



Evaluation of some reproductive traits, growth, and survival in native Dağlıç sheep

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ABSTRACT

The aim of this study was to determine the fertility, survival rate, and growth of Dağlıç sheep and the environmental factors that affect these characteristics, using the records of 14,695 head of sheep and 43,915 lambs from 2011 through 2021 in Afyonkarahisar Province, Türkiye. Lambing rates and litter size for the Dağlıç sheep were determined to be 84.83% and 1.04, respectively. Gradual increases in these characteristics were observed throughout the years studied, and the lambing rate reached the highest values (94.30%) in 2019-2020. The average survival rates at weaning were 92.19%. The fluctuations in fertility parameters and survival from year to year were also significant ($P < 0.05$). The overall mean values of birth weight, weight at 3 months, daily weight gain, weight at weaning, weight at 6 and 12 months were 3.23; 17.83; 0.168; 22.44; 30.50 and 36.64 kg, respectively. The effects of herd, birth month, breeding season, sex of the lamb, type of birth, age of the dam, and weaning age on growth traits were statistically significant ($P < 0.05$). It was concluded that growth traits were affected by different environmental factors, and selection programs must be organised considering these factors. Fertility, survival rate and growth traits increased progressively over the years.

Key words: sheep; Dağlıç; fertility; lamb survival; growth

Introduction

Türkiye is one of the leading countries in terms of its number of sheep. According to Turkish Statistical Institute data, there were 44,687,888 head of sheep in Türkiye in 2022 ([TUİK, 2023](#)). Native breeds, such as Akkaraman, Awassi, Morkaraman, Kıvrıkcık, and Karayaka, make up the majority of

Türkiye's sheep population. Until the 1980s, the Dağlıç breed was found throughout Afyonkarahisar, Burdur, Eskişehir, Isparta, Kütahya, and Uşak Provinces in Western and Central Anatolia, and it was considered to be third most abundant of the native sheep in Türkiye ([YALÇIN, 1982](#); [AKÇAP-İNAR, 1994](#)). However, because of the changing

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consumption habits of the people and uncontrolled crossbreeding, the number of Dağlıç sheep has significantly decreased. Some local genotypes, such as Çandır, Kesber, Kamakuyruk, Pırlak, and Ram- lıç, have been produced by crossbreeding Dağlıç sheep with other breeds. Dağlıç is a native sheep breed with a small-sized and a fat tail. However, the Dağlıç breed has been improved by the pure breeding and selection studies coordinated by the General Directorate of Agricultural Research and Policies of Turkish Ministry of Agriculture and Forestry (Fig. 1 and 2).



Fig. 1. A three-year-old Dağlıç Ram



Fig. 2. A five-year-old Dağlıç Ewe

The lambing rate, twin lambing rate, and litter size of Dağlıç sheep were found to be 87.7-88.7%; 0.44-0.80%, and 1.00-1.02, respectively, in the literature ([YALÇIN et al., 1977](#); [EVRİM, 1978](#);

[DEMİR, 1989b](#)). Researchers have reported that the weight of Dağlıç lambs at birth, weight at 3 months, weaning, and 6 and 12 months were 2.98-3.56; 17.45-20.50; 21.85-26.26; 24.39-26.65 and 31.59 kg, respectively ([YALÇIN, 1969](#); [YALÇIN et al., 1972](#); [YALÇIN et al., 1977](#); [EVRİM, 1978](#), [DEMİR, 1989a](#); [DEMİR, 1995](#); [TEKERLİ et al., 2001](#)). The lamb survival rate at weaning was reported to be 95.3 - 98.0% ([YALÇIN et al. 1972](#); [YALÇIN et al., 1977](#); [EVRİM, 1978](#); [DEMİR, 1989b](#); [TEKERLİ et al., 2002](#)).

The objective of this study was to investigate fertility, survival rate, and the effects of some environmental factors on the pre- and post-weaning growth traits of the Dağlıç sheep breed in Afyonkarahisar province, Türkiye.

