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RESEARCH PAPER

Objective Characterization for Maraz Goat Fleece

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A B S T R A C T:
This study was undertaken on 101 Maraz does from a private commercial farm to characterize the fleece and to determine the effect of age (1 to 6 years), doe status (kidding and non-kidding), and coat color (light brown, blonde/tan and dark brown) on live body weight and fleece physical traits and the relationships among them. The overall means were for live body weight 26.6kg, greasy fleece weight 703.6g, washing yield 88.9%, staple length 12.2cm, fiber length 16.0cm, fiber diameter 33.9µm, cashmere yield 1.4%, medullated fiber 10.5%, kemp fiber 1.7% and breaking strength 11.8g/tex. Statistical analysis revealed a significant effect of doe age on body weight and most fleece traits and the effect of coat color was significant only on fiber diameter. Given the differences between goats and the correlations existed between traits, there seems to be substantial scope to improve Maraz goat fleece quantitatively and qualitatively through selection

KEY WORDS: Age, Cashmere, Coat color, Doe status, Fleece traits, Maraz goat.
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1. INTRODUCTION:

Goats are considered to be important farm animals in many parts of the world, especially in arid, semi-arid, and mountainous zones, because of their adaptability to various environments and biophysical conditions, and utilize marginal lands and poor quality feed stuffs to produce high quality products (Kumar, 2007; Aziz, 2010; Nair *et al*., 2021).Probably the greatest advantage of goats relative to large ruminants being small sized, easily managed, low capital investment, prolific and its multipurpose activity (meat, milk and fiber), and is a major source of livelihood for small and marginal farmers, and landless families in rural areas of many countries (Alkass, 2012; Singh *et al*., 2021) Over 70 goat breeds globally has been listed by Mason (1996) that they are used for either hair or cashmere production purposes, besides providing meat and milk. Later, Lupton (2010) indicated that 150 breeds of goats produce cashmere and many of which were not improved and raised by rangeland nomads.

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Maraz goats known as Kurdi originated in Kurdistan; Iraq and Iran. Also, they are known as Markhaz, Marghaz, Morghoz, or Morghose (Iran) (Gurang and Solaiman, 2010) which are a cashmere producing breed (Millar, 1986; Aziz, 2009; Gurang and Solaiman, 2010) and found at high altitudes in the mountainous region. The primary target of raising this breed is producing fine fibers which are utilized in the Kurdish national costume fabrication (Aziz and Hamad, 2004; Aziz, 2009). Additionally, is a source of meat and milk (Alkass and Merkhan, 2013). The significance of animal fiber characteristics on price, processing and spinning performance, and yarn and end-uses properties is reviewed and well known (McGregor, 2012; Hunter, 2020). The variation in raw wool/hair is due to the complicated interactions of environmental and genetical factors (Ryder and Stephenson, 1968; Alkass *et al*. 2019). Although some physical characteristics of Maraz goat fleeces have been studied earlier (Khoshnaw, 2002; Shamsaddin *et al*., 2006; Al-Qasmy, 2015), nevertheless some conflicting results on the properties of this type of fleece had been documented. Due to this, the current study aimed to take additional steps, such as study more physical characteristics by modern

instruments and in the most advanced laboratories which concern with the production of fine fibers. Accordingly, this study is designed to review Maraz goat fleece quantitatively and qualitatively, in addition to determine the effect of age, goat status and coat colour on studied traits, and the relationships among them.

2.MATERIALS AND METHODS

2.1 Location of the study

Data processed during the course of the current study were collected from a private commercial farm located in Angoz village which, is located (Latitude 36°19'13.11"N, Longitude 44°44'00.71"E and Elevation of 993m) on the slopes of mount Makok, Peshdar district, Sulaimani Governorate, Kurdistan region, Iraq.

2.1 Animals and management

One hundred and one randomly selected goats, from a herd numbering over 300 goats, were used. The goats belonged to six age groups (1, 2, 3, 4, 5 and 6 years old), two statuses for the animals (kidding and non-kidding), and three coat colors (light brown, blonde/tan and dark brown). The goats depend on grazing a mountainous natural pasture during the entire year, limited supplementary feeding in the form of barley grain, chopped wheat straw, and dry plant leaves or hay are also provided during winter season.

