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## **Some production traits of indigenous Hair goats bred under extensive conditions in Turkey. 1<sup>st</sup> communication: reproduction, milk yield and hair production traits of does**

### **Abstract**

This study was conducted to investigate the reproductive performance, milk yield, hair production, fleece characteristics and body weight after shearing of Hair goats (Anatolian Black Goats), bred under extensive conditions in Turkey. The material of the study was formed a total data of 456 Hair goats, which were between 2 and 7 years of age bred in the period of two years. Conception rate, infertility rate, abortion rate, kidding rate, single birth rate, twin birth rate, the percentage of kids born according to mated does and litter size were 97.81 %, 2.19 %, 3.59 %, 94.30 %, 97.91 %, 2.09 %, 96.27 % and 1.02, respectively. Lactation length, milk yield in lactation period, milking period and milk yield in milking period of goats were determined as 232.29 days, 100.92 kg, 132.09 days and 43.14 kg, respectively. Hair production, fibre diameter and staple length of Hair goats in the study were determined as 381.00 g, 76.70 micrones and 13.63 cm, respectively. It was found that the effects of production year and farm on the reproductive traits given by percentage weren't statistically significant, whereas the difference among production years for litter size was significant. It was found that the effect of production year on milk production traits except for lactation length and on the hair production; the effect of farm factor on the hair production, staple length and live weight after shearing; the effect of age on the milk production traits, hair production traits and live weight after shearing; the effect of live weight on the hair production were statistically significant ( $p < 0.05$ ).

**Keywords:** Hair goat, reproductive performance, milk yield, hair yield

### **Zusammenfassung**

**Titel der Arbeit: Leistungen einheimischer Haarziegen, gehalten unter extensiven Bedingungen in der Türkei. 1. Mitteilung: Reproduktionsleistungen, Milch- und Haarertrag**

In vorliegender Studie werden die Fortpflanzungsleistungen, die Milch und Haarerträge sowie Vlieseigenschaften und Körpergewichte nach der Schur von Haarziegen, die unter extensiven Bedingungen in der Türkei gehalten wurden, untersucht. Die Daten umfassen die zweijährigen Ergebnisse von 456 zwei bis sieben Jahre alten Geißen. Erfasst wurden die Trächtigkeits-, Unfruchtbarkeits-, Aufzucht-, Einlings- und die Zwillingsrate sowie der Anteil geborener Kitze je Geiß. Die Durchschnittswerte in % dieser Reihenfolge betragen 97,81, 2,19, 3,59, 94,30, 97,91, 2,09, 96,27 und 1,02 Kitze. Weiterhin wurden die Laktationsdauer, Milchertrag in der Laktationsperiode, Dauer der Milchperiode und Milchertrag in der Milchperiode erfasst, welche folgende Ergebnisse auswiesen: 232,29 Tage, 100,92 kg, 132,09 Tage und 43,14 kg. Der Haarertrag lag bei 381 g der Faserdurchmesser bei 76,7 Mikrometer und die Stapeltiefe betrug 13,63 cm. Die untersuchten Effekte der Produktionsbedingungen, der Jahre, Einzelfarmen und des Alters der Geißen auf die Reproduktionsleistungen waren nicht signifikant sie beeinflussten jedoch signifikant die Wurfgröße. Die Auswirkungen dieser Einflussgrößen auf den Milchertrag, die Haarproduktion und weitere untersuchte Merkmale waren teilweise signifikant.

**Schlüsselwörter:** Haarziege, Reproduktionsmerkmale, Milchertrag, Haarertrag

## Introduction

The goat breeding in Turkey is based mainly on extensive systems carried out by smallholder farmers living in poor agricultural fields. Hair goat, indigenous breed of Turkey, is the most common goat breed in Turkey. The goat population is estimated at 6.5 million, of which approximately 6.3 million are Hair goats according to data of TURKSTAT, 2005 (Republic of Turkey, Prime Ministry Turkish Statistical Institute) (ANONYMOUS, 2005).

Hair goats, generally a combined productive breed for production of meat and milk, have long pendulous ears, long and coarse hairs, predominantly black colour to brown, grey and white colours. These goats are mostly located in the mountain areas of the Mediterranean and Aegean regions, although widely distributed throughout Turkey. Hair goats, of which feeding depends on natural pasture of leaves and branches in the scrub fields, are bred under traditional managements by small farmers. Hair goats, enduring animals against diseases and harsh environment conditions, have adapted on conditions of climate and environment of Turkey (YALCIN, 1990; ERTUGRUL, 1997).

