https://doi.org/10.52973/rcfcv-e34482 Revista Científica, FCV-LUZ / Vol. XXXIV, rcfcv-e34482

Some mohair characteristics of different Angora goat varieties

Algunas características del vellón de distintas variedades de cabra de Angora

***Senem Esin Selçuk*[1]*, *Özge Özmen*[2], *Ayşe Yener*[3]**

[1]*International Center for Livestock Research and Training. Ankara, Türkiye.*
[2]*Ankara University, Faculty of Veterinary Medicine, Department of Genetics. Ankara, Türkiye.*
[3]*Ankara University, Faculty of Veterinary Medicine, Department of Statistics. Ankara, Türkiye.*
**Corresponding author: senemesinselcuk@gmail.com*

ABSTRACT

This study was conducted to determine the mohair quality characteristics of Eskisehir, Lalahan and Siirt variety Angora goats. In the study, mohair samples were taken from the shoulder, rump and rib regions of each Angora goat of Eskisehir, Lalahan and Siirt varieties during the mohair shearing period. A total of 57 samples from 19 heads of Angora goats were analyzed in terms of quality characteristics such as clean weight, dirty weight, yield, length, fineness, elasticity and tenacity. According to the results obtained, the effect of variety and gender on the dirty weight, clean weight and yield variables was statistically significant ($P<0.05$), while the effect of the region was found to be insignificant ($P>0.05$). The effect of variety and region on the length variable was found to be statistically significant, while the effect of gender was found to be insignificant. The effect of variety and gender on the fineness variable was found to be statistically significant, while the effect of region was found to be statistically insignificant. The effects of variety, gender and region on the elasticity variable were found to be statistically insignificant. The effect of variety on the tenacity variable was found to be statistically significant, while the effect of gender and region was found to be statistically insignificant. According to the information obtained from this study, variety, region and gender variables have various effects on mohair characteristics. It is thought that these characteristics will contribute to studies on breeding Angora goats and improving mohair quality.

Key words: Mohair, quality traits; natural fiber

RESUMEN

Este estudio se llevó a cabo para determinar las características de calidad del vellon de las cabras de Angora (AG) de las variedades Eskisehir, Lalahan y Siirt. En el estudio se tomaron muestras de vellon de las regiones de la paletilla, la grupa y las costillas de cada cabra de AG de las variedades Eskisehir, Lalahan y Siirt durante el periodo de esquila del vellon. Se analizaron un total de 57 muestras de 19 cabezas de cabras de AG en términos de características de calidad, como peso limpio, peso sucio, rendimiento, longitud, finura, elasticidad y tenacidad. Según los resultados obtenidos, el efecto de la variedad y el sexo sobre las variables peso sucio, peso limpio y rendimiento fue estadísticamente significativo ($P<0,05$), mientras que el efecto de la región resultó insignificante ($P>0,05$). El efecto de la variedad y la región sobre la variable longitud resultó ser estadísticamente significativo, mientras que el efecto del género resultó ser insignificante. El efecto de la variedad y el sexo en la variable finura resultó estadísticamente significativo, mientras que el efecto de la región resultó estadísticamente insignificante. Los efectos de la variedad, el sexo y la región en la variable elasticidad no fueron estadísticamente significativos. El efecto de la variedad sobre la variable tenacidad resultó ser estadísticamente significativo, mientras que, el efecto del género y la región resultó ser estadísticamente insignificante. Según la información obtenida en este estudio, las variables variedad, región y género tienen diversos efectos sobre las características del vellon. Se considera que estas características contribuirán a los estudios sobre la cría de cabras de AG y la mejora de la calidad del vellón.

Palabras clave: Vellón; calidad; fibra natural

Received: 07/07/2024 Accepted: 12/10/2024 Published: 23/12/2024

INTRODUCTION

Goats (*Capra hircus*) are a suitable source of milk [1], meat [2], skin and fiber [3] for human use [4] and have a wide distribution on the world. The goat population in Türkiye is around 10,708,674 heads and Angora goat (AG), which is an important genetic resource of our country, constitutes 212,516 heads of this population [5].

AG, which is an important genetic resource of Türkiye, is bred mainly for its mohair. In our country, AG breeding is mostly carried out in the Ankara province and is intensively practiced in Güdül, Kizilcahamam, Beypazari line located in the basin where Kirmir Creek is located [6]. Other provinces in Türkiye where AG is bred are Konya, Karaman, Eskisehir, Afyon, Cankiri, Corum, Kastamonu, Kirsehir, Kutahya, Nigde, Yozgat, Bolu. In Eastern and Southeastern Anatolia provinces such as Siirt, Mardin, Bitlis and Van, it is bred under the name of the colored AG, colored mohair goat or Siirt goat. AGs are mostly white in color. AG raised in Konya and its region are cream and yellow, while those raised in Eastern and Southeastern provinces are silvery gray, brown and black (FIG. 1) [7].

