

Some morphological and production traits of Ramlıç sheep raised in a private farm

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ABSTRACT

This study was conducted on Ramlıç sheep raised on a private farm to determine the fertility traits, milk yield, post-shearing body weight, several body measurements, and fleece characteristics of ewes, as well as the growth and survival rates of lambs. The study animals consisted of 286 Ramlıç ewes and 298 lambs born to those ewes. Mean values for fertility traits were: 87.1% for single birth rate, 12.9% for twin birth rate, 1.1 lambs for litter size, and 104.2% for lamb production. The milk yields during lactation of Ramlıç ewes aged 2, 3, and 4 years were 57.04, 57.44, and 63.40 kg, respectively; the corresponding lactation periods were 175.88, 177.64, and 178.62 days. The highest lactation milk yield and the longest lactation period were observed in the 4-year-old group, but the differences between groups were not significant ($P>0.05$). The average body weight, withers height, rump height, chest depth, body length, and chest circumference of Ramlıç ewes were 54.19 kg, 70.90 cm, 70.45 cm, 31.89 cm, 67.94 cm, and 95.72 cm, respectively. The effect of age was significant ($P<0.001$) for all traits investigated. Therefore, the Ramlıç breed could provide an important resource for breeders, depending on the observed levels of yield characteristics.

Keywords: Fertility, Growth, Milk yield, Ramlıç, Survival rate

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Introduction

The world population is steadily increasing, heightening concerns about human food security (1). Livestock products play an important role in providing people with healthy, balanced nutrition by meeting their basic biological needs, supporting economic and social development, and improving their welfare (20, 26). Animal-origin food sources are valuable for nutrition because of their high protein content (14). Sheep breeding is an important source of income for all countries and influences their national economies in various ways. This is due to climate, geography, and production methods (3). Nearly 3% of the world's sheep were bred in Türkiye (15). Türkiye ranks high in the number of animals but not in yield per animal. In 2019, sheep accounted for 22% of total red meat production and approximately 5% of annual milk production. Among the sheep, 9.7% were Merino or

Merino crossbreeds, and 90.3% were native breeds in Türkiye (29).

The majority of sheep in Türkiye are native breeds with low combined yields and are reared under extensive or semi-intensive production systems. These breeds, which have adapted to the region's conditions, are successfully farmed. However, yield per animal should be increased in sheep breeding (3). Increasing animal yield can be achieved only by improving genotypes and environmental factors. Improvements in environmental factors are not permanent. Therefore, genotypes with higher yields should be bred under existing conditions rather than under improved environmental conditions in animal breeding (2). Various cross-breeding studies have been conducted between native breeds in Türkiye and breeds imported from abroad to develop high-yielding genotypes for sheep breeding. As a result of these studies,

several native high-yield breeds and hybrid genotypes were developed, such as Bafra, Karacabey Merino, Central Anatolian Merino, Ramlıç, Acıpayam, Malya, and Türkgeldi (18, 19, 30, 31, 32, 33).

The Ramlıç breed was developed at Eskişehir-Çifteler Stud Farm as a result of crossbreeding between the Dağlıç breed and the Rambouillet, a U.S.-origin sheep breed that was brought from the Karacabey Stud Farm to the Çifteler Veterinary and Animal Science Research Institute in 1969. The purpose of these studies was to improve the meat yield, fleece yield, and fleece quality in the Dağlıç breed. Ramlıç sheep have a genetic composition of 30–35% Dağlıç and 65–70% Rambouillet (33). Ramlıç sheep are bred in some regions of Türkiye, including Central and Western Anatolia (6).

The aim of this study was to examine the fertility traits, milk yield, post-shearing body weights, selected body measurements, and fleece characteristics of Ramlıç sheep and to assess the growth and survival rates of their lambs under breeder-managed (semi-intensive) conditions.

Materials and Methods

Animal Materials: The study included 286 Ramlıç sheep and 298 lambs born to these sheep at the enterprise. The animal material used in this study was obtained from the National Small Ruminant Improvement Program, conducted by the General Directorate of Agricultural Research and Policies of the Ministry of Agriculture and Forestry of Türkiye. All sheep on the private farm were identified using ear tags. The ages of the sheep were taken from their records.

