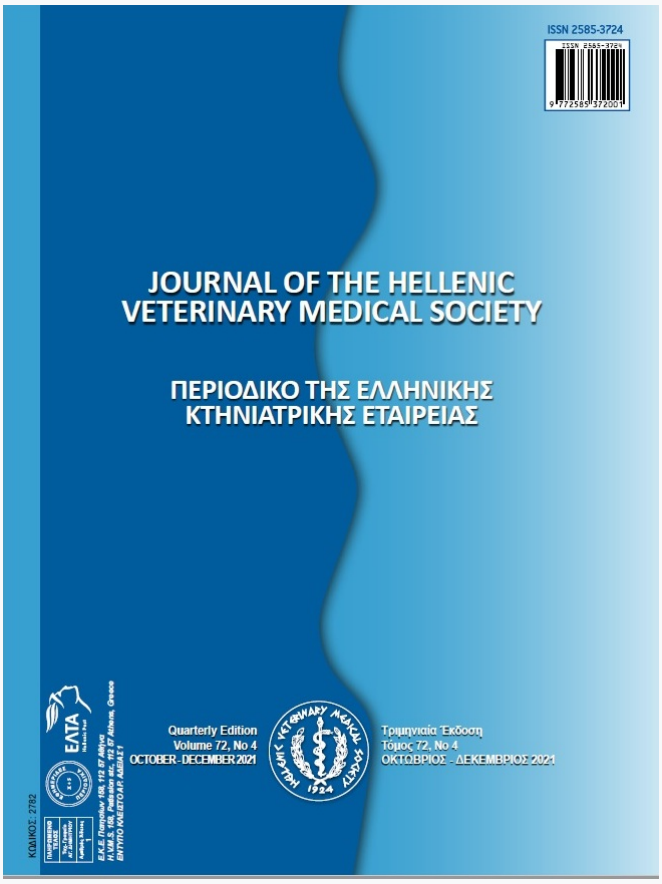
Journal of the Hellenic Veterinary Medical Society

Vol 72, No 4 (2021)



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doi: 10.12681/jhvms.29392

To cite this article:

YAĞCI, S., & BAŞ, S. (2022). Some testicular characteristics of Şavak Akkaraman rams and their relationship with live weight. *Journal of the Hellenic Veterinary Medical Society*, *72*(4), 3435–3442. https://doi.org/10.12681/jhvms.29392

J HELLENIC VET MED SOC 2021, 72(4): 3435-3442
ΠΕΚΕ 2021, 72(4): 3435-3442

Research article
Ερευνητικό άρθρο

Some testicular characteristics of Şavak Akkaraman rams and their relationship with live weight

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ABSTRACT: In this study, relationships between body weight and testicular characteristics were investigated in Şavak Akkaraman rams. Measurements taken from 60 rams in 7 traditional breeding farms were subjected to variance analysis to determine effects of the ram's age and the farm, and correlations between traits were calculated. Live weight (LW) average in rams was determined as 74.74±1.33 kg. Scrotum circumference (SC), scrotum width (SW), scrotum length (SL), scrotum thickness (ST), scrotum-ground distance (SGD), right testicular length (RTL), left testicular length (LTL), right testicular diameter (RTD) and left testicular diameter (LTD) values were calculated as 32.98±0.28 cm, 11.27±0.11 cm, 19.11±0.28 cm, 0.597±0.20 cm, 26.30±0.41 cm, 14.31±0.14 cm, 13.91±0.14 cm, 7.15±0.07 cm, 6.78±0.07 cm, respectively. Positive and significant correlations were determined between the body weight of the rams and testicular characteristics, except for SGD measurement. Correlation coefficients between LW and SD (0.620), RTL and LTL (0.541 and 0.524), RTD and LTD (0.676 and 0.561) were high. This study is the first study to determine the relationship between body weight and testicular characteristics in Şavak Akkaraman rams. Due to the limited number of studies on Şavak Akkaraman rams; considering the correlation findings between testicular measurements and live weight, it can be said that morphometric testis measurement results can contribute to future studies as a preliminary information and a descriptive study.

