



RESEARCH ARTICLE

Milk yield and reproductive performance of Hair goats raised under the extensive condition in Konya and Karaman regions of Turkey

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Konya ve Karaman bölgesinde halk elinde yetiştirilen Kıl keçilerinin süt ve döl verimi

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Öz

Amaç: Bu çalışma, Konya ve Karaman bölgesinde halk elinde yetiştirilen Kıl Keçilerinin süt ve döl verimi özelliklerini araştırmak amacıyla yapılmıştır.

Gereç ve Yöntem: Çalışmada, süt verimi için 383; döl verimi için, 58044 kayıt kullanılmıştır. Süt verimi özellikleri için 30 gün ara ile 6 kontrol yapılmıştır. Bireysel laktasyon süt verimi, laktasyon eğrisinin altındaki alan hesabı şeklinde hesaplanmıştır. İstatistik analizlerde süt verimi özellikleri için işletme, keçi yaşı ve doğurma tipi faktörlerini içeren doğrusal model; döl verimi özellikleri için Ki kare testi kullanılmıştır.

Bulgular: Laktasyon süresi, günlük süt verimi ve laktasyon süt verimi ortalamaları, sırasıyla, 171,0 gün, 753,7 ml ve 128,9 l bulunmuştur. İncelenen üç özellik üzerine doğurma tipi faktörünün etkisi önemsiz ($p>0.05$) iken işletme faktörü her üç özelliğe, keçi yaşı faktörü ise günlük süt verimi ve laktasyon süt verimine etkili ($p<0.001$) bulunmuştur. Doğum oranı %81, İkizlik %9, teke altı keçi başına oğlak verimi 0,88 bulunmuştur. Döl veriminde iller arası ve her ilde yıllar arası fark önemli ($p<0.01$) bulunmuştur.

Öneri: Sonuç olarak, bölgede yetiştirilen Kıl keçilerinde laktasyon süt verimi ve laktasyon süresi literatürde bildirilen seviyelerin üzerinde; doğum oranı ve oğlak verimi ise düşük bulunmuştur.

Anahtar kelimeler: Kıl keçisi, süt verimi, döl verimi, Karaman, Konya

Abstract

Aim: This study was conducted to investigate the characteristics of milk yield and reproductive performance of Hair goats raised under the extensive condition in Konya and Karaman regions of Turkey.

Materials and Methods: For this purpose, 383 and 58044 records were analyzed for milk yield and reproductive performance, respectively. Six measurements were performed with 30 days intervals for evaluating of the goats' milk yield characteristics. Individual lactation milk yield was calculated as area under the lactation curve. General linear model involving factors of region, farm, goat age and birth type were used for milk yield characteristics in statistical analyses, Chi square test was employed for evaluating the reproductive performance.

Results: The mean of the lactation period, daily and lactation milk yield, were found as 171.0 days, 753.7 mL, and 128.9 L, respectively. Despite the fact that the effect of birth type factor on all three characteristics was not significant ($p>0.05$), it was found that the region and farm factors had a significant effect on all three characteristics ($p<0.001$). Goat age factor had a significant effect on daily milk yield and lactation milk yield ($p<0.001$). Birth rate, twin rate, and kidding rate of goats were found as 81%, 9%, and 0.88, respectively. In reproductive performance, the significant difference between two regions and also significant differences among years in each regions were seen ($p<0.01$).

Conclusion: In conclusion, the parameters of the lactation milk yield and lactation period in Hair goats raised in both regions were seen in higher value than the levels reported previously in the literature.

