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Live Weight, Fleece Yield and Quality after Shearing in Hamdani and Karakaş Sheep

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- Hakkari
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ABSTRACT:

This study was carried out to determine some wool yield characteristics and post-shearing live weight of 35 head Hamdani and 40 head Karakaş sheep reared in fully extensive conditions in Central Budakli village of Hakkari province.In the study, the results for length (Hauter), length (Barbie), elasticity, fineness, strength, clean fleece percentage, greasy fleece weight and post-shearing live weight were found to be; 42.38 mm-40.51 mm-, 58.25 mm-54.64 mm, 32.34%-32.31%, 36.64 µ-37.62 µ, 36.15 cN ^{tex} -34.80 cN ^{tex}, 63.88%-65.94%, 2.12 kg-1.84 kg and 60.33 kg-48.55 kg respectively in Hamdani and Karakaş ewes.In Hamdani sheep, the correlation between elasticity and strength (0.499) and between greasy fleece weight and post-shearing live weight (0.599) was very significant ($p<0.01$). In Karakaş sheep, the highest positive correlation was found between Barbie and Hauter lengths (0.925). The correlation was found between elasticity and strength (0.549) and between greasy fleece weight and post-shearing live weight (0.471) very significant ($p<0.01$) in Karakaş sheep. As a result, it has been understood that Karakaş and Hamdani sheep fleeces are classified as coarse wool.

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INTRODUCTION

Sheep is one of the first animals that humans domesticated. From the first human societies until today, sheep have always been near man. Sheep, which have been meeting the most important needs of people with their milk, meat, fleece, skin, manure and hide for thousands of years, also play a major role in the lives of 21st century people (Yılmaz and Odabaşıoğlu, 2006; Kaymakçı, 2010; Koyuncu and Taşkın, 2013). Sheep breeding, which has an important place in animal husbandry, one of the oldest production activities of mankind, vary according to the direction and quantity of yield depending on geographical situation, climate, traditional production activities and industries of countries. Sheep breeding, shaped by these differences, has led to the emergence of more than 200 sheep breeds (Tuncer, 2008). Although animal fibers such as fleece, mohair, silk, goat upper coarse hair and cashmere are mainly produced in Türkiye, their contribution to the general economy is very low. (Dellal et al., 2013).

Türkiye is one of the numerically leading countries in the world with the presence of sheep reported over 46 million. The majority of the sheep raised in Türkiye are combined breeds that are not very high in terms of yield level and are bred in family-type extensive conditions. In the category of small cattle in Türkiye, as of the end of June 2022, the number of sheep increased by 2.1% compared to December of the previous year and became 46 million 123 thousand heads (TÜİK, 2022).

Wool is a natural product, produced in a natural form by the skin to protect against climatic conditions like human hair. Wool basically consists of a special protein called keratin. Being very durable, keratin acts as a barrier against environment and thus protects sheep from heat, cold, sun, wind and rain. Thanks to their wool, sheep are able to live all over the world, for example, in temperatures ranging from minus 40 degrees in Mongolia to 40 degrees in Australia. The fineness of wool is classified by measuring the fiber diameter in microns and determining the average wool diameter on a hide or a wool batch. Micron is a measurement given to a thousandth of a millimeter. Wool fibers can have a diameter ranging from less than 12 microns to larger than 50 microns; Merino wool fibers are among the thinnest end of scale, typically in the 12-to-21-micron range. Because of the fact that merino wool fiber is so thin, each Merino sheep has around 100 million fibers growing rapidly at 0.3 millimeters per day (Anonymous, 2022)

The hairs obtained in the form of sleeves during shearing in sheep and rams and the collection of ringlets formed by them are called wool. , The state in which the wool is measured and weighed after being washed and cleaned and made ready for yarn making is called tops. The fleece used in the textile and weaving industry are classified as thin, semi-thin and coarse mixed fleece, and the sheep with thin leaves are Merino type sheep. From this type of wool, thin and high-quality fabrics are obtained. Semi-fine wool is mixed with synthetic fibers to make sports fabrics. Coarse-mixed fleece is used in the weaving industry such as carpets, rugs, blankets and socks. As a matter of fact, the various properties of the fleece and the fact that it is an easily obtained substance bring along the economic value as well as the social value it covers. In Türkiye, many studies have been made about the yield and quality of the fleece related to domestic sheep. However, the increase in the use of artificial fibers in the textile and weaving industry in recent years has not led to a decrease in the importance given to the leaf. In recent years, since coarse-mixed fleece is sought after in the carpet industry and products made from natural wool are healthier and more useful, studies towards determining the properties of wool are increasing day by day (Gürgen, 2008).