A group of AGs was brought from Eskisehir Anatolian Agricultural Enterprise to the International Center for Livestock Research and Training (ICLRT) of the Turkish Ministry of Agriculture and Forestry in 1997 and formed the Eskisehir variety of AGs. Eskisehir variety of AGs carry US AG blood in their genotype and have been bred pure since 1997. The other AGs bred within ICLRT is the Lalahan variety. The Lalahan variety of AG has been pure bred since 1930. Both varieties of AGs have been under protection since 1997 [8]. The colored AG has also been protected by the same project implemented by General Directorate of Agricultural Research and Policies (GDARP) of the Ministry of Agriculture and Forestry of the Republic of Türkiye, and its breeding has been supported in Siirt province since 2012 [9] and in Mardin and Sırnak provinces since 2023 [10].

Mohair produced by AGs is one of main textile fibers of animal origin. Its distinctive properties such as smoothness and natural luster make it one of the most outstanding fibers for garment design with high economic value [11]. In addition, the fineness (diameter) and quantity of mohair are most important factors determining its economic

FIGURE 1. Angora goat (AG) varieties (A) Eskisehir variety of AG, (B) Lalahan variety of AG, (C) Siirt variety AG

value. The economic value of mohair in the world markets depends primarily on quantity, length, corrugation, elasticity and tenacity. For this reason, efforts are made to improve these characteristics and to improve the quality of the product in general in the countries where mohair is produced [12].

In the study conducted by Ozturk and Goncagul [13], mohair fiber fineness was 31.34 ± 0.30 µm, length 16.16 ± 0.31 cm, elasticity 27.39% ± 0.20, tenacity 23.63 ± 0.39 g in 2-year-old females; mohair fineness 32.34 ± 0.38 µm, length 15.81 ± 0.47 cm, elasticity 27.50% ± 0.27, tenacity 23.45 ± 0.48 g in 2-year-old males. Erol *et al.* [14] determined fiber diameter 36.31 ± 0.45 µm, length 115.60 ± 2.58 mm, elasticity 40.36 ± 0.31 %, tenacity 19.52 ± 0.61 cN/tex in 2-year-old goats. Bilgen *et al.* [15] determined fiber fineness 33.48 ± 0.44 µm, nozzle length 6.23 ± 0.13 cm, elasticity 37.51 ± 0.65%, tenacity 9.46 ± 0.23 g. Odabasioglu *et al.* [16] compared the mohair characteristics of colored mohair goat kid and Angora goat × colored mohair goat F1 cross kids. Mohair yield, fineness, length, elasticity and tenacity values were determined as 74.3% and 75.9%; 36.4 µm and 30.1 µm; 7.4 cm and 7.8 cm; 32.4% and 31.6%; 8.2 g and 6.3 g, respectively, in colored mohair goat and F1 crossbreds.

Since the number of AGs in our country is constantly decreasing, various organizations and researchers, especially the Republic of Türkiye Ministry of Agriculture and Forestry, and academicians are working the eliminate the decrease the number of AGs [6].

This research was carried out to determine the mohair quality characteristics of Eskisehir and Lalahan varieties of AGs under protection in the ICLRT and colored Angora (Siirt) goats (Siirt variety AG) under breeding in the hands of breeders within the scope of the "Protection of Domestic Animal Genetic Resources Project" carried out under the GDARP of Ministry of Agriculture and Forestry of the Republic of Türkiye.

MATERIAL AND METHODS

Animal Material

The animal material of this research was collected from Eskisehir (3 females and 3 males), Lalahan (4 females and 3 males) and Siirt variety (3 females and 3 males) AGs within the scope of the protection project carried out by the Republic of Türkiye, Ministry of Agriculture and Forestry, GDARP. Mohair samples of Eskisehir and Lalahan variety AGs were provided by ICLRT located in Ankara (latitude 39°58'25.05" N and

longitude 33°6'25.81" E) and Siirt mohair samples were provided from a breeder in Siirt (latitude 37°59'47.86" N and longitude 42°3'38.20" E). The goats used in the study were selected from clinically healthy and 2 years old goats.