2.3. Sample collection and measurements

The animals were hand shorn, prior to initiation of shedding, in late of March 2021 and subsequently weighed. Whole greasy fleeces were weighed too. Greasy fleece samples were taken from the right midside of each animal. Four staples of hair were randomly selected from each midside greasy sample, and used for the measurement of staple length without pulling the staple, by ruler, from the base to the midway in the pyramid formed by the staple tip (Bergen, 1963). The remaining greasy midside samples were conditioned (65±2% R.H and 20±2℃ for 24 hr) and weighed. Thereafter, samples were scoured in non-ionic detergent, and washing yield was calculated as a percent of scoured oven dry weight at 16% regain to the conditioned greasy sample's weight (Aziz, 1991). About 200 fibers were randomly withdrawn from a degreased staple per sample and used to measure fiber length, by a graduated ruler, after being removed from crimps. Fiber diameter and tensile strength measurements were done at the Animal Science Research Center Laboratory in Karaj, Tehran, Iran. The diameter of 400 fibers was measured by a Micro-Projector from each sample in accordance to the ASTM (1989a). While measuring fiber diameter, the percentage of fiber medullation and kemp were also determined according to ASTM (1989b); the fibers in which the diameter of the medulla is less than 60% of the diameter of fiber is classified as medullated fibers, whereas fibers in which the diameter of the medulla is more than 60% of the diameter of the fiber is classified as kemp fibers. A bundle of about 100 fibers from a staple of each sample was used for measuring tensile strength (breaking strength) by Instron (Model 4501) universal testing machine according to the method described by IOS (2002). Moreover, from each scoured sample, one staple was randomly drawn which, consists of cashmere (undercoat) and guard hair (outercoat), and then manually de-haired (separating fiber types; cashmere and hair). The dehaired cashmere and outercoat were weighed separately in order to determine the percentage of cashmere yield of the sample (Trana *et al*., 2004; Ansari-Renani, 2013).

2.4 Statistical analysis

The statistical analysis of data was performed using the General Linear Model; GLM procedure of the Statistical Analysis System; SAS (2002-2003) to study the effect of age, goat status and coat colour on studied traits and correlations among them. The following linear model was applied:

$$Y_{ijkl} = \mu + A_i + D_j + C_k + E_{ijkl}$$

Where, Y_{ijkl} is the 1st observation of the ith age at the jth doe status and kth coat color, μ is the overall mean, A_i is the age effect, D_j is the doe status effect, C_k is the coat color effect and E_{ijkl} is the random error. The differences between means of subclasses were detected by Duncan Multiple Range Test using SAS.

3.RESULTS

The results presented in Table 1 display that the overall mean and range of live body weight, greasy fleece weight and washing yield of Maraz does were 26.6kg (15.5-38.6kg), 703.6g (350.0-1250.0g) and 88.9% (66.7-93.0%), respectively. Age of goats showed a significant effect (P≤0.05) on live body weight and greasy fleece weight. Live body weight increased significantly (P≤0.05) from 19.6kg in the 1 year

old group to 33.7kg in the 5 years old group. The lightest (534.2g) and the heaviest (880.4g) greasy fleece weight were produced by goats aged 1 and 3 years old, respectively. Kidding does obtained heavier live body weight (31.5 vs 20.9kg) and greasy fleece weight (803.8 vs 588.3g) compared with non-kidding does. Blonde coat colour group had lower (24.2kg) live body weight than light (27.3kg) and dark brown (30.2kg) coat colour groups. Goat variables proved to have a non-significant effect on washing yield (Table 1).

Physical properties of Maraz goat fleece are illustrated in Table 2. The overall mean and range of staple length and fiber length were found to be 12.2cm (7.9-19.6cm) and 16.0cm (10.0-23.2cm), respectively. The corresponding values for fiber diameter, cashmere yield, medullated fiber, kemp fiber and breaking strength were 33.9µm (27.9-39.9µm), 1.4% (0.3-5.7%), 10.5% (2.3-34.3%), 1.7% (0.7-4.7%) and 11.8g/tex (6.3-15.3g/tex) in the same order. Age of animal showed a significant effect ($P \leq 0.05$) on most fleece Physical traits (Table 2). The effect of doe status and coat colour appeared to be non-significant on all properties except coat colour on fiber diameter ($P \leq 0.05$); where dark brown group recorded finer fleeces compared to light brown ones (31.1vs 34.6 µm, $P \leq 0.05$).The phenotypic correlation coefficients among body weight and fleece characteristics studied are given in Table 3. There were significant relationships among most of the important traits.

4..DISCUSSION

Similar findings to the current study in terms of body weight (Aziz and Hamad, 2004; Aziz, 2009) and fleece washing yield (Aziz and Hamad, 2004; Oramari and Al-Qasmy, 2016) were reported for the same breed. In general, the live body weight of Maraz does is almost similar to Cashmere does raised in Australia (Restall and Pattie, 1989) and New Zealand (Newman and Paterson, 1996), and also to Markhoz goats (Rashidi *et al*., 2008), but it is smaller compare to Iraqi native goats (Juma and Alkass, 2005). A significant annual increases in body weight occurred for does aged 1-4 years (Restall and Pattie, 1989; Newman and Paterson, 1996) which were similar to doe body weights in this study.

