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REPRODUCTIVE PERFORMANCE OF HAIR GOAT AND GROWTH TRAITS OF HAIR GOAT AND SAANEN X HAIR (F1) CROSSBRED KIDS IN RURAL CONDITIONS

HILAL TOZLU ÇELİK[1]*; MUSTAFA OLFAZ[2]
[1]*Ordu University, Ulubey Vocational School, Department of Food Processing, 52850, Ulubey, Ordu, Turkey*
[2]*Ondokuz Mayıs University, Faculty of Agricultural, Department of Animal Science,55139 Atakum, Samsun, Turkey*

Abstract

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The goal of this study was to analyse Hair goats' (Turkish Kil goat) reproductive performance and vitality, growth characteristics and some body measurements of Saanen x Hair (F1) crossbred and Hair goat kids raised in rural conditions in Turkey. The study was conducted under rural farm conditions in the province of Amasya in the Middle Black Sea region. Totally 287 goats, 143 does, 2 Hair bucks, 2 Saanen bucks, 37 Hair goat kids and 103 Saanen x Hair F1 crossbred kids were used. Mean reproductive values of the flocks were 9.09% for infertility rate, 90.91% for pregnancy rate, 1.03 for fecundity and 1.13 for prolificacy rate. The live weights for birth, 30th and 75th days were not affected by genotype but live weights of kids were significantly affected ($P < 0.05$) by sex and birth type. Live weight gain and all the body measurements of kids in various periods were significantly affected ($P < 0.05$) by sex and birth type. Growth rate of Saanen x Hair F1 crossbred kids were significantly ($P < 0.05$) higher than Hair goat kids (175.49 g vs 157.57 g; 176.2 g vs 163.3 g) at 30th day and the weaning period (75th day), respectively. Daily weight gain was significantly affected ($P < 0.05$) by genotype, gender, birth type and dams' age. Significant increases ($P < 0.05$) in wither height, chest width, chest depth, and chest circumference were noted for crossbred kids at 75th day when compared with the Hair goat kids. Survival rate of Saanen x Hair F1 crossbred kids had higher than those of Hair goat kids at 30th day and 75th day. These results suggest that growth rate and survival rate of kids are influenced from crossbreeding of Saanen dairy goat breed with the indigenous Hair goat breed at a significant level.

Key words: Hair goat; reproductive performance; crossbreeding; growth performance; body measurements; survival rate

Introduction

Goat production has been practised under extensive conditions all over Turkey, especially hilly, mountainous and border of forest areas. The national goat population is 10 million (TÜİK, 2017), of which 98% are consisted of Hair (it is named as Turkish Hair Goat, Anatolian Black Native Goat or Turkish Black Goat) goats. They have low performance, mature weight of female 35-42 kg, ranging 0.6-1.0 in litter size and about 80-130 kg milk yield depending on breeders' conditions and they have highly adaptability in hilly and mountainous conditions (Erten and Yılmaz, 2013).

Goat rearing is an agricultural production system in most hilly and mountainous areas and goat breeders have gained their income from only this activity in Turkey. Therefore, this research has been carried out to determine the reproductive performance of Hair goats, and to compare the growth performance of Hair goat kids and Saanen x Hair F1 crossbred kids.

**Corresponding author:* hilal5529@gmail.com

Materials and Method

Location of the study

This research has been conducted in a private farm in Sarilar village in Amasya (40º 39′ N; 35º 52′ E) in the middle of Black Sea Region of Turkey. It is located about 1150 m above the sea level (Anonymous, 2012).

Animals and their management

The animal material of this experiment was 143 Hair goats and 2 Hair bucks that reared under extensive farm conditions and 2 Saanen bucks were provided from the Research Farm of the Agricultural Faculty of Ondokuz Mayıs University, situated in Middle Black Sea Region of Turkey. They were randomly allocated into two groups in order to breed Hair bucks (n = 41) and Saanen Bucks (n = 102).

