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Some reproductive, lactation, and kid growth characteristics of Kilis goats under semiintensive conditions

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Abstract: This study was carried out to determine some reproductive and kid growth characteristics as well as some lactation traits of Kilis goats raised under semiintensive conditions in Kilis Province in Turkey. The animal material of the study comprised 502, 698, and 753 heads of Kilis goats in 2013, 2014, and 2015, respectively. At the end of study, multiple birth rates were calculated between 31.5% and 35.7% during the years. Lactation length and lactation milk yield were determined to be between 207.1 ± 0.81 and 232.4 ± 0.65 days and between 315.7 ± 4.16 l and 375.6 ± 3.4 L, respectively during the years. Lactation characteristics of the goats changed due to lactation number. Birth and weaning weights were found as 3.6 ± 0.02 kg and 12.3 ± 0.04 kg, respectively. It was also detected that birth weight was affected by year, sex, birth type, and farm diversity while weaning weight was not affected by birth type. It was concluded that the Kilis goat has satisfactory milk yield and multiple kidding rates in semiintensive conditions in Kilis Province.

Key words: Kilis goat, reproductive and lactation traits, kid growth

1. Introduction

Turkey is an important goat-producing country with a goat population of 10.4 million heads and 400,000 t/year milk production (1). This milk yield amount is not considered sufficient when compared with the goat population size. The first reason for this situation is that the Hair goat constitutes 98% of the goat population and it is known for low genetic capacity for milk yield and litter size. The other reason is related to herd management systems.

Goat milk is important with different characteristics including amino acid type, lactose content, and mineral content. Goat milk is also known as the most similar milk to breast milk (2). Because of these properties and having a lower percentage in the total milk production, the demand for goat milk has been increasing in recent years in Turkey. The Kilis goat is an important gene resource for meeting this growing demand.

Although not included in official statistics, it is estimated that approximately 0.5 million heads of Kilis goat exist in the Kilis, Gaziantep, and Hatay provinces of Turkey. The Kilis goat is known to have higher milk yield and reproductive characteristics than the Hair goat. Gül et al. (3) found the twinning rate to be 10%–34% and lactation milk yield to be 294–408 L for Kilis goats. On the other hand, the lactation milk yields of Hair goats and

Damascus goats raised in this region were reported as 80.5–226.8 kg and 277.5–458.0 kg, respectively (4,5).

Fertility is another important trait in livestock production since both milk and meat production depends on it and it is needed for the start of milk production and production of fattening material. The twinning rate, an indicator of fertility, was reported as 22% for Kilis goats (6).

The Kilis goat has important advantages in terms of higher milk yield and reproductive traits with better toleration for warm environments and drought under extensive or semiintensive management conditions in arid and hot climates compared to other local breeds. Because of these advantages, the milk yield and reproductive traits of Kilis goats should be improved by selection. Sufficient variation for milk yield that is the first requirement for selection practices is at a compensatory level and this yield can be improved by this method.

The General Directorate of Agricultural Research and Policies in the Ministry of Food, Agriculture, and Livestock has been running a national animal breeding project by using selection in cooperation with universities and sheep and goat breeder associations in Turkey. Improvement of the Kilis goat's lactation milk yield is a part of this national project. This study, carried out within the framework of

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this project, aimed to determine some reproductive and kid growth characteristics as well as some lactation traits of Kilis goats in large flocks.

2. Materials and methods

This study was conducted between 2013 and 2015 on the Kilis Goat National Breeding Project in Kilis Province. The goat flocks were named as elite flocks since mating dams and bucks were recorded. In the study, 502 heads of Kilis goats aged 2, 3, and 4+ years and their kids were used in 2013. The goat number was 698 heads in 2014 and 753 heads in 2015 with the same age groups. Goats were in 5 flocks in 2013 and in 6 flocks in 2014 and 2015. During the experimental years, the same flocks were employed. Different performance characteristics of the goats were determined in semi-intensive conditions with goats given about 1 kg/head of concentrate and 0.2 kg/head wheat straw per day in addition to pasture. Barley, cracked wheat, and cotton seed could be found individually or together in the concentrated feed of the goats raised under farm condition. Kids sucked their dams for 60 days after birth and consumed the same concentrate offered to the dams after 45 days of age, which was followed by grazing after 60 days of age.

