ORIGINAL ARTICLE

Comparison of yield characteristics of Damascus and Kilis goats in dry climatic conditions

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ABSTRACT. The aim of this study was to compare the reproductive traits, lactation milk yield, and body measurements of the Damascus (Shami) and Kilis goats raised as dairy goats in the dry climatic conditions of the Southeastern Anatolia region of Turkey. The study was perfomed using 596 Damascus goats and 82 Kilis goats between 3-5 years old. It was observed that the lactation milk yield, lactation period, withers height, and leg circumference of the Damascus goats (175.86 kg, 227.48 days, 72.67 cm, and 74.10 cm, respectively) were significantly higher ($P<0.05$) than those of the Kilis goats (107.48 kg, 170.39 days, 69.70 cm and 71.83 cm, respectively). This analysis indicated that the Damascus goat may be a good breed for dry climatic conditions. It is suggested that focusing on growing Damascus goats could increase productivity in the Southeastern Anatolian region of Turkey.

Key words: goat, body measurements, reproductive, lactation traits.

INTRODUCTION

As of 2017, although the total number of goats in Turkey (11,010,590 heads) was close to that of the entire European Union (12,615,362 heads), the annual milk production of Turkey (463,270 tons) is one-quarter of the volume of milk produced in the countries of the European Union (1,931,676 tons) (FAO 2017). The low goat milk production in Turkey is due to an overwhelming majority of its stock, as high as 98%, consisting of the hair goat (TUIK 2017), while only 2% are Cashmere goats (Angora) and dairy goats, such as the Damascus and Kilis goats (Tuncel and Bayındır 1983, Ilgar and Kırcan 2016). This is an indicator of the shortcomings of the milk yield-oriented goat breeding studies carried out in Turkey since the 1960s (Kaymakçı *et al* 2005, Atay 2016).

The Southeastern Anatolia region holds important potential for goat breeding. According to 2016 data, the region provides 22.6% of the goat stock and 24.1% of the goat milk production in Turkey (TUIK 2017).

In Turkey, the Damascus (Keskin 2000) and Kilis goats (Keskin and Tüney 2015) are bred in the Mediterranean and Southeastern Anatolia regions. The most prominent features of the Damascus goats include its adaption to high temperatures and suitability for breeding in plain areas (lowlands); it has an advantage over sheep in terms of its reproductive ability to benefit from arid pastures (Barıtçı and Adıgüzel 2017).

As in all economic activities, the goal of goat breeding is to earn profits. In order to increase profitability, it is necessary to increase fertility. An increase in goat farm production can be achieved by increasing the number of births and the number of kids at birth (Erten and Yılmaz 2013). Fertility is the most important yield trait in continuing the lineage, commencing milk production, and providing stock for meat production (Keskin *et al* 2016).

Reproductive traits are determined by environmental conditions, rather than genotypic factors. Therefore, the progress achieved with genetic selection alone is reduced. On the other hand, following some simple rules while selecting a breeding animal will contribute to an increase in reproductive yields, albeit at a slower pace than that of selection. While selecting breeding animals, giving priority to twin does or bucks and being careful to select animals among the progenies of twin parents, or selecting the breeding animals from families with high reproductive yield will lead to a slightly increased reproductive yield in the next generations (Çam *et al* 2012, Tozlu and Oflaz 2015).

In this study, the reproductive traits of the Damascus and Kilis goats of varying ages were investigated to determine their potential for use in the breeding studies carried out in the important goat-breeding region of Southeastern Anatolia in Turkey.

MATERIAL AND METHODS

The study was carried out on an experimental goat farm (37^0 50' 55'' N 40^0 39' 57'' E) in Bismil. The lowest altitude (546 m), Bismil district, in Diyarbakir province, where the study was carried out, was found to have moderate dry climate conditions during the study period. Diyarbakır is a city in the Southeastern Anatolia region of Turkey with an average temperature of 15.8 °C according to long-term meteorological data (1929-2016) (Anonymous 2017). The animals used in the study consisted of 3 to 5 year-old Damascus (n=596) and Kilis goats (n=82).

The goats were grouped according to their milk yields and daily feed requirements were determined by taking their milk yields into account. Vetch fodder grown by the establishment was used as roughage and as a concentrate feed. The sheep and goat milk feed, a mixture also prepared by the establishment that contains 17.9% crude protein and 3 Mcal/Kg metabolic energy was comprised of barley, soybean meal, bran, mineral-vitamin premix, ground limestone, and salt (table 1). The mixture was provided twice daily, in the morning and evening. Fresh and clean water was provided for the animals. Milking was performed two times a day (early in the morning and towards the evening). Attention was given to taking an 8-hour break on average between two milking processes. The milking process was carried out with the aid of an automatic milking machine and all the data for milk were recorded in the herd registry system.