Does were exposed to two experienced teaser Hair bucks for 40 days in twice a day to determine their oestrus beginning at the end of November. Then, does in oestrus were hand-mated by bucks (Saanen or Hair bucks). A total of 147 Kids were born in late March in 2006. The kids were stay together with their mothers in the first 75 days. Then, they were weaned at the 75th day. The goats and bucks were ear tagged and tetovired at the beginning of study. The fertility criterion was found in the research according to kidding results.

Kids were weighed on the first day after they were born and numbered with plastic earrings. Date of birth, birth weight and birth type, gender of the kids, kid ear number, dam's age and dam's ear number were recorded within 24 hours after birth. Birth weight and other weights were determined by weighing with a scales operating in 100-g sensitivity. Body measurements such as body length (cm), chest circumference (cm), wither height (cm), chest width (cm), chest depth (cm), circumference of leg (cm), circumference of the front cannon bone (cm), body weight (kg) and survival values (%) of Saanen x Hair (F_1) crossbreds and Hair goat kids were recorded on 30th and 75th days. For the detection of live weights, the kids were left hungry in the evening before the day of weighing. The kids in both groups were raised in the same care feeding conditions. The kids were grazed together with their mothers in their mountainous areas all year round. Graizing time was aproximately 7-9 hours per day from dawn to evening. Barley grain and hairy vetch straw were offered to animal during the breeding season and so on. The hairy vetch straw and alfa grain were offered to the animals during the gestation, and hairy vetch straw were offered after birth.

Statistical analysis

The model used for statistical analysis was $Y_{ijklm} = \mu + a_i + b_j + c_k + d_l + e_{ijklm}$, where Y_{ijklm} is an individual observation, μ is the overall mean, a_i is the genotype effect, b_j is type of birth effect, c_k is the sex effect, d_l is the age of dam effect and e_{ijklm} is the residual error (SPSS, 1999). There were no significant changes on kids' body weights at 30th and 75th days of age between 3- year's ages and later or third and later parous of dams, thus those dates were pooled.

Results and Discussion

Reproductive characteristics

Reproductive performance of does mated with Hair and Saanen bucks were presented in Table 1. The infertility rate of does mated with hair bucks was found to be higher in

Table 1
Reproductive performance of does with mated in Hair and Saanen bucks

	Hair Buck		Saanen Buck		Total	
	n	Rate (%)	n	Rate (%)	n	Rate (%)
Does	41		102		143	
Infertile goats*	7	17.07	6	5.88	13	9.09
Pregnancy / Kidding	34	82.93	96	94.12	130	90.91
Single kidding	28	82.35	85	88.54	113	86.92
Twin kidding	6	17.65	11	11.46	17	13.08
Total number of kids	40		107		147	
Stillbirth	1	2.94	2	2.08	3	2.31
Weaning kids	28		98		126	
Prolificacy =[(Kid number / does kidding) x 100]		117.65		111.46		113.08
Fecundity = [(Kid number/ does eligible for kidding) x 100]		97.56		104.90		102.80
Litter size at birth	1.17	11.76	1.12	111.5	1.13	113.08
at weaning	0.82	82.35	1.02	102.08	0.97	96.92

*: $P < 0.05$, $X^2 = 4.432$

does mated with Saanen bucks ($X^2 = 4.32$, $P < 0.05$) when compared to does mated with Saanen bucks. However, this difference might be explained with that Saanen bucks, which had been reared intensively, were obtained from Ondokuz Mayis University and so they had been better condition than those of Hair bucks. On the other hand, the most plausible explanation of this difference is that the Hair bucks are close inbreeding and thus does mated with these Hair bucks might be occurred early embryonic wastages. The other reproductive performance between mated with Hair bucks and Saanen bucks were no difference. Litter size at birth was not significantly affected by the breed of buck (P=0.508, χ^2 = 0.439), indicating that this trait is a characteristic of the does.

