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### Fleece Yield and Some Characteristics of Karadi Sheep

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#### ABSTRACT

This research was carried out to investigate fleece yield and characteristics of Karadi sheep in Hasar village of Kirkuk/Iraq. Sixty two ewes and four rams were used in this study. Greasy fleece yield (GFY), breaking strength (BS), fiber elasticity (FE), fiber diameter (FD), fiber length (FL) and clean fleece percentage (CFP) and effects of some environmental factors on these characteristics have been also studied. Least squares mean for body weight at shearing (BWS), GFY, BS, FE, FD, FL and CFP were 52.28 kg, 1.65 kg, 21.74 cN/tex, 31.58 %, 36.10  $\mu\text{m}$ , 18.33 cm and 67.98 %, respectively. Effects of ewe age on BS, FE and CFP was statistically significant ( $P < 0.05$ ), but on the other characteristics were not significant. The effect of BWS was statistically insignificant on all characters. From sortiman value (44'S) calculated, it was concluded that Karadi breed could be evaluated in the class of carpet wool fleece sheep.

#### 1. Introduction

Sheep breeding in Iraq keeps an important place in breeding of the country and sheep is bred for its meat, milk, and wool. The annual incomes of these products in sheep is about 60%, 25%, and 15% (Aziz and Hama, 2008). Karadi sheep, like the other Iraqi breeds of sheep (İvesi and Arabi) is of sheep group, which is fatty tail and gives carpet fleece and consists of approximately 18-20% of sheep existence in the country. It is bred in dry farming lands, characterized with Mediterranean climatic conditions, and highlands of Northern Iraq (Juma and Alkass, 2000). It is reported that Karadi sheep has 5 species as kurdi, cafi, hamdani, dizeyi and herki (Anonymous, 2016). Karadi sheep, a local breed, which is bred the most in highlands of Northern Iraq (Kirkuk, Erbil, Mosul, Dohok and Suleymaniye), is a breed, which is fatty tail, white color, and has black spots on its shoulder and different regions of its body, whose live weight ranges between 60 to 80 kg, and which can yield fluffy and mixed fleece (Al-Saigh and Gezal, 1980). Karadi sheep, according to 2004 data, is an important breed

in terms of country sheep breeding due to the fact that it forms about 20% (i.e. 1,310,000 heads of 6,545,146 heads of sheep present in Iraq (Anonymous, 2017a), Breed is a low yield and primitive breed, whose all yields are valued, whose fleece is carpet wool and mixed, and which has suitable attributes for carpet weaving. Although carpet business does not develop in the region, breeders have possibility to export the fleece they produce. As a matter of fact, in 2017, 113 ton of fleece were exported from Iraq to some European countries (Anonymous, 2017b).

This study was carried out to identify some physical characteristics (thinness, length, yield, elasticity and strength) of fleece of Karadi sheep, and the effect of live weights and ages of sheep during shearing on these characteristics.

#### 2. Material and method

The animal material of the study consists of Karadi

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sheep in herd, bred in a private breeding farm in Hasar village taking place 50 km north of Kirkuk and consisting of 58 heads of ewes and 4 heads of rams. In the night before shearing and during shearing, which was performed at the end of April, the animals sheared were left hungry. i. e. they were not fed. The animals were weighed in 500 g of accuracy before shearing and their live weights were determined and, simultaneously, their ages were determined by examining their teeth (since they do not have any ear number and record). Simultaneously recording the weight and age determined, fleece samples taken were placed in small plastic bags and preserved. Fleece samples were taken from three spots as shoulder, side (rib), and button as reported by Ertuğrul (1996). After shearing, the amount of fleece obtained from each animal by shearing was determined by weighing fleece in accuracy of 100 g. In fleece samples, the determination of physical characteristics such as yield (%), fiber diameter (length, mm), elasticity (%), and strength (cN/tex) was carried out in Directorship of Lalahan International Breeding Research and Education Center (Ankara). Fiber lengths were measured by us with a mm-calibrated ruler on a black cloth ground and recorded in cm, after clasping two ends of hair, whose curls were removed by means of a forceps without tightening it, because the relevant devices in the institute do not work. Yield determination were carried out, after weighing the samples in greasy state, cleaning them in washing unit, and keeping them in drying oven for 6 hours at 105°C, by identifying the clean weight and dividing clean weight by greasy weight. Fiber diameter (thinness) was determined by USTER OFDA 100 device (Optic Fiber Diameter Analyzer). Elasticity (%) and strength (cN/tex) analyses were made by the device of Single Fiber Tensile Tester

Assuming that there is no significant correlation between the factors whose effect are examined on fleece yield characteristic in statistical analyses, in the analysis of environmental factors, computer package program, developed by Harvey (1987), was utilized. The differences between factor levels were determined by using Duncan comparison test (Düzgüneş et al., 1993). For fleece yield and characteristics, in least square variance analysis, the following mathematical model was used.