The fleece obtained only from sheep is the fiber with the highest production among the natural fibers of animal origin. In wild sheep, the fleece shirt consists of two different parts: the upper rough and the lower thin shirt. The upper coarse fibers are produced by the primary follicles, while the lower

fine fibers are produced from the secondary follicles. Lower fine fibers are usually shed in the spring-early summer months. Sheep wool has been accepted as a building material in the European Union since 2003. Due to its coefficient of thermal conductivity, wool has the advantages of continuous efficiency and latent (potential) heat storage in structures (Leonte et al., 2011). In domestic sheep, especially Merinos, the fleece shirt is of the only shirt type, which consists mainly of secondary fibers. Since there is continuous fiber growth in these, periodic fiber breakdown is not generally observed. The fiber diameter, which is the most important textile feature of leaf fibers, is approximately 13-18 µ in thin Merino leaves, while it is 36-45 µ in coarse leaves obtained from other sheep breeds (Russel and Bishop, 1990). The average fiber diameter of wool is the main determinant of price, processing performance and textile quality (McGregor and Butler, 2016).

In addition to the use of the leaf in carpet-weaving and clothing industries, these wools are also used in the medical field, in dressings, pressure bandages, wound dressings (Bahtiyari et al., 2008), as a separator, reinforcer and filter agent in highways, airports, railways, sports fields, dams, roofs and embankments as geotextiles, and in covering, protection and packaging applications in agriculture and horticulture. In addition to these, with the effect of environmental awareness spreading rapidly in the world, the demand for organic products in the textile sector is increasing day by day, and the use of natural fiber instead of synthetic fiber is becoming widespread. In recent years, since coarse-mixed fleece is sought after in the carpet industry and products made from natural wool are healthier and more useful, studies towards determining the properties of wool are increasing day by day (Gürgen, 2008).

It can be said that the fleece of Hamdani sheep largely complies with the criteria of ideal carpet type fleece (Küçük et al., 2000). In the Hakkari region, the fleece obtained from Hamdani sheep is used to make beds, duvets and pillows.

Fleece has an important place both in terms of protecting the sheep against environmental factors and meeting the needs of people with better quality. From this point of view, the issue of fleece, which is almost forgotten in Türkiye, should be brought to the agenda again, and the studies in this field should gain momentum in order not to keep Türkiye out of this area in terms of the developments in the field of natural fiber and its sustainability.

The general race in Eastern Anatolia is Morkaraman. However, in addition to the Morkaraman breed, there are also sheep breeds or types such as Akkaraman in the western and southern parts of the region, and Kangal, Tuj, Ayvaz, Hamdani, Asurani, Karakaş, Norduz breeds which are in demand in the regions where they are locally grown, which are well adapted to the harsh environment and management methods and are resistant to malnutrition and diseases (Cengiz and Eliçin, 1986; Bingöl, 1998; Yılmaz et al., 2007; Eyduran et al., 2008; Kaymakçı, 2010; Karakuş and Akkol, 2013).

MATERIALS AND METHODS

A total of 75 head of sheep from Hamdani (35 heads) and Karakaş sheep flocks (40 heads) which were raised entirely under village conditions, were used as materials in the experiment conducted in a sheep farm Budaklı village of Hakkari province.

The health, care and feeding operations of the farm herd were controlled. These procedures were routinely repeated. Animals from which fleece samples would be taken from the herd were determined, and their ear numbers were checked and recorded.

The live weight and greasy fleece weights of the sheep after shearing were determined by weighing.The maintenance feeding of the sheep took place entirely under the care feeding conditions applied by the sheep owners. In the research, the teeth of all animals were examined, and their ages were determined. The sheep to be sheared were starved the night before and during the shearing, and the

