Research Article

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Investigation of Mohair Production, Clean Yield, and Fibre Characteristics in Coloured Mohair Goat and F_1 Cross-Bred Kids of Angora Goat × Coloured Mohair Goat*

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Abstract: The aim of this study was to compare some fleece and fibre characteristics of kids of Coloured mohair goat with F_1 cross-bred kids of Angora × Coloured mohair goat to reveal the effects of this cross-breeding on mohair production, clean yield, and fibre quality.

This study was carried out using goats of the Coloured mohair goat breed at the Experimental Farm of the Faculty of Veterinary Medicine of Yüzüncü Yıl University. Four Angora goats were used as male material. In 2001, greasy fleece weight, clean mohair yield, fibre diameter, fibre length, fibre elasticity, breaking strength, kemp fibre content, and medullated fibre content of kids at 12 months of age (36 F_1 cross-bred, 18 pure) were examined.

Greasy fleece weight and clean mohair yield were 420 g and 74.3% for kids of Coloured mohair goat, and 830 g and 75.9% for F_1 cross-bred kids. Mean values for fibre diameter, fibre length, fibre elasticity, breaking strength, kemp fibre content, and medullated fibre content were 36.4 µm, 7.4 cm, 32.4%, 8.2 g, 16.2%, and 13.1% for kids of Coloured mohair goat, and 30.1 µm, 7.8 cm, 31.6%, 6.3 g, 3.4%, and 2.3% for F_1 cross-bred kids, respectively.

The effect of genotype (but not sex) on greasy fleece weight, fibre diameter, breaking strength, kemp fibre content, and medullated fibre content were significant ($P < 0.001$). Effects of genotype and sex on fibre length, fibre elasticity, and clean yield were not significant ($P > 0.05$).

In conclusion, an overall improvement of mohair production traits was observed on F_1 kids developed by crossing Angora goat and Coloured mohair goat. It could be supposed that Angora goats have been selected more for mohair production compared to Coloured mohair goats. Thus one way to improve the quality of mohair of Coloured mohair goat could be crossbreeding.

Key Words: Coloured mohair goat, Angora goat, crossbreeding, mohair characteristics

Renkli Tiftik Keçisi ve Ankara Keçisi × Renkli Tiftik Keçisi F_1 Melezi Oğlaklarda Tiftik Üretimi, Temiz Tiftik Verimi ve Elyaf Özelliklerinin Araştırılması

Özet: Bu araştırma, Ankara keçisi × Renkli tiftik keçisi F_1 melezi oğlakların çeşitli tiftik özellikleri bakımından Renkli tiftik keçisi oğlakları ile karşılaştırılması ve söz konusu melezlemenin F_1 melezi oğlaklarda tiftik üretimi, temiz tiftik verimi ve elyaf kalitesi üzerine etkisini ortaya koymak amacıyla yapılmıştır.

Çalışma, Yüzüncü Yıl Üniversitesi Veteriner Fakültesi Araştırma ve Uygulama Çiftliğinde yetiştirilen Renkli tiftik keçisi sürüsünde yürütülmüştür. Erkek materyal olarak 4 baş Ankara keçisi tekesi kullanılmıştır. Tiftik verimi ve özellikleri için 2001 yılında doğan ve 12 aylık yaştaki oğlaklarda (36 F_1 melezi, 18 saf) tiftik verimi, tiftik randımanı, elyaf inceliği, elyaf uzunluğu, elyaf elastikiyeti, mutlak mukavemet, kempli ve medullalı elyaf oranları incelenmiştir.

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Kirli tiftik verimi ve tiftik randımanı Renkli tiftik keçisi oğlaklarında genel olarak 420 g ve % 74,3, melez F_1'lerde 830 g ve % 75,9 olarak saptanmıştır. Renkli tiftik keçisi oğlaklarında elyaf inceliği, elyaf uzunluğu, elyaf elastikiyeti, mutlak mukavemet, kempli elyaf oranı ve medullalı elyaf oranı genel olarak sırasıyla 36,4 µm, 7,4 cm, % 32,4, 8,2 g, % 16,2, % 13,1, melez F_1'lerde aynı sıra ile 30,1 µm, 7,8 cm, % 31,6, 6,3 g, % 3,4 ve % 2,3 olarak bulunmuştur.