Methods

Approximately 20 g of mohair samples were taken from shoulder, rump and rib area of each goat during the mohair shearing period. In total, 57 mohair samples of 19 AGs were analyzed for fiber properties such as dirty weight, clean weight, yield, length, fineness, elasticity and tenacity. These measurements were carried out at the Wool–Mohair Laboratory at ICLRT, and length measurements were carried out at the Breeding Sheep and Goat Breeders Association of Ankara province. Mohair samples were weighed on (Mettler Toledo AG204, Switzerland) a precision scales and the weight (dirty weight) was recorded. These samples were washed with water with detergent at the temperature of 55°C and pH=10 and dried in an oven (Memmert Modell 100–800, Memmert GmbH+Co., Germany) at the 105°C for 6 hours. The dried samples were kept under laboratory conditions for a while and then weighed. After weighing the clean weights, yield values were calculated using the formula below.

- Mohair yield (%): [Clean and dry mohair amount (g)×(100 + 13.87%)] / Dirty mohair amount (g). (13.87% = Amount of moisture retained by dry mohair (standard moisture retention capacity) [17].

The homogeneous portion of the samples, which were washed and cleaned from foreign materials, was chopped with guillotine shears and placed between two glasses called slides. The slide was placed in USTER OFDA100 (OFDA: Optical–Based Fiber Diameter Analyzer)(Uster, OFDA 100, Switzerland) and fiber diameter (fineness) was measured. Length measurements were conducted using the OFDA2000 Portable (Australia) device measuring according to IWTO (International Wool Textile Organization) analysis method. Elasticity and tenacity measurements of the samples were performed on FAFE–GRAPH (Textechno, Textechno H. Stein GmbH & Co. KG, Moenchengladbach, Germany) device.

Statistical analysis

Descriptive statistics of the data were calculated and presented as "Arithmetic Mean ± Standard Error". Three–way design analysis of variance (ANOVA) was used to examine the effect of variety, gender, and region factors on dirty weight, clean weight, yield, length, fineness, elasticity and tenacity variables. In the model, the main effects of variety, gender and region and all possible two–way and three–way interaction terms related to these main effects were included. Sample effects analysis with Bonferroni correction was used to analyze significant interaction terms. $P<0.05$ criterion was used for all statistical evaluations. SPSS 21 package program was used for statistical analyses.

RESULTS AND DISCUSSION

The effect of variety and gender on dirty weight (TABLE I), clean weight (TABLE II) and yield (TABLE III) variables was found statistically significant ($P<0.05$), while the effect of the region on these variables was found statistically insignificant ($P>0.05$). Variety and gender interactions for dirty weight and clean weight variables were found statistically significant ($P<0.05$). According to these results, dirty weight and clean weight values of Siirt variety were lower than Eskisehir and Lalahan varieties, while the yield value was higher. In all varieties, dirty weight, clean weight and yield values of females were lower than males (TABLE I, II, III).

TABLE I
Effect of variety, gender and region factors and their interactions on dirty weight variable*

Variable	Gender	Variety	Region		
			Shoulder	Rump	Rib
			$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
Dirty Weight (g)	Female^{x}	Eskisehir^{b}	9.07 ± 0.12	8.99 ± 1.03	7.92 ± 0.61
		Lalahan^{a}	14.81 ± 1.57	12.95 ± 1.54	14.66 ± 1.39
		Siirt^{c}	5.36 ± 0.56	4.82 ± 1.20	5.35 ± 1.59
	Male^{y}	Eskisehir^{b}	19.37 ± 1.06	14.34 ± 2.70	17.58 ± 1.04
		Lalahan^{a}	18.49 ± 2.21	15.57 ± 1.91	17.09 ± 1.64
		Siirt^{c}	9.20 ± 2.57	9.41 ± 3.74	5.09 ± 0.62

* $\bar{X}$: mean, $S_{\bar{x}}$: standard error, ^{x,y}: The differences between different letters within the gender groups statistically significant, ^{a,b,c}: The differences between different letters within the variety groups statistically significant

TABLE II
Effect of variety, gender and region factors and their interactions on clean weight variable*

Variable	Gender	Variety	Region		
			Shoulder	Rump	Rib
			$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
Clean Weight (g)	Female^{x}	Eskisehira^{a}	6.68 ± 0.63	7.06 ± 1.01	6.23 ± 0.42
		Lalahan^{a}	10.41 ± 1.49	10.44 ± 1.40	10.53 ± 1.29
		Siirt^{b}	5.06 ± 5.09	4.46 ± 1.20	4.741 ± 1.76
	Male^{y}	Eskisehir^{a}	16.67 ± 0.46	12.15 ± 2.43	15.07 ± 1.43
		Lalahan^{a}	15.53 ± 1.29	12.70 ± 1.33	14.25 ± 0.97
		Siirt^{b}	8.65 ± 2.65	9.00 ± 3.55	4.85 ± 0.60