***Keywords*:** Şavak Akkaraman, body weight, testicular characteristics, correlation

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Date of initial submission: 16-10-2020
Date of acceptance: 14-04-2021

INTRODUCTION

There has been the privileged place of the sheep farming in Turkey until today from the past. Therefore, sheep breeding has been common in the livestock sector. Turkey, ovine animals for the presence among world countries takes 8th place (FAOStat, 2020). Turkey had about 23.974 million sheep assets in 2008, and this presence rose to 37.276 million sheep in 2019. The number of sheep has increased by about 60% in the last ten years. However, in the same period, sheep milk production increased by approximately 80% and reached 1 344 000 tons (TÜİK, 2019). The number of sheep in Turkey has rapidly increased in recent years, therefore, the improvement works in the sheep farming have been gained more importance. Many sheep breeds are grown in Turkey. Akkaraman sheep breed constitutes 47% of its sheep assets in Turkey (Kaymakçı, 2016). There are many varieties of the Akkaraman sheep breed. One of these varieties is the Şavak Akkaraman sheep, which is locally bred in Erzincan, Elâzığ and Tunceli provinces (Yağcı, 2017).

The Şavak Akkaraman sheep takes its name from the Şavak Tribe that breeds them. The Şavak Tribe is a community that continues its life with sheep farming in a semi-nomadic system from past to present. The people of Şavak, their animals which have adapted to the geography and climatic conditions in which they live, have been raised them with their own traditional methods in order to obtain more milk and produce their stocks. The Şavak Akkaraman sheep are generally considered to have a smaller size and a more delicate body than Akkaraman and Kangal Akkaraman sheep (Yağcı, 2017). Although the fleece covers are longer and brighter, there are more stains on their faces. The vast majority of milk is used in cheese making and a very good income is obtained from the cheese produced. Cheese, a special local product, has a geographical indication certificate and is called "Şavak Tulum Cheese" (Yağcı et al., 2018).

Şavak Akkaraman sheep is one of the important local gene resources that has been supported by the Ministry of Agriculture and Forestry since 2011 within the scope of the " National Domestic Animal Genetic Resources Conservation and Improvement Project". With this project, primarily by protecting the populations of Şavak Akkaraman, the best breeding rams have been selected and high-yielding herds have been tried to be obtained (Daşkıran et al., 2015). In this sense, it is important to determine the various characters of the rams to be selected as breeders, which are important for breeding. This is also necessary to improve economic gain by increasing productivity in the population (Elmaz ve ark., 2008).

Determining breed-specific characters in sheep breeding has an important effect on increasing performance (Abbasi and Kesbi, 2011). In this context, it is especially important to determine the reproductive characteristics that ensure the continuity of the species. There have been many studies on the reproduction characteristics of sheep in different breeds (Koyuncu et al., 2000; Kulaksız et al., 2010; Yakubu et al., 2013; Al-kawmani et al., 2014; Babashani, 2015; Adjibode et al., 2016). Except this, relationship studies between reproductive traits and different characters were also made. In a study examined the relationships between live weight and testicular diameter, testicular length, scrotum length, scrotum circumference and scrotum volume in Karayaka yearlings; all correlations were found to be significant except these between body weight and testicular length, and between scrotum length and testicular diameter and scrotum circumference. In addition, the coefficients of determining testicular measurements of live weight were found to be significant except for testicular length (Koyuncu et al., 2000). In a study conducted on Kıvırcık rams, the effect of age of yearling lambs and body weight on testicular measurements was found to be significant (Koyuncu et al., 2005). Similarly, it was reported that there was a positive correlation between live weight and testicular measurements for Najdi male lambs by Al kawkani et al. (2013), and for rams in Djallonke and Ouda breeds raised in northern Benin by Benoit et al. (2017). As can be understood from the studies conducted, especially the scrotum circumference that is one of testicular measurements, sperm production and quality are important indicators for reproductive potential (Bourdon and Brinks, 1986; Hahn et al., 1969). These testicular features can also be used as selection criteria (Toe et al., 2000). For this reason, it is important to determine testicular characteristics and to reveal their relationships with other characters.