Genotipin etkisi tiftik verimi, elyaf inceliği, mutlak mukavemet, kempli ve medullalı elyaf oranları üzerine önemli ($P < 0,001$), aynı özelliklere cinsiyetin etkisinin önemsiz olduğu tespit edilmiştir. Elyaf uzunluğu, elyaf elastikiyeti ve tiftik randımanı üzerine hem genotipin hem de cinsiyetin etkisi görülmemiştir ($P > 0,05$).

Sonuç olarak, Ankara keçisi ve Renkli tiftik keçisinin melezlenmesi ile elde edilen F_1 oğlaklarında tiftik üretimi ve elyaf özellikleri üzerine genel bir iyileşmenin olduğu gözlenmiştir. Bu da, Ankara keçilerinin Renkli tiftik keçilerine göre daha fazla tiftik üretimi için seleksiyona tabii tutulduğunu işaret etmektedir. Bundan dolayı, Renkli tiftik keçilerinin tiftik verimini ve kalitesini iyileştirmenin bir yolu Ankara keçisiyle melezleme olabilir.

Anahtar Sözcükler: Renkli tiftik keçisi, Ankara keçisi, melezleme, tiftik özellikleri

Introduction

Goat is well-known in developing countries because of its higher tolerance to under nourishment compared to other animals. Thus, goat farming is an important branch of livestock production where low quality ranges are present.

The white Angora goat is normally associated with mohair production. However, in addition to the white Angora goat, there are Coloured mohair goats in the East and South East Anatolia regions of Turkey. These goats have been generally raised in Siirt, Batman, and Şırnak region for a long time. These goats are black, white, brown, grey, yellow, red, and light brown (1,2).

Angora goat is the sole producer of white, lustrous mohair among the many goat breeds. Average fibre diameter and length are important quality characteristics of mohair as they are in other animal fibres. Many factors such as breed, age, season, management types, and number of shearing affect fibre diameter and fibre length (3-5). Kemp and medullated fibres are undesirable characteristics. Kemp fibre lacks elasticity and strength and is very hard to dye. Clothes with kemp fibre are not preferred in foreign markets, because kemp fibre is considered as a defect (4,6,7).

The aim of this study was to compare some fleece and fibre characteristics of kids of Coloured mohair goat with F_1 cross-bred kids of Angora × Coloured mohair goat to reveal the effects of this cross-breeding on mohair production, clean yield, and fibre quality.

Materials and Methods

This study was carried out at Research and Experimental Farm of the Faculty of Veterinary Medicine of Yüzüncü Yıl University. Sixty-five Coloured mohair goats were utilized as female material. Four Angora goats brought from Eskişehir (Anatolia State Farm) were used as male material. Management and feeding of goats were accomplished in farm conditions. Goats were grazed on pasture when weather conditions permitted. Ground alfalfa-sainfoin hay and concentrate mixture bought from a feed milling company were fed to animals during winter season. Angora goats were brought to the region 3 months before mating for adaptation.

The study was initiated with mating in 2000. Pure (Coloured mohair goat, n = 18) and F_1 cross-bred kids (Angora goat × Coloured mohair goat, n = 36) were born in 2001. Kids were first fed with colostrum just after birth. Then, they were numbered for registry. Kids were kept with their mothers for the first week, and they were kept in separate lots afterwards. Goats were grazed during daytime when weather conditions permitted and they were kept together with their kids overnights. Kids were offered concentrate feed and forage starting at the second week of their birth. Kids were weaned when they were 105 days old.

The kids were shorn at 12 months of age and greasy fleece weights were recorded. Shearing was done in April 2002. The midrib of Angora goats gives adequate representation for most of the fleece variables analyzed (8). Fleece samples were collected from midrib area of the body of the individual animals and processed for the quality parameters (8). Analyses were carried out at Lalahan Livestock Research Institute according to ASTM and IWTO standards for determining fibre characteristics, fibre diameter (9), fibre length (10), fibre elasticity and breaking strength (11), and medullated and kemp fibre contents (12). Fibre diameter was measured using an optical-based fibre diameter analyzer (USTER OFDA 100). Breaking strength and fibre elasticity were analysed by the FAFEGRAPH HR + ME equipment. Fibre length was analysed by the USTER FL 100 equipment. The barbe method was used to determine the mean fibre length in this study.