The breeding of Hair goat has an important role in the rural economy of Turkey. Hair goats have been known to contribute to the sustenance of smallholder farmers in mountainous and forestry regions by generating income and employment as well as being a source of animal protein for breeder nutrition. However, there are few studies related to the production performances of Hair goats under the extensive conditions. Further investigation on the production performance of these animals reared under extensive conditions is needed to evaluate their future role in animal breeding in Turkey.

The aim of this study is to determine the reproduction, milk yield, hair production, fleece characteristics and body weight after shearing of Hair goats bred under extensive conditions.

## Materials and methods

### *Animals and management*

The material of the study was formed a total data of 456 Hair goats at two private farms in Aydin province of Aegean region in Turkey, which were between 2 and 7 years of age bred in breeding periods of two years. The goats were completely fed on natural pasture including scrub areas without giving any extra feed. No health programs were in effect in the goat herds. All the goats were identified with ear tags. Does and bucks were left together all the year round. The birth of kids began at the end of December and lasted until April. The kids weaned approximately at 3 months of age. The kids were left with their dams to suckle all time daily until weaning. Milk yield of goats was evaluated in milking period after weaning, because the milk yield of goats under extensive conditions in preweaning period was sufficient for only feeding of kids.

### *Data collection*

The pregnancy, fertility, infertility, abortion, kidding, single birth and twin birth rates and litter size were investigated to determine reproduction traits of does.

Pregnancy rate was calculated as the number of pregnant does/number of does bred.

Fertility rate was calculated as the number of total kids born/number of does bred. Infertile rate was calculated as the number of does no pregnant/number of does bred. Abortion rate was calculated as the number of does aborting/number of does pregnant. Kidding rate was calculated as the number of does kidding/number of does bred. Single birth rate was calculated as the number of does kidding single kid/number of does kidding. Twin birth rate was calculated as the number of does twinning/number of does kidding. Litter size was calculated as the number of total kids born/number of does kidding.

After weaning, does were hand-milked once daily and their production was measured on one day every month until individual yield dropped below 50 g/day at which milking was terminated. The lactation period was defined as the time from kidding day to drying day, although milking period was defined as the time from weaning day to drying day of does.

The following formula was used to calculate milk yield in lactation period and milk yield in milking period:

$$M = [(A_1 - D) \cdot k_1] + \sum_i^n \left[ \frac{k + k'}{2} \cdot (A' - A) \right] + [(T - A_n) \cdot k_n]$$

where:  $M$  = milk yield in lactation period and milking period of any doe,  $A$  and  $A'$  = the date of control following each other,  $D$  = the date of kidding (for milk yield in lactation period) and the beginning date of milking of does (for milk yield in milking period),  $T$  = the date of drying,  $k$  and  $k'$  = amount of milk at control dates following each other.

The goats were sheared once a year in June in 2003 and in May in 2004. During shearing, fleece samples from shoulder, side (upper rib) and hip districts of each doe were taken for analysis of fibre diameter and staple length. The body weight and hair weight of each goat were determined individually after shearing. Fibre diameter and staple length of total 300 fibres were measured, as amount of 100 fibres for each district. Fibre diameter was measured by using projection microscope. The mean fibre diameter and staple length values of each doe were determined by calculating means of obtained values.

### *Statistical analysis*

In the present study, chi square test was performed for the statistical analysis of reproductive traits (STEEL and TORRIE, 1980). The effects of the factors on the other production traits were analysed by using least squares methods (HARVEY, 1975). Significant differences between least square means were assessed using the contrast-test (SEARLE, 1971).

Body weight after shearing, milk yield and hair production traits were analysed by linear models of statistical analysis as shown below.

For body weight after shearing, fibre diameter and staple length:

$$Y_{ijkl} = \bar{\mu} + a_i + b_j + c_k + e_{ijkl}$$

For hair weight:

$$Y_{ijklm} = \bar{\mu} + a_i + b_j + c_k + d_l + e_{ijklm}$$

For lactation length, milking period, milk yield in lactation period and milk yield in milking period:

$$Y_{ikm} = \bar{\mu} + a_i + c_k + e_{ikm}$$

where:  $Y_{ikm}$  = the individual observation,  $\mu$  = the expected mean,  $a_i$  = the effect of production year ( $i$ : 2003 and 2004),  $b_j$  = the effect of farm ( $j$ : 1 and 2),  $c_k$  = the effect of age ( $k$ : 2, 3, 4, 5, 6 and 7),  $d_l$  = the effect of body weight ( $l$ : <42, 42-45 and >45 kg),  $e_{ijklm}$  = the random error. It was assumed that there was no significant interaction between factors under investigation

The data were analysed with general linear models (GLM) procedure of the SPSS programme package (OZDAMAR, 1999).