Fecundity and twin kidding (102.80-13.08) values obtained in this study were higher than the 0.95 and 9.21 reported by Atay et al. (2010), but infertility (9.09) value was lower than 13.45 reported by Atay et al. (2010). Litter size (1.13) value was determined similar 1.09 reported by Atay et al. (2010). Pregnancy and kidding (82.93-82.93) values obtained in this study were lower than 94.87%-85.89%, but single birth and twining birth (82.35%-17.65%) values were determined similar with 82.09%-17.91% reported by Erten and Yılmaz (2013). Litter size at weaning (0.82) value was determined lower than 0.91 reported by Erten and Yılmaz (2013).

Kids Growth Characteristics

Body weight and live weight gain

The body weights of kids are reported in Table 2. The breed of buck was not significant ($P > 0.05$) effect on the weight of kids at birth, 30th day and 75th day. Live weight values for birth, 30th day and 75th day were 3.59 kg, 3.72 kg and 8.86 kg, 8.50 kg, 16.80 kg and 16.00 kg for Saanen x Hair (F1) crossbred and Hair kids, respectively. Birth type and gender of kids were significant affected on the weight of kids at all over the growing periods ($P < 0.05$). In general, birth type was affected by body weight of an animal because of nutrition supported by dams divided between twins or triplets etc. during the prepartum and postpartum periods, and it is possible that myogenesis might be affected during pregnancy (Gökdal et al., 2013).

Also, gender might effect on growth characteristics due to positive relationship between male gonadal cells and growth hormones that are related to growth performance. These findings are consistent with various researches (Cengiz et al., 1995; Mourad and Anous, 1998; Cam et al., 1999a, b; Koşum et al., 2004; Gökdal et al., 2013). Birth and 30th day weights values for Saanen x Hair (F1) crossbred and Hair goats were higher than Saanen x Hair (F1) crossbred (2.86-6.57) and Hair goat kids (2.75-6.60) reported by Gökdal et al. (2013). The results obtained in the research were higher than Hair goat kid (3.12 kg-17.01 kg) and Saanen x Hair (F1) crossbred kids (3.11 kg-16.88 kg) reported by Erduran and Yaman (2012). Saanen x Hair (F1) and Hair goat 75th day weights values were higher than Saanen x Hair (F1) (13.18 kg) and Hair goat (13.98 kg) reported by Gökdal et al. (2013). It is thought that these differences are caused by genetic variation, care feeding practices and climatic differences in the race.

Effect of the age or parity stage of dams on birth weight of kids was not found significant and dam's age on live weights at 30th day and at 75th day of kids was found significant (Table 3). The live weights of the kids born from 2 or 3 aged dams were found to be lower ($P<0.05$) than those aged over 3 years (Figure 1). This is explained by the milk production physiology in does, which increases after the first lactation till fourth lactation and then begins to decrease. However, dam parity stage had no effect on any measurement. Growth performance (daily live weight gain) of Saanen x Hair F1 crossbred kids on 30th and 75th day was higher than those of Hair kids. Reason of this difference may be contributed of crossbreeding advantage. Inherited traits are sire by which

Table 2

Live weight of pure and crossbred kid at birth, at 30 and at 75 days of age

General *Genotype*	n	Birth ($\bar{X} \pm S_{\bar{x}}$)	n	30th day ($\bar{X} \pm S_{\bar{x}}$)	n	75th day ($\bar{X} \pm S_{\bar{x}}$)
Saanen x Hair (F1)	103	3.59±0.05	101	8.86±0.11	97	16.80±0.22
Hair Goat	37	3.72±0.10	30	8.50±0.25	28	16.00±0.53
Birth type						
Single	108	3.75±0.05a	102	9.13±0.10a	96	17.17±0.22a
Twin	32	3.19±0.04b	29	7.53±0.16b	29	14.78±0.43b
Gender						
Male	65	3.81±0.07a	62	9.23±0.17a	58	17.53±0.36a
Female	75	3.46±0.06b	69	8.37±0.11b	67	15.83±0.20b
Overall	140		131		125	

a.b; means in columns within males and females, and single and twin superscript differ significantly ($P < 0.05$)

contributed half from the gamete, and dam by which contributed half from the gamete (Soysal, 1996). Results obtained in the present research indicated that crossbred kids had better daily weight gains than from Hair goat kids.