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

where  $Y_{ijk}$  represents fleece and yield characteristics of the sheep in the number of k in live weight group j in age i (yield of greasy fleece, yield, thinness, length, elasticity, and strength);

$\mu$ : overall mean,

$a_i$ : amount of effect of age of sheep i ( $i = 1, 2, 3, 4, \geq 5$ ),

$b_j$ : amount of effect of live weight group j [ $1^{\text{st}}$  Group (32.50-50.50kg),  $2^{\text{nd}}$  Group (50.51-59.50kg) and  $3^{\text{rd}}$  Group (59.51-68.50 kg)], and

$e_{ijk}$ : random error.

### 3. Result and Discussion

As a result of the study carried out on 62 heads of Karadi sheep belonging to a private farm in Hasar Village of Kirkuk, the mean values of least squares belonging to live weight of sheep was found  $52.278 \pm 2.812$  kg. The mean values belonging to the weight of greasy fleece and characteristics of the fleece examined are given in Table 1. In the herds, whose average live weight was identified as 52.28 kg, the average greasy fleece yield (GFY) of the sheep was found as  $1.646 \pm 0.326$  kg. These values are higher than the values of 1.47 and 0.94 kg, respectively, reported by Al-Dabbagh (2009) for Awassi and Hamdani breeds in Mosul, and the value of 1.58 kg, reported by Peşmen and Yardımcı (2012) for Mene-men Sheep. In return to this, this value is lower than the values of 2.24 and 2.96 kg, reported by Demir (1989) for Dağlıç and Ramlıç; 2.0 kg, reported by Koyuncu et al. (1999) for Karayaka yearling lambs; 2.46 and 2.36 kg, reported by Çolakoğlu and Özbeyaz (1999) for Akkaraman and Malya; 2.14 kg, reported by Arık et al. (2002) for Akkaraman; and 1.94 kg., reported by Aksoy et al. (2001) for Tuj sheep. In addition, the values of 2.24 and 3.29 kg, 2.91 kg, 1.75 and 2.13 kg, 2.3 and 1.8 kg, and 2.41 kg, reported for Akkaraman and İvesi (Elibol and Dağ, 2004), Norduz (Yılmaz and Denk, 2004), Hamdani (Aziz and Oramary, 2005), Karadi (Aziz and Hama, 2008), and Hamdani (Öztürk and Odabaşoğlu, 2011), respectively, are higher than GFY, calculated in this study. As in all yields, genetic and environmental factors are more effective on the present differences. Hence, the differences result from these two factors.

As a result of statistical analysis carried out, the effect of the age and live weight of sheep on the yield of greasy fleece turned out insignificant. Although this result is incompatible with the literature reports (Dağ 1996; Çolakoğlu and Özbeyaz, 1999; Elibol and Dağ, 2004; Aziz and Oramary, 2005; Öztürk and Odabaşoğlu, 2011), Vanlı (1974) found the effect of age on greasy fleece yield (GFY) insignificant in Morkaraman sheep, while Yılmaz and Denk (2004) reported that in Norduz sheep, the effect of live weight was insignificant and the effect of age, significant. In this study, that the effect of age on GFY is insignificant can be explained that the number of animal in the age group 1 and 2 is less (respectively, three and four heads) and, generally, the number of sheep. Similar state can also be said for live weight due to the fewness of the number in the group of live weight i.e. low variation.

Table 1

Least squares means (LSM) and standard errors (SE) for greasy fleece yield, breaking strength, fiber elasticity, fiber diameter, fiber length and clean fleece percentage .

