distance between the right and left tuber coxae. Chest width (CW): Horizontally measured distance right behind the caput humeri. Chest depth (CD): The vertical distance between the withers and the sternum. Chest girth (CG): The circumference measured right behind the scapulae. Thigh circumstances (TC): Girth from the posterior extremity of the tuber coxae to the top of the tuber ischii. Cannon bone girth (CBG): The circumference of mid metacarpus. Head length (HL): The distance from the crista occipitalis to the end of the incisivum. Head width (HW): The distance between the outer ends of both eyes. Forehead width (FW): The distance from the highest point of the forehead to the line connecting the inner angles of the eyes. Ear length (EL): The distance from the bottom to the tip of the ear. Ear width (EW): The transversely measured distance from the middle of the ear.

Figure 1. Yalova genotype.
Şekil 1. *Yalova genotipi*

Figure 2. Yalova genotype.
Şekil 2. *Yalova genotipi*

Figure 3. Yalova genotype.
Şekil 3. *Yalova genotipi*

The mathematical model used for analysis of variance is presented below:

$$Y_{ijk} = \mu + a_i + b_j + e_{ijk} \quad (1)$$

Y_{ijk} = Observations for live weight and body measurements

μ = Overall mean of the trait

a_i = Effect of flock (i = 1, 2 ,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)

b_j = Effect of age (j = 1, 2, 3, 4, 5≤),

e_{ijk} = Independent and random error

The analysis of data was performed by the least square means method and Duncan's multiple-range test using SPSS 23 software (SPSS, 2015). In addition, phenotypic correlations between live weight and body measurements were detected.

RESULT and DISCUSSION

Live weight, height and body length measurements are shown in Table 1. Table 2 demonstrates the width and circumference measurements. Head measurements and phenotypic correlation coefficients between live weight and body measurements are indicated in Table 3 and 4, respectively.

The average live weight of Yalova genotype was found as 55.63 kg and 85.75 kg for ewes and rams, respectively. This weight of for Kıvırcık ewes was determined higher than Çelik's (49.44 kg) (Çelik, 1995) and Yılmaz and Altin's studies (48 and 44 kg) (2004), Yilmaz et al. (2004) reported 55.2 kg and Koyuncu et al. (2018) reported 57.1 kg similar result with this study. Live weight of Yalova genotype compared to other indigenous breeds like Akkaraman, Dağlıç, İvesi,

Çine Çaparı, Güney Karaman, Karagül, Tuj, Sakız (Chios), Herik, Karayaka, Bafra, Gıcık, Gökçeada (Imroz), Pırlak and Karya is higher, whereas Acıpayam, Malya, Norduz, Karacabey Merino and Kangal sheep breeds are heavier than Yalova genotype. The weights of Hemşin, Morkaraman, Kıvırcık x Akkaraman (F_1) are similar with Yalova genotype (Çimen et al., 2003; Ünal et al., 2004; Ural, 2015; Özbeyaz et al., 2018; Anonymous, 2019).

The withers height was found as 71.30 cm for ewes and 80.30 cm for rams. A study reported that the wither height of Kıvırcık is 64 cm and 69 cm for ewes and rams, respectively Özcan (1970a and 1970b) and Anonymous (2019) found these values as 66 cm and 65 cm for the Kıvırcık sheep. The withers height of Yalova genotype is higher than Akkaraman, Morkaraman, Dağlıç, İvesi (Awassi), Çine Çaparı, Güney Karaman, Karagül, Tuj, Herik, Karayaka, Gökçeada (Imroz), Pırlak, Zom breeds, similar to Karya, Sakız (Chios), Hemşin, Norduz, Karacabey Merino and lower than Kangal Akkaraman (Yılmaz ve ark., 2011; Koncagül et al., 2012; Yılmaz et al., 2013; Özbeyaz et al., 2018; Anonymous, 2019).