Materials and methods

Materials. The records of 14,695 head of Dağlıç sheep and their 43,915 lambs, maintained on 43 farms from 2011 through 2021, were used in the study. The sheep farms located in the Bolvadin District in Afyonkarahisar Province are situated at 38° 42' 45.3636'' N 31° 2' 54.2436'' E. The data were recorded within the scope of the National Small Ruminant Improvement Program, coordinated by the General Directorate of Agricultural Research and Policies of the Ministry of Agriculture and Forestry in Türkiye.

Methods. The mating season for Dağlıç sheep in Afyonkarahisar is between July and October. Dağlıç ewes are generally kept indoors during the lambing period, between midwinter and midspring, after which they were kept on poor quality pastures. When feed from the pasture is not sufficient, 0.5 kg roughage and 0.5 kg concentrate feed per sheep are provided by the farmers to supplement the feed.

The information on live born lambs was recorded, and lambs were weighed within the first 24 hours. Periodic weighing was conducted until weaning (about 120 days) for all lambs, and until yearling age only for selected animals. Daily weight gain until weaning was calculated from the birth weight and weaning weight. Live weights at 3, 6 and 12 months were estimated by computer software named Çoban Yıldızı ([TEKERLİ, 2023](#)) using the interpolation

method. Lambing rate, litter size, and survival rates at weaning were calculated from the herd records. Lambing rate was calculated as the number of lambing sheep/ number of ewes exposed to a ram, and litter size was the total number of lambs born per ewe at lambing.

Lambs with birth weights <1 kg, weaning weights <12 kg, and weaning age >180 days were not included in the analysis. The records on selected animals were used to analyze post-weaning traits.

Statistical analysis. The following models for birth weight, daily weight gain, live weights at weaning and 3, 6 and 12 months of age, were used to determine the effects of environmental factors:

For birth weight, weight at three months and daily weight gain:

$$Y = \mu + H_i + BM_j + BS_k + S_l + BT_m + DA_n + e_{ijklmno}$$

For weights at weaning, and six- and twelve-months live weights:

$$Y_{ijklmnop} = \mu + H_i + BM_j + BS_k + S_l + BT_m + DA_n + WA_o + BW_p + e_{ijklmnop}$$

Where: Y is the vector of observations, μ is the overall mean, H_i is the effect of i^{th} herd (1, 2, 3, ..., 41, 42 and 43), BM_j is the effect of j^{th} birth month (December, January, February and March), BS_k is the effect of k^{th} breeding seasons (2011-2012; 2012-2013;2020-2021), S_l is the effect of the sex of the lamb (male and female), BT_m is the effect of m^{th} birth type (single and twin), DA_n is the effect of n^{th} age of dam (≤ 730 ; 731-1095; 1096-1460 and >1460 days), WA_o is the effect of o^{th} weaning age groups (<90;

90-1_{th}20; 121-150 and >150 days), BW_p is the effect

of p birth weight groups (<3.5 and ≥ 3.5 kg), and e is the random error. The Chi-square test was used for comparison of lambing rate, single and twin lambing rate, and survival rate between breeding seasons. ANOVA and multiple comparison tests (Tukey) were used for body weights and daily weight gain. All statistical procedures were performed by MINITAB 18.0 software (MINITAB, 2018).

Results

The findings related to some of the fertility traits and survival rates are presented in Table 1. The av-

erages of the lambing rates, twin lambing rates, and litter size were 84.83%; 3.65%, and 1.04, respectively. The highest litter size and twin lambing rates were in the 2015-2016 period. The survival rate over a 10-year period was 92.19%, where the highest was 98.09% in the 2018-2019 period. The differences in these characteristics between the breeding seasons were statistically significant ($P < 0.05$).

The least-squares means and standard errors of pre- and post-weaning growth characteristics for Dağlıç lambs are presented in Tables 2 and 3. The overall means of birth weight, weight at 3 months, and daily weight gain were 3.23 ± 0.01 ; 17.83 ± 0.07 kg and 168.35 ± 0.56 g, respectively. The effects of herd, birth month, breeding season, sex of the lamb, type of birth, and age of the dam on all characteristics studied were statistically significant ($P < 0.001$).

The mean of the weaning weight and weights at 6

and 12 months were 22.44 ± 0.07 ; 30.50 ± 0.12 and 36.64 ± 0.19 kg, respectively. The effects of herd, birth month, breeding season, sex of the lamb, type of birth, age of dam, birth weight, and age at weaning-on-weaning weight, besides weights at 6 and 12 months (except age of dam) were significant ($P < 0.05$).