Care and Feeding: Taking pasture and climatic conditions into account, the sheep were cared for and fed according to the enterprise's routine program. The sheep were bred by hand. The rams were 2, 3, and 4 years old and were kept at a ratio of one ram to 25 ewes. The sheep were fed in a pen during the lambing season (from 15 January to 15 February 2018). Turkey is located between the temperate and subtropical zones. Sivrihisar is located in the Central Anatolia Region. In Central Anatolia, grasses in pastures begin to grow in spring and reach a length suitable for sheep grazing. During this period, sheep begin to go out to pasture with their lambs. Sivrihisar, located at 793 meters above sea level, has a mean annual temperature of 13.7°C and an average annual rainfall of approximately 67 millimeters.

When the sheep were not allowed to graze, they were fed three times daily with concentrate feed (18% CP, 2700 kcal/kg) and roughage (alfalfa hay, vetch hay, and barley stubble). At the beginning of the pasture period, they were fed twice daily. During the period, the sheep were fed only roughage, consisting of alfalfa hay, vetch hay, and barley stubble. After the lambs were weaned, the sheep were fed

entirely on pasture. The lambs were kept in a lambing pen with their mother for the first week after birth. The lambs were suckled twice daily until they were allowed to go to pasture with their mothers. After the second week, the lambs were fed with starter feed. When the lambs were on pasture with their mothers, they were suckled once daily; when they returned to the pen, they were fed concentrate (16% CP, 2500 kcal/kg). The lambs were weaned in June at approximately 120 days of age.

Fertility Traits, Survival Rate and Body Weight of the Lambs:

Fertility traits in sheep (birth rate, single birth rate, twin birth rate, lambing yield, litter size, ratio of lambs weaned, and ratio of infertile lambs) were calculated (3). The survival of the lambs was examined at 30, 60, 90, and 120 days of age (up to four months). The survival rate was calculated by dividing the number of lambs living in each period by the total number of lambs born alive. At birth, lambs were assigned identification numbers using ear tags, and the following information was recorded: birth weight, date of birth, type of birth, sex, and dam age. To determine growth characteristics, lambs were weighed monthly until weaning. The body weights on days 75, 90, and 120 were calculated by interpolation. The lambs were weighed using Konel functional scales with 10-g and 100-g precision.

Lactation Milk Yield and Lactation Period: Milk controls were carried out on ewes randomly selected from the three age groups (17 two-year-old, 14 three-year-old, and 13 four-year-old ewes). The milk controls began when the first-born lamb reached 25 days of age and were carried out every 30 days until the ewes' milk yield decreased to 50 g on a control day.

The lambs were separated from their mothers at weaning (6:00 p.m.) on the day before the control day, and the ewes were hand-milked once between 6:00 and 7:00 p.m. on the following day. The milk was weighed using a scale with a precision of 5 g. Lactation milk yield was calculated using the Trapeze II (Fleischmann) method (21). In the Trapeze II method, lactation milk yield (LMY) is calculated using the following formula.

$$LMY = [(k_1 A) + ((k_1 + k_2) / 2) a_1 + \dots + ((k_{n-1} + k_n) / 2) a_n + (k_n C)]$$

LMY; lactation milk yield, k ; daily milk yields at the beginning and end of the control period ($k_1, k_2, k_3, \dots, k_n$), a ; control interval (days) ($a_1, a_2, a_3, \dots, a_n$), n ; number of controls, A ; the days between the birth and the first control date, C ; the days between the last control day and the first day of the dry period.

Body Measurements and Body Weight After Shearing:

The sheep were weighed, and their heights at the withers and at the rump, chest depth, chest circumference, and

body length were measured. Their withers-rump height, chest depth, and body length were measured with a measuring stick; chest circumference was measured with a measuring tape; and body weight was measured with an electronic scale with a precision of 100 g.