* $\bar{X}$: mean, $S_{\bar{x}}$: standard error, ^{x,y}: The differences between different letters within the gender groups statistically significant, ^{a,b,c}: The differences between different letters within the variety groups statistically significant

TABLE III
Effect of variety, gender and region factors and their interactions on yield variable*

Variable	Gender	Variety	Region		
			Shoulder	Rump	Rib
			$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
Yield (%)	Female^{x}	Eskisehir^{b}	73.70 ± 6.46	78.13 ± 2.29	78.83 ± 1.15
		Lalahan^{b}	70.75 ± 7.05	80.15 ± 3.09	71.80 ± 3.84
		Siirt^{a}	94.70 ± 5.57	91.83 ± 2.03	85.40 ± 7.93
	Male^{y}	Eskisehir^{b}	86.47 ± 2.60	84.43 ± 1.32	85.50 ± 3.55
		Lalahan^{b}	84.80 ± 2.99	82.10 ± 2.72	84.00 ± 2.51
		Siirt^{a}	92.07 ± 4.23	95.97 ± 0.42	95.47 ± 0.59

* $\bar{X}$: mean, $S_{\bar{x}}$: standard error, ^{x,y}: The differences between different letters within the gender groups statistically significant, ^{a,b,c}: The differences between different letters within the variety groups statistically significant

In this study, the yield values (TABLE III) obtained in Siirt variety were higher than reported by Ariturk *et al.* [18] (77%) in the goat herd at Lalahan Zootechny Research Institute, by Muftuoglu and Orkiz [19] (78.4, 73.8, 73, 67.3, 82.2 and 88.4%) in goats raised by public in Nigde, Ankara, Eskisehir, Yozgat, Konya, Kastamonu provinces, Duzgunes *et al.* [20] (73.38%) in 188 kids provided by public in Beypazari, Ayas, Kalecik, Elmadag and Keskin districts, and the yield values provided from females in Eskisehir variety were similar to Muftuoglu and Orkiz [19] for goats raised by public in Ankara, Eskisehir and Yozgat provinces, and by Duzgunes *et al.* [20] in Beypazari, Ayas, Kalecik, Elmadag and Keskin districts. In addition, the yield values of the Siirt variety were found to be higher than the values obtained from the Lalahan and Eskisehir varieties in this study.

The effect of variety and region on the length variable was found statistically significant ($P<0.05$), while the effect of gender was statistically insignificant ($P>0.05$). The interaction of variety and gender for length variable was found statistically significant ($P<0.05$). Other interactions for this variable were not statistically significant ($P>0.05$). According to these results, the length values of Siirt variety were lower than Eskisehir and Lalahan varieties. Shoulder region length values were higher than rump and rib region (TABLE IV).

TABLE IV
Effect of variety, gender and region factors and their interactions on length variable*

Variable	Gender	Variety	Region		
			Shoulder^{A}	Rump^{B}	Rib^{B}
			$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
Length (mm)	Female	Eskisehir^{a}	113.33 ± 11.67	105.00 ± 2.89	110.00 ± 7.64
		Lalahan^{a}	133.75 ± 2.39	120.00 ± 9.13	127.5 ± 11.27
		Siirt^{b}	120.00 ± 26.46	75.00 ± 7.64	90.00 ± 12.58
	Male	Eskisehir^{a}	148.33 ± 7.26	101.67 ± 6.01	120.00 ± 13.23
		Lalahan^{a}	120.00 ± 2.89	83.33 ± 4.41	111.67 ± 18.78
		Siirt^{b}	120.00 ± 8.66	106.67 ± 11.67	68.33 ± 29.49

* $\bar{X}$: mean, $S_{\bar{x}}$: standard error, ^{A,B}: The differences between different letters within the region groups statistically significant, ^{a,b}: The differences between different letters within the variety groups statistically significant

The effect of variety and gender on the fineness variable was found statistically significant ($P<0.05$), while the effect of region was not statistically significant ($P>0.05$). All interactions between variables for the fineness variable were found statistically insignificant. According to these results, the fineness values of Siirt variety were higher than Eskisehir and Lalahan varieties. In all varieties, females had lower fineness values than males (TABLE V).