shearing process was done by the same person to ensure uniformity by using the shearing scissors by hand. The sheep were sheared with shearing scissors towards the end of June 2016, and the dirty fleece weight was measured with a precision scale of 10 grams. In the shearing, about 50 g of fleece samples were taken from the rib (side) area of each animal and sent to Lalahan Livestock Research Institute, Wool-Mohair Laboratory in plastic sample bags. In terms of fleece features, length, fineness, elasticity, strength and fleece yield properties were examined. The analyzes of the samples were performed in Wool-Mohair Laboratory according to ASTM (1997) (American Society for Testing and Materials) and IWTO (International Wool Textile Organization) standards. In the research laboratory, a device named "Uster AL100-FL100" was used for the analysis of the ringlet length. This device measures two length values called Hauter (H) and Barbie (B). Of these, Hauter is the average fiber length value based on the number of fibers. Barbie is a weight-based average fiber length value, two of which are used in the textile industry (IWTO, 1995). Both Hauter and Barbie values were used in the study. Uster AL100-FL100 measuring principle is that fiber length measurement unit of the device measures the length of the placed fiber samples with the help of a conductor from many points of the fiber by capacitive method. Measuring ranges are from 0.125–0.250 mm. Measurements are evaluated digitally. "Uster OFDA 100" (Instrument for Measuring Wool Diameter) was used for fiber diameter (fineness) analysis, and Single Fibre Tensile Tester Fafegraph device was used for elasticity and strength analysis. For yield determination, the samples were washed with hot detergent water and left to dry in a drying oven set to 1050°C. After the drying process is finished, the ratio of the number of clean leaves obtained by weighing again to the number of dirty leaves was found as the yield.

The live weight of the sheep at the end of shearing process was determined by the electronic closed scale with a capacity of 600 kg. The live weight and fleece characteristics of the sheep at the end of shearing will be evaluated by appropriate statistical methods. To transform the data to be obtained as a result of the research into a more useful and understandable form, the statistical evaluations to be made were based on simple mean, ratio and variance analyzes. For the statistical analysis of data, SPSS 14.0 software (SPSS, 2015) was used. In the comparison of each variable according to age groups, one-way analysis of variance (One Way ANOVA) was used for independent sample.

The following model was used for statistical calculations:

$Y_{ijk} = \mu + a_i + e_{ijk}$

Y_{ijk}: measured trait

μ: overall mean

a_i: effect of age (2,3.4,5,6)

e_{ijk}: residual error

RESULTS AND DISCUSSION

When Table 1 is examined, the averages standard errors and their variation coefficients related to the live weight and fleece characteristics after shearing in Hamdani sheep were given. According to the Table, the average of dirty fleece weight (DFW), live weight after shearing (LWAS), length (hauter), length (barbie), elasticity, fineness, strength and Clean wool percentage in Hamdani sheep were determined as 2.12 kg, 60.33 kg, 42.38 mm, 58.25 mm, 32.34%, 36.64 μ, 36.15 cN ^{tex} and 63.88%, respectively. The coefficients of variation (%) for the same features were found to be 6.75, 2.76, 26.46, 28.60, 12.08, 12.23, 27.51 and 19.49, respectively. When the table is examined, it is understood that while the length (hauter and barbie) and strength are interpreted as being more distant (dispersed) from

the average, the weights of the sheep in the herd are close to each other in terms of LV after shearing (kg).

In the study, the live weight values of Hamdani sheep after shearing and the fleece weight, clean wool percentage, fiber diameter, ringlet length, elasticity and strength of the fleece quality characteristics are shown in Table 2. There was no statistical difference in terms of all the features examined ($p>0.05$).

According to the findings given in Table 2, the lowest clean wool percentage was found in 5-6-year-old sheep, and the highest clean wool percentage was found in 3-year-old sheep. In this study, the fineness of the fleece can be expressed as < 4-year-old 3-year-old < 5-6-year-old. When viewed from the same table, it is observed that the age with the highest average live weight after shearing is 5-6 years. When the Barbie length measure was examined, it was determined that the shortest value was in 5-6-year-old sheep.

Table 1. Averages of live weight and fleece characteristics after shearing in Hamdani sheep

Factors	N	Average	Minimum	Maximum	Standard error	CV (%)
Greasy fleece weight (kg)	35	2.12	1.80	2.35	0.02	6.75
LV after shearing (kg)	35	60.33	57.45	64.10	0.28	2.76
Length (Hauter) (mm)	35	42.38	28.70	75.70	1.90	26.46
Length (Barbie) (mm)	35	58.25	34.80	103.00	2.82	28.60
Elasticity (%)	35	32.34	21.75	38.33	0.66	12.08
Thinness (µm)	35	36.64	27.15	44.59	0.76	12.23
Strength (cN ^{tex}**)**	35	36.15	18.99	57.43	1.68	27.51
Clean wool percentage (%)	35	63.88	36.60	87.00	2.11	19.49