Discussion

In this study it was found that the lambing rate for Dağlıç sheep during the periods studied was 84.83%, which was lower than the values (87.7-88.7%) reported in the literature (YALÇIN et al., 1977; EVRİM, 1978; DEMİR, 1989b). In terms of

our results, twin lambing rates and litter size (3.65% and 1.04) were higher than those of YALÇIN et al.,

1977, EVRİM, 1978, and DEMİR, 1989b. This situation may have resulted from the selection program applied throughout years, and from improvements in feeding and management conditions on the farms. The survival rate (92.19%) on the investigated commercial farms was lower than that stated in the results of other research (95.3-98.0%) obtained from state-controlled farms (YALÇIN et al., 1972; YALÇIN et al., 1977; EVRİM, 1978; DEMİR, 1989b; TEKERLİ et al., 2002).

The least square mean of birth weight in lambs was 3.23 kg, which was comparable to the results

Table 1. Some fertility traits and survival rate in Dağlıç sheep

Breeding seasons/traits	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	Overall
Animals exposed to rams	5326	5488	5609	5467	5157	5157	4415	4468	4191	4667	49945
Lambing sheep (head)	4593	4729	4686	4814	4538	3837	3844	3669	3952	3705	42367
Lambing rate (%)	86.24 ^c	86.17 ^c	83.54 ^d	88.06 ^b	88.00 ^b	74.40 ^f	87.07 ^{bc}	82.12 ^d	94.30 ^a	79.39 ^e	84.83
Single lambing sheep (head)	4458	4570	4533	4629	4156	3631	3701	3614	3861	3666	40819
Single lambing rate (%)	97.06 ^b	96.64 ^{bc}	96.73 ^{bc}	96.16 ^c	91.58 ^e	94.63 ^d	96.28 ^c	98.50 ^a	97.70 ^b	98.95 ^a	96.35
Twin lambing sheep (head)	135	159	153	185	382	206	143	55	91	39	1548
Twinning rate (%)	2.94 ^d	3.36 ^{cd}	3.27 ^{cd}	3.84 ^c	8.42 ^a	5.37 ^b	3.72 ^c	1.50 ^e	2.30 ^d	1.05 ^e	3.65
Litter size	1.03	1.03	1.03	1.04	1.08	1.05	1.04	1.01	1.02	1.01	1.04
Number of live lambs at birth	4728	4888	4839	4999	4920	4043	3987	3724	4043	3744	43915
Lamb survival at weaning (head)	4064	4433	4432	4474	4540	3601	3852	3653	3837	3598	40484
Survival rate at weaning (%)	85.96 ^g	90.69 ^c	91.59 ^{de}	89.50 ^f	92.28 ^d	89.07 ^f	96.61 ^b	98.09 ^a	94.90 ^c	96.10 ^b	92.19

^{a,b,c,d,e,f,g}: Different superscript letters indicate significant differences within the same line (P<0.05)

Table 2. Effect of birth month and breeding season on body weights and daily weight gain at different ages in Dağlıç sheep