## Results

### *Reproductive traits*

Table 1 shows the the reproductive traits of Hair goats bred under traditional management conditions.

Table 1  
Some reproductive traits of Hair goats. (Reproduktionsmerkmale der Haarziegen)

Studied Traits	n	%
Number of does at mating	456	–
Pregnancy	446	97.81
Kidding	430	94.30
Infertility	10	2.19
Abortion	16	3.59
Number of kids born	439	–
Fertility	–	96.27
Single kidding does	421	97.91
Twinning does	9	2.09
Litter size	1.02	–

Out of 456 goats in breeding periods of two years, 446 (97.81%) conceived. Among those which conceived, 16 goats (3.59%) aborted and also 9 goats (2.09%) twinned. The reproductive performance of does in 2003 was higher than that 2004 and the difference between the production years was statistically significant in terms of only litter size ( $p < 0.05$ ). The differences between the farms in terms of the reproduction traits were not statistically significant.

### *Milk production traits*

The expected mean values of lactation length, milk yield in lactation period, milking period and milk yield in milking period were 232.29 days, 100.92 kg, 132.09 days and 43.14 kg, respectively (Table 2). It was determined that the effect of year on milk production traits except for lactation length and the effect of age on all milk production traits were statistically significant ( $p < 0.001$ ). All milk production traits increased with age up to 5 years old and decreased afterwards. It was found that the milk production traits except for lactation length were higher in 2003 than that 2004.

Table 2

Least squares means and standard errors of milk production traits of Hair goats  
(Kleinste Quadratmittel und Standardfehler der Milcherträge)

Factors	n	Lactation Length (day)		Milk Yield in Lactation Period (kg)		Milking Period (day)		Milk Yield in Milking Period (kg)	
		$\bar{x}$	$S_{\bar{x}}$	$\bar{x}$	$S_{\bar{x}}$	$\bar{x}$	$S_{\bar{x}}$	$\bar{x}$	$S_{\bar{x}}$
<i>Expected mean</i>	220	232.29	2.33	100.92	1.59	132.09	0.82	43.14	0.61
<i>Production years</i>		n.s.		***		***		***	
2003	102	229.22 <sup>a</sup>	3.39	111.67 <sup>a</sup>	2.31	139.31 <sup>a</sup>	1.20	52.33 <sup>a</sup>	0.89
2004	118	235.36 <sup>a</sup>	3.07	90.18 <sup>b</sup>	2.09	124.87 <sup>b</sup>	1.09	33.95 <sup>b</sup>	0.81
<i>Ages</i>		***		***		***		***	
2	35	196.19 <sup>c</sup>	5.60	61.97 <sup>c</sup>	3.81	116.91 <sup>d</sup>	1.98	27.02 <sup>c</sup>	1.47
3	32	242.18 <sup>ab</sup>	5.75	99.61 <sup>c</sup>	3.92	135.62 <sup>c</sup>	2.03	41.87 <sup>c</sup>	1.51
4	43	248.70 <sup>a</sup>	4.95	119.05 <sup>b</sup>	3.38	142.90 <sup>b</sup>	1.75	53.16 <sup>b</sup>	1.30
5	54	253.61 <sup>a</sup>	4.44	131.19 <sup>a</sup>	3.03	148.37 <sup>a</sup>	1.57	60.06 <sup>a</sup>	1.16
6	38	228.99 <sup>b</sup>	5.27	110.17 <sup>b</sup>	3.59	130.68 <sup>c</sup>	1.86	44.52 <sup>c</sup>	1.38
7	18	224.05 <sup>b</sup>	7.66	83.56 <sup>d</sup>	5.22	118.08 <sup>d</sup>	2.70	32.22 <sup>d</sup>	2.01

a, b, c, d, e = differences between groups with different letters groups are statically significant ( $p < 0.05$ ); n.s. =  $p > 0.05$ ; \*\*\* =  $p < 0.001$

### *Hair production traits*

Hair production, fibre diameter and staple length are presented in Tab.3. Hair production was determined as 381.00 g in this study. The effects of year, farm, age and the body weight on the hair production were statistically significant ( $p < 0.001$ ). For shoulder, side and hip districts, the mean values of fibre diameter were 70.76, 73.97 and 85.36  $\mu$ , respectively. The means of staple length for same parts of the body were 12.83, 13.33 and 14.72 cm, respectively. The effects of year and farm factors on the fibre diameter were insignificant, although the effect of age on this trait was significant ( $p < 0.001$ ). Fibre diameter increased with age. The effect of year on the staple length was insignificant, whereas the effects of farm and age were significant ( $p < 0.001$ ).