The fleece, which is a very important yield of sheep, is a good raw material for the weaving and carpet industry with its properties such as fineness, strength, heat retention, moisture extraction and matting. In this study conducted, it is considered that the differences seen in the value of dirty fleece yield are primarily related to breed, regional conditions, care and feeding. In the study, the average weight of the dirty fleece belonging to Hamdani sheep was found to be 2.12 kg. When this obtained value is compared with other domestic sheep genotypes raised in the region, it was found that this value is higher than the values reported by Karakuş et al. (2005) for Karakaş sheep (1.72 kg) and Norduz sheep (1.96 kg); 1.70 kg reported by Tuncer (2008) for Karakaş sheep raised in semi-intensive conditions; 1.93 kg reported by Hakan (2013) for Karakaş sheep; 1.8-1.4 kg reported by Yalçın and Müftioğlu (1969) for Akkaraman sheep; 1.94 kg reported by Aksoy et al., (2001) as fleece yield in Tuj sheep; 1.58 kg reported by Peşmen and Yardımcı (2012) as dirty fleece yield in Menemen sheep fleece; 1.80, 1.69, 1.62 and 1.58 kg respectively for the dirty fleece yield in sheep aged 2, 3, 4 and 5 years and older in a study on the characteristics of the fleece in Kangal Akkaraman sheep (Garip et al., 2010); and 1.08 kg value reported by Alarslan et al., (2021) for Yalova type sheep. It was determined that the average dirty fleece weight value detected in Hamdani sheep was similar to the 2.10 kg value reported by Al-Barzinji (2009) as dirty flee yield in Hamdani sheep, but it was lower than 3.17 kg value reported by Gürgen (2008) for dirty fleece yield of Karayaka sheep; 2.28 kg in 2-2.5-year-old, 2.58 kg in 3-3.5-year-old, 2.39 kg in 4-year-old and older and 2.91 kg value reported by Yılmaz and Denk (2004) as the dirty fleece yield of Norduz sheep; 2.22 kg value reported by Tuncer (2008) in Norduz sheep; and 2.29 kg value reported by Bingöl (2014) for Hamdani sheep. It can be said that the value of 1.84 kg determined for Karakaş sheep in the study is generally in paralllel with the values reported for domestic breeds. However, it is a fact that the

Hamdani sheep dirty fleece obtained in the same study is lower than the average value. Hamdani sheep in particular can be a result of their body size.

The value determined as the average live weight after shearing in Hamdani sheep (60.33 kg) was found to be higher than findings in other studies such as 42.95 and 48.40 kg, respectively, reported by Erol and Akçadağ (2009) as the live weight of adult female and male Karagül sheep at the end of shearing; 51.80 and 49.08 kg as reported live weight values at the end of shearing in Sakız and İmroz sheep (Çörekçi and Evrim, 2001); 51.62 kg (Alarslan et al., 2021) reported as the live weight of Yalova genotype sheep at the end of shearing, 49 kg reported by Aktaş (2003) as the average live weight of shearing time in Morkaraman sheep of Varto region; 54.6 kg reported by Yüceer et al. (2010) for Acıpayam sheep breed; 52.85 kg value reported by Tabbaa et al. (2001) for Ivesi sheep. The same value (60.33 kg) was higher than the 48.55 kg value detected for Karakaş sheep in the study. According to the results of the study, when the live weight values after shearing were examined, it was concluded that the value of 60.33 kg determined for Hamdani sheep was higher than the averages reported for domestic breeds, and in compliance with Karakaş sheep values.

Table 2. Averages and variation coefficients (CV) of live weight and fleece characteristics after shearing in Hamdani sheep

Factors	Age	N	Average	Standard error	Minimum	Maximum	CV (%)
Greasy fleece weight (kg)	3	10	2.09	0.03	1.95	2.28	4.22
	4	15	2.13	0.04	1.86	2.32	6.89
	5-6	10	2.18	0.06	1.80	2.35	7.95
	Total	35	2.12	0.02	1.80	2.35	6.75
LV after shearing (kg)	3	10	59.96	0.65	57.45	64.10	3.41
	4	15	60.48	0.36	58.58	63.27	2.32
	5-6	10	60.60	0.62	58.96	63.56	2.91
	Total	35	60.33	0.28	57.45	64.10	2.76
Length (Hauter) (mm)	3	10	49.77	4.52	30.70	75.70	28.71
	4	15	41.43	2.47	28.70	65.60	23.05
	5	8	37.04	1.89	31.60	48.40	14.44
	Total	35	42.38	1.89	28.70	75.70	26.46
Length (Barbie) (mm)	3	10	65.00	5.72	35.10	93.90	27.83
	4	15	57.22	4.54	34.80	103.00	30.71
	5-6	10	54.90	4.69	43.10	86.00	24.14
	Total	35	58.25	2.82	34.80	103.00	28.60
Elasticity (%)	3	10	30.75	1.46	21.75	36.08	15.03
	4	15	32.30	1.02	22.21	36.98	12.18
	5-6	10	34.19	0.98	30.04	38.33	8.10
	Total	35	32.34	0.66	21.75	38.33	12.08
Fineness (µ)	3	10	37.34	1.59	28.33	44.06	13.51
	4	15	35.59	1.28	27.15	44.59	13.88
	5-6	10	38.10	1.11	34.74	44.17	8.28
	Total	35	36.64	0.76	27.15	44.59	12.23
Strength (cN ^{tex})	3	10	33.14	3.86	18.99	56.37	36.87
	4	15	36.44	2.19	24.64	56.97	23.23
	5-6	10	39.79	3.22	26.23	57.43	22.87
	Total	35	36.15	1.68	18.99	57.43	27.51
Clean wool percentage (%)	3	10	67.42	4.29	43.80	82.60	20.15
	4	15	62.60	3.17	36.60	87.00	19.62
	5-6	10	59.60	4.30	41.90	71.50	20.43
	Total	35	63.88	2.11	36.60	87.00	19.49