The births occurred from February to March. The live weights of the goats and kids after birth were determined using precision scales sensitive to 50 g. The kids were kept with the dams during a 15-day period after birth and then were separated from the dams and transferred to a separated kid pen. Within the pen, the kids were allowed to suckle the dams two times a day until weaning.

The milk records were obtained from the herd management program maintained at the goat farm.

Of the body measurements of interest in the study, withers heights (WH), body length (BL), chest depth (CD), and chest width (CW) were measured using a measurement stick, and chest girth (CG) and leg circumference (LC) were measured using a measuring tape (Cengiz *et al* 1989).

Birth rate, infertility rate, litter size, and single, twin or triplet birth rate, as reproductive features, were all calculated by the method proposed by Kaymakçı and Sonmez (1996).

Statistical evaluation was performed using SAS (2018). Multivariate Anova was used to evaluate the effect of gender, type of birth and age on birth weight. Independent t-test was used to obtain the differences between the goat breeds on birth weight.

RESULTS

Table 2 shows the descriptive values for reproductive traits obtained in this study. According to the table, there is no statistical difference in point of reproductive performance between goat breeds.

Table 3 shows the birth weights of the Damascus and Kilis kids. The birth weights of the male kids of both the Damascus and Kilis goats were significantly higher (P<0.05) than those of the female kids. The highest (*P*<0.05) birth weight was observed in single-birth type in Damascus goats, while the lowest birth weight was found in the 5-year age group. In Kilis goats, the highest (*P*<0.05) birth weight was found in single and twin births and in the age group of 3 years.

Table 1. Composition and nutrient contents of the feed used in the research.

Ingredients	g/kg
Barley	646.9
Soyabean meal	131.0
Wheat bran	187.6
Mineral-vitamin premix	2.5
Ground limestone	24.5
Common salt	7.5
Chemical composition (DM basis)	%
Dry matter	89.0
Crude Protein	17.9
Crude fiber	7.8
Ether extract	2.4
Crude ash	3.9
Calcum	1.1
Phosphorus	0.6
Metabolizable energy (Mcal/kg)	3.0

Table 4 shows the descriptive values for the lactation milk yield and lactation period of the Damascus and Kilis goats. The lactation milk yield of 5-year-old Damascus and Kilis goats and the length lactation period of 5-year-old Kilis goat were lower than the other age groups (*P*<0.05). The lactation milk yield and lactation period of the Damascus and Kilis goats were 175.86 kg and 107.48 kg, and 227.48 days and 170.39 days, respectively. It was found that the average milk yield and lactation period of Damascus goats were higher than Kilis goats (*P*<0.05).

Table 5 shows the descriptive values for the body measurements of the Damascus and Kilis goats As seen in Table 5, WH and LC of the Damascus goats were higher (*P*<0.05) than those of the Kilis goats.

As shown in table 6, in the Damascus goats, there were high correlations (*P*<0.01) between LW and CD (0.693), LW and CG (0.742), LW and LC (0.600), WH and LC (0.517), CW and CG (0.670), CW and LC (0.573), and CG and LC (0.572).

In the Kilis goats (table 7), there were high correlations (*P*<0.01) between LW and BL (0.660), LW and CD (0.566), LW and CW (0.629), LW and CG (0.673), LW and LC (0.597), BL and LC (0.485), CD and CW (0.496), CD and CG (0.707), CW and CG (0.739).

DISCUSSION

Almost all the reproductive traits of the Damascus goats were higher than those of the Kilis goats (table 2). The birth rate of the Damascus goats (99.30%) was similar to that reported by Keskin *et al* (2016) in Damascus goats, while the birth rate of the Kilis goats (93.90%) was higher than that reported in the same literature for the Kilis x Hair goat crossbreeds. The multiple birth rates of the Damascus and Kilis goats were lower (Gül *et al* 2010, Keskin *et al*

Table 2. The descriptive values for the reproductive traits of the Damascus and Kilis goats.

	Damascus		Kilis	
	n	%	n	%
Infertility rate	28	4.70	–	–
Gestation rate	568	95.30	82	100.00
Number of birth	564	99.30	77	93.90
Single kidding	303	53.35	47	57.32
Twin kidding	237	41.73	29	35.37
Triplet kidding	23	4.08	1	1.22
Quadruplet kidding	1	0.18	–	–
Livebirth	850		108	
Abortion	9	1.58	1	1.30
Stillbirth	4	0.70	4	4.88
Litter size		150.70		140.00

Table 3. The birth weights (kg) of the Damascus and Kilis kids.