Keywords: Hair Goat, milk yield, fertility, Karaman, Konya





Introduction

Hair goat is a highly valuable indigenous breed of Turkey and especially reared in the Taurus Mountains. According to national statistical records, the number of goats was almost 5 million in 2008 (TUIK 2011). Following the National Sheep and Goat Breeding Project of Turkey in 2010, the number of Hair goat population has been getting higher and their economic value has been better appreciated. Today, there are more than 10 million Hair goats in Turkey (TUIK 2017). It is not possible to overlook the goat-forest relationship and the potential forest damage that can be caused by the goats. However, it is important to point out that the 'human' factor is the one of the most critical factors determining the extent of forest damage caused by the goats. It is important to note that if properly managed, the Hair goat might even be beneficial to the forest (Keskin et al 2015). Thus, as the public has been properly informed and the breeder has been adequately educated about breeding practices, the negative feelings about Hair goat is gradually disappearing. The current thinking is that both the forest and Hair goat should co-exist. Therefore, the policy of the Ministry of Food, Agriculture and Livestock is to continue to support the Hair goat industry with breeding projects under the extensive condition.

People raising Hair goat earn income from both meat and milk productions. Milk production is offered to the consumer mostly in the form of dairy products like cheese. Meat production is also offered as the sale of meat and sale of the live animal for the purpose of sacrifice during 'Sacrifice Feast' (Kurban Bayramı). However, there are significant problems about marketing of both products. Especially, the absence of kid market and lack of public knowledge and awareness about the value of the goat meat are the most important problems now. When these problems are addressed, it is likely that the goat industry will become a profitable and self-sustaining segment of livestock industry.

The past research about Hair goat is relatively limited. Kaymakçı (2010) has reported in the book titled Goat Breeding (Keçi Yetiştiriciliği) that lactation milk yield of Hair goats is 70-80 kg. Additional studies have conducted on the milk yield of Hair goat or some genotypes of Hair goat crossbreeds. Lactation period, daily milk yield and lactation milk yield of Hair goats are 144 days, 0.56 kg, and 81 kg, respectively and that there is a significant effect of age on these characteristics (Şengonca et al 2003). Marketable milk yield obtained at the end of the suckling period in Hair goats named Hatay goat is 96 kg and lactation duration is 155 days (Keskin and Biçer 1997). In another study (Çam et al 2003) lactation milk yield of Hair goats raised under extensive conditions is 94 kg and lactation period is 167 days. Ata (2007) has found that lactation period, daily milk yield and lactation milk yield are 132 days, 0.45 kg, and 64 kg respectively, and that the age has a significant effect on milk yield. In another

study (Erten and Yılmaz 2013) for Hair goats raised under extensive conditions, lactation milk yield is 110 kg, lactation period is 163 days, and the age of goat has no significant effect on the lactation period, it has a significant effect on lactation milk yield, but the effect of birth type is not significant on both characteristics. Toplu and Altinel (2008) have found that Hair Goats' lactation period is 232.29 days, lactation milk yield is 100.92 kg. Crossbreed Taurus and Çukurova goats' lactation milk yield are 376 and 352 kg, respectively (Güney et al 1992) and lactation milk yield of crossbreeds of Damascus Goats and German Fawn x Hair goats are 348 and 317 kg, respectively (Keskin et al 2004). As for the reproductive performance of Hair goats, there are even fewer studies. Toplu and Altinel (2008) have found that Hair Goats' birth rate was 94.3% and kid number for one birth was 1.02.

This current study was conducted to investigate milk yield and reproductive performance of Hair goats raised under the extensive condition in Konya and Karaman regions in Turkey.

Material and Methods

Material

Animals subject to this research consists of 383 goats in different ages (each between 2-7 year old), giving birth in 2014 and belonging to five breeders from Konya and Karaman regions, registered in project of small ruminant breeding under the extensive condition conducted by Ministry of Food, Agriculture and Livestock for milk yield. This study is based on 58044 records of goats (each between 2-7 year old), giving birth in 2012-2015 for reproductive performance.

Measurements of the milk yield

Goats that gave birth at least 5 days and at most 35 days prior to the study were selected among each breeder's herd for this study. After the first measurement, subsequent, additional measurements were made with a 30-day interval. Thus, a total of six measurements were made. Once the average daily milk yield of goats was less than 200 ml, no further measurements were made.