The greasy fleece weight of Maraz does in the present work is within the range of 526 to 900g as indicated by earlier workers (Aziz and Hamad, 2004; Shamsaddin *et al*., 2006; Aziz, 2009; Al-Barzinji, 2012; Oramari and Al-Qasmy, 2016). However, this difference could be due to the variability in genetic makeup of individuals as well as to the differences in environmental conditions. In general, the greasy fleece weight tends to increase with advancing of age and the peak was obtained at 3 and 4 years old and thereafter declined (Aziz, 2009).

The average staple length and fiber length obtained in the current study were closer to the results observed by Aziz and Hamad (2004) and Shamsaddin *et al*. (2006), but higher than that stated by Oramari and Al-Qasmy (2016) for the same breed. Such differences might be due to the technical and environmental factors. Earlier researchers (Aziz and Hamad, 2004; Oramari and Al-Qasmy, 2016) found similar values of fiber diameter to the current result whereas, coarser value (44.7µm) was reported by Shamsaddin *et al*. (2006). This difference might be attributed to the technical and environmental factors. The low value of cashmere yield of Maraz goat presumably due to the tendency of growers was imposed to increase the rate of outercoat (guard hair) because of the local market demand. Consequently, the rate of undercoat (cashmere) will be decreased as farmers are unfamiliar with the importance of cashmere fibers (Aziz, 2009). Comparing the values of medullated and kemp fibers to the values of previous works on the same breed; it appears that the current result of medullated fiber is higher, while the kemp fiber is within the range of 0.5-3.4% (Aziz and Hamad, 2004; Oramari and Al-Qasmy, 2016). The value of breaking strength for yearling Maraz does in this study was found to be higher (10.6 vs 8.1g/tex) than their counterparts of coloured mohair does in Turkey (Odabasioglu *et al*., 2009).

The finest fiber diameter and the highest cashmere yield, but the weakest fibers are produced by 1 year old group. Similar trend was observed earlier by Aziz and Hamad (2004) for Maraz goat. The effect of reproductive status in the present study was contrary to the general expectation, with kidding does heavier in body and fleece weights, coarser and stronger fibers, and lower cashmere yield than non-kidding does. The possible explanation is that almost of the non-kidding does were aged 1 year.

Most of the earlier studies on Maraz goats (Khoshnaw, 2002; Shamsaddin *et al*., 2006; Aziz, 2009; Oramari and Al-Qasmy, 2016), New

Zealand cashmere goats (Newman and Paterson, 1996), Tibetan cashmere goats (MaoNian *et al*., 1999) and Cashmere hair goats (Tuncer, 2018) revealed to the similar trends of the correlations among studied traits. it is worth noting to the current investigation that the highly significant (P≤0.01) negative correlations existed between cashmere yield and each of fiber diameter and kemp fibers from one side and the significant (P≤0.05) positive correlations between cashmere yield and fiber length from the other side means that selecting goats with cashmere yield will select animals with finer and longer fibers, and lower faulty kemp contamination, hence improving the quality of cashmere of Maraz goats (Hunter, 2020).

Table (1) Means ± S.E. for Live Body Weight, Greasy Fleece Weight and Fleece Washing Yield of Maraz goats.

Goat Variables	No.	Live Body Weight (kg)	Greasy Fleece Weight (g)	Washing Yield (%)
Overall Mean	101	26.6 ± 0.63	703.6 ± 21.88	88.9 ± 0.39
Age (year)		*	*	NS
1	38	19.6 ± 0.33 d	534.2 ± 17.60 c	88.0 ± 0.79
2	8	24.1 ± 0.92 c	787.5 ± 65.29 ab	90.6 ± 1.52
3	25	30.0 ± 0.43 b	880.4 ± 40.49 a	89.1 ± 0.37
4	17	33.4 ± 0.52 a	705.9 ± 48.67 b	90.4 ± 0.45
5	8	33.7 ± 0.89 a	825.0 ± 85.57 ab	89.1 ± 0.94
6	5	32.1 ± 1.82 a	770.0 ± 51.48 ab	86.3 ± 3.29
Doe Status		NS	NS	NS
Kidding	55	31.5 ± 0.41	803.8 ± 28.66	89.2 ± 0.4
Non-kidding	46	20.9 ± 0.57	588.3 ± 23.81	88.5 ± 0.7
Coat Color		NS	NS	NS
Light Brown	66	27.3 ± 0.78	697.9 ± 29.74	88.6 ± 0.55
Blonde	27	24.2 ± 1.16	700.0 ± 34.50	89.7 ± 0.53
Dark Brown	8	30.2 ± 2.01	800.0 ± 69.52	88.4 ± 0.88

* P≤ 0.05 NS = Non-significant

Means having different letters within each variable/column differ significantly (P≤ 0.05)

Table (2) Means ± S.E. for Fleece Physical Characteristics of Maraz goats.