	N	Greasy fleece yield (kg)	Breaking strength (cN/Tex)	Fiber elasticity (%)	Fiber diameter (µm)	Fiber length (cm)	Clean fleece percentage (%)
		LSM±SE	LSM±SE	LSM±SE	LSM±SE	LSM±SE	LSM±SE
Overall mean	62	1.646±0.3263	21.743±4.2746	31.584±3.6114	36.104±4.2493	18.329±3.2873	67.986±9.4309
(Age)		NS	*	*	NS	NS	*
3		1.34 ± 0.213	15.09±2.743 <sup>B</sup>	33.51±2.437 <sup>AB</sup>	37.94±2.874	18.23±2.232	78.58±6.222 <sup>A</sup>
4		1.51 ± 0.177	18.25±2.335 <sup>AB</sup>	36.21±1.906 <sup>A</sup>	34.75±2.365	20.67±1.805	75.08±5.169 <sup>AB</sup>
20		1.66 ± 0.086	23.02±1.147 <sup>A</sup>	31.75±0.981 <sup>AB</sup>	34.88±1.142	18.09±0.893	67.54±2.562 <sup>ABC</sup>
18		1.63 ± 0.091	22.59±1.213 <sup>A</sup>	29.50±0.986 <sup>B</sup>	35.06±1.202	17.48±0.929	63.85±2.624 <sup>BC</sup>
17		1.64 ± 0.090	21.98±1.213 <sup>A</sup>	30.38±1.011 <sup>B</sup>	36.37±1.206	16.89±0.911	61.51±2.513 <sup>C</sup>
LWS		NS	NS	NS	NS	NS	NS
25		1.66 ± 0.129	19.33±1.700	34.69±1.397	38.09±1.701	20.83±1.286	77.71±3.567
27		1.57 ± 0.081	20.31±1.084	31.92±0.931	36.05±1.097	18.10±0.848	69.74±2.422
10		1.45 ± 0.211	20.92±2.849	30.20±2.401	33.26±2.805	15.89±2.165	60.49±6.199

A,B,C = Means followed by different letters with in classes differ; LWS: Live weight of shearing; NS: Non-significant; \*: P<0.05

According to ages and live weight groups of sheep, the mean values of strength are given in Table 1. As can also be seen from the table, the mean value of strength expressing the strength of fleece fibers until the rupture moment and, expressed in g in some resources, is  $21.743 \pm 4.274$  cN/tex. This value is higher than is the value of 20.69 cN/tex, calculated by Peşmen and Yardımcı (2012) for Mememen sheep. The strength values in the fibers of Anatolian merino, Kıvrıcık, and Türkgeldi sheep were identified as 13.73, 12.50, 11.70 and 13.71 g, respectively (Koyuncu et al., 1996). Yılmaz and Denk (2004) reported the strength value they identified for Norduz sheep as 13.73, 12.50, 11.70 and 13.71 g. The strength values, identified by Koyuncu and Duru (2008) for Karacabey Merino and Kıvrıcık sheep, are 2.8 and 7.4 g, respectively. As the diameter of fleece fibers increases, strength also increases. Since the fibers of Karadi sheep fleece are thick, strength turned out high.

In the study, the effect of sheep age on strength turned out significant ( $P<0.05$ ), and the effect of live weight, insignificant. Küçük et al. (2000) found the effect of age on strength significant for Morkaraman, Hamdani and Karagül sheep and Koyuncu and Duru (2008) for Karacabey merino, while Yılmaz and Denk (2004) found significant the effect of age on live weight on strength for Norduz.

The characteristic of fleece fibers that elongates with application of force and reverts back after the effect of force is removed is termed elasticity and the fibers, in which peg channel does not exist, become more flexible, while those having peg channel become less flexible. In this study, elasticity value calculated for the fibers of Karadi sheep, is  $31.584 \pm 3.611\%$ . This value found is higher than elasticity val-

ue of 31.46%, reported by Küçük et al. (2000) for Morkaraman, and elasticity values of 19.0% and 28.7%, reported by Koyuncu and Duru (2008) for Karacabey Merino and Kıvrıcık, respectively. In return to this, the values of 32.5%, 39.3%, and 41.5% reported for Anatolian Merino, Kıvrıcık and Türkgeldi sheep, respectively (Koyuncu et al., 1996) are smaller than the values of 30.03% and 30.67% reported for Hamdani and Karakul, respectively, and the value of 32.71% reported for Norduz (Yılmaz and Denk, 2004) and the value of 32.60% reported for Mememen sheep (Peşmen and Yardımcı, 2012).

In the study, among the factors whose effect on elasticity is examined, the effect of age turned out significant ( $P<0.05$ ), and the effect of live weight insignificant. The same result was reported by Yılmaz and Denk (2004) for Norduz sheep. While Koyuncu and Duru (2008) found the effect of age on elasticity significant for Kıvrıcık sheep, the effect of age was found insignificant in Morkaraman, Hamdani and Karakul breeds (Küçük et al., 2000) and Karacabey Merino (Koyuncu and Duru, 2008).