Mohair length is one of the important characteristics of textile industry [21]. The length values obtained in this study were lower than length values obtained by Ozturk and Goncagul [13]. Horst *et al.* [22] reported the average fiber length as 17.176 ± 0.106 cm in Turkish origin and 18.13 ± 0.351 cm in American origin AGs, respectively. In this study, the length values obtained from all varieties were lower than the values obtained by Horst *et al.* [22] and higher than the values obtained by Odabasioglu *et al.* [16]. The fineness values obtained by Bilgen *et al.* [15] are higher than the values obtained in females of Eskisehir and Lalahan varieties; it is similar to the fineness values obtained in females in the Siirt variety, and lower than Siirt variety males.

TABLE V
Effect of variety, gender and region factors and their interactions on length variable*

Variable	Gender	Variety	Region		
			Shoulder	Rump	Rib
			$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
Fineness (μm)	Female^{x}	Eskisehir^{b}	27.33 ± 1.33	23.97 ± 1.67	25.17 ± 1.32
		Lalahan^{b}	28.67 ± 1.05	25.70 ± 1.41	25.13 ± 1.19
		Siirt^{a}	33.80 ± 2.17	30.70 ± 2.64	32.73 ± 2.35
	Male^{y}	Eskisehir^{b}	33.03 ± 1.98	28.50 ± 2.61	29.10 ± 1.86
		Lalahan^{b}	32.90 ± 2.28	31.03 ± 2.13	30.60 ± 0.66
		Siirt^{a}	37.07 ± 3.29	36.03 ± 3.78	36.00 ± 2.38

* $\bar{X}$: mean, $S_{\bar{x}}$: standard error, ^{x,y}: The differences between different letters within the gender groups statistically significant, ^{a,b,c}: The differences between different letters within the variety groups statistically significant

Mohair fineness (diameter) is one of the leading characteristics in textile industries [23]. In this study, the fiber fineness values taken from shoulder, rump and rib region of females in Eskisehir and Lalahan varieties are lower than Ozturk and Goncagul [13], Siirt variety are similar to the values obtained in Ozturk and Goncagul [13]. In addition, mohair fiber fineness values taken from the same regions in males similar to the values obtained in Ozturk and Goncagul [13], and the fineness values obtained from the Siirt variety are higher than Ozturk and Goncagul [13]. The fineness values obtained from Eskisehir, Lalahan and Siirt variety females and Eskisehir and Lalahan variety males were lower than Erol *et al.* [14] were, while Siirt variety males are similar to Erol *et al.* [14]. Odabasioglu *et al.* [16] found that the fineness value (36.4 μm) obtained from colored AGs was higher than the fineness values obtained in both gender of the three varieties in this research. The fineness value (30.1 μm) obtained from colored AG crossbred was higher than fineness value obtained from females in Eskisehir and Lalahan varieties, lower than in Siirt variety females and males of three varieties. Gunes *et al.* [24] reported fiber fineness as 29.83 μm and 28.29 μm in Turkish and American AGs, respectively. These values were found to be higher than females in Lalahan and Eskisehir varieties, but lower than the fineness value obtained from males in all varieties. The fineness values of mohair taken from females in Eskisehir and Lalahan varieties were similar to the fineness values of mohair taken from spring shearing in AGs in the western region of Argentina in the study conducted by Sacchero *et al.* [25].

The values obtained from females were close to the values determined by Yerturk and Odabasioglu [26] (31.60, 34.40 and 35.38 μm), while the values obtained from males were higher in current study. Yerturk and Odabasioglu [26] determined the length values for the same region 15.88, 16.75, 14.89 cm. In this study, these values were determined as 12.00, 7.50, 9.00 cm in females and 12.00, 10.60, 6.83 cm in males, respectively and lower values were obtained than Yerturk and Odabasioglu [26].

The effect of variety, gender and region on elasticity variable was found statistically insignificant ($P>0.05$). Interactions for this variable were found statistically insignificant ($P>0.05$, TABLE VI).