Factors	Birth weight (kg)		Three month weight (kg)		Daily weight gain (g)		Weaning weight (kg)		Six month weight (kg)		Twelve month weight (kg)	
	n	LSM±SE	n	LSM±SE	n	LSM±SE	n	LSM±SE	n	LSM±SE	n	LSM±SE
μ	42381	3.23 ± 0.01	31534	17.83 ± 0.07	37828	168.35 ± 0.56	37828	22.44 ± 0.07	10013	30.50 ± 0.12	8615	36.64 ± 0.19
Birth month		***		***		***		***		***		***
December	8705	3.27 ± 0.01 ^a	6238	17.46 ± 0.08 ^b	7985	153.80 ± 0.69 ^d	7985	24.32 ± 0.10 ^a	2358	30.84 ± 0.16 ^a	2055	38.77 ± 0.24 ^a
January	20321	3.22 ± 0.01 ^b	17932	17.11 ± 0.06 ^c	18732	157.99 ± 0.59 ^c	18732	22.80 ± 0.08 ^b	5278	30.26 ± 0.14 ^b	4590	36.67 ± 0.22 ^b
February	9154	3.21 ± 0.01 ^b	6804	17.64 ± 0.07 ^b	7984	166.95 ± 0.68 ^b	7984	21.51 ± 0.09 ^c	1710	30.32 ± 0.15 ^b	1430	36.29 ± 0.25 ^b
March	4201	3.21 ± 0.01 ^b	560	19.12 ± 0.18 ^a	3127	194.65 ± 0.88 ^a	3127	21.13 ± 0.14 ^d	667	30.58 ± 0.23 ^{ab}	540	34.81 ± 0.37 ^c
Breeding season		***		***		***		***		***		***
2011-2012	3958	3.29 ± 0.01 ^{ab}	3124	14.86 ± 0.10 ^f	3247	135.36 ± 0.89 ^h	3247	18.36 ± 0.11 ^f	723	27.11 ± 0.18 ^g	643	35.70 ± 0.29 ^d
2012-2013	4555	3.19 ± 0.01 ^{de}	3745	18.27 ± 0.09 ^c	4217	169.35 ± 0.80 ^d	4217	22.82 ± 0.10 ^c	824	29.92 ± 0.17 ^e	757	35.56 ± 0.28 ^d
2013-2014	4807	3.15 ± 0.01 ^f	4062	17.21 ± 0.09 ^d	4333	160.24 ± 0.81 ^f	4333	22.53 ± 0.10 ^c	1165	30.01 ± 0.16 ^{de}	1083	38.08 ± 0.25 ^b
2014-2015	4819	3.26 ± 0.01 ^{bc}	3002	16.70 ± 0.10 ^e	4242	164.01 ± 0.80 ^e	4242	22.06 ± 0.09 ^d	1143	30.58 ± 0.16 ^c	982	36.90 ± 0.25 ^c
2015-2016	4762	3.18 ± 0.01 ^{ef}	3825	18.06 ± 0.09 ^c	4253	168.11 ± 0.77 ^d	4253	22.15 ± 0.09 ^d	887	29.80 ± 0.17 ^c	665	32.50 ± 0.28 ^f
2016-2017	3985	3.23 ± 0.01 ^{cd}	2790	16.87 ± 0.10 ^e	3330	156.40 ± 0.87 ^g	3330	21.07 ± 0.10 ^e	919	28.63 ± 0.17 ^f	918	34.04 ± 0.25 ^e
2017-2018	3985	3.33 ± 0.01 ^a	3316	19.40 ± 0.10 ^{ab}	3559	180.53 ± 0.88 ^b	3559	23.67 ± 0.10 ^b	1117	32.43 ± 0.16 ^b	1077	37.90 ± 0.25 ^b
2018-2019	3724	3.25 ± 0.01 ^{bc}	2759	19.24 ± 0.10 ^b	3533	180.40 ± 0.87 ^b	3533	23.69 ± 0.10 ^b	1123	32.67 ± 0.16 ^b	1123	40.40 ± 0.25 ^a
2019-2020	4043	3.14 ± 0.01 ^f	2456	18.07 ± 0.11 ^c	3579	173.08 ± 0.86 ^c	3579	22.53 ± 0.10 ^c	1127	30.50 ± 0.17 ^{cd}	1127	36.63 ± 0.25 ^c
2020-2021	3743	3.27 ± 0.01 ^{bc}	2455	19.63 ± 0.11 ^a	3535	196.01 ± 0.87 ^a	3535	25.51 ± 0.11 ^a	985	33.35 ± 0.17 ^a	240	38.66 ± 0.41 ^b

*** P<0.001

a,b,c,d,e,f,g,h: The differences between the means of subgroups carrying various letters in the same column are significant (P<0.05)

Table 3. Effect of sex, birth type, age of dam, weaning age, and birth weight on body weights and daily weight gain at different ages in Dağlıç sheep