Goats were mated in a traditional system by using 1 head of buck for 25 heads of female goats. All goats were vaccinated against caprine mycoplasma pneumonia, agalactia, *Brucella melitensis*, clostridiosis, and pox disease since September 2013. Goats were also checked for internal and external parasites. The data regarding reproductive performance were recorded in kidding seasons. The determined parameters are as follows:

Birth rate: (number of goats giving birth/number of goats during mating period) \times 100

Litter size: (number of kids at birth/number of goats giving birth)

Single kidding rate: (number of goats with single kid/number of goats giving birth) \times 100

Twinning rate: (number of goats with twin kids/number of goats giving birth) \times 100

Triplet kidding rate: (number of goats with triplet kids/number of goats giving birth) \times 100

Survival rate: (number of living kids at weaning/number of living kids at birth) \times 100

All kids were identified with ear-tags and weighed by electronic balance (1 g sensitivity) within 12 h after birth to determinate birth weight. Birth type and sex of the kids were also recorded at this time. All kids were weighed at 60 days of age for determining weaning weight.

Milk yield controls in all years were made with the ATC method in the ICAR procedure at intervals of 28 days. The Fleischman method was used for each goat lactation milk yield calculation (7). Lactation milk yield

and lactation length were calculated by using the control day's milk yield.

The mathematical model for lactation milk yield and lactation length is as follows:

$$Y_{ijkl} = \mu + \alpha_i + \beta_j + \gamma_k + e_{ijkl}$$

Y_{ijkl} , recorded value of the i^{th} animal in the j^{th} age, and k^{th} farm

μ , mean of population

α_i , effect of year, $i = 2013, 2014, 2015$

β_j , effect of age, $j = 2, 3, 4$

γ_k , effect of farm, $k = 1, 2, 3, 4, 5, 6$

e_{ijkl} , error term

The mathematical model for birth weight and weaning weight of kids is as follows:

$$Y_{ijklm} = \mu + \alpha_i + \beta_j + \gamma_k + \lambda_l + e_{ijklm}$$

Y_{ijklm} , recorded value of the m^{th} animal in the i^{th} year, j^{th} sex, k^{th} farm, and l^{th} birth type

μ , mean of population

α_i , effect of year, $i = 2013, 2014, 2015$

β_j , effect of sex, $j = 1, 2$

γ_k , effect of farm, $k = 1, 2, 3, 4, 5, 6$

λ_l , effect of birth type

e_{ijklm} , error term

The data regarding birth weight, weaning weight, milk yield, and lactation length were analyzed by using least squares means in SPSS. Comparisons between group averages were made by using the Duncan multiple range test in the same software. Reproductive parameters were analyzed by chi-square test in SPSS (8).

3. Results

Some reproductive characteristics and the birth types of the experimental Kilis goats are shown in Table 1 and the Figure. The average birth rate, litter size, survival rate, and single birth rate were calculated as 89.7%, 1.30, 89.2%, and 61.3%, respectively. The years did not statistically affect any of these characteristics ($P > 0.05$). It was also determined that farm diversity did not affect the investigated reproductive characteristics ($P > 0.05$), except single and twinning birth rate ($P < 0.001$). As seen in the Figure, the single birth rate for the goats was calculated between 64.3% and 68.5% during the 3 years. Twin and triplet birth rates were 30.4% and 2.4%, 31.4% and 4.3%, and 29.7% and 1.8% during the years, respectively. The survival rate of all groups varied from 83.2% in 2013 to 92.7% in 2015.

Birth weight and weaning weight of kids during the 3 years can be seen in Table 2. The year, sex, and farm diversity had important effects on birth weight and weaning weight. Average birth weights were calculated as 3.7 ± 0.05 kg, 3.5 ± 0.02 kg, and 3.4 ± 0.03 kg in 2013, 2014, and 2015, respectively. Male kids were heavier than female kids at birth and weaning ($P < 0.01$). While single, twin, and triplet kids on birth were weighed as 3.7 ± 0.02

Table 1. Effect of year and flock diversity on some reproductive traits in Kilis goats.

Source	Birth rate	Litter size	Survival rate	Single birth rate	Twining rate	Triplet rate
Year						
2013	89.0	1.36	83.2	67.2	30.4	2.4
2014	87.3	1.23	91.4	64.3	31.4	4.3
2015	90.0	1.33	92.7	68.5	29.7	1.8
Chi-square	0.053	0.709	0.629	0.190	0.022	2.000
P	0.974	0.701	0.730	0.909	0.989	0.368
Farm						
1	88.1	1.47	91.1	51.4	44.1	4.5
2	99.8	1.38	87.1	58.6	38.1	3.3
3	73.2	1.15	92.0	78.4	19.5	2.1
4	96.0	1.29	86.2	58.6	39.6	1.8
5	87.4	1.32	90.7	58.5	39.8	1.7
6	89.8	1.13	89.2	85.9	14.1	0.0
Chi-square	4.854	6.713	0.328	35.117	23.673	2.429
P	0.434	0.243	0.997	0.000	0.000	0.657
Total	89.7	1.30	89.2	61.3	35.8	2.9

P, statistical significance value.