Greasy fleece weight including the amount of samples taken was determined using a scale with a sensitivity of 0.01 g. For determination of clean mohair percentages, 15 g of samples were taken using a scale with a sensitivity of 0.01 g. After cleaning the foreign materials, fibres were placed into bags, made up of transparent curtain cloth, and numbered. Then, samples were washed with detergent 3 times. After air-drying, samples were dried in an oven at 105 °C until completely dried. Then, clean mohair yield was calculated using the following formula (13):

$$\text{Clean Yield (\%)} = \frac{\text{Clean sample weight (g)} + \text{Clean sample weight (g)} \times 14\%}{\text{Original sample weight (g)}}$$

There was no interaction between genotype and sex at pre-statistical analysis. Effects of some factors such as genotype and sex on greasy fleece yield and mohair features were examined using the LSM procedure of SAS (14). For greasy fleece yield and mohair features of kids, $Y_{ijk} = \mu + G_i + S_j + e_{ijk}$ model was developed, where; Y_{ijk}: individual value, μ: expected mean, G_i : effect of genotype ($_i$: pure and F1 cross-bred), S_j: effect of sex ($_j$:male and female), e_{ijk}: error term.

Results

Greasy fleece weights and values related to mohair features based on sex in pure and F_1 cross-bred kids are presented in Table 1. The least squares means of fibre diameters, fibre lengths, fibre elasticity, breaking strengths, kemp fibre contents, medullated fibre contents, greasy fleece weights, and clean mohair yields for pure and F_1 cross-bred male kids were 36.1 µm and 30.2 µm; 7.3 cm and 7.9 cm; 32.9% and 31.1%; 8.3 g and 6.4 g; 15.2% and 3.4%; 12.6% and 2.2%; 440 g and 830 g ; 74.5% and 78.0%, respectively. Same features mentioned above for pure and F_1 cross-bred female kids were 36.7 µm and 30.1 µm; 7.5 cm and 7.7 cm; 31.7% and 31.9%; 8.1 g and 6.3 g; 17.4% and 3.3%; 13.7% and 2.4%; 410 g and 830 g; 74% and 74.4%, respectively. Fibre diameter, breaking strength, kemp fibre content, medullated fibre content, and greasy fleece weight were significantly different between pure and F_1 cross-bred kids for both males and females ($P < 0.05$).

The least squares means of greasy fleece weight and different values indicating mohair quality of kids are given in Table 2. The least squares means of fibre diameter, fibre length, fibre elasticity, breaking strength, kemp fibre content, medullated fibre content, greasy fleece weight, and clean mohair yield for pure kids were 36.4 µm, 7.4 cm, 32.4%, 8.2 g, 16.2%, 13.1%, 420 g and 74.3%, respectively. Same features mentioned above for F_1 cross-

Table 1. The least squares means and standard errors (S.E.) of greasy fleece weight and mohair characteristics based on sex in pure and F_1 cross-bred kids.

			Fibre diameter (µm)		Fibre length (cm)		Fibre elasticity (%)		Breaking strength (g)	
Sex	Genotype	n	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Male	Pure	10	36.1[a]	1.6	7.3	0.6	32.9	1.3	8.3[a]	0.4
	Cross-bred	16	30.2[b]	0.8	7.9	0.4	31.1	0.9	6.4[b]	0.3
Female	Pure	8	36.7[a]	0.9	7.5	0.3	31.7	2.0	8.1[a]	0.7
	Cross-bred	20	30.1[b]	0.7	7.7	0.4	31.9	0.7	6.3[b]	0.3
			Kemp fibre (%)		Medullated fibre (%)		Greasy fleece weight (kg)		Clean mohair yield (%)	
Male	Pure	10	15.2[a]	6.6	12.6[a]	2.0	0.44[b]	0.69	74.5	2.0
	Cross-bred	16	3.4[b]	0.7	2.2[b]	0.3	0.83[a]	0.40	78.0	1.1
Female	Pure	8	17.4[a]	8.6	13.7[a]	1.8	0.41[b]	0.44	74.0	1.5
	Cross-bred	20	3.3[b]	0.5	2.4[b]	0.2	0.83[a]	0.41	74.4	1.6

Values with different letters (a and b) within the same column are significantly different ($P < 0.05$).

Table 2. The least squares means and standard errors of greasy fleece weight and mohair characteristics in kids.