Fleece Characteristics: The sheep were sheared in May 2018. 15 sheep were randomly selected from each age group, and 100-g fleece samples were taken from their last-rib area. The fleece characteristics (fiber diameter, fiber length, clean fleece percentage, fiber elasticity, and breaking strength) were examined at the Fleece and Mohair Laboratory at the International Center for Livestock Research and Training. Fiber diameter was measured using the USTER OFDA 100 (Instrument for Measuring Wool Diameter; OFDA, Optical-based Fiber Diameter Analyzer), fiber length was measured using the USTER FL 100, and breaking strength and fiber elasticity were measured using the Single Fiber Tensile Tester FAFEGRAPH HR+ME (5, 25).

Statistical Analysis: Descriptive statistics were calculated for the data obtained. One-way analysis of variance (ANOVA) was used to examine lactation milk yield, lactation period, body weight after shearing, selected body measurements, and various fleece characteristics. The GLM was used to analyze lamb body weights at birth and on days 75, 90, and 120 using the following statistical model.

$$Y_{ijkl} = \mu + MA_i + B_j + G_k + e_{ijkl}$$

Y_{ijkl} ; observation value, μ ; expected mean value, MA_i ; effect of the mother age (i = at the age of 2, 3, and 4), B_j ; effect of the birth type (j = single, twin), G_k ; effect of the gender (k = male, female), e_{ijkl} ; random error.

Tukey's test was used for post hoc analysis of variables that showed significant differences. A chi-square

test was used to analyze lamb survival rates in relation to the examined factors. Statistical significance was set at $P < 0.05$ for all analyses. Data were analyzed using SPSS 14.01 (27).

Results

The single-birth rate was 87.1%, the twin-birth rate was 12.9%, and the overall birth rate was 92.3%. The litter size was 1.1, and the lambing yield was 104.2% (Table 1). The mean body weights were 4.36 kg, 20.01 kg, 22.47 kg, and 27.72 kg at birth and 75, 90, and 120 days, respectively (Table 2). The survival rates of the Ramlıç lambs at 30, 60, 90, and 120 days are presented in Table 3. As a result of the chi-square test, the effects of dam age, gender, and birth type were not statistically significant ($P > 0.05$; Table 3). Survival rates on day 30 were 96.00% for males, 99.32% for females, 97.83% for singletons, and 97.06% for twins; on day 120, they were 90.67% for males, 95.95% for females, 93.48% for singletons, and 92.65% for twins (Table 3).

Table 1. Fertility traits in the Ramlıç sheep

Fertility traits	Values
Number of ewes inseminated	286
Number of ewes giving birth	264
Number of ewes giving birth to a single lamb	230
Number of ewes giving birth to twin lambs	34
Number of infertile ewes	22
Birth rate (%)	92.3
Single birth rate (%)	87.1
Twin birth rate (%)	12.9
Lambing yield (%)	104.2
Litter size	1.1
Rate of infertile ewes (%)	7.7

Table 2. Effect of dam age, sex and birth type on body weight in the Ramlıç lambs ($\bar{X} \pm S_x$)

Factors	n	Birth weight	n	75 th day	n	90 th day	n	120 th day
Dam Age		**		**		**		-
2	128	4.164±0.067 ^a	123	19.281±0.275 ^a	122	21.672±0.297 ^a	119	26.922±0.421
3	85	4.418±0.080 ^b	80	20.333±0.331 ^b	79	22.826±0.358 ^b	79	28.360±0.502
4	85	4.491±0.080 ^b	81	20.420±0.328 ^b	80	22.919±0.357 ^b	80	27.871±0.501
Sex		*		***		***		**
Male	150	4.456±0.062	140	20.669±0.258	138	23.216±0.280	136	28.612±0.396
Female	148	4.259±0.064	144	19.355±0.263	143	21.729±0.284	142	26.824±0.399
Birth type		***		***		***		***
Single	230	4.851±0.047	219	21.341±0.192	217	24.141±0.208	215	29.814±0.292
Twin	68	3.864±0.085	65	18.683±0.349	64	20.804±0.378	63	25.622±0.534
Overall	298	4.358±0.049	284	20.012±0.200	281	22.473±0.217	278	27.718±0.306

a, b: The difference between the means with different letters in the same column is significant ($P < 0.05$). -: $P > 0.05$, **: $P < 0.01$, *** $P < 0.001$