Due to the reproductive performance of Şavak Akkaraman sheep is low, it is necessary to determine and improve the reproductive performance of this breed (Yağcı, 2017). Studies on Şavak Akkaraman sheep are limited, and no study has been found on testicular characteristics in rams. Conducting research on reproductive traits of Şavak Akkaraman sheep which is one of varieties of Akkaraman breed which is indigenous

genetic resource cultivated extensively in Turkey, will provide data / contribution to improvement of reproductive traits in breeding studies.

In this study, it was aimed to investigate some testicular measurements and the relationship between these testicular measurements and live weight in Şavak Akkaraman rams.

MATERIALS AND METHODS

Location

This study was carried out in Erzincan Province, Turkey where Şavak Akkaraman sheep is widely breed. The equatorial location of the region is between 39 ° 02′ - 40 ° 05′ north latitudes and 38 ° 16′ - 40 ° 45′ longitudes and its surface area is 11903 km². The city center is 1.185 meters above sea level (Karadeniz and Altınbilek, 2016). Erzincan has a continental climate characteristic (Anon, 2019).

Collection of Data

The animal material of the study consisted of 60 rams between the ages of 2 and 6, in similar conditions, randomly selected from 7 different farms in the Şavak Akkaraman Sheep Public Breeding Project in central and Tercan districts of Erzincan, Turkey. Similar practices were made for the rams within the scope of the project in the studied farms. The rams were generally grazed on the pasture, and care and feeding were carried out in the pen in winter. Hay straw and barley were given to the rams in the pen. No other supplementary feeding program was applied to the rams during the mating season. In the farms where the research was conducted, the participation of rams was carried out for approximately 60-70 days at the beginning of October and the free-mating method was applied. Testicular characteristics measured together with body weight in rams were performed once in August, at the beginning of the mating season.

On Şavak Akkaraman rams; live weight (LW), scrotum circumference (SC), scrotum width (SW), scrotum length (SL), scrotum thickness (ST), scrotum-ground distance (SGD), right testicular length (RTL), left testicular length (LTL), right testicular diameter (RTD) and left testicular diameter (LTD) were measured. Live weight measurement was made with a sensitive electronic scale up to 100 g (Ovine Livestock Scale, IMMAX, EB-600). Testicular measurements were made by gently holding the hand. TD, TL and ST were determined with metal caliper precision to 0.01 mm. SC was measured with a tape measure, SW and SGD were measured with a tape measure.

Statistical Analysis

Statistical evaluation of the data obtained in the study was performed using the Least-Squares analysis method in the statistical package program of IBM SPSS Version 23.0 (IBM Corp. Released, 2015). Statistical model used in analysis;

$$Y_{ijl}=\mu+a_i+b_j+e_{ijl}$$

In the model; Y = the value of any ram in terms of the attribute considered at any sub-level of any factor, μ = the expected average of the population in terms of the investigated trait, a = the age of the ram, b = the farm that grown the ram, e = normal, independent, chance error (0, σ2).

RESULTS

Least squares means, standard errors, significance test results of live weight and testicular characteristics determined in Şavak Akkaraman rams were given in Table 1, and the relationship between live weight and testicular characteristics was given in Table 2.

The average live weight of Şavak Akkaraman rams was 74.74 ± 1.33 kg. Among testis properties, SC, SW, SL, ST, SGD, RTL, LTL, RTD and LTD values were calculated as 32.98 ± 0.28 cm, 11.27 ± 0.11 cm, 19.11 ± 0.28 cm, 0.597 ± 0.20 cm, 26.30 ± 0.41 cm, 14.31 ± 0.14 cm, 13.91 ± 0.14 cm, 7.15 ± 0.07 cm, 6.78 ± 0.07 cm, respectively

The farm factor was found to be high significant ($P<0.01$) for LW, SC, SW, RTD and LTD. In the farm with the highest average live weight of rams (83.80 kg), testis characteristics such as SC (34.92 cm), SW (11.98 cm), RTL and LTL (15.16 and 14.47 cm) and RTD (7.61 cm) were the highest calculated. The farm with the highest average live weight also had the second highest value in terms of SL (19.92 cm) and LTD (6.99 cm) measurements. The SGD (25.88 cm) value detected in this weight group indicated that the testicles were neither too droopy nor too close to the body.