TABLE VI
Effect of variety, gender and region factors and their interactions on elasticity variable*

Variable	Gender	Variety	Region		
			Shoulder	Rump	Rib
			$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
Elasticity (%)	Female	Eskisehir	35.57 ± 3.21	34.77 ± 5.28	35.50 ± 1.65
		Lalahan	34.05 ± 0.81	33.38 ± 1.93	35.96 ± 2.27
		Siirt	35.33 ± 0.84	34.95 ± 1.39	34.78 ± 1.47
	Male	Eskisehir	33.59 ± 1.25	38.23 ± 2.28	35.92 ± 4.77
		Lalahan	35.32 ± 1.35	37.51 ± 1.44	33.23 ± 0.71
		Siirt	34.19 ± 1.94	32.25 ± 1.53	27.34 ± 4.70

* $\bar{X}$: mean, $S_{\bar{x}}$: standard error

The effect of variety on tenacity variable was statistically significant ($P<0.05$), while the effect of gender and region was statistically insignificant ($P>0.05$). Interactions between all variables were found statistically insignificant ($P>0.05$). According to these results, tenacity values of Siirt variety were lower than Eskisehir and Lalahan varieties (TABLE VII).

TABLE VII
Effect of variety, gender and region factors and their interactions on tenacity variable*

Variable	Gender	Variety	Region		
			Shoulder	Rump	Rib
			$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$	$\bar{X} \pm S_{\bar{x}}$
Tenacity (cN/tex)	Female	Eskisehir[a]	28.19 ± 6.29	34.03 ± 8.27	27.61 ± 4.99
		Lalahan[ab]	24.18 ± 2.68	29.03 ± 4.12	29.44 ± 1.34
		Siirt[b]	23.03 ± 0.29	24.12 ± 1.46	22.98 ± 0.49
	Male	Eskisehir[a]	23.42 ± 1.13	29.78 ± 7.87	26.25 ± 2.32
		Lalahan[ab]	29.79 ± 7.63	31.03 ± 3.99	22.34 ± 2.36
		Siirt[b]	21.64 ± 1.79	21.91 ± 0.69	19.82 ± 1.28

* $\bar{X}$: mean, $S_{\bar{x}}$: standard error, [a,b]: The differences between different letters within the variety groups statistically significant

The elasticity values in this study are higher than obtained by Ozturk and Goncagul [13], Odabasioglu *et al.* [16], and lower than Erol *et al.* [14] (40.17 ± 0.0553%), Bilgen *et al.* [15] (37.51 ± 0.648%).

Tenacity has been reported in different units (g and g/denier) in various studies Ariturk *et al.* [18], Bilgen *et al.* [15], Ozturk and Goncagul [13, 27], Vatansever and Akcapinar [21]. Since the tenacity values determined in this research were determined in cN/tex unit, they were compared with the literature measuring tenacity through this unit. The tenacity values obtained in the research conducted by Erol *et al.* [8, 14] (18.70 ± 0.470 cN/tex, 19.52 ± 0.607 cN/tex, respectively) and were found to be lower than this study.

CONCLUSIONS

This study provided a comprehensive evaluation of the mohair quality characteristics of Eskisehir, Lalahan, and Siirt varieties of AGs. The results demonstrated significant effects of variety and gender on mohair yield, length, fineness, and tenacity, while regional differences were less pronounced. Notably, the Siirt variety showed higher yield values, but lower tenacity compared to Eskisehir and Lalahan varieties. Gender differences were evident, with males generally exhibiting greater yield and coarser fiber compared to females. The findings suggest that genetic factors, in conjunction with environmental and management conditions, play a pivotal role in determining the quality traits of mohair. These results can be utilized to enhance breeding programs focused on optimizing mohair production and quality in AGs. Future studies should consider a broader range of environmental factors and include a larger sample size to validate these findings and provide more nuanced insights into the complex interplay between genotype and environment in mohair production.

ACKNOWLEDGEMENTS

The authors would like to thank the Republic of Türkiye, Ministry of Agriculture and Forestry, General Directorate of Agricultural Research and Policies, for providing financial support for the research (Project Number: TAGEM/HAYSÜD/A/20/A4/P2/2195).

Ethical Statement

This study was carried out as part of the Project to "Determination of the Genes Affecting Mohair Development in Angora Goats by RNA Sequencing (RNA–seq)". In order to use animal materials in this project, ethics committee permission numbered 205, dated September 15, 2022, was obtained from the ICLRT animal experiments local ethics committee.

Conflict of interest

The authors declare there are no conflicts of interest.