The most important characteristic expressing fleece quality is thinness. In this study, the thinness (fiber diameter) in the fleece of Karadi sheep was identified as  $36.104 \pm 4.2493$  µm. Sortiman ('S) value this value corresponds to is 44 (Topal and Emsen, 2011), it can be said that the fleece of Karadi sheep is included in coarse wool. This thinness value found in this study is lower than the thinness values of 42.0 µm, 37.51 µm and 37.2 µm, reported by (Koyuncu et al., 1999) for Karayaka yearling lambs, Yılmaz and Denk (2004) for Norduz sheep, and Aziz and Oramary (2005) for Karadi sheep. In return to this, it is higher than the thinness value of 30.8 µm, reported by Aziz

and Hama (2008) for Karadi sheep. In addition, it is seen that the thinness values reported for a number of sheep breed is smaller than that found in this study (Aksoy et al., 2001; Elibol and Dağ, 2004; Koyuncu and Duru, 2008; Al-Dabbagh, 2011; Öztürk and Odabaşoğlu, 2011; Ahmed et al., 2012; Peşmen and Yardımcı, 2012; Topal and Emsen, 2011; Al-Dabbagh and Sabbagh, 2014).

In this study, it was identified that the effects of the factors (age and live weight) whose effects are examined on the fleece thinness are insignificant. While Elibol and Dağ (2004) and Al-Dabbagh (2009) reported that the effect of the age factor on thinness was insignificant, Dağ (1996), Aziz and Hama (2008) and Aziz and Oramary (2005) found the effect of age significant. In Norduz sheep, the effect of both age and live weight on fleece thinness was found significant (Yılmaz and Denk, 2004).

There is a very strict relationship between the length and thinness of fleece hairs. The thin fleeces are shorter and thick fleeces are longer. In this study, carried out on the fleece of Karadi sheep, the mean of least squares of hair length was found to be  $18.329 \pm 3.287$  cm. The length values of 8 cm, 18.3 cm and 18.4 cm, reported by Demir (1989) for Dağlıç sheep in Çifteler (Eskişehir), Aziz and Oramary (2005) for Hamdani sheep in Erbil (Iraq), and Öztürk and Odabaşoğlu (2011) for Hamdani sheep in Van, respectively, are quite close values to the value calculated in this study. The length values of 11.49 cm, 6.89 cm, 12.8cm, 9.92 and 8.75 cm, 15.59 cm, and 17.90 cm reported for Tuj (Aksoy et al. 2001), Norduz (Yılmaz and Denk, 2004), Karadi (Aziz and Hama, 2008), İvesi and Hamdani (Al-Dabbagh, 2011), and Morkaraman and İvesi (Topal and Emsen, 2011) sheep, respectively, are smaller than the value calculated in this study. In return to this, the length value (21.4 cm) identified by Koyuncu et al. (1999) for male yearling lambs is higher than the length calculated in this study.

In this study, the effect of sheep age and pre-shearing live weight on the actual length of fleece turned out insignificant. This result is consistent with the result Yılmaz and Denk (2004) reported for Norduz sheep. Al-Dabbagh (2009) reported the effect of only age on the length to be insignificant. In return to this, there are also some researchers reporting that the effect of age (Küçük et al., 2000; Aziz and Oramary, 2005; Aziz and Hama, 2008; Shihab and Hamdoon, 2011; Ahmed et al., 2012).

The fleece yield value calculated in the study is  $67.986 \pm 9.4309$ . In general, in coarse wool sheep, fleece yield is high (55-65%), in thin fleece sheep, it is low (30-35%). This result supports the information that Karadi sheep is coarse wool fleece. Although the yield value calculated in this study is close to the yield value of 68.9 %, reported for Karayaka yearling lamb (Koyuncu et al., 1999); 66.78 %, for Menemen

sheep (Peşmen and Yardımcı, 2012); 68.25 %, for Norduz sheep (Yılmaz and Denk, 2004); and 68.39 %, for Hamdani breed, it is lower than some values reported in the literature and higher than some value (Aziz and Hama, 2008; Al-Dabbagh, 2009; Öztürk and Odabaşoğlu, 2011; Al-Dabbagh and Sabbagh, 2014).

The effect of sheep age on fleece yield was found to be significant ( $P < 0.05$ ) and effect of live weight to be insignificant. In related to the effect of age, while Küçük et al. (2000), Yılmaz and Denk (2004), and Al-Dabbagh (2009) reported similar results, Dağ (1996) and Aziz and Hama (2008) reported the results in the opposite direction. In related to the effect of live weight, the finding by Yılmaz and Denk (2004) is consistent with that of this study.

In the light of findings obtained, in Karadi sheep forming the study herd, it can be said that fleece yield is low; that its characteristics are not superior; and its fleece is fluffy-mixed. In this case, it is suitable to value Karadi fleece in carpet and similar weaving sector. First of all, fleece improvement should be considered rather than increasing fleece yield. With this aim, crossbreeding and selection can be suggested.

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