In the study, since there were no rams from every age group in every farms, the age effect was examined by dividing the rams into two age groups, which can be called younger and older ones. The average body weight (67.92 kg) of the 2 and 3-year-old rams (37 heads) used in the study was calculated 13.63 kg lower than the average body weight (81.55 kg) of the 4, 5 and 6 aged rams.

Table1. Least squares means, standard errors and significance test results of live weight and testicular measurements in Şavak Akkaraman rams

	n	Live Weight (kg) $\bar{X} \pm S_{\bar{x}}$	Scrotum Circumference (cm) $\bar{X} \pm S_{\bar{x}}$	Scrotum Widht (cm) $\bar{X} \pm S_{\bar{x}}$	Scrotum Lenght (cm) $\bar{X} \pm S_{\bar{x}}$	Scrotum Thickness (cm) $\bar{X} \pm S$	Scrotum Height (cm) $\bar{X} \pm S_{\bar{x}}$	Testicular Lenght		Testicular Diameter	
								Right (cm) $\bar{X} \pm S_{\bar{x}}$	Left (cm) $\bar{X} \pm S_{\bar{x}}$	Right (cm) $\bar{X} \pm S_{\bar{x}}$	Left (cm) $\bar{X} \pm S_{\bar{x}}$
Overall mean	60	74.74±1.33	32.98±0.28	11.27±0.11	19.11±0.28	0.60±0.02	26.30±0.41	14.31±0.14	13.91±0.14	7.15±0.07	6.78±0.07
Farms		**	**	**	ns	ns	ns	ns	ns	**	ns
1	10	65.92±3.15	30.14±0.67	10.25±0.25	17.22±0.65	0.65±0.05	27.92±0.97	13.65±0.34	13.73±0.33	6.41±0.16	6.33±0.17
2	9	64.33±3.21	32.48±0.68	11.32±0.26	18.92±0.66	0.55±0.05	25.46±0.98	14.60±0.34	14.28±0.34	6.95±0.16	6.70±0.17
3	10	80.99±3.15	33.61±0.67	11.16±0.25	19.41±0.65	0.68±0.05	25.58±0.97	13.78±0.34	13.45±0.33	7.45±0.16	6.85±0.17
4	11	74.28±2.92	31.96±0.62	11.14±0.23	19.28±0.61	0.62±0.04	25.95±0.90	14.09±0.31	13.51±0.31	6.95±0.15	6.62±0.16
5	6	83.80±3.95	34.92±0.84	11.98±0.32	19.92±0.82	0.61±0.06	25.88±1.21	15.16±0.42	14.47±0.41	7.61±0.20	6.99±0.22
6	8	77.83±3.47	34.76±0.73	11.84±0.28	20.32±0.72	0.54±0.05	25.69±1.07	14.87±0.37	14.44±0.36	7.52±0.18	7.23±0.19
7	6	76.01±4.03	33.02±0.85	11.17±0.32	18.67±0.84	0.53±0.06	27.59±1.24	14.03±0.43	13.52±0.42	7.16±0.21	6.76±0.22
Ages		**	**	ns	ns	ns	ns	**	**	**	**
2 and 3	37	67.92±1.64	31.96±0.35	11.09±0.13	18.09±0.34	0.56±0.03	27.16±0.50	13.84±0.17	13.41±0.17	6.86±0.08	6.57±0.10
4, 5 and 6	23	81.55±2.19	34.01±0.46	11.44±0.18	20.12±0.46	0.63±0.03	25.43±0.67	14.79±0.23	14.42±0.23	7.44±0.11	7.00±0.12

*:P<0.05, **: P<0.01; ns : non significant

Table 2. Correlation coefficients and significance levels between body weight and testicular measurements detected in Şavak Akkaraman rams