Goat Variables	No.	Staple Length (cm)	Fiber Length (cm)	Fiber Diameter (µm)	Cashmere Yield (%)	Medullated Fiber (%)	Kemp Fiber (%)	Breaking Strength (g/tex)
Overall Mean	101	12.2 ± 0.26	16.0 ± 0.29	33.9 ± 0.45	1.4 ± 0.1	10.5 ± 0.63	1.7 ± 0.1	11.8 ± 0.19
Age (year)		NS	*	*	*	NS	*	*
1	38	12.0 ± 0.43	16.3 ± 0.52 abc	31.4 ± 0.35 c	1.9 ± 0.22 a	11.7 ± 1.09	2.3 ± 0.18 a	10.6 ± 0.29 b
2	8	14.1 ± 1.08	18.7 ± 1.10 a	33.3 ± 0.85 bc	1.8 ± 0.47 a	9.6 ± 2.27	1.3 ± 0.14 b	11.9 ± 0.72 ab
3	25	12.6 ± 0.45	16.0 ± 0.50 bc	36.5 ± 0.39 ab	1.0 ± 0.09 ab	8.9 ± 1.03	1.1 ± 0.13 b	12.8 ± 0.27 a
4	17	11.3 ± 0.62	14.9 ± 0.44 bc	33.9 ± 2.08 abc	1.1 ± 0.16 ab	10.3 ± 1.67	1.6 ± 0.21 ab	12.1 ± 0.44 ab
5	8	12.1 ± 1.04	14.3 ± 0.36 c	36.2 ± 0.57 ab	1.0 ± 0.14 ab	9.8 ± 1.03	1.7 ± 0.37ab	12.9 ± 0.49 a
6	5	12.7 ± 0.55	17.2 ± 1.62 ab	37.3 ± 0.40 a	0.8 ± 0.10 b	13.5 ± 4.49	1.3 ± 0.19 b	13.1 ± 0.99 a
Doe Status		NS	NS	NS	NS	NS	NS	NS
Kidding	55	12.1 ± 0.32	15.6 ± 0.32	35.6 ± 0.68	1.1 ± 0.08	9.7 ± 0.82	1.3 ± 0.10	12.6 ± 0.22
Non-kidding	46	12.4 ± 0.42	16.4 ± 0.49	31.2 ± 0.74	1.8 ± 0.19	11.3 ± 0.96	2.2 ± 0.16	10.9 ± 0.27
Coat Color		NS	NS	*	NS	NS	NS	NS
Light Brown	66	12.1 ± 0.32	16.0 ± 0.32	34.6 ± 0.37 a	1.3 ± 0.12	10.2 ± 0.82	1.6 ± 0.13	12.0 ± 0.24
Blonde	27	12.5 ± 0.46	16.6 ± 0.63	33.0 ± 0.50 ab	1.6 ± 0.23	9.9 ± 0.81	1.9 ± 0.19	11.1 ± 0.30
Dark Brown	8	13.0 ± 1.46	14.7 ± 1.20	31.1 ± 1.17 b	1.1 ± 0.20	15.11 ± 3.39	1.6 ± 0.30	13.2 ± 0.86

* $P \leq 0.05$ NS = Non-significant

Means having different letters within each variable/column differ significantly ($P \leq 0.05$)

Table (3) Correlation coefficients for Live Body Weight and Fleece Physical Characteristics of Maraz goats.

Traits	Fleece Weight	Washing Yield	Staple Length	Fiber Length	Fiber Diameter	Cashmere Yield	Medullated Fiber	Kemp Fiber	Breaking Strength
Body Weight	0.42 **	0.21 *	0.01	- 0.18	0.42 **	- 0.32 **	- 0.10	0.47 **	- 0.29 **
Fleece Weight		0.10	0.31 **	0.15	0.30 **	- 0.17	0.04	0.33 **	- 0.33 **
Washing Yield			0.23 **	0.05	0.03	- 0.05	0.03	0.29 **	- 0.13
Staple Length				0.42 **	0.22 *	0.01	0.04	0.43 **	- 0.17
Fiber Length					0.11	0.22 *	0.19 *	0.09	- 0.09
Fiber Diameter						- 0.28 **	0.01	- 0.24 **	0.35 **
Cashmere Yield							- 0.05	- 0.29 **	0.22 *
Medullated Fiber								- 0.09	0.33 **
Kemp Fiber									- 0.45 **

**P≤0.01 *P≤0.05

5.CONCLUSION

Although Maraz goats belong to cashmere bearing goat breeds, the results of the present study indicated that cashmere yield percentage in the fleeces was low. However, the large variations existed in hair physical traits among fleeces may suggest that it should be possible to produce the required fleeces by initiating a selection trial with improved management

CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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