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Growth and Development Performances of Cukurova Saanen Kids under Tropical Climate Conditions

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Abstract: This study was carried out at the Dairy Goat Research farm of the Faculty of Agriculture of Cukurova University. Four single-born female, nine twin-born female, five single-born male and sixteen twin-born male of Cukurova Saanen kids were constituted the material of this study. The effects of birth type and sex on some growth parameters of Cukurova Saanen kids were investigated. Kids were weaned at 60 days of age. Weaning Weight (WW), Weight Gains for each month (WG) and Live Weights (LW) of kids were recorded at birth, 1^{ts}, 2nd, 3rd, 4 and 5th months of age. Body measurement such as; Height At Withers (HAW), Body Length (BL), Chest Depth (CD), Heart Girth (HG), Height of Sacrum (HS) and Width Through Hip Joints (WTHJ) were measured at 1st, 2nd,3 rdand 4 months of age. WG_1 and WG_5 were found significant ($p<0.05$). WW was also statistically significant by permutation test ($p<0.05$). HAW_3, HAW_4, BL_4, HS_4, HG_2, CD_2 and CD_4 were found statistically significant for birth type ($p<0.05$). The results of the study indicated that single born kids showed faster growth rate than twin born kids and males than females. The highest growth rate was determined in all groups between first and second months. Single born female kids were more affected by weaning shock in terms of LW and WTHJ.

Key words: Saanen, kids, weaning, growth, development

INTRODUCTION

Goat production becomes an important alternative livestock production for the farmers in the mountainous and marginal regions of Turkey. They are being recommended as a considerable food source because of their ability to convert otherwise unusable vegetation on poor grazing land to meat, milk, fiber and skins. Turkey's goat population is about 6.7 million head and 6 million of this population are of the indigenous Hair goat. They are multi-purpose breed and characterized with low milk yield, short lactation period and low litter size. Among all genotypes Hair goat possesses the priority for improvement. In this respect Saanen goats are used to improve yield characteristics of Hair goat. In order to improve the production performances of Hair goat, two crossbred dairy goat types namely Çukurova and Taurus were developed and described by Güney *et al.*[1].

Recently, to avoid the inbreeding, University of Cukurova initiated a long term crossbreeding project to improve and develop a new high producing genotype called *Cukurova Saanen*. In other words Cukurova Saanen was outcome of Saanen×Cukurova, Saanen×Taurus and posses about more than 90% of Saanen breed.

Observing some growth characteristics of the kids may useful to select breeding stock animals earlier and make some improving studies. In this study growth performances and some body measurement of Cukurova Saanen crossbred kids were determined according to their birth type and sex. It is evident that only by this way we can speed up the growth rate and performances of native goats.

MATERIALS AND METHODS

This experiment was conducted at the Cukurova University, Agriculture Faculty, Dairy Goat Research Farm located in Adana, on the Mediterranean coast of Turkey. The region is also called Cukurova plains. It is in 27° north latitude and 35° east longitude. Annual rainfall and relative humidity are 646 mm and 66%, respectively. Five single-born male, sixteen twin-born male, four single-born female and nine twin-born female of Cukurova Saanen kids were assigned for the study. Kids were weaned at 60

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days of age. Kids were divided into two groups as male and female. After 14 days of age, all kids had free access to good quality alfalfa hay, concentrate and fresh water. Kids were kept with their dams first two weeks than allowed to creep feeding. Kids were fed with residual milk in the morning and evening and kept with their dams at nights until six weeks of age. But in the last 2 weeks they are given residual milk only at night. The live weights of kids were recorded at 1st, 2nd, 3rd, 4 and 5th month, Birth Weight (BW) and weight gains were calculated for each month. Some body measurements such as, height at withers, body length, chest depth, heart girth, width through hip joints and height of socrum were also recorded until the fourth month of age.

The obtained data on growth traits were evaluated by one-way ANOVA using SPSS Statistical Package Program 10.0 (SPSS, 1999) and DISTLM for permutation test written by Anderson[2]. Mathematical model that are used for birth type and sex can be written as

$$\hat{Y}_{ij} = \mu + \alpha_i + e_{ij}.$$

Where,

$\hat{Y}_{ij}$: observation value,
μ : population mean,
α_i : the effect of birth types and sex to analyze by birth type and sex factors, respectively.
e_{ijk} : residual error.

RESULTS AND DISCUSSION

In this study, we focused on how growth performance of single females and males and twin females and males were affected during the experiment trial. Considered variables were executed by one-way ANOVA for sex within birth type and sex factors. The results of significance levels of those parameters are given in Table 1 and 2 for sex within birth type and sex, respectively.

Differences of WG were calculated by subtraction of prior months from posterior months. The effect of birth type on WG were evaluated by one-way ANOVA and the WG_1 and WG_5 were found statistically significant ($p<0.05$). WG_1 of single borns were higher than twin borns, although twin kids had higher weight gain in fifth month than single kids. Another interesting finding is that single born kids had higher weight gain than twin born kids until LW_4.

The results of these analyses showed that single born kid's growth and development rate were faster than twin born kids. In addition, these results agree with the data given on Table 1.