For the first three measurements, 24 hours of separation period of kids from their dam was divided into two and each measurement was performed within two consecutive days. For this purpose, kids were separated from their dam at 08:00 pm before the measurement (1st day) and in the next day (2nd day), milking was done at 07:00 am and milk amount in 11 hours was determined, after which, kids were allowed to suckle for 24 hours. Kids were separated from their dam at 7:00 am on the 3rd day and milking was done at 8:00 pm and milk amount in 13 hours was determined. In subsequent

measurements, kids were separated from their mothers for 24 hours and the milking was performed in the same day's morning and evening. All milk measurements were made using a 1000 ml measuring cylinder and the amounts were recorded in milliliters.

Lactation milk yield of each goat was calculated as the area under lactation curve as described by Akçapınar (2000) for the sheep. Lactation period was calculated by multiplying the number of measurements and the number of days within each measurement period, and by adding the number of days between the birth and first measurement. The daily milk yield was calculated after lactation milk yield was divided by the number of days within lactation period. More specifically, the calculation was made as described below and depicted in Figure 1.

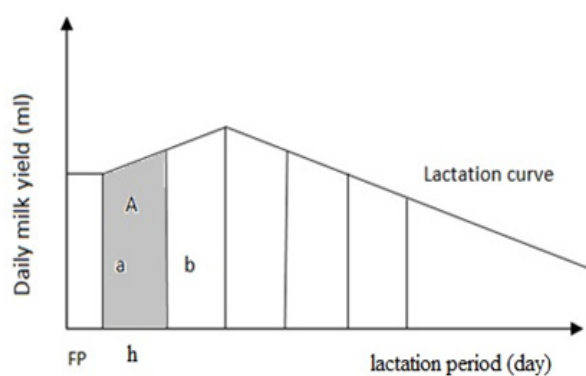


Figure 1. Calculating lactation milk yield of a goat

$$A = (a + b) / 2 \times h$$

"A" is the area of each trapezoid, "a" is the previous measurement, "b" is the next measurement and, "h" is the measurement period

In addition to the period between the birth and first measurement, there are as many trapezoids as the number of measurements under lactation curve. Thus, the calculation was made using the following formula:

$$A = (a + b) / 2 \times h$$

In the equation, A is area of each trapezoid, a is previous measurement, b is next measurement and h is measurement period. Lactation milk yield was calculated with sum of area of consecutive trapezoids which was sum of periodic milk yield (A1, A2 ...) and the area of rectangle formed for the first period (Figure 1).

The calculation of lactation period (LP; days) was made using the following equation:

$$LP = FP + nMP$$

In the equation, FP (first period) is the period from birth to the first measurement (days); n is the number of measurements, and MP is the measurement period, which is 30.4 days in the current study.

Care and feeding of goats, taking them to pasture, lactation and milking processes were completely under initiative of breeder; there was no separate process. In 2014 when milk controls were made, pasture conditions of regions, it was neither good nor bad depending on rainfall.

Measurements of the reproductive performance

After culling and selection processes carried out in August and September every year, numbers of breeding goats were determined using sound business practices for each operation. Mating time was between October and November, all goats kidded during February and March. All kids' date of birth and birth weight recorded in account of number of born kids, its mother was recorded in account of goats giving birth. Number of breeding goats, number of goats giving birth, number of born kids, fecundity, kidding rate and, birth rate were also recorded in this same way.

All parameters used in this study was defined by those measurements:

Fecundity = Number of born kids / Number of goats giving birth;

Kidding rate = Number of born kids / Number of breeding goats;

Birth rate = Number of goats giving birth / Number of breeding goats

Statistical analyses

Following additive model consisting of region, farm (nested in region), goat age and birth type factors in milk yield as fixed factors were used (Tekin 2010).

$$Y_{ijklm} = \mu + a_i + b_{ij} + c_k + d_l + e_{ijklm}$$

In the model;

Y_{ijklm} : Daily/lactation milk yield or lactation period of a goat

μ : Population mean,

a_i : Region effect (Konya and Karaman)

b_{ij} : Farm effect (five farms nested in region),

c_k : Goat age effect (goats with ages 2, 3, 4, 5, 6 and 7),

d_l : Birth type effect (twin and single)

e_{ijklm} : Error.