BIBLIOGRAPHIC REFERENCES

[1] Mioč B, Prpc Z, Vnucec I, Barać Z, Sušić V, Samaržija D, Vesna P. Factors affecting goat milk yield and composition. Mljekarstvo [Internet]. 2008 [cited 24 May 2024]; 58(4):305–313. Available in: https://hrcak.srce.hr/file/48496

[2] Mazhangara IR, Chivandi E, Mupangwa JF, Muchenje V. The potential of goat meat in the red meat industry. Sustainability [Internet]. 2019; 11(13):3671. doi: https://doi.org/gv9whh

[3] Salehi M, Kadim I, Mahgoub O, Negahdari SH, Eshraghi Naeeni RS. Effects of type, sex, and age on goat skin and leather. Anim. Prod. Sci. [Internet] 2013; 54(5):638–644. doi: https://doi.org/f53vrp

[4] Abioja MO, Logunleko MO, Majekodunmi BC, Adekunle EO, Shittu OO, Odeyemi AJ, Nwosu EU, Oke OE, Iyasere OS, Abiona JA, Williams TJ, James IJ, Smith OF, Daramola JO. Roles of candidate genes in the adaptation of goats to heat stress: A review. Small Rumin. Res. [Internet]. 2023; 218(3):106878. doi: https://doi.org/g8v6k3

[5] Turkish Statistical Institute (TURKSTAT). Animal Production Statistics ver 2022. [Internet]. 2023 [cited 30 June 2024]. Available in: https://goo.su/Ps4gwe

[6] Ankara İli Damizlik Koyun Keçi Yetiştiricileri Birliği [Ankara Province Breeding Sheep-Goat Breeders Association]. Ankara Keçisi Tiftik Raporu 2021 [Angora Goat Mohair Report 2021]. [Internet]. 2021 [cited 30 Jun. 2024]. 58 p. Turkish. Available in: https://goo.su/cxjjPKt

[7] Official Gazette. Communiqué on the Registration of Domestic Animal Breeds and Lines. (Communiqué No: 2004/39) Appendix 15 published in Official Gazette No: 25668 dated 12 December 2004. [Internet]. 2004 [cited 30 Jun. 2024]. Available in: https://goo.su/JsElcq

[8] Erol H, Ünal N, Ünal M, Akçadağ HI. Gen kaynağı olarak koruma altında yetiştirilen Ankara keçilerinde önemli verim özellikleri [Important production traits of Angora goats reared under conservation as a gene resource]. Ankara Üniv. Vet. Fak. Derg. [Internet]. 2014; 61(3):211-216. Turkish. doi: https://doi.org/g8v6k4

[9] Official Gazette. On-Site conservation and development of animal genetic resources. Notification on implementation principles on support. (Notification No: 2012/54) [Internet]. 2012 [cited 25 Jun. 2024]. Available in: https://goo.su/xCpJs1

[10] Official Gazette. Implementation of livestock support. Notification (Notification No: 2023/41). [Internet]. 2023 [cited 25 Jun. 2024]. Available in: https://goo.su/Haecz

[11] Pienaar L, Partridge A, Morokong T. The Mohair industry: Economic impact of possible market closure. Western Cape Province (South Africa): Western Cape Department of Agriculture. [Internet]; 2018 cited 30 Jun. 2024]. 17 p. Available in: https://goo.su/xjktJo

[12] Dellal G. Çiftlik Hayvanlarinda Lif Üretimi [Fiber production in farm animals] Lecture Notes (11th week). Ankara University, Faculty of Agriculture, Department of Zootechnics. [Internet]. 2018 [cited 30 Jun. 2024]; 15 p. Available in: https://goo.su/U7NnwwX

[13] Öztürk A, Goncagül T. Ankara Keçilerinde Doğum Ağirliği Ve Farkli Yaşlardaki Canli Ağirliğin Tiftik Verim Ve Kalitesi Üzerine Etkisi [Effect of birth weight and live weight on mohair yield and quality in Angora goats]. Lalahan Hay. Arast. Enst. Derg. [Internet]. 1994 [cited 30 Jun. 2024]; 34(1-2):103-109. Turkish. Available in: https://goo.su/dNn76

[14] Erol H, Özdemir P, Odabas E, Senyüz HH, Ünal N, Behrem S. Enstitü ve Yetiştirici Elinde Korunan Ankara Keçilerinde Çeşitli Verim Özelliklerinin Araştırılması [Investigation of various production traits of Angora goat herds kept as gene source both Ex Situ and In Situ conditions]. Lalahan Hay. Arast. Enst. Derg. [Internet]. 2017 [cited 30 Jun. 2024]; 57(1):1-12. Turkish. Available in: https://goo.su/HtUpqp