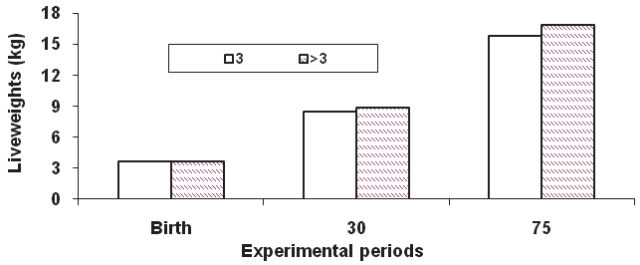

Fig. 1. The effect of dam parity stage on kids body weight at birth, 30th day and 75th day (weaning) (P < 0.05)

The growth performance is a genetic characteristic of living organism that generally affected by gender, birth type and management practices. These findings in our study are consistent with the findings of Dhanda et al. (1999), Karua and Banda (2006). Daily weight gains of Saanen x Hair (F1) and Hair goat at 0-30th day and 0-75th day were 113.78 g-115.95 g and 107.63 g-117.32 g reported by Gökdal et al. (2013), respectively. Birth-30th day and birth-75th day daily weight gain values were higher than the findings reported by Gökdal et al. (2013). Şimşek and Bayraktar (2006) reported that daily weight gain of 0.124 g and 0.147 g of Saanen x Hair goat F1 and Hair goat at range of 0-90th day, respectively. In this study, values obtained were higher than those reported by Şimşek and Bayraktar (2006). Tüfekci and Olfaz (2016) reported that 30th and 75th day daily weight gains were 151.50 g and 146.90 g for Saanen x Hair G1, respectively. This literature values were lower than the findings in this study. Effect of dam's age on kids' daily weight gain for 30th day and 75th day has been found significant (P < 0.05) in this current study. These findings were found different from the findings of Şimşek and Bayraktar (2006) and Şimşek et al. (2007). The differences among literatures may be resulted genotypic structure, climatic and altitude differences and feeding and care practices.

Body measurements

In various growth periods, the body measurements of Hair goat kids and Saanen x Hair goat F1 crossbred kids are presented in Table 4. Effect of genotype on body length, circumference of leg and the circumference of front cannon bone of kids at 30th day and on withers height, body length, chest width, chest depth and chest circumference at 75th day were found significant (P < 0.05). Birth type (single or twin) had a significant effect (P < 0.05) on all the body measurements at 30 days of age and 75 days of age. Similarly, gender had an important effect (P < 0.05) on all the body measurement except chest depth at 30 days of age and chest width at 75 days of age.

Body lengths of single-born kids were found longer than twinborn kids at 30 days of age and at the weaning age. These results agree with results reported for Akkeçi (Saanen x Kilis G1) goats by Cengiz et al. (1995). Results show that chest width and chest depth of kids at the 30th day increased with effect of crossbreeding with Saanen (Table 4). Chest circumferences of genotypes were found similar with this study. Circumference of leg of Hair goat kids was found higher than Saanen x Hair F1 crossbred kids. Turkish hair goats have meat type characteristics (Cam et al., 2010).

Table 3
Kids' growth performance at birth-30 days of age and at birth-75 days of age (Daily weight gain).

Genotype	Birth – 30 days of age			Birth –75 days of age		
	n	g/day	Significance levels	n	g/day	Significance levels
Hair Goat	30	157.57±7.41**b**	P<0.01	28	163.29±6.61**a**	P < 0.05
Saanen x Hair F1	101	175.50±3.07**a**		97	176.21±2.83**b**	
Gender						
Male	62	180.08±5.06**a**	P<0.001	58	183.12±4.63**a**	P < 0.001
Female	69	163.58±3.09**b**		67	164.82±2.60**b**	
Birth Type						
Single	102	178.89±3.15**a**	P<0.0001	96	178.91±2.81**a**	P < 0.0001
Twin	29	145.00±5.26**b**		29	154.79±5.70**b**	
Dam's Age						
Dam age 3	24	159.67±6.10**b**	P<0.05	24	162.08±5.61**b**	P < 0.05
Dam age >3	107	174.00±3.33**a**		101	175.98±2.98**a**	