Table 3. Survival rates in the Ramlıç lambs

Factors	Lambs born alive	30 th day		60 th day		90 th day		120 th day		P
Dam Age	n	n	%	n	%	n	%	n	%	
2	128	125	97.66	123	96.09	122	95.31	119	92.97	
3	85	82	96.47	80	94.12	79	92.94	79	92.94	-
4	85	84	98.82	83	97.65	80	94.12	80	94.12	
Sex										
Male	148	147	99.32	145	97.97	143	96.62	142	95.95	
Female	150	144	96.00	141	94.00	138	92.00	136	90.67	-
Birth type										
Single	230	225	97.83	221	96.09	217	94.35	215	93.48	
Twin	68	66	97.06	65	95.59	64	94.12	63	92.65	
Overall	298	291	97.65	286	95.97	281	94.30	278	93.29	-

-: P>0.05

Table 4. Statistic values for lactation milk yield and lactation period in Ramlıç sheep

Lactation milk yield (kg)					
Age	n	$\bar{x}$	S _x	Minimum	Maximum
2	17	57.04	2.06	38.54	74.03
3	14	57.44	5.15	33.57	79.62
4	13	63.40	1.93	51.09	73.73
P			-		
Lactation period (days)					
Age	n	$\bar{x}$	S _x	Minimum	Maximum
2	17	175.88	3.11	168.00	199.00
3	14	177.64	4.15	152.00	199.00
4	13	178.62	4.49	154.00	199.00
P			-		

-: P>0.05

Table 5. Some statistic values for body measurements (cm) and body weight after shearing (kg) in Ramlıç sheep ($\bar{X} \pm S_x$)

Factor	n	Body weight	Wither height	Rump height	Chest depth	Body length	Chest circumference
Age		***	***	***	***	***	***
2	132	51.88±0.18 ^a	70.32±0.1 ^a	69.26±0.1 ^a	31.41±0.0 ^a	67.17±0.1 ^a	94.69±0.20 ^a
3	67	56.19±0.42 ^b	71.75±0.2 ^b	71.72±0.2 ^b	32.07±0.1 ^b	68.62±0.2 ^b	97.49±0.37 ^c
4	65	56.82±0.51 ^b	71.18±0.2 ^b	71.55±0.2 ^b	32.66±0.1 ^c	68.80±0.3 ^b	95.99±0.30 ^b
Overall	264	54.19±0.23	70.90±0.12	70.45±0.14	31.89±0.07	67.94±0.13	95.72±0.58

a, b, c: The difference between the means with different letters in the same line is significant (P<0.05). ***P<0.001

The lactation milk yield was 57.04, 57.44, and 63.40 kg in Ramlıç sheep aged 2, 3, and 4 years, respectively. The highest milk yield during lactation was observed in those aged 4 years, but the difference between the groups was not statistically significant (P>0.05). The lactation periods of Ramlıç sheep at 2, 3, and 4 years of age were 175.88, 177.64, and 178.62 days, respectively. The longest lactation period was observed in those aged 4 years; however, the difference between the groups was not statistically significant (P>0.05, Table 4).

Body weight after shearing, withers height, rump height, chest depth, body length, and chest circumference of Ramlıç sheep were 54.19 kg, 70.90 cm, 70.45 cm, 31.89 cm, 67.94 cm, and 95.72 cm, respectively. The effect of age was significant (P<0.001) for all these traits (Table 5).

The fiber diameters were 22.62, 24.16, and 24.27 μ m at 2, 3, and 4 years of age, respectively. The effect of age on the fiber diameter was significant (P<0.05). Fiber lengths were 7.23 cm, 5.80 cm, and 6.10 cm in Ramlıç sheep at 2, 3, and 4 years of age, respectively. The effect of age on fiber length was significant (P<0.05; Table 6).