The correlation coefficients revealing the relationship between the fleece characteristics of Hamdani sheep are given in Table 3. The highest positive correlation length was found between Barbie

and Hauter lengths (0.844), while negative correlation was not found in terms of any characteristics. The correlation between elasticity and strength (0.499) and between shearing fleece weight and post-shearing live weight (0.599) in Hamdani sheep was found to be highly significant ($p<0.01$).

When Table 4 and 5 are examined, the averages standard errors and their variation coefficients related to the live weight and fleece characteristics after shearing in Karakaş sheep were given. When the table is examined, it is interpreted that the length (hauter and barbie) diverges (disperses) more from the mean.

According to the table 5, it is observed that the age group with the heaviest average in terms of live weight after shearing is 5-6-year-old sheep. Again, according to the dirty fleece weight averages, it is understood that the lowest value is the average of 3-year-old animals.

Table 3. Correlations between live weight and various fleece characteristics after shearing in Hamdani sheep

	LV after shearing	Fiber length[1] Hauter, mm	Fiber length[2] Barbie, mm	Elasticity	Fineness	Strength	Clean wool percentage
Greasy fleece	0. 599**	-0.215	-0.135	-0.030	-0.212	-0.198	0.125
LV after shearing	-	-0.259	-0.137	-0.119	-0.182	-0.167	0.226
Fiber length[1]		-	0.844**	0.077	0.298	0.097	0.130
Fiber length[2]			-	0.265	0.406*	0.120	0.255
Elasticity				-	0.368*	0.499**	0.214
Fineness					-	0.540**	-0.058
Strength						-	-0.153

Correlations between *p<0.05 and ** p<0.01 are significant

Table 4. Averages of live weight and fleece characteristics after shearing in Karakaş sheep

	N	Average	Standard error	Minimum	Maximum	CV (%)
Greasy fleece weight (kg)	40	1.84	0.02	1.56	2.15	8.07
LV after shearing (kg)	40	48.55	0.59	41.84	55.80	7.72
Length (Hauter) (mm)	40	40.51	2.01	20.30	73.80	31.31
Length (Barbie) (mm)	40	54.64	2.79	27.80	107.70	32.35
Elasticity (%)	40	32.31	0.71	19.54	40.77	13.94
Thinness (µ)	40	37.62	0.88	29.15	51.95	14.83
Strength (cN ^{tex})	40	34.80	1.54	16.03	55.98	28.02
Clean wool percentage (%)	40	65.94	2.10	26.00	86.90	20.15

Some of the characteristics that should be emphasized in the breeding of the fleece of domestic sheep in Türkiye by selection are fleece yield, length, durability and uniformity. In other words, while increasing the yield of the fleece, it is an important issue to produce the same type of fleece in terms of length and thinness within the limits foreseen for carpet fleece. The correlation coefficients revealing the relationship between the fleece characteristics of Karakaş sheep are given in Table 6. The highest positive correlation length was found between Barbie and Hauter lengths (0.925). The correlation between elasticity and strength (0.549) and between shearing fleece weight and post-shearing live weight (0.471) in Karakaş sheep was found to be highly significant ($p<0.01$). Again, when the table is examined, it is seen that there is a significant ($p<0.01$) correlation between elasticity and fiber lengths (Hauter and Barbie). It is understood that there is also a very important correlation between strength and fineness.