Duncan's multiple test was used to compare multiple groups. In reproductive performance characteristics, comparison of years and provinces were done by Chi-square analysis. Statistical analyses were performed in the SPSS package program (IBM SPSS Statistics, Version 21).

Results

Results of the milk yield traits of Hair Goats in the different farms were shown in the Table 1. The mean of the Lactation period, daily milk yield and lactation milk yield values were found as 171 days, 753.7 mL and 128.9 L, respectively. Statistically significant differences were found between farms and

the highest value in milk and lactation milk yield was found in the farm-3 and the lowest value was found in the farm -1 ($p<0.001$). The ages of goats did not effect on their lactation period ($p>0.05$) however, there were a significant effects on other two traits ($p<0.001$). The lowest values in milk yield

were found in goats at the age of 2 and it was determined that values gradually increased until age 6 and they tended to fall at the age of 7 ($p<0.001$). In milk yield characteristics of twin kids or single kid of goat, there were mathematical difference in favor of goats having twin kinds. But, these were found statistically insignificant ($p>0.05$).

Reproductive performance characteristics of goats were given in Table 2. The data shows that the rate of birth in Hair Goats was on average 81%. Although difference between two regions was found statistically significant, there was no significant difference in breeding practices among the operations that are in these two regions. Birth rate varied between two regions according to years, it varied between 76% and

Table 1. Least squares means of milk yield traits

Examined factors	Lactation period (day)			Daily milk yield (ml)		Lactation milk yield (l)	
	n	Mean	SEM	Mean	SEM	Mean	SEM
Overall	383	171.0	1.23	753.7	19.86	128.9	3.56
Region		$p=0.001$		$p=0.001$		$p=0.019$	
Konya		166.6	2.04	827.5	32.97	137.4	5.90
Karaman		174.0	1.21	704.4	19.47	123.3	3.49
Farm		$p=0.022$		$p=0.001$		$p=0.001$	
Farm -1	112	173.1	^a 1.67	636.3	^c 26.88	111.7	^c 4.81
Farm -2	43	161.7	^b 2.51	714.6	^{bc} 40.52	114.9	^c 7.26
Farm -3	37	171.4	^a 2.84	940.5	^a 45.76	159.9	^a 8.19
Farm -4	78	176.1	^a 2.24	790.4	^b 36.20	139.4	^b 6.48
Farm -5	113	172.8	^a 1.82	686.6	^{bc} 29.39	118.7	^c 5.26
Goat age		$p=0.624$		$p=0.001$		$p=0.001$	
2	41	168.5	2.55	633.6	^c 41.21	107.0	^c 7.38
3	61	169.3	2.14	698.6	^{bc} 34.60	118.5	^{bc} 6.20
4	88	171.4	1.87	803.2	^a 30.11	137.1	^a 5.39
5	60	170.9	2.11	811.2	^a 34.06	139.3	^a 6.10
6	105	171.1	1.81	826.3	^a 29.15	141.4	^a 5.22
7	28	175.0	3.49	749.1	^{ab} 56.38	130.3	^{ab} 10.10
Birth type		$p=0.190$		$p=0.149$		$p=0.088$	
Twin	66	171.8	2.22	792.5	35.82	136.0	6.41
Single	317	168.8	1.07	739.4	17.30	124.7	3.10

a,b,c: The mean carrying different letters in the same column are statistically different ($p<0.05$).