Table 1. The least square means for body weight, height and some lenght measurements and multiple-range test in Yalova genotype.
Tablo 1. *Yalova genotipinde vücut ağırlığı, yükseklik ve bazı uzunluk ölçülerine ait en küçük kareler ortalamaları ve çoklu karşılaştırmaları.*

		Live weight (kg)		**Withers height (cm)**		**Back height (cm)**		**Rump height (cm)**		**Body length (cm)**		**Tail length (cm)**	
Factor	n	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max
						Female							
Flock		***		**				*		**		***	
1	50	59.60±1.00^{a}	49.00-77.00	71.04±0.47^{ab}	63-78	70.74±0.45	63-77	71.54±0.45^{ab}	63-77	71.64±0.41^{ab}	64-78	19.54±0.51^{c}	10-27
2	50	55.71±0.76^{b}	43.70-65.00	71.84±0.36^{a}	65-79	70.32±0.39	64-79	71.52±0.40^{ab}	65-80	71.60±0.36^{ab}	64-79	21.34±0.47^{ab}	12-28
3	50	53.38±0.86^{b}	43.10-67.60	71.12±0.32^{ab}	67-76	70.30±0.30	67-75	70.68±0.31^{bc}	66-75	71.26±0.27^{bc}	68-76	22.08±0.5^{a}	15-30
4	50	49.27±0.71^{c}	40.30-60.60	70.44±0.40^{b}	60-77	69.54±0.43	60-78	70.36±0.42^{c}	60-77	70.34±0.38^{c}	59-76	19.14±0.41^{c}	12-26
5	50	60.20±1.04^{a}	49.00-79.70	72.02±0.32^{a}	68-79	70.84±0.31	67-77	71.94±0.33^{a}	67-77	72.32±0.29^{a}	68-78	20.38±0.40^{bc}	13-26
Age		***											
1	40	50.30±0.82^{b}	40.30-63.20	71.23±0.40	63-77	70.10±0.33	63-75	71.10±0.40	64-77	71.20±0.35	65-76	20.40±0.60	12-29
2	42	55.80±0.85^{a}	44.30-65.60	71.70±0.40	68-79	70.60±0.34	65-77	71.43±0.34	67-77	71.71±0.32	68-78	20.80±0.55	11-28
3	72	56.12±0.80^{a}	43.70-79.70	70.70±0.32	60-76	70.11±0.34	60-76	70.90±0.35	60-77	70.94±0.32	59-76	20.40±0.40	12-29
4	45	58.50±1.40^{a}	41.00-79.60	71.84±0.44	65-78	70.71±0.40	64-77	71.73±0.43	64-77	72.10±0.42	66-78	20.62±0.51	12-30
5≤	51	56.47±1.04^{a}	43.10-74.40	71.40±0.40	64-79	70.43±0.45	64-79	71.16±0.41	65-80	71.50±0.36	66-79	20.43±0.50	10-27
General	250	55.63±0.50	40.30-79.70	71.30±0.17	60-79	70.40±0.17	60-79	71.21±0.17	60-80	71.43±0.16	59-79	20.50±0.21	10-30
						Male							
Flock												*	
1	4	90.60±3.24	84.40-99.20	75.50±1.19	72-77	76.00±0.71	74-77	76.25±0.85	74-78	78.25±0.90	76-80	25.25±1.75^{bc}	21-29
2	5	80.90±3.02	74.60-92.10	80.80±1.60	75-84	79.60±1.50	74-82	81.20±1.71	75-84	81.00±1.40	76-83	27.00±0.54^{ab}	25-28
3	5	89.70±8.02	75.40-114.40	83.20±1.00	80-86	82.40±1.00	80-86	83.00±1.00	80-86	83.00±1.00	80-86	30.40±1.60^{a}	27-34
4	5	91.40±5.62	74.00-101.00	81.60±2.32	74-87	80.60±2.21	73-86	81.00±2.50	73-87	80.80±2.33	73-87	26.80±0.60^{ab}	25-28
5	7	80.30±4.81	60.70-95.80	78.60±1.00	76-84	77.30±1.10	74-83	78.14±1.10	75-84	78.30±1.10	76-84	27.30±0.71^{ab}	24-29
6	5	89.40±2.93	82.10-97.50	83.40±0.70	82-86	82.00±1.10	80-86	83.00±0.60	82-85	82.80±0.80	82-86	26.20±2.22^{abc}	19-33
7	3	93.40±1.90	90.80-97.00	80.33±0.90	79-82	79.00±0.58	78-80	80.33±1.00	79-82	80.33±0.90	79-82	27.00±1.00^{ab}	25-28
8	15	83.22±2.90	63.80-102.50	79.90±0.80	71-84	78.53±0.70	71-82	79.53±0.83	70-84	79.60±0.70	72-83	26.93±0.90^{ab}	21-34
9	3	83.40±2.02	80.30-87.20	79.33±3.20	73-83	78.70±3.40	72-83	79.00±3.51	72-83	79.70±3.40	73-84	23.33±2.33^{bc}	19-27
10	2	77.30±5.65	71.60-82.90	81.00±4.00	77-85	78.50±4.50	74-83	79.50±3.50	76-83	80.00±4.00	76-84	21.50±0.50^{c}	21-22
11	4	80.50±6.43	67.30-94.50	79.00±2.00	75-84	77.75±2.30	73-83	78.75±2.14	74-84	79.00±2.00	75-84	24.50±1.32^{bc}	22-28
12	4	87.23±6.82	73.30-99.80	80.50±1.20	79-84	79.25±1.00	78-82	80.25±1.00	79-83	80.25±1.00	79-83	23.75±0.75^{bc}	22-25
13	8	89.63±3.11	77.10-102.60	80.90±1.30	75-86	79.90±1.20	75-84	80.13±1.33	75-86	80.90±1.41	75-87	25.25±1.16^{bc}	21-30
Age		***		*						*			
1	20	77.75±1.90^{c}	60.70-92.40	79.60±0.80^{b}	72-84	78.40±0.75	73-83	79.45±0.80	73-84	79.60±0.74^{ab}	73-84	26.75±0.79	21-34
2	20	84.75±2.62^{b}	63.80-114.40	79.20±0.82^{b}	71-86	78.30±0.85	71-86	78.75±0.90	70-86	79.15±0.80^{b}	72-86	26.50±0.78	19-34
3	17	92.55±1.50^{a}	82.90-102.50	82.20±0.80^{a}	76-87	80.82±0.73	76-86	81.77±0.70	77-87	81.77±0.70^{a}	77-87	24.94±0.63	19-29
4	13	90.63±2.70^{ab}	74.60-102.60	80.62±0.80^{ab}	75-86	79.62±0.74	74-84	80.50±0.81	75-86	81.00±0.76^{ab}	76-87	26.80±0.93	21-34
General	70	85.74±1.30	60.70-114.40	80.30±0.42	71-87	79.20±0.41	71-86	80.00±0.42	70-87	80.24±0.40	72-87	26.24±0.39	19-34