Table 5. Averages and variation coefficients (CV) of live weight and fleece characteristics after shearing in Karakaş sheep

Factors	Age	N	Average	Standard error	Minimum	Maximum	CV (%)
Greasy fleece weight (kg)	2	5	1.77	0.08	1.65	2.00	9.70
	3	8	1.75	0.04	1.56	1.92	6.65
	4	12	1.87	0.04	1.60	2.01	6.72
	5	8	1.93	0.07	1.59	2.15	10.07
	6	7	1.85	0.03	1.77	1.98	4.50
	Total	40	1.84	0.02	1.56	2.15	8.07
LV after shearing (kg)	2	5	45.72	0.89	43.85	48.65	4.37
	3	8	44.21	0.58	41.84	46.58	3.70
	4	12	49.86	0.78	44.88	53.75	5.42
	5	8	52.56	1.03	46.36	55.80	5.53
	6	7	48.68	0.89	45.23	51.40	4.85
	Total	40	48.55	0.59	41.84	55.80	7.72
Length (Hauter) (mm)	2	5	40.64	5.26	28.50	58.80	28.97
	3	8	50.85	5.13	32.00	73.80	28.54
	4	12	37.33	2.49	22.60	53.10	23.10
	5	8	35.90	3.17	24.60	49.40	24.96
	6	7	39.29	6.37	20.30	73.30	42.93
	Total	40	40.51	2.01	20.30	73.80	31.31
Length (Barbie) (mm)	2	5	59.22	9.43	39.10	92.10	35.59
	3	8	64.49	5.37	40.20	82.10	23.54
	4	12	49.57	3.72	27.80	68.20	25.97
	5	8	49.05	5.47	28.70	73.20	31.53
	6	7	55.17	9.58	28.70	107.70	45.92
	Total	40	54.64	2.79	27.80	107.70	32.35
Elasticity (%)	2	5	33.68	1.75	28.10	37.89	11.65
	3	8	33.94	1.66	26.05	40.77	13.82
	4	12	33.08	1.07	27.61	38.94	11.24
	5	8	30.75	1.50	24.85	36.19	13.77
	6	7	29.96	2.19	19.54	37.40	19.37
	Total	40	32.31	0.71	19.54	40.77	13.94
Thinness (µ)	2	5	36.31	1.73	32.16	41.93	10.63
	3	8	40.72	2.67	29.78	51.95	18.52
	4	12	35.76	0.98	30.42	43.11	9.51
	5	8	38.21	2.05	29.15	48.37	15.17
	6	7	37.49	2.50	30.10	47.86	17.67
	Total	40	37.62	0.88	29.15	51.95	14.83
Strength (cN ^{tex})	2	5	33.65	2.77	28.10	43.52	18.42
	3	8	42.52	3.11	31.57	53.33	20.70
	4	12	33.76	2.14	20.44	48.99	21.92
	5	8	33.49	4.61	19.12	55.98	38.93
	6	7	30.10	3.64	16.03	42.75	31.98
	Total	40	34.80	1.54	16.03	55.98	28.02
Clean wool percentage (%)	2	5	65.36	2.41	59.20	71.60	8.23
	3	8	58.41	3.66	49.00	81.50	17.71
	4	12	71.07	4.44	40.90	86.90	21.64
	5	8	63.19	5.94	26.00	80.00	26.61
	6	7	69.33	3.55	58.60	82.40	13.55
	Total	40	65.94	2.10	26.00	86.90	20.15

Some of the characteristics that should be emphasized in the breeding of the fleece of domestic sheep in Türkiye by selection are fleece yield, length, durability and uniformity. In other words, while increasing the yield of the fleece, it is an important issue to produce the same type of fleece in terms of length and thinness within the limits foreseen for carpet fleece. The correlation coefficients revealing the relationship between the fleece characteristics of Karakaş sheep are given in Table 6. The highest positive correlation length was found between Barbie and Hauter lengths (0.925). The correlation

between elasticity and strength (0.549) and between shearing fleece weight and post-shearing live weight (0.471) in Karakaş sheep was found to be highly significant ($p<0.01$). Again, when the table is examined, it is seen that there is a significant ($p<0.01$) correlation between elasticity and fiber lengths (Hauter and Barbie). It is understood that there is also a very important correlation between strength and fineness.