Measurments		LW	SC	SW	SL	ST	SGD	RTL	RTD	LTL
SC	**Corr.**	**.620****								
SW	**Corr.**	**.490****	**.871****							
SL	**Corr.**	**.439****	**.550****	**.540****						
ST	**Corr.**	**.395****	.214	.203	.253					
SGD	**Corr.**	-.203	-.335	-.338	-.563	-.144				
RTL	**Corr.**	**.541****	**.672****	**.607****	**.649****	**.294***	-,370			
RTD	**Corr.**	**.676****	**.893****	**.702****	**.458****	**.260***	-,326	**.645****		
LTL	**Corr.**	**.524****	**.623****	**.550****	**.657****	**.362****	-,416	**.913****	**.565****	
LTD	**Corr.**	**.561****	**.835****	**.695****	**.491****	.218	-,309	**.665****	**.861****	**.651****

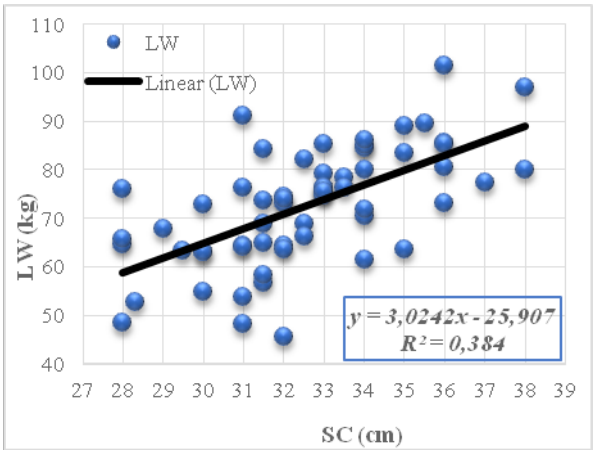
*: significant (P<0.05). **: high significant (P<0.01); Live weight (LW), Scrotum circumference (SC), scrotum width (SW), scrotum length (SL), scrotum thickness (ST), scrotum-ground distance (SGD), right testicular length (RTL), left testicular length (LTL), right testicular diameter (RTD) and left testicular diameter (LTD)

The effect of age group on live weight was found to be high significant (P<0.01). Likewise, the effect of the age group on testicular features such as SC, RTL and LTL, RTD and LTD was high significant (P <0.01). Except for SGD feature, the values in 4, 5 and 6 year old rams were calculated higher than the values calculated for 2 and 3 year old rams (Table 1). The low value of this group in terms of SGD essentially showed that the testicles were more developed and the distance to the ground was less.

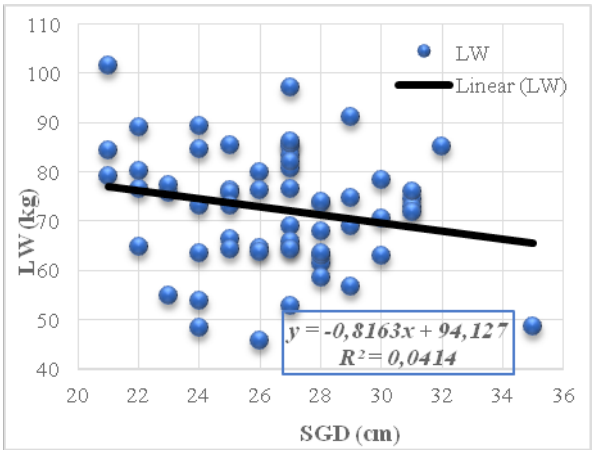
The relationships between live weight and testicular characteristics in Şavak Akkaraman rams were given in Table 2. Positive, high and very significant (P<0.01) correlations were determined between live weight and testicular characteristics, except SGD.

Correlation coefficients calculated between live weight and SC, RTL and LTL, RTD and LTD (0.620, 0.541, 0.524, 0.676, 0.561, respectively) indicated very strong relationships between live weight and these characteristics. The weak negative correlation determined between body weight and SGD meant that as body weight increases, the distance of the scrotum to the ground decreases, which indicated that the testicles were more developed.