*: p<0.05; **: p<0.01; ***: p<0.001; a, b, c: Values in same column not having a common superscript differ significantly (p<0.05).

Table 2. The least square means for width, circumference measurements and multiple-range test in Yalova genotype.
Tablo 2. *Yalova genotipinde genişlik ve çevre ölçülerine ait en küçük kareler ortalamaları ve çoklu karşılaştırmaları.*

		Rump width (cm)		Chest width (cm)		Chest depth (cm)		Chest girth (cm)		Thigh circumstances (cm)		Cannon bone girth (cm)	
Factor	n	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max	$\overline{X}\pm S_{\overline{X}}$	Min-Max
Female													
Flock		***		***		***		***		***		***	
1	50	23.62±0.34^{a}	19-34	22.56±0.24^{a}	19-27	33.26±0.27^{a}	27-37	96.38±0.85^{a}	84-110	82.10±0.74^{bc}	69-96	8.18±0.07^{a}	7-9
2	50	22.70±0.20^{b}	20-26	21.72±0.21^{b}	19-25	32.40±0.20^{b}	29-35	92.48±0.70^{b}	79-104	80.78±0.65^{c}	69-97	7.96±0.08^{ab}	7-9
3	50	21.72±0.23^{c}	19-26	20.40±0.23^{c}	17-23	33.12±0.20^{a}	30-36	92.38±0.61^{b}	85-103	82.24±0.63^{bc}	74-93	7.84±0.07^{bc}	7-9
4	50	22.02±0.18^{bc}	20-25	20.32±0.17^{c}	18-24	31.62±0.21^{c}	29-35	89.54±0.55^{c}	81-99	82.80±0.71^{b}	61-94	7.70±0.07^{c}	7-9
5	50	23.42±0.18^{a}	20-26	22.66±0.17^{a}	21-26	33.24±0.24^{a}	30-37	96.26±0.65^{a}	89-107	87.52±0.51^{a}	79-98	8.00±0.08^{ab}	7-9
Age						***		***					
1	40	22.03±0.21	19-24	21.13±0.24	18-25	31.33±0.24^{c}	29-36	89.50±0.67^{b}	81-100	81.85±0.85	61-90	7.85±0.92	7-9
2	42	23.00±0.34	20-34	21.93±0.27	19-26	32.43±0.26^{b}	27-37	93.81±0.81^{a}	83-104	84.00±0.62	69-90	7.93±0.93	7-9
3	72	22.94±0.18	20-27	21.64±0.21	17-26	32.84±0.20^{ab}	29-37	93.82±0.60^{a}	85-108	83.43±0.70	73-97	7.94±0.06	7-9
4	45	22.73±0.27	19-27	21.51±0.28	17-25	33.30±0.22^{a}	31-36	94.60±0.88^{a}	79-107	83.53±0.74	74-98	7.93±0.08	7-9
5≤	51	22.60±0.26	19-27	21.40±0.26	18-27	33.40±0.22^{a}	30-37	94.53±0.80^{a}	83-110	82.50±0.73	69-96	7.94±0.10	7-9
General	250	22.70±0.11	19-34	21.53±0.11	17-27	32.72±0.11	27-37	93.41±0.34	79-110	83.10±0.33	61-98	7.92±0.04	7-9
Male													
Flock										***			