Factors	Birth weight (kg)		Three month weight (kg)		Daily weight Gain (g)		Weaning weight (kg)		Six month weight (kg)		Twelve month weight (kg)	
	n	LSM±SE	n	LSM±SE	n	LSM±SE	n	LSM±SE	n	LSM±SE	n	LSM±SE
μ	42381	3.23 ± 0.01	31534	17.83 ± 0.07	37828	168.35 ± 0.56	37828	22.44 ± 0.07	10013	30.50 ± 0.12	8615	36.64 ± 0.19
Sex		***		***		***		***		***		***
Male	21005	3.29 ± 0.01 ^a	15544	18.55 ± 0.07 ^a	18706	176.79 ± 0.60 ^a	18706	23.49 ± 0.07 ^a	925	33.91 ± 0.16 ^a	759	40.63 ± 0.26 ^a
Female	21376	3.17 ± 0.01 ^b	15990	17.11 ± 0.07 ^b	19122	159.91 ± 0.59 ^b	19122	21.39 ± 0.07 ^b	9088	27.09 ± 0.11 ^b	7856	32.64 ± 0.17 ^b
Birth type		***		***		***		***		***		***
Single	39383	3.51 ± 0.01 ^a	29387	18.60 ± 0.06 ^a	35268	172.81 ± 0.42 ^a	35268	23.09 ± 0.05 ^a	9511	30.91 ± 0.09 ^a	8170	35.55 ± 0.15 ^b
Twin	2998	2.95 ± 0.01 ^b	2147	17.07 ± 0.10 ^b	2560	163.88 ± 0.90 ^b	2560	21.79 ± 0.11 ^b	502	30.09 ± 0.19 ^b	445	37.72 ± 0.30 ^a
Age of dam (days)		***		***		***		***		***		NS
≤730	2762	3.15 ± 0.01 ^c	2150	17.11 ± 0.11 ^c	2581	161.87 ± 0.93 ^c	2581	21.67 ± 0.11 ^c	641	30.18 ± 0.18 ^c	566	36.51 ± 0.29
731-1095	5556	3.20 ± 0.01 ^b	3931	17.65 ± 0.09 ^b	5037	166.80 ± 0.74 ^b	5037	22.20 ± 0.09 ^b	1358	30.38 ± 0.15 ^{bc}	1136	36.61 ± 0.24
1096-1460	5070	3.28 ± 0.01 ^a	3663	18.30 ± 0.09 ^a	4688	172.68 ± 0.76 ^a	4688	23.00 ± 0.09 ^a	1451	30.79 ± 0.15 ^a	1223	36.65 ± 0.23
>1460	28993	3.28 ± 0.01 ^a	21790	18.26 ± 0.07 ^a	25522	172.05 ± 0.52 ^a	25522	22.89 ± 0.06 ^a	6563	30.66 ± 0.11 ^{ab}	5690	36.77 ± 0.18
Weaning age (days)	-	-	-	-	-	-		***		***		*
< 90	-	-	-	-	-	-	3908	18.73 ± 0.12 ^d	756	29.52 ± 0.21 ^c	587	36.29 ± 0.35 ^{ab}
90-120	-	-	-	-	-	-	12151	21.54 ± 0.08 ^c	3171	29.85 ± 0.14 ^c	2738	36.34 ± 0.22 ^b
121-150	-	-	-	-	-	-	18676	23.79 ± 0.08 ^b	5159	30.80 ± 0.14 ^b	4484	36.72 ± 0.23 ^{ab}
> 150	-	-	-	-	-	-	3093	25.71 ± 0.12 ^a	927	31.84 ± 0.19 ^a	806	37.20 ± 0.30 ^a
Birth weight (kg)								***		***		***
< 3,5	-	-	-	-	-	-	19982	21.72 ± 0.07 ^b	5402	30.11 ± 0.12 ^b	4592	35.56 ± 0.20 ^b
≥ 3,5	-	-	-	-	-	-	17846	23.16 ± 0.08 ^a	4611	30.89 ± 0.13 ^a	4023	37.71 ± 0.21 ^a

NS (Non-Significant) P>0.05, * P<0.05, *** P<0.001

^{a,b,c,d}: The differences between the means of subgroups carrying various letters in the same column are significant (P<0.05)

(2.98-3.56 kg) of other researchers ([YALÇIN, 1969](#); [YALÇIN et al., 1972](#); [YALÇIN et al., 1977](#); [EVRİM, 1978](#); [DEMİR, 1989a](#); [DEMİR, 1995](#); [TEKERLİ et al., 2001](#)). The effect of the herd, birth month, breeding season, sex of the lamb, type of birth and age of dam on birth weight was statistically significant ($P < 0.001$), which was also consistent with the results reported by [DEMİR \(1989a\)](#) and [TEKERLİ et al. \(2001\)](#). Lambs born from older ewes (>3 year) were heavier than those born from younger ewes. Male lambs had more weight than female ones.