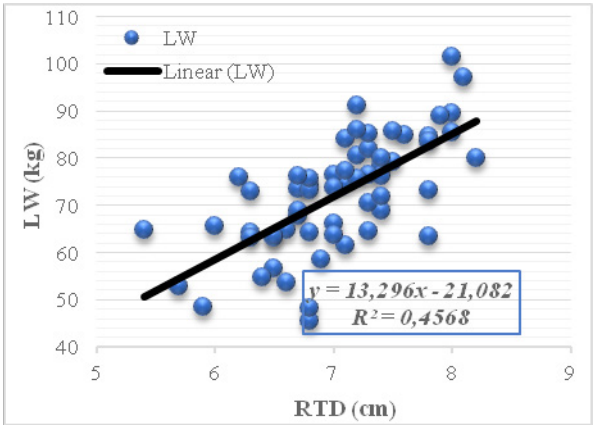
The scatter chart showing the relationships between the live weights of the rams and some testicular measurements was given in Figure 1 and the regression equations in Table 3.



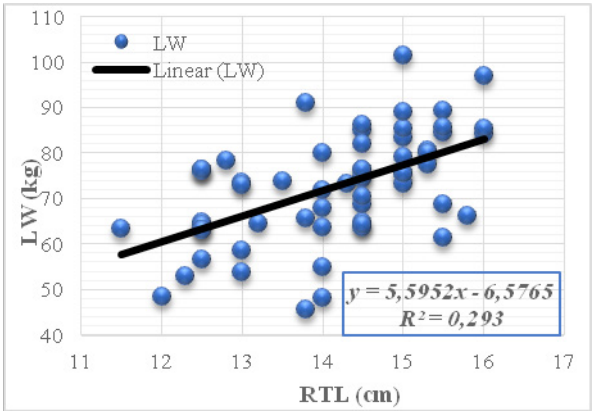
Scrotum circumference



Scrotum - ground distance



Right testicular diameter



Right testicular lenght

Figure 1. Scatter plot of some testicular measurements in Şavak Akkaraman rams

Table 3. Regression equations and determination coefficients of body weight according to some testicular measurements in Şavak Akkaraman rams

Live Weight = Constant + Regression Coefficient x Testis Size	R^2 (%)
Y = (-25.907) + 3.0242 x SÇ	38.4
Y = (-2.2803) + 6.7027 x SG	23.98
Y = 27.057 + 2.417 x SU	19.31
Y = 54.028 + 31.083 x SK	15.64
Y = 94.127 + (-0.8163) x SYAM	4.14
Y = (-21.082) + 13.296 x Sağ TÇ	45.68
Y = (-6.5765) + 5.5952 x Sağ TU	29.3

DISCUSSION

Scrotum circumference was determined as 32.98 cm in Şavak Akkaraman rams. This calculated value was similar to the values reported for genotypes such as Chios (32.1 cm) (Öztürk et al., 1996), and 2-4 years old Karayaka rams (32.5) (Aslan et al., 2019), and were higher than the values reported for genotypes such as Akkaraman (30.7 cm) (Öztürk et al., 1996), 206 days-old Kıvırcık male lambs (26.88 cm) (Özdemir and Altın, 2002), Dağlıç (30.8 cm), Awassi (31.8 cm) measured pre-mating (Gündoğan et al., 2003), 480 days-old Norduz male lambs (29.74 cm) (Yılmaz and Cengiz, 2006), Karayaka rams (29.80 cm) (Kulaksız et al., 2010)

Scrotum circumference value found in this research was lower than the values reported for the genotypes such as Akkaraman (33.75 cm) (Öztürk et al., 1996) and Karya (33.98 cm) (İnce & Karaca, 2009),

18-20 month-old Pırlak rams (35 cm) measured in October (Yeni and Gündoğan, 2018). Same time; the findings of this research were higher than the values of Balami (31.25 cm) (İbrahim et al., 2012), Najdi male lambs (25 cm) (Al-kawmani et al., 2014), Yankasa rams (26.8 and 26.34 cm) (Babashani, 2015), Djallonke male lambs (23.26 and 21.08 cm) (Adjibode et al., 2016), Djallonke and Ouda rams (21.41 ve 24.51 cm) (Benoit et al., 2017), and lower than the values of Uda (38 cm) and Yankasa rams (35.25 cm) (Yakubu et al., 2013).