1	4	27.50±1.04	25-30	26.75±0.63	25-28	38.75±0.75	37-40	107.75±1.93	104-113	95.50±2.40^{bc}	89-100	10.25±0.25	10-11
2	5	26.00±0.63	24-28	25.00±0.55	23-26	37.20±0.60	36-39	101.80±1.71	96-105	90.40±3.14^{c}	78-95	9.60±0.25	9-10
3	5	28.20±1.10	25-31	26.60±1.10	24-29	35.80±2.20	28-40	109.40±4.10	100-120	99.40±2.73^{bc}	94-107	10.20±0.20	10-11
4	5	27.00±0.71	25-29	27.20±0.37	26-28	38.20±1.00	35-40	111.60±2.90	102-119	100.00±1.00^{bc}	97-103	9.40±0.51	8-11
5	7	28.00±0.40	27-29	25.90±0.80	22-28	37.14±0.90	34-40	105.00±2.14	97-114	98.14±2.00^{bc}	91-106	9.43±0.30	8-10
6	5	26.00±0.71	24-28	25.20±1.10	23-29	36.20±0.92	34-38	103.40±2.82	98-112	98.60±2.73^{bc}	90-107	9.40±0.25	9-10
7	3	28.00±1.53	26-31	27.33±0.70	26-28	39.00±1.00	37-40	112.70±1.20	111-115	103.00±0.60^{ab}	102-104	9.70±0.33	9-10
8	15	27.73±0.63	22-33	25.90±0.60	22-30	37.53±0.73	33-42	109.33±2.06	92-124	105.10±1.63^{ab}	94-114	9.60±0.13	9-10
9	3	26.33±1.00	25-28	27.00±0.00	27-27	36.00±0.60	35-37	107.33±1.33	106-110	110.33±4.10^{a}	103-117	10.00±0.00	10-10
10	2	25.50±1.50	24-27	24.50±1.50	23-26	37.00±2.00	35-39	103.50±6.50	97-110	96.00±3.00^{bc}	93-99	9.50±0.50	9-10
11	4	27.00±1.10	25-30	26.00±1.41	24-30	36.50±1.60	33-40	108.00±4.70	96-118	100.25±6.50^{bc}	89-119	9.75±0.25	9-10
12	4	28.25±0.63	27-30	27.00±1.15	25-29	37.50±1.32	34-40	110.00±4.40	102-119	97.75±5.00^{bc}	83-104	9.75±0.25	9-10
13	8	26.90±0.58	25-29	26.12±0.44	24-28	37.50±0.80	35-41	111.75±1.90	104-118	110.50±1.48^{a}	104-116	9.75±0.16	9-10
Age		**		**		***		***					
1	20	26.05±0.26^{b}	24-28	25.00±0.38^{b}	22-29	35.15±0.55^{c}	28-40	102.75±1.10^{b}	96-112	97.60±1.51	89-117	9.45±0.15	8-10
2	20	28.30±0.42^{a}	25-33	26.35±0.39^{a}	23-30	37.30±0.48^{b}	33-40	109.45±1.75^{a}	92-124	103.00±1.61	83-113	9.65±0.13	9-11
3	17	27.18±0.50^{ab}	22-31	27.00±0.48^{a}	22-30	38.82±0.27^{a}	37-40	111.90±0.94^{a}	105-118	103.24±2.00	89-119	9.90±0.12	9-11
4	13	27.62±0.53^{a}	24-30	26.40±0.45^{a}	23-29	38.54±0.62^{ab}	35-42	109.54±2.00^{a}	96-119	102.15±2.73	78-115	9.85±0.15	9-11
General	70	27.30±0.23	22-33	26.13±0.23	22-30	37.30±0.30	28-42	108.14±0.83^{b}	92-124	101.40±1.00	78-119	9.70±0.07	8-11