Table 6. Statistical values for the fleece characteristics in the Ramlıç sheep

Traits		n	Age			Overall	P
			2	3	4		
Fiber diameter (μm)	$\bar{X} \pm S\bar{x}$		22.62 $\pm$ 0.55 ^b	24.16 $\pm$ 0.56 ^a	24.27 $\pm$ 0.38 ^a	23.68 $\pm$ 0.31	
	Minimum	45	19.71	20.93	20.95	19.71	*
	Maximum		26.94	27.39	26.35	27.39	
Fiber length (cm)	$\bar{X} \pm S\bar{x}$		7.23 $\pm$ 3.99 ^a	5.80 $\pm$ 3.34 ^b	6.10 $\pm$ 3.42 ^b	6.38 $\pm$ 2.23	
	Minimum	45	5.0	4.5	4.5	4.5	*
	Maximum		10.0	9.5	9.0	10.0	
Clean fleece percentage (%)	$\bar{X} \pm S\bar{x}$		51.0 $\pm$ 2.0	55.0 $\pm$ 2.0	55.0 $\pm$ 2.0	54.0 $\pm$ 1.0	
	Minimum	45	40.0	40.0	40.0	40.0	-
	Maximum		60.0	60.0	70.0	70.0	
Fiber elasticity (%)	$\bar{X} \pm S\bar{x}$		27.20 $\pm$ 1.41	29.22 $\pm$ 1.30	28.97 $\pm$ 0.83	28.46 $\pm$ 0.70	
	Minimum	45	11.84	16.31	23.01	11.84	-
	Maximum		34.07	35.34	33.86	35.34	
Breaking strength (cN tex)	$\bar{X} \pm S\bar{x}$		10.47 $\pm$ 0.61	12.46 $\pm$ 0.64	11.45 $\pm$ 0.79	11.46 $\pm$ 0.41	
	Minimum	45	7.62	8.19	8.26	7.62	-
	Maximum		15.1	16.61	20.40	20.40	

a, b: The difference between the means with different letters in the same line is significant ($P < 0.05$). -: $P > 0.05$, *: $P < 0.05$

Discussion and Conclusion

Farm profitability, the maintenance and growth of herd size, and the more effective selection of breeding stock in animal husbandry depend on fertility traits in sheep. The birth rate observed in this study for Ramlıç sheep was higher than those reported for Dağlıç, Malya, Akkaraman, Central Anatolian Merino, Karayaka, Bafra, Gökçeada, Sakız, Kıvrıkcık, and Karagül breeds; similar to rates reported for Central Anatolian Merino and to some reports for the Ramlıç breed; and lower than other reports for the Ramlıç breed in the literature (4, 9, 12, 13, 17, 30, 33).

The litter size observed in this study for the Ramlıç sheep was higher than those reported for Karayaka, Akkaraman, and Karagül breeds and lower than those reported for Malya, Akkaraman, Central Anatolian Merino, and Bafra breeds (4, 9, 13, 30, 34). In Ramlıç lambs, body weight at 90 days of age in this study was higher than that reported for Karayaka and Bafra breeds and similar to that reported for Akkaraman, Acıpayam, and Awassi breeds (4, 22, 23, 24).

The body weights of Ramlıç lambs were generally similar to or higher than those reported in the literature. This situation may have occurred because the Ramlıç breed has early maturation, and its meat characteristics reflect the influence of the Rambouillet breed and of improvement programs conducted on that breed.

Lamb survival rate is a major determinant of profitability in sheep breeding, particularly during the preweaning period. Many genetic and environmental factors affect lamb survival, such as genotype, dam age, maternal-offspring behavior, type of birth, lamb sex, and birth weight. In this study, the survival rate at 60 days of age for Ramlıç male lambs was similar to that reported for

Ramlıç and Dağlıç breeds (12). The survival rate of female Ramlıç lambs at 60 days of age was higher than that previously reported for the Ramlıç breed (17).

In general, the survival rates of the Ramlıç lambs were found to be similar to or higher than those reported in the literature. Dağlıç, which contributed to the origin of the Ramlıç breed, is a native breed highly adapted to the region. The high survival rate of the lambs may be attributable to the expression of the Dağlıç breed's adaptability in Ramlıç lambs, attentive care and feeding by local people, and confinement in pens during winter. In addition, the survival rates of the female lambs were higher than those of the male lambs in all examined periods (30, 60, 90, and 120 days). This is also consistent with the results reported in some studies (16, 23, 31).