Tekin et al. (1999) reported that there are great variations among different sheep breeds in terms of fleece yield and characteristics and that these characteristics are affected by environmental conditions such as gender, age, shearing years, care-feeding, and body weight. In terms of length, the length of the ringlet in Hauter and Barbie, which are used in the weaving industry, is significant in terms of the weaving industry and differs from the length of the ringlet determined in the classical literature. In Hamdani and Karakaş, the average length of the ringlet was 42.58 and 40.51 mm in the Hauter herd, and 58.25 and 54.64 mm in Barbie, respectively. In the study, it was seen that the length of the ringlet was generally shorter than the literature reports. In the study, USTER AL 100 (Almeter AL 100) and USTER FL 100 (Fibroliner FL 100) devices were used for the measurement of ringlet length. With this device, analysis is performed according to the number of fibers (Hauter, H) and fiber volume and weight (Barbie, B). However, Hauter and Barbie length values are quite different from manually measured length values (Ünal et al. 2004, Yüceer et al. 2010). For this reason, ringlet length values obtained in the study are lower than the values reported in many studies and obtained manually.

Table 6. Correlations between live weight and various fleece characteristics after shearing in Karakaş Sheep

	LV after shearing	Fiber length[1] Hauter mm	Fiber length[2] Barbie mm	Elasticity	Fineness	Strength	Clean wool percentage
Shearing fleece weight	0.471**	-0.144	-0.169	-0.140	-0.185	-0.307	0.146
LV after shearing	-	-0.090	-0.021	-0.104	0.059	-0.080	0.115
Fiber length[1] Hauter mm		-	0.925**	0.510**	0.593**	0.599**	-0.212
Fiber length[2] Barbie mm			-	0.587**	0.483**	0.553**	-0,218
Elasticity				-	0.069	0.549**	-0.074
Fineness					-	0.580**	-0,293
Strength						-	-0.199

*p<0.05 is significant, ** p<0.01 is highly significant

In the weaving industry, delicacy and uniformity is a desirable feature. The reason for this is that the less the fibers in the ringlet, the less they differ from each other in terms of fineness, the easier it is for this type of fleece to be processed in the industry and to give less waste (İmeryüz and Sandıkçıoğlu, 1968). It is desirable that the coefficient of fineness variation in a good quality carpet fleece is not more than 15% (Turner, 1971). In the study, the subtlety values and variation coefficient obtained in the enterprise ranged from 12.23% to 14.83% in Hamdani and Karakaş sheep, and fiber diameters ranged from 36.64 to 37.62 µ. It was determined that the fiber diameter values obtained in the study were higher than 28.63 to 26.96 µm as reported by Garip et al. (2010) for Kangal Akkaraman sheep; 30.91 reported by Peşmen and Yardımcı (2012) for Menemen sheep; 28.65 µm value Aksoy et al. (2001) reported for Tuj sheep; 31.35 µ and 32.04 µ reported by Tuncer (2008) for Karakaş and Norduz sheep raised in semi-

intensive conditions, respectively, and it was found that findings in this study were in compliance with the values of 33.68 μ and 36.58 μ reported by Çivi (1999) for 50 head Karakaş and 100 head Norduz lambs. When both genotypes used in the study are compared, it is understood that there is not much value range between Hamdani and Karakaş sheep. The fiber diameter, which is the most important textile feature of leaf fibers, is approximately 13-18 μ in thin Merino leaves, while it is 36-45 μ in coarse leaves obtained from other sheep breeds (Russel and Bishop, 1990). Therefore, it is seen that the obtained values are in this range. In other words, it falls into the rough leaf class.

In the study, elasticity was found to be 32.34% and 32.31% for Hamdani and Karakaş genotypes. These values were found to be higher than the values of 21.1% by Yalçın et al. (1972), and 23.4-25.3% in Australian Merinos (Turner 1971). However, it was found to be lower than the 37.62% value determined by Erol and Akçadağ (2009) in Ergin Karagül sheep. 31.46%, 30.03% and 30.67% values reported Küçük et al. (2000) for Morkaraman, Hamdani and Karagül sheep are in compliance with 30.15 μ value reported by Öztürk and Odabaşıoğlu (2011) in Hamdani sheep raised in the Van region. In the study, it was observed that age did not have an effect on elasticity.

In this study, clean wool percentage was determined as 63.88% and 65.94% for Hamdani and Karakaş sheep, respectively. These values are very similar to the 64.70% value reported by Demirel (1996) for Akkaraman sheep. These values found to be slightly lower than values such as 66.64% and 68.39% values reported by Küçük et al. (2000) respectively for Morkaraman and Hamdani sheep and 68.25% value reported by Yılmaz and Denk (2004) as the average clean wool percentage of Norduz sheep fleece. However, it was observed that these values were higher than 56.91% value reported by Öztürk and Odabaşıoğlu (2011) for Hamdani sheep, 60.78% value reported by Garip et al. (2010) as the fleece yield in Kangal Akkaraman sheep. In the study, the strength values of Hamdani and Karakaş sheep were found as 36.15 cN ^{tex} and 34.80 cN/tex, respectively. The data obtained in the study were found to be higher than 20.69 cN ^{tex} reported by Peşmen and Yardımcı (2012) for Menemen sheep, and higher than elite herd (20.04 cN ^{tex}) and base herd (16.67 cN ^{tex}) values reported by Garip et al. (2010) for Kangal Akkaraman sheep. It was not possible to compare the strength values obtained in the study with the study data conducted by many researchers. Because in previous studies, gram was generally used as unit, and it was observed that numerical values remained lower.