*: p<0.05; **: p<0.01; ***: p<0.001; a, b, c: Values in same column not having a common superscript differ significantly (p<0.05).

Back height, rump width, body length, rump width, chest width, chest depth and chest girth of Yalova genotype was higher than the reported values for Kivircik sheep. Head measurements were determined as similar to Kıvırcık. All these measurements of Yalova genotype were determined as higher than İvesi (Awassi), Gökçeada (Imroz), Dağlıç, Tuj, Akkaraman, Karayaka, Çine Çaparı, Güney Karaman breeds, whereas these values were similar with Sakız (Chios), Morkaraman, Norduz, Kangal, Hemşin (Yılmaz et al., 2011; Özbeyaz et al., 2018; Anonymous, 2019).

Tail length, one of the remarkable features of Yalova genotype, was determined as 20.50 cm in ewes and 26.24 cm in rams. This length was determined to be shorter than Kıvırcık rams (36.4 cm) and ewes (35.3 cm) in a study previously reported. It is also shorter than Sakız (Chios), Gökçeada (Imroz), Karayaka, Zom, Karagül, Tuj, Çine Çaparı breeds (Özcan, 1970a; Anonymous, 2009, Erol and Akçadağ, 2009; Koncagül et al., 2012).

In this study, the effect of flock factor for ewes was found to be statistically significant on rump height and body length, (p<0.05 and p<0.01, respectively), and on all of the other examined features (p<0.001). There was not any significant effect of flock factor on back height. For ewes, the age factor was statistically significant on live weight, chest depth, chest girth, head length (p<0.001) and ear length (p<0.05).