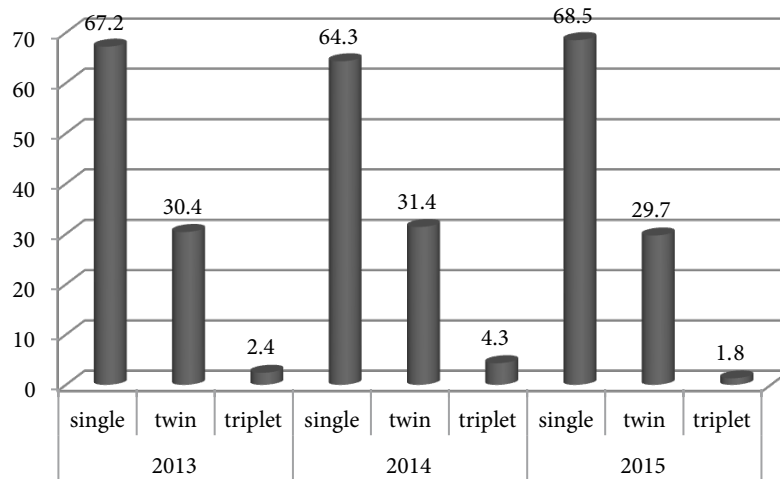


Figure. Birth type (%) of goats during 3 years.

kg, 3.5 ± 0.04 kg, and 3.1 ± 0.06 kg, respectively ($P < 0.01$), these initial differences disappeared at weaning ($P > 0.05$). Farm diversity affected birth weight and weaning weight ($P < 0.05$).

Lactation length and milk yield of experimental goats were calculated for the years of 2013, 2014, and 2015 and are presented in Table 3. Both lactation length and milk yield were affected by year, age, and farm diversity. The

Table 2. Least squares means for birth weight (kg) and weaning weight (kg) for Kilis goats (mean \pm standard error).

	n	Birth weight	n	Weaning weight
Variation sources	Year			
2013	826	3.7 \pm 0.05 ^a	687	11.9 \pm 0.08 ^b
2014	783	3.5 \pm 0.03 ^b	716	12.8 \pm 0.08 ^a
2015	967	3.4 \pm 0.03 ^b	896	12.1 \pm 0.06 ^b
Significance		P = 0.000		P = 0.000
	Sex			
Male	1240	3.8 \pm 0.04	1115	12.6 \pm 0.06
Female	1336	3.4 \pm 0.02	1184	11.9 \pm 0.05
Significance		P = 0.000		P = 0.000
	Birth type			
Single	1241	3.7 \pm 0.02 ^a	1132	12.2 \pm 0.06
Twin	1230	3.5 \pm 0.04 ^a	1074	12.3 \pm 0.06
Triplet	105	3.1 \pm 0.06 ^b	93	12.3 \pm 0.19
Significance		P = 0.000		P = 0.916
	Farm			
1	451	4.1 \pm 0.03 ^a	401	13.6 \pm 0.12 ^a
2	663	3.4 \pm 0.05 ^{cd}	565	12.6 \pm 0.08 ^b
3	320	3.2 \pm 0.03 ^d	299	11.8 \pm 0.08 ^c
4	510	3.5 \pm 0.06 ^c	442	11.0 \pm 0.08 ^d
5	371	3.8 \pm 0.04 ^b	349	11.7 \pm 0.08 ^c
6	261	3.3 \pm 0.03 ^{cd}	243	12.8 \pm 0.08 ^b
Significance		P = 0.000		P = 0.000
Total	2576	3.6 \pm 0.02	2299	12.3 \pm 0.04

P, statistical significance; a, b, c, different superscripts in same column indicate statistically different groups ($P < 0.01$).

lowest average lactation length and lactation milk yield were detected in 2014 as 207.1 ± 0.75 days and 315.7 ± 4.16 L. These traits were calculated as 232.4 ± 0.65 days and 375.6 ± 3.40 L, respectively, in 2015, which was the best production year for lactation. It was also detected that both lactation length and lactation milk yield changed depending on the age of dams in each year. Lactation milk yield were detected as 223.6 ± 3.04 L, 312.7 ± 3.01 L, and 429.1 ± 3.39 L for dams aged 2, 3, and 4 years, respectively ($P < 0.01$). Both lactation milk yield and lactation length were affected by farm diversity ($P < 0.01$).