The lactation milk yield detected in Ramlıç sheep in this study was higher than that reported for Karakaş and Akkaraman breeds, lower than that reported for Ramlıç and Acıpayam breeds, and similar to that reported for Dağlıç and Karakaş breeds. The lactation period was lower than that reported for the Acıpayam breed, similar to that reported for Dağlıç and Ramlıç, and higher than that reported for Karakaş and Akkaraman (12, 22, 23, 33, 34).

The low milk yield during lactation of Ramlıç ewes may be due to the breed being selected for meat and fleece yield; the low milk-yield trait of the Dağlıç breed is also evident in Ramlıç sheep; Ramlıç ewes are generally not milked. Lactation milk yield and lactation period are affected by many environmental factors. Therefore, significant differences have been reported in the literature. This may be due to differences in the methods used to determine milk yield and lactation period.

The post-shearing body weight of Ramlıç sheep determined in this study was higher than those reported for Dağlıç, Ramlıç, Karagül, and Awassi breeds; similar to that reported for Acıpayam; and lower than those reported for Central Anatolian Merino and Ramlıç breeds (8, 11, 13, 17, 24, 30, 35).

The height at the withers of Ramlıç sheep in this study was higher than that reported for the Awassi and Akkaraman breeds. Rump height was also higher than that reported for Awassi and Akkaraman. Chest depth was similar to that reported for the Awassi breed but higher than that reported for the Akkaraman breed. The body length was similar to those reported for Awassi and Akkaraman, and chest circumference was lower than that reported for the Akkaraman breed (24, 34).

Most body measurements and post-shearing body weights of Ramlıç ewes were higher than those reported in previous studies. This may be because the studied herd generally consisted of middle-aged and older animals; the herd was enrolled in an ongoing improvement study; care and feeding conditions varied; and breed composition varied.

The fiber diameter determined in this study was lower than those reported for Awassi, Akkaraman, Dağlıç, and Acıpayam breeds, and similar to that reported for Malya, Ramlıç, Turkish Merino, and Central Anatolian Merino. Fiber length was lower than that reported for Awassi, Akkaraman, Dağlıç, and Malya breeds; similar to those reported for Turkish Merino, Central Anatolian Merino, Karagül, Anatolian Merino, Karacabey Merino, and Ramlıç; and higher than that reported for Kaşmir Merino (7, 8, 9, 10, 12, 13, 28, 30, 33, 35).

In this study, the clean fleece percentage of Ramlıç sheep was similar to that reported for Ramlıç and Anatolian Merino, lower than that reported for Dağlıç and Kaşmir Merino, and higher than that reported for Malya and Akkaraman. Fiber elasticity was similar to that reported for Akkaraman and Acıpayam breeds and higher than that reported for Ramlıç. Breaking strength was lower than that reported for Acıpayam and similar to that reported for Ramlıç and Akkaraman breeds (7, 8, 9, 10, 33, 35). Differences between the values determined for Ramlıç sheep in this study and those reported in the literature may be attributable to variation in genotype, age, pasture, regional conditions, and management. Ramlıç sheep aged 2 years had greater fiber length than those aged 3 or 4 years. The most likely reason for this is that the two-year-old sheep were shorn for the first time. Fiber length was obtained using the USTER FL 100 device. This value is used in the textile industry (5). However, the length measurements differ substantially from those measured manually. Therefore, the fiber lengths observed in this study were lower than those reported for the Dağlıç and Ramlıç breeds (12).

Consequently, it was concluded that Ramlıç ewes have good fertility, body weight, and lamb survival rates under breeding conditions; however, lactation milk yield varies and is generally lower than that of other native breeds. They have greater body weight, larger body measurements, and high-quality fleece characteristics. Ramlıç sheep can make an important contribution to breeders and to production.

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Ethical Statement

This study was approved by the Ankara University Animal Experiments Local Ethics Committee (2017-17-136).

Conflict of Interest

The authors declare that there is no conflict of interest.

Author Contributions

The authors declare that they have contributed equally to the article. All authors provided significant contributions by giving feedback and helping to shape the manuscript.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Declaration of Generative Artificial Intelligence

The authors declare that generative artificial intelligence (AI) and AI-assisted technologies were not used in the writing of this manuscript.

Animal Welfare

The authors confirm that they have adhered to ARRIVE Guidelines to protect animals used for scientific purposes.

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