The effect of flock factor for rams on tail length (p<0.05), thigh circumference (p<0.001), head length (p<0.05), head width (p<0.001), ear length (p<0.05) and ear width (p<0.05) was found statistically important. It also was found that the effect of age on live weight, withers height, body length, rump width, chest width, chest depth and chest girth in rams was statistically significant (p<0.05, p<0.01 and p<0.001)

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Table 3. The least square means for head measurements and multiple-range test in Yalova genotype.
Tablo 3. *Yalova genotipinde kafa ölçülerine ait en küçük kareler ortalamaları ve çoklu karşılaştırmaları.*

		Head length (cm)		Head width (cm)		Forehead width (cm)		Ear length (cm)		Ear width (cm)	
Factor	n	$\overline{X} \pm S_{\overline{x}}$	Min-Max	$\overline{X} \pm S_{\overline{x}}$	Min-Max	$\overline{X} \pm S_{\overline{x}}$	Min-Max	$\overline{X} \pm S_{\overline{x}}$	Min-Max	$\overline{X} \pm S_{\overline{x}}$	Min-Max
						Female					
Flock		***		***		***		***		***	
1	50	27.92±0.19^{a}	25-31	15.80±0.20^{a}	12-19	10.42±0.10^{a}	9-12	12.40±0.17^{ab}	9-15	7.80±0.12^{a}	6-10
2	50	26.34±0.27^{bc}	16-29	14.06±0.12^{b}	12-16	9.68±0.11^{b}	8-11	12.12±0.17^{b}	10-15	7.84±0.09^{a}	6-10
3	50	26.84±0.17^{b}	23-30	13.90±0.12^{b}	11-16	10.50±0.10^{a}	8-12	12.26±0.16^{ab}	10-14	7.40±0.09^{b}	6-9
4	50	25.22±0.20^{d}	21-28	13.40±0.10^{c}	12-15	10.20±0.10^{a}	8-12	11.58±0.13^{c}	10-14	7.22±0.08^{b}	6-8
5	50	26.10±0.21^{c}	23-30	13.48±0.14^{c}	11-16	10.26±0.11^{a}	9-13	12.62±0.17^{a}	11-15	7.46±0.08^{b}	6-9
Age		***						*			
1	40	25.20±0.21^{c}	21-27	13.80±0.21^{c}	12-17	10.05±0.11	8-12	12.30±0.16^{ab}	10-14	7.65±0.10	6-9
2	42	26.30±0.22^{b}	23-29	13.90±0.14^{c}	12-16	10.17±0.13	8-13	11.81±0.20^{b}	10-15	7.52±0.08	6-8
3	72	26.50±0.23^{b}	16-31	14.24±0.17^{ab}	11-19	10.33±0.10	8-12	12.15±0.13^{ab}	9-15	7.44±0.07	6-9
4	45	27.00±0.22^{ab}	24-30	14.18±0.18^{ab}	11-18	10.27±0.12	8-12	12.13±0.17^{ab}	10-15	7.53±0.11	6-10
5≤	51	27.24±0.21^{a}	23-31	14.43±0.20^{a}	12-18	10.16±0.12	8-12	12.60±0.17^{a}	10-15	7.63±0.12	6-10
General	250	26.50±0.11	16-31	14.13±0.08	11-19	10.21±0.05	8-13	12.20±0.07	9-15	7.54±0.04	6-10
						Male					
Flock		*		***				*		*	
1	4	28.75±1.32^{d}	25-31	17.75±0.25^{a}	17-18	12-25±0.85	10-14	13.75±0.75^{a}	13-16	8.50±0.30^{ab}	8-9
2	5	30.20±0.73^{bcd}	29-33	17.20±0.37^{ab}	16-18	11.80±0.37	11-13	12.00±0.45^{bc}	11-13	8.00±0.00^{abc}	8-8
3	5	31.40±0.68^{abc}	30-34	16.60±0.40^{abc}	16-18	13.20±0.50	12-14	14.00±0.32^{a}	13-15	8.60±0.40^{a}	8-10
4	5	29.80±1.00^{cd}	27-32	16.40±0.75^{abcd}	15-19	13.40±0.51	12-15	12.40±0.60^{abc}	10-13	7.40±0.25^{c}	7-8
5	7	32.57±0.65^{ab}	30-35	15.14±0.34^{cde}	14-16	12.90±0.26	12-14	13.14±0.30^{ab}	12-14	7.71±0.30^{abc}	7-9
6	5	30.60±1.21^{abcd}	26-33	14.80±0.37^{e}	14-16	13.00±0.32	12-14	13.60±0.25^{ab}	13-14	7.80±0.20^{abc}	7-8
7	3	33.00±1.00^{a}	32-35	15.70±0.33^{cde}	15-16	13.33±0.33	13-14	11.33±0.90^{c}	10-13	7.70±0.33^{abc}	7-8
8	15	30.80±0.24^{abcd}	29-33	15.13±0.24^{cde}	14-17	12.30±0.21	11-14	13.13±0.32^{ab}	11-16	7.60±0.16^{bc}	7-9
9	3	31.00±0.60^{abcd}	30-32	15.70±0.70^{cde}	15-17	12.00±0.00	12-12	13.33±0.70^{ab}	12-14	7.33±0.33^{c}	7-8
10	2	30.00±0.00^{cd}	30-30	15.00±1.00^{de}	14-16	12.00±0.00	12-12	13.00±1.00^{ab}	12-14	8.50±0.50^{ab}	8-9
11	4	30.50±0.50^{bcd}	30-32	15.50±0.30^{cde}	15-16	13.00±0.71	12-15	12.75±0.25^{abc}	12-13	8.00±0.00^{abc}	8-8
12	4	30.75±0.48^{abcd}	30-32	16.00±0.41^{bcde}	15-17	12.00±0.60	11-13	13.00±0.41^{bc}	12-14	7.75±0.25^{abc}	7-8
13	8	30.63±0.26^{abcd}	30-32	15.50±0.33^{cde}	14-17	12.38±0.18	12-13	13.25±0.25^{ab}	12-14	7.90±0.23^{abc}	7-9
Age											
1	20	30.65±0.43	25-35	15.40±0.27	14-18	12.45±0.25	10-15	13.05±0.20	11-14	7.90±0.16	7-10
2	20	30.90±0.36	27-35	15.90±0.30	14-19	12.60±0.22	11-15	13.05±0.25	10-15	7.65±0.15	7-9
3	17	30.71±0.45	26-34	15.71±0.25	14-18	12.71±0.20	11-14	13.18±0.35	10-16	8.00±0.14	7-9
4	13	31.08±0.38	29-33	16.15±0.32	14-18	12.46±0.30	11-14	12.85±0.32	11-14	7.85±0.15	7-9
General	70	30.81±0.20	25-35	15.76±0.14	14-19	12.60±0.12	10-15	13.04±0.13	10-16	7.84±0.08	7-10