Scrotum length in Şavak Akkaraman rams was determined as 19.11 cm. This value is higher than the genotypes of Acıpayam (3.67 cm) (Kaymakçı et al., 1988), Morkaraman (10.2 cm) and Awassi (17.63 cm) (Odabaşıoğlu et al., 1992), Karakaş male lambs (9.27 cm and 8.31 cm), Konya Merino (12.33 cm) (Aygün and Karaca, 1995), Akkaraman rams (18.03 cm), Awassi rams (17.63 cm) (Öztürk et al., 1996), Dağlıç (16.69 cm) and Karayaka (18.7 cm) (Gündoğan, 1999).

Scrotum thickness in Şavak Akkaraman rams was found to be 0.59 cm. This value was similar to the values reported for genotypes such as Akkaraman (0.6 cm) (Gündoğan et al., 2003), Karayaka (0.57 cm) (Kulaksız et al., 2010), and lower than Chios (0.7 cm), and was higher than rams of Dağlıç (0.4 cm), Awassi (0.5 cm) (Gündoğan et al., 2003).

Right and left testicular diameters found in Şavak Akkaraman rams were 7.15 and 6.78 cm. This values were found higher than values of the genotypes of Akkaraman (6.44 cm) and Awassi (5.86 cm) (Öztürk et al., 1996), Kıvırcık male lambs (4.34 and 4.22 cm) (Özdemir and Altın, 2002), Kıvırcık (4.20 and 4.11 cm) Karya (5.64 cm), Çine Çapar (5.19 cm) (İnce and Karaca, 2009), Karayaka (5.9 cm) (Kulaksız et al., 2010).

The right and left testicular length values found in this study were 14.31 and 13.91 cm. These values were found higher than the values in the research on some sheep breeds such as Akkaraman (12.17 cm), Awassi (11.95) (Öztürk et al., 1996), Kıvırcık male lambs (10.24 and 10.12 cm) (Özdemir and Altın, 2002), Akkaraman rams (9.7 and 9.9 cm) (Gündoğan et al.,2003), Kıvırcık male lambs (5.94 cm) (Koyuncu et al., 2005), Karayaka (12.31 cm) (Kulaksız et al., 2010), and Balami (12.63 cm), Uda (12.75 cm) Yankasa (12.25 cm) in Nigeria (Yakubu et al., 2013).

It can be said that among the reasons for the values found as a result of the study being higher or lower than the literature values, factors such as the breed, age, care and feeding of the rams used in the research, the climatic conditions of the region where they were raised or the season in which they were measured (Gündoğan et al., 2003; Yılmaz and Aygün, 2001). The rams used in this study were grazed in the pasture under the conditions of the breeders, and in the winter season, care and feeding were carried out in the pen and care was fed with hay straw and barley crushed. If the rams are provided with better care and feeding conditions, it can be predicted that they will reach better condition and show higher performance. In this context, considering the positive relationships between testicular measurements and reproductive performance, if the existing care feeding conditions are improved, it can be expected that the reproductive traits of rams with better condition will also be superior.

CONCLUSION

In this study, the body weight and testicular characteristics of Şavak Akkaraman rams were defined and the effects of environmental factors such as the age of the rams and the farms where they were raised were determined. At the same time, it has been observed that body weight significantly affects testicular characteristics. Considering the significant correlation coefficients between live weight and testicular measurements of Şavak Akkaraman rams raised in the Erzincan region, Turkey, it was concluded that testicular characteristics and body weight values can be used as a criterion in breeding selection.

ACKNOWLEDGMENT

This study was supported within the scope of the General Directorate of Agricultural Research and Policies, Genetic Improvement of Şavak Akkaraman Sheep in Breeders (Project Code: 24SAV2011-01 and 24SAV2012-02).

CONFLICT OF INTEREST

None declared by the authors.

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