		Damascus		Kilis	
		n	$\bar{X} \pm S_x$	n	$\bar{X} \pm S_x$
Sex	Female	423	3.50±0.03b	44	3.44±0.10b
	Male	427	3.89±0.04a	64	3.78±0.08a
Birth type	Single	303	3.91±0.04a	47	3.88±0.10a
	Twin	476	3.61±0.03b	58	3.49±0.07ab
	Triplet	69	3.37±0.08c	3	3.07±0.75b
	Quadruplet	4	3.67±0.24b	–	–
Age	3	253	3.89±0.22a	16	3.90±0.45a
	4	345	3.91±0.16a	68	3.42±0.13b
	5	252	3.64±0.22b	24	3.49±0.31b
Total		850	3.69±0.02A	108	3.64±0.66A

$\bar{X} \pm S_x$: mean ± standart error.
a, b, c: Different lower cases in the same column represent statistically significant differences (*P*<0.05).
A, B: Different capital letters in the same row represent statistically significant differences (*P*<0.05).

Table 4. The lactation milk yields (kg) and lactation period (day) of the Damascus and Kilis goats.

	Age	Damascus		Kilis	
		n	$\bar{X} \pm S_x$	n	$\bar{X} \pm S_x$
Lactation milk yield	3	224	176.26±24.49a	17	109.40±35.31a
	4	248	180.60±35.17a	49	112.46±59.58a
	5	124	165.68±27.29b	16	90.60±27.71b
Total		596	175.86±29.23A	82	107.48±50.04B
Lactation period	3	224	229.45±31.70a	17	174.78±47.57a
	4	248	225.76±39.80a	49	173.98±38.48a
	5	124	227.38±29.81a	16	155.23±20.83b
Total		596	227.48±33.57A	82	170.39±37.32B

a, b: Different lower cases in the same lines represent statistically significant differences (*P*<0.05).
A, B: Different capital letters in the same row represent statistically significant differences (*P*<0.05).

Table 5. Body measurements of the Damascus and Kilis goats.

	Age	Damascus			Kilis	
		n	$\bar{X}\pm S_x$		n	$\bar{X}\pm S_x$
Withers height (cm)	3	224	71.89±4.31		17	68.75±1.75
	4	248	73.30±2.68		49	70.06±3.43
	5	124	72.80±3.42		16	69.58±2.13
Total		596	72.67±3.42a		82	69.70±2.91b
Body length (cm)	3	224	74.89±3.63		17	73.58±2.22
	4	248	76.30±2.64		49	74.31±3.02
	5	124	73.10±7.25		16	72.83±2.71
Total		596	75.10±4.24		82	73.87±2.79
Chest depth (cm)	3	224	32.11±1.50		17	31.92±1.50
	4	248	33.45±1.79		49	32.78±1.33
	5	124	34.00±1.00		16	32.67±1.40
Total		596	33.06±1.68			32.58±1.37
Chest width (cm)	3	224	19.56±1.72		17	19.50±1.95
	4	248	21.35±2.04		49	20.56±1.97
	5	124	20.50±0.71		16	20.83±2.42
Total		596	20.50±1.85		82	20.40±2.04
Chest girth (cm)	3	224	90.44±5.13		17	89.92±5.99
	4	248	93.90±4.42		49	93.42±4.88
	5	124	95.10±3.01		16	93.00±4.87
Total		596	92.85±4.71		82	92.63±5.12
Leg circumference (cm)	3	224	73.06±2.74		17	70.50±1.67
	4	248	74.80±1.55		49	72.58±2.29
	5	124	74.60±1.82		16	70.92±3.41
Total		596	74.10±2.20a		82	71.83±2.54b

a, b: Different lower cases in the same lines represent statistically significant differences ($P<0.05$).

Table 6. The relationships between the live weight and body measurements of the Damascus goats.

	LW	WH	BL	CD	CW	CG
WH	0.447*					
BL	0.045	0.415*				
CD	0.693**	0.508*	0.227			
CW	0.511*	0.294	0.185	0.537*		
CG	0.742**	0.448*	0.055	0.547*	0.670**	
LC	0.600**	0.517**	0.195	0.441*	0.573**	0.572**

*: $P<0.05$. **: $P<0.01$.
LW: Live Weight; WH: Withers Height; BL: Body Length; CD: Chest Depth; CW: Chest Width; CG: Chest Girth; LC: Leg Circumference.

Table 7. The relationships between the live weight and body measurements of the Kilis goats.

	LW	WH	BL	CD	CW	CG
WH	0.213					
BL	0.660**	0.216				
CD	0.566**	0.186	0.235			
CW	0.629**	–0.120	0.279	0.496**		
CG	0.673**	–0.042	0.305	0.707**	0.739**	
LC	0.597**	0.424*	0.485**	0.323	0.421*	0.399*

*: $P<0.05$. **: $P<0.01$.