*: p<0.05; **: p<0.01; ***: p<0.001; a, b, c, d, e: Values in same column not having a common superscript differ significantly (p<0.05).

Table 4. *Phenotypic correlation coefficients between live weight and body measurements of Yalova genotype*
Tablo 4. *Yalova Genotipinin canlı ağırlıkları ile vücut ölçüleri arasındaki fenotipik korelasyon katsayıları*

	WH	BH	RH	BL	TL	RW	CW	CD	CG	TC	CBG	HL	HW	FW	EL	EW
LW	0.333**	0.404**	0.391**	0.447**	0.027	0.616**	0.713**	0.594**	0.809**	0.479**	0.405**	0.448**	0.294**	0.162*	0.229**	0.251**
WH	1	0.868**	0.941**	0.916**	0.068	0.163**	0.221**	0.369**	0.283**	0.273**	0.217**	0.140*	0.084	0.052	0.193**	0.245**
BH		1	0.880**	0.879**	0.094	0.176**	0.284**	0.355**	0.339**	0.295**	0.243**	0.198**	0.197**	0.133*	0.141*	0.256**
RH			1	0.923**	0.062	0.205**	0.281**	0.356**	0.315**	0.279**	0.252**	0.165**	0.150*	0.083	0.190**	0.247**
BL				1	0.084	0.205**	0.312**	0.423**	0.368**	0.325**	0.283**	0.227**	0.177**	0.110	0.236**	0.308**
TL					1	-0.055	-0.064	0.032	-0.018	-0.050	0.109	0.087	0.055	0.071	0.061	0.046
RW						1	0.749**	0.308**	0.652**	0.355**	0.280**	0.236**	0.173**	0.004	0.069	0.127*
CW							1	0.391**	0.723**	0.403**	0.331**	0.274**	0.254**	0.068	0.158*	0.231**
CD								1	0.631**	0.373**	0.203**	0.406**	0.145*	0.182**	0.147*	0.111
CG									1	0.495**	0.316**	0.422**	0.184**	0.148*	0.134*	0.139*
TC										1	0.083	-0.007	-0.123	0.167**	0.065	-0.011
CBG											1	0.385**	0.284**	0.163**	0.233**	0.259**
HL												1	0.467**	0.177**	0.204**	0.337**
HW													1	0.145*	0.152*	0.326**
FW														1	0.098	0.016
EL															1	0.381**
EW																1