### *Body weight after shearing*

The body weight after shearing was determined as 42.17 kg. The effect of year on this trait was not statistically significant, however the effects of farm ( $p < 0.01$ ) and age ( $p < 0.001$ ) were significant. The goats bred in the first farm had the higher body weight than those of the second farm. Least squares means of this trait increased with age up to 6 age and then it decreased (Table 3).

## Discussion

### *Reproductive traits*

When the pregnancy, fertility and prolificacy rates in a herd are high, the reproduction performance in that herd is accepted as high (AKCAPINAR and OZBEYAZ, 1999).

High pregnancy and kidding rates achieved in Hair goats bred under extensive management conditions, however the twinning rate was found to be low.

The pregnancy and kidding rates (97.81% and 94.30%, respectively) determined in this study are higher than those of FERIK (1995) and ESER (1998) who also studied Hair goats. The infertility rate (2.19%) is lower than the rates of ESER (1998) and SENGONCA et al. (2003) who studied Hair goat and Saanen  $\times$  Hair goat. The

presumptive reason for the higher pregnancy and the lower infertility rates in the study than the other studies could be due to the keeping male and female together in the herd years along.

Table 3

Least squares means and standard errors of hair production, fibre diameter, staple length and body weight after shearing of Hair goats (Kleinste Quadratmittel und Standardfehler von Haarertrag, Faserdurchmesser Stapeltiefe und Körpergewicht nach der Schur)

Factors	n	Hair Production (g)		Fibre Diameter (microns)		Staple Length (cm)		Body Weight After Shearing (kg)	
		$\bar{x}$	$S_{\bar{x}}$	$\bar{x}$	$S_{\bar{x}}$	$\bar{x}$	$S_{\bar{x}}$	$\bar{x}$	$S_{\bar{x}}$
<i>Expected means</i>	347	381.00	2.44	76.70	0.36	13.63	0.07	42.17	0.15
<i>Production year</i>		***		n.s.		n.s.		n.s.	
2003	135	373.10 <sup>b</sup>	3.80	76.39 <sup>a</sup>	0.57	13.64 <sup>a</sup>	0.11	42.21 <sup>a</sup>	0.24
2004	212	388.89 <sup>a</sup>	2.72	77.00 <sup>a</sup>	0.42	13.61 <sup>a</sup>	0.08	42.13 <sup>a</sup>	0.18
<i>Farm</i>		***		n.s.		***		**	
1	235	390.40 <sup>a</sup>	2.66	76.81 <sup>a</sup>	0.40	13.93 <sup>a</sup>	0.08	42.62 <sup>a</sup>	0.17
2	112	371.59 <sup>b</sup>	3.88	76.58 <sup>a</sup>	0.59	13.32 <sup>b</sup>	0.12	41.72 <sup>b</sup>	0.25
<i>Age</i>		***		***		***		***	
2	67	303.27 <sup>d</sup>	5.64	69.41 <sup>d</sup>	0.75	12.98 <sup>c</sup>	0.15	37.96 <sup>d</sup>	0.32
3	58	362.70 <sup>c</sup>	5.26	74.62 <sup>c</sup>	0.79	13.64 <sup>b</sup>	0.15	41.77 <sup>c</sup>	0.33
4	64	402.85 <sup>b</sup>	5.01	77.09 <sup>b</sup>	0.76	13.94 <sup>ab</sup>	0.15	42.68 <sup>b</sup>	0.32
5	76	428.87 <sup>a</sup>	4.63	78.34 <sup>ab</sup>	0.69	14.20 <sup>a</sup>	0.14	44.19 <sup>a</sup>	0.29
6	45	427.53 <sup>a</sup>	6.14	80.26 <sup>a</sup>	0.92	14.30 <sup>a</sup>	0.18	44.58 <sup>a</sup>	0.39
7	37	360.77 <sup>c</sup>	6.47	80.46 <sup>a</sup>	0.98	12.69 <sup>c</sup>	0.19	41.83 <sup>bc</sup>	0.41
<i>The groups of body weight (kg)</i>		***							
<42	122	346.53 <sup>c</sup>	4.32						
42-45	146	379.36 <sup>b</sup>	3.36						
>45	79	417.10 <sup>a</sup>	4.91						

a, b, c, d = differences between groups with different letters groups are statically significant ( $p < 0.05$ ); n.s. =  $p > 0.05$ ; \*\* =  $p < 0.01$ ; \*\*\* =  $p < 0.001$

YALCIN (1990) and ESER (1998) reported that the twinning rate in Hair goats is 5-15% and 7-14%, respectively. However, this rate was 2.09% in this study. The reason for this low twinning rate could be explained as the feeding of does depended on completely the pasture conditions and the pregnancy period of does encountered to winter.