2016) or higher (Keskin and Biçer 1997, Keskin 2000) than those reported in some studies of the Damascus and Kilis x Hair goat crossbreeds. In this study, the litter sizes of Damascus and Kilis goats (150.7% and 140.3%) were lower than those reported by Keskin *et al* (2016) in Damascus goats and Kilis x Hair goat crossbreeds (180% and 162.5%), but higher than those reported by Kutlu (1990) in Akkeçi x Kilis and Saanen x Kilis goat crossbreeds (124.2% and 132.9%). The Damascus goat is recommended as a fertile goat breed in view of its good adaptability (Barıtçı and Adıgüzel 2017); the favorable results obtained in this study and also previous studies show that it has a higher litter size than that of the Nubian, Pygmy, American Alpine, French Alpine, Saanen, and Toggenburg goats (Amoah *et al* 1996), which are among the most fertile goats in the world.

A comparison of birth weights of the Damascus and Kilis kids (table 3), in terms of their sex and birth types, revealed that the birth weights of the male kids were significantly higher (*P*<0.05) than those of the female kids, and the birth weights of the kids from single births were slightly higher than those of the kids from multiple births. This result is compatible with those reported in other literature (Şimşek *et al* 2007, Akbaş *et al* 2013, Keskin *et al* 2016). The mean birth weights of the Damascus and Kilis goats were higher than those of the Saanen X Hair goat F_1 and G_1 crossbreeds (Şimşek *et al* 2007), Saanen (Akbaş *et al* 2013), Damascus, and Kilis x Hair goat crossbreeds (Keskin *et al* 2016). A comparison of birth weights with respect to the ages of the dams showed that the birth weights of kids of 3- and 4-year-old dams in Damascus and the birth weights of kids of 3-year-old dams in Kilis goats were slightly higher than kids of the dams at other ages.

The data showed (table 4) that the lactation milk yield and lactation period of the Damascus and Kilis goats were lower than those reported by Keskin (2000), Keskin *et al* (2004), Özuyanık (2004), Kaymakçı *et al* (2005) and Keskin *et al* (2016) in Damascus goats.

Table 5 shows the descriptive values for the body measurements of the Damascus and Kilis goats. The average WH of the Damascus and Kilis goats were higher than those reported by Aktepe (2009) in Kilis goats and by Bingöl *et al* (2011) in Norduz goats, but similar to those reported by Barıtçı and Adıgüzel (2017) in Damascus and by Ünalan and Ceyhan (2017) in Kilis goats. The average BL of the Damascus and Kilis goats (75.10 cm and 73.87 cm, respectively) were higher than those of Kilis goats (Aktepe, 2009, Alızadehasl and Ünal 2011, Ünalan and Ceyhan 2017), and similar to those of Damascus goats (Barıtçı and Adıgüzel 2017). The average CD of the Damascus and Kilis goats (33.06 cm and 32.58 cm, respectively) were higher than those reported by Aktepe (2009), Alızadehasl and Ünal (2011), and Ünalan and Ceyhan (2017) in Kilis goats, by Bingöl *et al* (2011) in Norduz goats, and by Karakuş (2016) in Hair goats and Saanen goats. The average CW of the Damascus and Kilis goats (20.50 cm and 20.40 cm,

respectively) were higher than those reported by Karakuş (2016) in Hair goats and Saanen goats and by Barıtçı and Adıgüzel (2017) in Damascus goats, but similar to those reported by Bingöl *et al* (2011) and Ünalan and Ceyhan (2017) in Kilis goats. The LC of the Damascus and Kilis goats (74.10 cm and 71.83 cm, respectively) were higher than those of the Norduz goats (Bingöl *et al* 2011).

As seen in Table 6, in the Damascus goats, there were high correlations (P<0.01) between LW and CD (0.693), LW and CG (0.742), and LW and LC (0.600), which agree with results from the studies that reported high correlations (*P*<0.01) between the live weights and body measurements of the Sanen, Kilis, and Hair goats (Pesmen and Yardimci 2008, Çam *et al* 2012, Alızadehasl and Ünal 2011).

As shown in table 7, the high and significant correlation (*P*<0.01) between CW and CG, CD and CG, and CW and CG in the Kilis goats agrees with results reported in the scientific literature (Cam *et al* 2010, Sarıyel 2013, Karakuş 2016).

It is concluded that the litter size, lactation milk yield, lactation period, WH and, LC of the Damascus goats were significantly higher than those of the Kilis goats. This analysis indicates that the Damascus goat may be better than Kilis goat breed for the dry climate of the important goat-breeding region of the Southeastern Anatolia region in Turkey. Based on the findings in that particular region of Turkey, it may be beneficial to compare the raising of Damascus goats in other parts of Turkey, or the world, with similar climates.

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