4. Discussion

As shown in Table 1, the years did not have an effect on birth rate, litter size, survival rate, or single and multiple birth rates. While the average litter size calculated this study is in line with that of Gül et al. (3), it was higher than reports of Çetin et al. (9). Lower litter size reported by Çetin et al. (9) may be caused by the mating calendar in their study; they mated the goats in June, when is a little early for the mating of Kilis goats. It is known that mating month has an influence on the goat's reproductive performance (10). This litter size is lower than that of

Table 3. Least squares means for lactation length (days) and milk yield (kg) of Kilis goats (mean \pm standard error).

	n	Lactation length	Lactation milk yield
Variation sources	Year		
2013	502	226.8 \pm 1.35 ^b	347.6 \pm 6.90 ^b
2014	698	207.1 \pm 0.75 ^c	315.7 \pm 4.16 ^c
2015	753	232.4 \pm 0.65 ^a	375.6 \pm 3.40 ^a
Significance		P = 0.000	P = 0.000
	Age		
2	445	198.9 \pm 0.82 ^c	223.6 \pm 3.04 ^c
3	592	219.0 \pm 0.87 ^b	312.7 \pm 3.01 ^b
4	916	235.0 \pm 0.71 ^a	429.1 \pm 3.39 ^a
Significance		P = 0.000	P = 0.000
	Farm		
1	294	219.3 \pm 1.93 ^{bc}	477.9 \pm 7.20 ^a
2	430	224.1 \pm 1.20 ^b	338.8 \pm 5.49 ^c
3	304	220.3 \pm 1.25 ^{bc}	251.8 \pm 4.87 ^e
4	421	218.0 \pm 1.25 ^c	314.7 \pm 4.49 ^d
5	255	230.2 \pm 1.17 ^a	383.8 \pm 6.31 ^b
6	249	221.5 \pm 1.20 ^{bc}	339.7 \pm 4.55 ^c
Significance		P = 0.000	P = 0.000
Total	1953	221.9 \pm 0.56	347.0 \pm 2.72

P, statistical significance; a, b, c, different superscripts in same column indicate statistically different groups (P < 0.01).

Damascus goats reported by Keskin (10). Multiple birth rates were calculated in this study similar to the results stated by different researchers (3,11). Keskin and Tüney (6) found a twinning rate for Kilis goats of 22% in Kilis Province. The difference between their report and the current study may be caused by flock differences. Although it is not statistically significant, survival rate appeared to be another remarkable case. The vaccination program, which was launched at the end of 2013, was attributable to the increase in survival rate in 2014 and 2015. On the other hand, Gül et al. (3) reported a lower survival rate than that in this study. This difference could be caused by flock number differences because only one Kilis goat flock was studied by Gül et al. (3).

Birth weight and weaning weight, important criteria for kid growth, were calculated in this study (Table 2). Birth weight was affected by birth type. Various studies previously done declared that single-born kids are heavier than multiple-born kids for birth weight (3,12,13).

Differences in birth weight due to birth type disappeared at weaning time as reported by some researchers (14,15). This may indicate that mothers have enough milk yield for multiple-born offsprings (16). Average birth weight of kids determined in this study was in line with that of Kilis goats as reported in different studies (3,6,17). Average weaning weight of kids was found to be statistically different during the years (P < 0.01). Gül et al. (3) and Aktepe (17) reported heavier weaning weights for Kilis goats raised in Hatay Province. This may be caused by better conditions of pastures that belonged to the flock owner. On the other hand, the current results for weaning weight are in line with those of others (6,18). It was also detected that the sex of the kids and farm diversity affected birth weight and weaning weight. These results are similar to the reports of different researchers (3,6,7,11,12).

Lactation length and milk yield of the goats are shown in Table 3. The lowest average lactation length and lactation milk yield were detected in 2014. This low milk yield

was caused by a lack of rain in 2014. Kilis experienced a drought continuing from autumn of 2013 until spring of 2014, as in the whole of Turkey. Although total monthly rainfall was averagely 453.4 kg/m² from November to April for many years, this value was 235.3 kg/m² from November in 2013 to April in 2014 (19). Our findings about lactation length and milk yield are in accordance with studies reported by other researchers (3,18,20) in terms of milk yield and lactation length of Kilis goats. Lactation length was reported as 214.7 ± 1.64 days in Kilis goats (20). Özder (21) found a lactation milk yield of 300–500 L. Gül et al. (3) emphasized that lactation milk yield and length were 293.7–408.3 L and 212.5–256.5 days, respectively, in Kilis goats. On the other hand, our findings about lactation milk yield and length were higher than those reported by Aktepe (17) and Özcan (22). These differences may be caused by year and farm diversity. Lactation milk

yield detected in the current study was similar to that of Damascus goats reported by Keskin et al. (5) and Keskin and Biçer (23). We also found that the dam's age influenced the lactation length and lactation milk yield. Both of these characteristics were increased by age or lactation number. There are numerous reports indicating that milk yield increases with age (24–26).

In conclusion, Kilis goats can be accepted as dairy goats with high milk yield and multiple kidding rates in semiintensive conditions. Lactation characteristics of the goats changed due to the dam's age, year, and farm diversity in this study. This breed should be improved by selection due to high variation in milk yield performance.

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