Factors	n	Fibre diameter (μm) Mean	S.E.	Fibre length (cm) Mean	S.E.	Fibre elasticity (%) Mean	S.E.	Breaking strength (g) Mean	S.E.
Expected mean	54	33.3	0.5	7.6	0.2	31.9	0.6	7.3	0.2
Genotype		***		ns		ns		***	
Pure	18	36.4	0.8	7.4	0.4	32.4	0.9	8.2	0.3
Cross-bred	36	30.1	0.6	7.8	0.2	31.6	0.7	6.3	0.2
Sex		ns		ns		ns		ns	
Male	26	33.2	0.7	7.6	0.3	31.9	0.8	7.3	0.3
Female	28	33.3	0.7	7.6	0.3	32.1	0.8	7.2	0.3
		Kemp fibre (%)		**Medullated fibre (%)**		**Greasy fleece weight (kg)**		**Clean mohair yield (%)**	
Expected mean	54	9.8	1.9	7.7	0.5	0.63	0.03	75.1	0.8
Genotype		***		***		***		ns	
Pure	18	16.2	3.0	13.1	0.8	0.42	0.04	74.3	1.4
Cross-bred	36	3.4	2.1	2.3	0.6	0.83	0.03	75.9	0.9
Sex		ns		ns		ns		ns	
Male	26	9.4	2.5	7.7	0.7	0.63	0.03	76.4	1.2
Female	28	10.1	2.5	7.5	0.7	0.62	0.03	73.8	1.2

ns: non-significant, ***:P < 0.001

bred kids were 30.1 μm, 7.8 cm, 31.6%, 6.3 g, 3.4%, 2.3%, 830 g and 75.9%, respectively. While greasy fleece weight, fibre diameter, breaking strength, kemp fibre content, and medullated fibre content were significantly affected by genotype (P < 0.001), they were not affected by sex. However, fibre length, fibre elasticity, and clean mohair percentage were not significantly affected by both genotype and sex.

Discussion

F_1 cross-bred kids had 98% greater greasy fleece weight than that of pure kids (P < 0.001). Yertürk (15) reported that greasy fleece weight for 2 and 3 year-old Coloured mohair goats were 520 and 710 g, respectively. The greasy fleece weight obtained for pure kids in this study was lower than the values reported by Yertürk (15), which could be due to the differences in the age of the goats used in these 2 studies. The results in the present study showed that the increase in greasy fleece weight by cross-breeding appears to be fairly high. Thus, it can be said that cross-breeding had a very positive effect on greasy fleece weight. Greasy fleece yield reported by Küçük et al. (16) for Coloured mohair goats (709 g) was lower than the value obtained for F_1 cross-bred kids, but higher than the values obtained for pure kids in the present study. When greasy fleece weights of pure and F_1 cross-bred kids were compared with the values reported for Angora goats in the literature, they were considerably lower than greasy fleece weights (1.26-1.51 kg) reported by Güneş and Evrim (17) for 1 year-old Angora goats with different genotypes. However, greasy fleece weight of F_1 cross-bred kids was similar to the greasy fleece weight reported for Angora goat crossed with a different goat type (18). Heritability (0.13-0.20) of greasy fleece weight is considered to be low (19,20), indicating that mohair yield can be improved by cross-breeding.

Fibre diameters of pure kids were greater than those of F_1 cross-bred kids in this study. Fibre diameter, being one of the most important fibre characteristics, was 17% thinner in F_1 cross-bred kids compared with pure kids (P < 0.001). Fibre diameter is very important for textile industry. Fibre classification can be based on diameter as extra (26-30.5 μm), normal (30.5-36 μm), and rough (36-42 μm) (21). Cross-breeding Coloured mohair goat with Angora goat seemed to improve fibre diameter.

Fibre diameter obtained for pure kids in this study was similar to the value (35.4 μm) reported by Yertürk (15) for 2 year-old Coloured mohair goats, but lower than the value (44 μm) reported by Yertürk (15) for 3 year-old Coloured mohair goats. Considering that as animal gets older, fibre diameter also gets thicker; these results were somewhat in agreement. Fibre diameter of F_1 cross-bred kids in this study was also lower than the values reported by Yertürk (15) for both ages.

While fibre diameters of pure and F_1 cross-bred kids in this study were lower than the value (48.4 µm) reported by Küçük et al. (16) for 3 year-old Coloured mohair goats, they were higher than the values reported by Koyuncu (18) for F_1 cross-bred of Angora goat × Hair goat and Erdoğan et al. (22) for G_1 cross-bred of Hair goat × Angora goat.