87% ($p < 0.01$). It was seen that twin rate was 9% and kidding rate was 0.88 in hair goats. In reproductive performance, the difference between two regions and differences among years in each regions were found to be significant ($p < 0.01$).

Discussion

Milk measurements in this study, as described in Materials and Methods were made with a measuring cylinder and data were recorded using liter as the unit. In the studies cited in the present study, kg was used as the unit of the measurement. However, the values from the current study and published studies were directly compared (the density of milk is 1.034).

In the current study, without taking the differences among the operations (farms), the lactation period which was 171 days, daily milk yield which was 753.7 g and lactation milk yield which was 128.9 kg in Hair Goats which were raised under the extensive condition in Konya and Karaman regions. These values are higher than both values stated by Kaymakçı (2010) and values found by various previous studies (Keskin and Biçer 1997, Şengonca et al 2003, Çam et al 2003, Ata

2007, Erten and Yılmaz 2013) in purebred Hair Goats. However, our values were lower than values found by Güney et al (1992) and Keskin et al (2004) in Hair Goat crossbreeds. The closest values to these research findings were 110 kg of lactation milk yield and 163 days of lactation period values, which Erten and Yılmaz (2013) obtained from Hair Goats in similar conditions. It is similar to the findings of Ata (2007) and Erten and Yılmaz (2013) stating that birth type did not have any significant effect on three studied traits; however, goat age had a significant effect on traits except lactation period.

The reason of the higher parameters belong to milk yield and fertility might be related to the genotypic and regional factors also measurement techniques. More specifically, in order to avoid keeping the kids away from their dams too long, we made the measurements not on the same day, but in two consecutive days in the first three measurements of this study. Those approaches may resulted in higher milk yield values than those in the literature. In addition, it should be considered that all previous studies carried out in Hair goat were performed in different regions of Turkey having different weather conditions and management types.

Table 2. Fertility traits of goat by years and regions

	Mating goat	Kidding goat	Kids born	NKPGGB	NKPGM	Birthrate
	(n)	(n)	(n)	(fecundity)	(kidding rate)	(%)
Karaman						$\chi^2=252.1$ $p=0.001$
2012	5400	4662	4220	0.91	0.78	86 ^a
2013	6085	4787	5444	1.14	0.89	79 ^c
2014	10999	8313	9106	1.10	0.83	76 ^d
2015	11800	9731	10797	1.11	0.92	82 ^b
Konya						$\chi^2=322.8$ $p=0.001$
2012	5985	4903	5296	1.08	0.88	82 ^b
2013	5495	4779	5717	1.20	1.04	87 ^a
2014	6143	4651	5139	1.10	0.84	76 ^c
2015	6137	5067	5423	1.07	0.88	83 ^b
General						$\chi^2= 19,2$ $p=0,001$
Karaman	34284	27493	29567	1.08	0.86	80
Konya	23760	19400	21575	1.11	0.91	82
Overall	58044	46893	51142	1.09	0.88	81

a,b,c: The rate carrying different letters in the same column are statistically different ($p < 0.001$).

NKPGGB: The number of kids born per goat giving birth.

NKPGM: The number of kids per goat mating.





As for the reproductive performance values, the birth rate (81%) is lower than the values reported by Toplu and Altinel's (2008). In contrast, the fecundity or twin rate in our study is higher than their findings. The significant differences between years may be due to climatic effects. According to previous years, there is no regular improvement in the following years, so no administrative improvement that originating from the project can be mentioned.

Conclusion

Findings of this study constitute the first study about milk yield characteristics of Hair goats raised under the extensive condition in Konya and Karaman regions. Similar studies in different pasture and regional conditions should be conducted to further confirm the values reported in the current research. It can be said that findings related to reproductive performance in the form of average of four years reflect characteristic of Hair goat in general. According to the results, lactation milk yield and lactation period in Hair goats raised in the region were higher, but birth rate and kid yield were lower than the values reported in the literature.

Conflict of Interest

The authors did not report any conflict of interest or financial support.

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