CONCLUSION

Although the fleece obtained from sheep in developing and underdeveloped countries is suitable for carpet weaving, breeding studies in Türkiye in the direction of quality carpet fleece production are not at a sufficient level. The data obtained from the study are expected to shed light on the breeding studies to be carried out.

It is important to examine the fleece yield characteristics of Menemen sheep to determine the yield-related characteristics of Turkish domestic sheep breeds under extensive and semi-intensive conditions and to provide information about which characters can be improved by pure breeding, selection or crossbreeding.

The fleece of domestic sheep is low in yield and quality. In Australia and New Zealand, an average of 5-6 kg of fleece is obtained from a sheep, while an average of 1.5 kg of fleece is obtained from the domestic sheep in this study. The fleece produced in Türkiye is not of the quality required by the weaving industry. Some of these wools are used in the carpet-rug industry, some in the production of beds, quilts, socks and sweaters, some in fabric production; the rest is exported to foreign countries. Although carpet-type fleece (coarse fleece) is subjected to standardization in some countries, there is no such study yet in Türkiye (Kaymakçı and Sönmez, 2002). Therefore, it is hoped that this study will contribute to

activities in this direction. In addition, long and thin homogeneous fleece, despite being coarse, has started to increase in the weaving industry. Thus, with the production of uniform sheets in terms of various properties, on the one hand, quality raw materials will be provided for carpet weaving, and on the other hand, the chance of using these leaves in the fabric industry, which has been trying to provide fine uniform fleece for years, will begin to increase. Thus, especially in recent years, the domestic fleece, which has no return for the grower, will have the opportunity to evaluate, and the raw fleece will not be imported from abroad for carpet weaving and other weaving by giving foreign currency. In Türkiye, which is among the important countries producing carpet type fleece, the leaf yield, delicacy and the length of the ringlet should be among the criteria to be emphasized in the selection studies to be carried out to improve the fleece of Turkish domestic sheep that are easiest to breed. In other words, it is an important issue, while increasing the yield of the fleece, to produce the same type of fleece in terms of length and thinness within the limits foreseen for carpet fleece. On the other hand, although coarse, uniform fleece has started to be used in the weaving industry in recent years. Thus, quality raw materials for carpet weaving will be provided by producing uniform fleece in terms of various features, and the chance to evaluate rotting leaves in the idle will will arise. In the selections made for live weight increase, progress will also be made in the direction of the leaf with a positive high relationship between live weight and living weight. Fleece yield and fleece characteristics, which are important yields for sheep, should be included in selection studies. In addition to increasing the basic yields in the studies, the yield of the fleece should be tried to be increased and ways to produce uniform fleece should be sought.

In this study, some fleece characteristics such as dirty fleece yield, thinness, length, yield of Hamdani and Karakaş sheep in the hands of the public were tried to be determined. In Türkiye, which is among the countries producing significant carpet type fleece, the fleece yield, delicacy and the length of the ringlet should be among the criteria to be emphasized in the selection studies to be carried out to improve the fleece of Turkish domestic sheep that are easiest to breed. On the other hand, although coarse, uniform fleece has started to be used in the weaving industry in recent years. Therefore, with the production of uniform sheets in terms of various properties, on the one hand, quality raw materials will be provided for carpet weaving, and on the other hand, the chance of using these leaves in the fabric industry, which has been trying to provide fine uniform fleece for years, will begin to increase. It was determined in the study that the values obtained for the fleece yield and fleece characteristics of Hamdani and Karakaş sheep were similar to these characteristics of other sheep breeds in the region. Therefore, when the features discussed are evaluated together, it was concluded that Hamdani and Karakaş sheep fleece were an important raw material for carpet making. On the one hand, the findings will shed light on breeding and improvement programs, and on the other hand, it is thought that the expansion of Hamdani and Karakaş sheep breeding will give positive results in terms of the country's animal husbandry.

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Conflict of Interest

The article authors declare that there is no conflict of interest between them.

Author's Contributions

The authors declare that they have contributed equally to the article.

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