LW: Live weight, WH: Withers height, BH: Back height, RH: Rump height, BL: Body length, TL: Tail length, RW: Rump witdth CW: Chest width, CD: Chest depth, CG: Chest girth, TC: Thigh circumtances, CBG: Cannon bone girth, HL: Head length, HW: Head width, FW: Forehead width, EL: Ear length, EW: Ear width. *: p<0.05; **: p<0.01

There are some studies, whose results similar with this study, reporting that the effect of the age factor on live weight, withers height, body length, chest girth, chest depth, chest width and rump width is statistically significant (Mengistie et al., 2010; Bimerow et al., 2011; Yılmaz et al., 2013; Özbeyaz et al., 2018). Özbeyaz et al. (2018) found that the effect of age on head length was statistically significant for İvesi (Awassi) sheep. Yılmaz et al. (2013) reported that the effect of flock factor for Karya sheep on live weight, withers height, body length, rump height, chest girth, chest width, chest depth was statistically significant and their results are similar to this study.

In this study, we found high positive phenotypic correlations between live weight and body measurements. In the analysis of correlation coefficients between live weight and body measurements, there was no correlation between tail length and other body measurements whereas high correlations were found between withers height, back height, rump height and body length.

CONCLUSION

This study was carried out to identify some morphological characteristics of Yalova genotype, which are reared under extensive conditions in Yalova genotype and neighbouring provinces and also known as "Yalova, and Yalova type", and to determine the effects of some environmental factors on these characteristics.

In this study, it was found that the adult live weight of Yalova genotype was similar to other indigenous breeds in Turkey. Although the genetic potential of animals depends on the type of breed, macro environmental factors like animal care and feeding considerably affect the live weight of sheep. Therefore, future studies on the live weight of Yalova genotype should be done.

The determined body measurements of Yalova genotype compared to other indigenous breeds, withers height of Yalova genotype was higher. The chest and rump width, body length, chest girth, chest depth, chest and rump height of Yalova genotype was higher than Kıvırcık sheep, whereas head measurements were similar to Kıvırcık and other indigenous sheep breeds.

The structure of tail is an important tool used for classification of sheep breeds. The Yalova genotype is different from other indigenous breeds due to its short tail with low fleece or no naked tail.

National Animal breeding studies conducted by General Directorate of Agricultural Research and Policies (GDAR) have been sustained in Yalova since 2012 and the phenotype of Yalova genotype have been identified. It is observed that the herds in Yalova are closed and sheep breeders do not use different breeds/genotypes of rams in their flock. There are some studies about genotypic and phenotypic characteristics of Yalova genotype. Yalova genotype have differed from Kıvırcık in terms of the distribution of fleece, the structure of tail and body measurements.

The studies especially on the determination of body measurements in sheep are aimed to measure live weight. In these studies, the number of variables must be decreased and multicollinearity should be considered. Therefore, univariate and multivariate analysis techniques should be used together.

This is the first study on morphological features of Yalova genotype. Such studies are important to provide information about the identification, conservation and breeding of indigenous animal breed.

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