[15] Bilgen A, Akman N, Erol H, Ankarali B, Aytac M. Lalahan Hayvancilik Merkez Araştirma Enstitüsü'nde Yetiştirilen Ankara Keçilerinde Bazi Tiftik Özellikleri Ve Kirkim Sonu Canli Ağirliği [Some mohair characteristics and live weights after shearing of Angora goats reared at Lalahan Livestock Research Institute]. Lalahan Hay. Arast. Enst. Derg. [Internet]. 2008 [cited 30 Jun. 2024]; 48(1):25-33. Turkish. Available in: https://goo.su/AnHy

[16] Odabasioglu F, Küçük M, Yilmaz O. Investigation of Mohair production, clean yield, and fibre characteristics in coloured Mohair goat and F1 cross-bred kids of Angora goat × coloured Mohair goat. Turk. J. Vet. Anim. Sci. [Internet]. 2009; 33(1):7-13. doi: https://doi.org/g8v6k5

[17] Dellal, G. Ciftlik Hayvanlarinda Lif Uretimi [Fiber production in farm animals] Ankara (Türkiye): Metsa Basimevi; 2021. 390 p. Turkish.

[18] Ariturk E, Yalcın BC, Imeryuz F, Muftuoglu S, Sincer N. Genetic and environmental aspects of Angora goat production. 1. General performance levels and the effect of some measurable environmental factors on the production traits. İstanbul Üniv. Vet. Fak. Derg. 1979; 5:1-18.

[19] Muftuoglu, S, Orkiz M. Halk elinde yetiştirilen ankara keçilerinde Tiftik verimi ve önemli tiftik özellikleri [A study on Mohair production and Mohair quality in turkish Angora goat]. Livest. studies [Internet]. 1982 [cited 30 Jun. 2024]; 22(1-4):3-20. Turkish. Available in: https://goo.su/MtCEx

[20] Düzgüneş O, Eliçin A, Akman N. Ankara Keçisinde Çeşitli Verim Özelliklerinin Yörelere Göre Durumu. 1. Tiftik Özellikleri [Status of various production characteristics of Angora goat according to regions. 1. Mohair characteristics]. Atatürk Üniv. Ziraat Fak. 1985; 35(1-2-3-4):338-348. Turkish

[21] Vatansever H, Akapinar H. Lalahan Hayvancilik Merkez Araştirma Enstitüsü'nde Yetiştirilen Farkli Kökenli Ankara Keçilerinde Büyüme, Döl Verimi Ve Tiftik Özellikleri [Growth, reproduction and Mohair characteristics of Angora goats of different origines which bred at Lalahan Livestock Research Institute]. Lalahan Hay. Arast. Enst. Derg. [Internet]. 2006 [Cited 30 Jun. 2024]; 46(2):1-11. Turkish. Available in: https://goo.su/BpuEvx

[22] Horst P, Zarate AV, Gunes H, Yalcin BC. Growth rate and wool production of crossbred progeny from Turkish and North American Angora goats. Anim. Res. Dev. 1993; 38:92-99.

[23] Shelton M. Angora goat and Mohair production. San Angelo (Texas, USA): Anchor Publishing Company; 1995. 240 p.

[24] Gunes H, Marthur PK, Horst P, Yalcın BC. Genetic improvement in Turkish Angora goats through outcrossing with North American germplasm. In: 5th International Conference on Goats; 2-8 March 1992; New Delhi, India. New Delhi: International Goat Association; 1992. 260 p.

[25] Sacchero D, Gonzalez EB, Maurino J, Lopez M, Cortes MV, Alvarez R, Bidinost F. Performance of Angora goats, Mohair production, and farmer income in extensive livestock systems of north Patagonia, Argentina. Front. Anim. Sci. [Internet] 2023; 4:1208778. doi: https://doi.org/g8v6k6

[26] Yertürk M, Odabaşiolu F. Doğu ve Güneydoğu Anadolu Bölgesinde Yetiştirilen Renkli Tiftik Keçilerinin Yarı Entansif Şartlarda Verim özelliklerinin Araştırılması [Investigation on the yield characters of the colored Mohair goats being bred in the eastern and southeastern parts of Anatolia]. YYU. Vet. Fak. Derg. [Internet]. 2007 [cited 25 Jun. 2024]; 18(2):45-50. Turkish. Available in: https://goo.su/Z1MLBI9

[27] Öztürk A, Goncagül T. Muhtelif Yaşlardaki Ankara Keçilerinde Tiftikverimi Ve Tiftik Özellikleri [The Mohair characteristics and yield of Angora goats at different age]. Lalahan Hay. Araşt. Enst. Derg. [Internet]. 1995 [cited 25 Jun. 2024]; 35(1-2):67-78. Turkish. Available in: https://goo.su/CPFro