Table 4. The linear body measurements of Hair goat and Saanen x Hair (F1) crossbred kids at 30th day and 75th day

	n	WH (cm)	BL (cm)	CW (cm)	CD (cm)	CC (cm)	CL (cm)	CCB (cm)
30th day								
Genotype		ns	*	*	ns	ns	*	*
Hair goat	30	44.80±0.47	38.40±0.67**a**	7.95±0.19**a**	15.93±0.23	47.65±0.59	38.46±0.56**a**	6.88±0.09**a**
SaanenxHair (F1)	101	44.18±0.24	36.47±0.29**b**	8.34±0.08**b**	15.87±0.09	47.70±0.23	36.46±0.25**b**	6.47±0.05**b**
Gender		*	*	*	ns	*	*	*
Male	62	45.24±0.36**a**	38.05±0.43**a**	8.44±0.13**a**	16.04±0.15	48.21±0.35**a**	37.82±0.37**a**	6.76±0.06**a**
Female	69	43.49±0.20**b**	35.88±0.32**b**	8.09±0.08**b**	15.75±0.09	47.22±0.26**b**	36.12±0.29**b**	6.39±0.05**b**
Birth type		*	ns	*	*	*	*	*
Single	102	44.78±0.23**a**	37.14±0.33	8.36±0.09**a**	16.00±0.10**a**	48.09±0.25**a**	37.18±0.28**a**	6.63±0.05**a**
Twin	29	42.69±0.40**b**	36.10±0.50	7.88±0.15**b**	15.47±0.15**b**	46.29±0.40**b**	36.03±0.44**b**	6.34±0.08**b**
75th day								
Genotype		*	ns	*	*	*	ns	ns
Hair goat	28	51.89±0.55**a**	45.66±0.71	9.86±0.23**a**	18.61±0.34**a**	55.59±0.78**a**	45.00±0.76	7.09±0.13
SaanenxHair (F1)	97	54.23±0.33**b**	46.75±0.36	10.39±0.09**b**	19.61±0.10**b**	57.41±0.27**b**	44.41±0.29	7.16±0.04
Gender		*	*	ns	*	*	*	*
Male	58	54.69±0.50**a**	47.49±0.47**a**	10.21±0.14	19.65±0.18**a**	57.89±0.43**a**	45.28±0.45**a**	7.34±0.08**a**
Female	67	52.85±0.32**b**	45.66±0.42**b**	10.31±0.12	19.15±0.14**b**	56.22±0.34**b**	43.89±0.35**b**	6.98±0.05**b**
Birth type		*	*	*	*	*	*	*
Single	96	54.24±0.32**a**	47.04±0.35**a**	10.37±0.10**a**	19.68±0.11**a**	57.74±0.27**a**	44.90±0.31**a**	7.24±0.05**a**
Twin	29	51.93±0.63**b**	44.74±0.70**b**	9.93±0.19**b**	18.39±0.29**b**	54.53±0.63**b**	43.34±0.63**b**	6.84±0.10**b**

WH (Wither height); BL (Body length); CW: Chest width, CD (Chest depth), CC (Chest circumference); CL: Circumference of leg, CCB: The circumference of front cannon bone.

Note: ns, *, not significant, significant at $p \leq 0.05$, respectively

In various periods, results obtained in this research show that wither height, body length, chest width, chest depth, and chest circumference increased with the level of crossing with Saanen, but except only circumference of leg (Table 4). The results were found higher than those reported for 3 month body measurements of Kilis goat by Barıtçı and Eliçin (2003). Body measurements of Saanen x Hair (F1) kids at 75th day (weaning) were higher than reported for Saanen goat by Bolacalı and Kucuk (2012) (wither height 48.80, chest width 9.8, chest depth 21.6, chest circumference 53.5, cannon bone circumference 6.5 at 90th day) but body length, chest depth, circumference of leg values were similar with Bolacalı and Kucuk (2012) (body length 50.5, chest depth 21.6, circumference of leg 49.4 at 90th day).