Fibre lengths were similar between pure and F_1 cross-bred kids in this study. These values were lower than the values reported by Yertürk (15) for 2 year-old (16.8 cm) and 3 year-old (16.3 cm) Coloured mohair goats. Although fibre lengths observed in the current study were also lower than the values reported by Küçük et al. (16), the difference between these 2 studies was lower compared to the study mentioned above.

Fibre and staple lengths observed for Angora goats originating from South Africa, USA, and Turkey, ranged from 15.6 cm to 24.2 cm. (1,17,23,24). Fibre lengths observed for both pure and F_1 cross-bred kids were considerably shorter compared to the values previously reported. This difference may have been resulted from equipment and methodology used in this study (the "barbe" method was used to determine the mean fibre length in this study). Fibre lengths measured in this study were similar to the values reported for F_1 cross-bred (8.4 cm) of Angora goat × Hair goat by Koyuncu (18) and for G_1 cross-breed of Hair goat × Angora goat (6.2 cm) by Erdoğan et al. (22).

Mean values for fibre elasticity and breaking strength were 32.4% and 8.2 g, and 31.6% and 6.3 g for pure and F_1 cross-bred kids, respectively. While fibre elasticity was similar, breaking strength was significantly different ($P < 0.001$) between genotype groups.

Fibre elasticity values obtained in this study were similar to that of Küçük et al. (16) for Coloured mohair goats (37.7%), however breaking strength values for both pure and F_1 cross-bred kids were lower than the value (14.9 g) reported by Küçük et al. (16). The values for fibre elasticity and breaking strength of Angora goat widely vary in the literature. Fibre elasticity values for pure and F_1 cross-bred kids were similar to the value (29.5%) reported by Arıtürk et al. (23), but breaking strength values were well below compared with the result (16.4 g) reported by Arıtürk et al. (23). Both fibre elasticity (38.26%) and breaking strength (13.96 g) values reported by Güneş and Evrim (17) were higher than the values observed for pure and F_1 cross-bred kids in the present study.

While kemp fibre content was 16.2% in pure kids, it was 3.4% in F_1 cross-bred kids. Medullated fibre content was 13.1% in pure kids, but it was 2.3% in F_1 cross-bred kids. Both kemp fibre content and medullated fibre content were significantly greater ($P < 0.001$) in pure kids compared to F_1 cross-bred kids and this was a desired result. Lower percentage or even absence of kemp and medullated fibres is desired in mohair. However, if selection program was not applied in the herd to eliminate these fibres, a higher percentage of these fibres could be seen in mohair of this herd. Heritability of these characteristics was reported to be 0.43 by Shelton and Bassett (25) and 0.37 by Allain and Roguet (19), respectively.

The data indicated that these characteristics have moderate heritability and a significant genetic improvement can be obtained, even in the first generation, by selection or crossing. In the present study, lower contents of kemp and medullated fibres were obtained with cross-breeding. This was considered to be one of the most significant results of this study.

The contents of kemp and medullated fibres obtained in this study were higher than the values (0.8% and 1.01%) reported by Emre (26) for 2 year-old Angora goats. However, kemp fibre content of F_1 cross-bred kids was similar to the value obtained from shoulder (2.16%), rib (1.27%), and thigh (1.98%) areas of male Angora goats (27). Kemp fibre content and medullated fibre content of pure kids were considerably higher than those mentioned above.

The contents of kemp and medullated fibres obtained in this study were lower than the values (8.4% and 6.8%) reported for F_1 cross-breed of Angora goat × Hair goat by Koyuncu (18). Furthermore, kemp fibre content of F_1 cross-breed was lower than the value (9.76%) reported by Jaktap et al. (28) for Angora goat cross-breed grown in India.

Clean mohair yield of pure kids in this study was similar to the value obtained for F_1 cross-bred kids. These clean mohair yields were a bit lower than the values reported for Angora goat (23,29). Similarly, the values obtained for both genotypes were lower than the values reported by Yertürk (15) and Küçük et al. (16).

In conclusion, the global improvement of mohair production traits was observed on F_1 kids developed by crossing Angora goat and Coloured mohair goat. It could be supposed that Angora goats have been selected more for mohair production compared Coloured mohair goats. Thus one way to improve the quality of mohair from Coloured mohair goat could be crossbreeding.

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