The pregnancy, kidding, fertility, twinning rates and litter size in 2003 were higher than those obtained in 2004. The higher reproductive performance in 2003 could be the result of the climate and pastoral conditions.

#### *Milk production traits*

OZCAN et al. (1974), YALCIN (1990), FERIK (1995), ESER (1998), DARCAN (2000), SENGONCA et al. (2003) reported the mean value of lactation length for Hair goats as 213.9 days, 150-160 days, 169.5 days, 166.99 days, 158.4 days and 143.7 days, respectively. However, this value (232.29 days) in the present study was rather higher than literature declarations (PETERS and LAES-FETTBACK, 1995). It was possible that does were milked more long time for more profit in the farm in which the study was carried out.

Milk yield in lactation period is higher than the findings of ESER (1998) and SENGONCA et al. (2003), whereas it is similar with the finding of FERIK (1995).

The significant effect of age on the lactation length and milk yield in lactation period in this study is similar to the results of SENGONCA et al. (2003) who have studied Hair goats and Saanen × Hair crossbred goats and the results of MONTALDO et al. (1995) and KHAN et al. (2000) who studied other goat breeds.

#### *Hair production traits*

Hair production of Hair goats is 0.5-0.6 kg annually. Fibres, which are coarse, smooth and long, are used in products such as tents, stiffening cloth, card weaning, floor weaning, saddle-bags, bags, sacks, animal feeding bags and socks especially in rural regions of Turkey where Hair goats are bred (YALCIN, 1990; DELLAL et al., 2001). Hair production in the present study was 381.0 g. KOYUNCU (1990), FERIK (1995) and ESER (1998) found the mean values of this trait as 409.2 g, 354.9 g and 353.30 g, respectively. The presumption reason of the difference between values of hair production could be management conditions and shearing.

It was found that the effect of the environmental factors on hair production was statistically significant ( $p < 0.001$ ). The difference between the farms in terms of hair production could be related with management conditions. The difference between production years could be due to shearing time. In this study, low hair production obtained in 2003 could be due to falling out of the hair. Because shearing time in 2003 was later than 2004. Increasing of the hair production with age in the study was in accordance with the results of FERIK (1995) and also increasing observed in this production yield traits with the weight of goats was similar to those of ESER (1998). In the study, it was found that the most thick and the most long fibres were in hip district, following side and shoulder. The mean value of fibre diameter ( $76.70 \mu\text{m}$ ) was higher than those of KOYUNCU (1990) and FERIK (1995). However, it was lower than the values that DELLAL et al. (2001) and SOYLEMEZOGLU et al. (2002) reported for Hair goats. The mean value of staple length (13.63 cm) was similar to the results of KOYUNCU (1990) and FERIK (1995) although it was higher than the results of DELLAL et al. (2001) and SOYLEMEZOGLU et al. (2002). It was interpreted that the reason of these differences could be the environmental conditions in different regions of Turkey where the goats were bred. LANARI et al. (2003) found also great differences in hair-type within the race interpreted by different regions in Argentina.

#### *Body weight after shearing*

To be able to maintain good reproductive performance in goats and better growth and survival rates for kids, a sufficient body weight is definitely necessary.

In the present study, the body weight after shearing was similar to the traditional adult body weight of Hair goats. On the other hand, KOYUNCU (1990), FERIK (1995) and ESER (1998) reported for this value as 43.5 kg, 36.85 kg and 35.96 kg, respectively. This difference between the values could be the result of environmental and management conditions.

The important effect of age on the body weight after shearing was in accordance with results of ESER (1998), VEGARA et al. (1999) and PRASAD and SENGAR (2002) who studied this trait on the different goat breeds.

Hair goats had the high performance especially in terms of reproduction, although they were bred under the traditional extensive conditions. The environmental factors,

of which the effects could be measured, on the production traits caused the variations. It concluded that the production performance of Hair goats could be increased by improving the management conditions and using the appropriate breeding methods.

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