Survival rate

Survival rates of Saanen x Hair F1 crossbred and Hair goat kids at 30th day were found the 97.14% and 78.95%, respectively. These results were similar with the finding (93.70%) reported by Gökdal et al. (2013) for Saanen x Hair (F1) crossbred goat kids, but to be lower than the finding (88.59%) reported by the same researchers for Hair goat kids. Yılmaz et al. (2013) reported that survival rates of 94.44%, 100.00% of Saanen x Hair F1 crossbred kids and Hair goat kids on 30 days of age, respectively. The survival rates found for Saanen x Hair F1 crossbred on 30th day in the present research were similar with the findings reported by Yılmaz et al. (2013), but to be lower than the findings reported by the same researchers for Hair goat kids. In this study, the effect of genotype, birth type and gender on survival rate were not significant. These findings were similar with findings reported by Yılmaz et al. (2013) and Şimşek et al. (2007). Atay et al. (2010) reported that effects of farm and birth type on survival rate at 30th day were not significant, but effects of farm, year and birth type on survival rate at 60th day were significant. Atay et al. (2010) reported that survival rates of 85.81% and 81.82 of Hair goat kids on 30th day and 60th day, respectively. Yılmaz et al. (2013) reported that survival rates of 90.28%, 90.24% of Saanen x Hair F1 crossbred kids and Hair goat kids on 60 days of age, respectively. Şimşek et al. (2007) reported that survival rates of 86.20% of Saanen x Hair F1 crossbred kids on 90 days of age.

Survival rates of Saanen x Hair F1 crossbred and Hair goat kids at 75 days of age in this study were found 93.33% and 73.68%, respectively. Survival rates of Saanen x Hair F1 crossbred on 75 days of age were similar with findings reported by Yılmaz et al. (2013), but survival rates of Hair goat on 75 days of age were lower than the findings reported

by Yılmaz et al. (2013) and Atay et al. (2010). Survival rates of Saanen x Hair F1 crossbred on 75 days of age were higher than the finding reported by Şimşek et al. (2007). Şimşek and Bayraktar (2006) reported that survival rates of 82.50% and 90.62% Hair goat kids and Saanen x Hair F1 crossbred kids on 90 days of age, respectively. This study values were similar with the finding Şimşek and Bayraktar (2006).

A large part of the income obtained in goat breeding is the sale of the kids. For this reason, number of kid at weaning age is very important. In this study, survival rate of crossbred kids was significantly higher than those of Hair goat kids at 30th day (Figure 2). This survival rate might reflect the inbreeding depression in Hair kids. This result indicated us that the bucks used as a breed in close inbreeding system should be bought different confidential herds or it should be prepared in a good breeding plan if it continues inbreeding. It is known as reality, which close inbreeding causes inbreeding depression. The survival of the kids is influenced by the birth weight and the frequency of the disease (Daş and Savaş, 2002). It is thought to be influential in breeder applications as well.

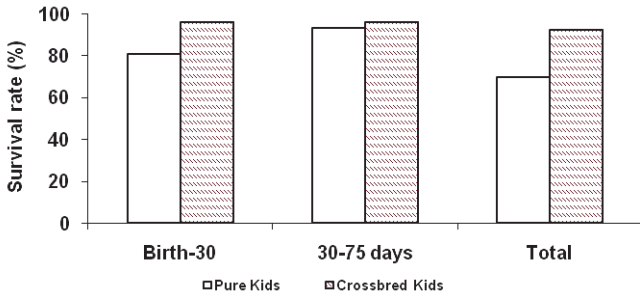

Fig. 2. Survival rate in Pure and Crossbred kids during the experiment

Conclusion

The results from this study displayed that Hair goat had lover prolificacy, and Hair goat kids had lower survival rate and daily weight gain when compared to the crossbred kids. Thus, based on these findings, it may be suggested that crossing of Saanen dairy goat breed with the indigenous Turkish Hair goat breeds are economically beneficial as it results into significant improvement in growth and meat production potential.

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