The overall means for weight at 3 months, daily weight gain, and weight at weaning were 17.83 kg, 168.35 g, and 22.44 kg, respectively. During 2020-2021, the highest values for weight at 3 months and daily weight gain were 19.63 kg and 196.01g, respectively. Pre-weaning growth parameters were found to be comparable to the values in previous studies ([YALÇIN, 1969](#); [YALÇIN et al., 1972](#); [YALÇIN et al., 1977](#); [EVRİM, 1978](#); [DEMİR, 1989a](#); [DEMİR, 1995](#)).

In this study, where selection was made in terms of growth performance, the live weight means at 6 and 12 months were 30.50 and 36.64 kg, respectively. The effects of herd, birth month, breeding season, sex of the lamb, type of birth, birth weight, and weaning age on these characteristics were statistically significant ($P < 0.001$). When weights at 6 and 12 months were considered, the values obtained in 2018-2019 and 2020-2021 periods were higher than those obtained in 2011-2012. Post-weaning parameters were higher than those in other research ([YALÇIN et al., 1972](#); [YALÇIN et al., 1977](#); [DEMİR, 1989a](#); [TEKERLİ et al., 2001](#)) because only the records of selected animals were collected after weaning.

In conclusion, this was the first study conducted in the past 20 years to measure the fertility, survival rate, and growth performance of Dağlıç sheep, a breed that has become endangered. In this study some developments were observed in twin lambing rate, litter size, and weights at 6 and 12 months of age. In general, herd, birth month, breeding season, sex of the lamb and type of birth must be considered as significant environmental factors in any selection program. Fertility, sur-

vival rate, and growth characteristics showed a tendency to increase relative to the beginning of the research. The progression in the growth parameters appears to have been triggered by the selection program within a countrywide small-ruminant improvement project.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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SAŽETAK

Cilj istraživanja bio je odrediti plodnost, stopu preživljenja i rast ovce pasmine Dağlıç te čimbenike okoliša koji utječu na navedene značajke. Podaci su prikupljeni iz evidencije 14 695 jedinki ovaca i 43 915 jedinki janjadi uzgajanih od 2011. do 2021. u pokrajini Afyonkarahisar u Turskoj. Ustanovljeno je da je stopa janjenja 84,83%, dok je veličina legla ovce Dağlıç 1,04. Tijekom istraživanih godina zapažen je postupan porast istraživanih značajki, pri čemu je stopa janjenja najveću vrijednost (94,30%) dosegla 2019. i 2020. godine. Prosječna je stopa preživljenja pri odbiću iznosila 92,19%. Također je uočena znakovita ($P<0,05$) fluktuacija u pokazateljima plodnosti i preživljenja od godine do godine. Za kapacitete rasta utvrđene su sljedeće ukupne srednje vrijednosti: porođajna masa 3,23 kg, tjelesna masa u dobi od tri mjeseca 17,83 kg, dnevni prirast tjelesne mase 0,168 kg, tjelesna masa pri odbiću 22,44 kg, tjelesna masa u dobi od 6 mjeseci 30,50 kg i tjelesna masa u dobi od 12 mjeseci 36,64 kg. Statistički znakovit ($P<0,05$) utjecaj na pokazatelje rasta imali su čimbenici stada, sezone parenja, mjeseca janjenja, tipa janjenja, spola janjadi i dobi janjadi pri odbiću. Zaključeno je da na svojstva rasta utječu različiti čimbenici iz okoliša te da bi ih trebalo uzeti u obzir pri izradi programa selekcije. Pri tome, važno je naglasiti da su se tijekom promatranih godina u ovom istraživanju postupno povećavali plodnost, stopa preživljenja janjadi i svojstva rasta.

Cljučne riječi: ovca Dağlıç; plodnost; preživljenje janjadi; rast