Table 1: ANOVA analyses for all investigated parameters for sex within birth type

Variable	Sig.	Variable	Sig.	Variable	Sig.
BW	0.045*	BL_1	0.104	HG_4	0.086
WW	0.035*	BL_2	0.076	$WTHJ_1$	0.591
LW_1	0.04*	BL_3	0.211	$WTHJ_2$	0.082
LW_2	0.013*	BL_4	0.035*	$WTHJ_3$	0.197
LW_3	0.013*	HS_1	0.156	$WTHJ_4$	0.268
LW_4	0.03*	HS_2	0.222	CD_1	0.3
LW_5	0.06	HS_3	0.055	CD_2	0.026*
HAW_1	0.242	HS_4	0.015*	CD_3	0.139
HAW_2	0.292	HG_1	0.193	CD_4	0.011*
HAW_3	0.01*	HG_2	0.09		
HAW4	0.0088*p	HG3	0.129		

p: Significance level obtained by permutation test; *: ($P<0.05$)

Table 2: Results of ANOVA analyses for all investigated parameters for sex

Variable	Sig.	Variable	Sig.	Variable	Sig.
BW	0.181	BL_1	0.024*	HG_4	0.025*
WW	0.243	BL_2	0.131	$WTHJ_1$	0.51
LW_1	0.23	BL_3	0.058	$WTHJ_2$	0.475
LW_2	0.173	BL_4	0.009*	$WTHJ_3$	0.106
LW_3	0.304	HS_1	0.072	$WTHJ_4$	0.059
LW_4	0.079	HS_2	0.096	CD_1	0.463
LW_5	0.026*	HS_3	0.013*	CD_2	0.021*
HAW_1	0.266	HS_4	0.06	CD_3	0.071
HAW_2	0.213	HG_1	0.245	CD_4	0.032*
HAW_3	0.045*	HG_2	0.206		
HAW_4	0.035*	HG_3	0.334		

*: ($P<0.05$)

Permutation test was evaluated to avoid Type I and Type II errors on some variables as HAW_4, BL_2, HS_3, HG_4 and LW_5 for birth type and BL_3, HS_1, HS_4, $WTHJ_4$ and DC_3 for sex because these significance levels were very close to the selected significance threshold ($\alpha = 0.05$). Only HAW_4 was statistically significant by permutation test. Here, the null hypothesis was rejected by permutation test but accepted by one-way ANOVA and Type II error was avoided by permutation test.

To determine correlation coefficient between BW and WW, Pearson correlation method was used and the obtained results of this correlation coefficient is found 0.558 and $p = 0.001$. This result shows that WW increases 0.558 units versus one unit increase of BW. Effect of sex on various parameters were appreciated by one way ANOVA and the results are given in Table 2.

Growth performance: Growth performance data including mean birth weights, live weights and standard derivation were given in Table 3. The birth weight of the kids were found 3.55±0.15, 3.54±0.25, 2.93±0.15 and 3.28 ±0.09 kg for single females and males and for twin females and males, respectively.

Live weight values of the kids at 1st, 2nd, 3rd, 4 and 5th months of age were lower than by Cagraş *et al.*[3] d higher than Cengiz *et al.*[4] findings. For 3rd and 6th months live weight, our findings were higher than by Tuncel *et al.*,[5].

Table 3. Birth weight and live weight from birth to 5th months of age of kids (kg)

Months	Sex	Birth type	n	Live weight $\bar{X} \pm S_{\bar{x}}$	Max	Min
BW	M	T	16	3.28±.0.09^{ab}	4.20	2.70
		S	5	3.54±0.25^{a}	4.30	3.00
	F	T	9	2.93±0.15^{b}	3.70	2.30
		S	4	3.55±0.15^{a}	4.00	3.30
1.	M	T	16	8.65±0.31^{bc}	11.00	6.70
		S	5	10.52±0.95^{a}	13.60	8.00
	F	T	9	7.62±0.30^{c}	9.40	6.50
		S	4	10.05±1.04^{ab}	11.90	7.20
2.						
	M	T	16	12.78±0.48^{ab}	16.50	9.00
		S	5	15.34±2.01^{a}	22.20	9.70
	F	T	9	10.72±0.58^{b}	12.60	7.00
		S	4	14.72±1.86^{a}	17.30	9.20
3.						
	M	T	16	16.23±0.63^{ab}	20.80	11.10
		S	5	19.58±2.79^{a}	29.50	12.40
	F	T	9	13.85±0.94^{b}	17.80	7.40
		S	4	19.52±1.66^{a}	22.70	15.00
4.	M	T	16	20.63±0.75^{ab}	25.40	16.00
		S	5	23.76±2.96 a	33.50	15.40
	F	T	9	17.54±0.93^{b}	22.00	12.00
		S	4	21.82±1.60^{ab}	25.20	17.60
5.	M	T	16	25.50±0.77	30.40	20.00
		S	5	28.34±2.92	37.20	19.70
	F	T	9	23.48±0.93	29.00	20.00
		S	4	21.37±2.96	30.00	16.50

[a, b] Least square means in same month rows at birth type column with different alphabets are statistically significant ($p<0.05$) M: Male; F: Female; T: Twin and S: Single

Birth weight for birth type was found significantly until 5th month ($p<0.05$). Single kids showed a faster growth rate than twins in both sexes however, after 3rd month an obvious deficiency of live weight in single female kids was observed Fig. 1. This weight lose may be a result of some stress factors, such as weaning shock. Male kids were not affected negatively during weaning. Live weight of twin and single males increased linearly during the trial period. The birth weight values of the kids were similar of Ugur *et al.*[5], Tuncel *et al.*[6] and Yargıcı *et al.*[7], higher than those reported by Cengiz *et al.*[4] and lower than by Morand-Fehr *et al.*[8] and Cagraş *et al.*[3].

Birth type was found significant after third month for height at withers ($p<0.05$). On third and fourth month single males are separated with the highest mean from the others, the lowest mean observed in twin female kids during this period Table 4. It is evident that after first month a concrete increase comes in sight in single male kids Fig. 2.

Findings for height at withers in fourth month was lower than by Cagraş *et al.*[3], for first month were higher than by Cengiz *et al.*[4] and single kids height at withers on third month were higher than and twins which are similar to the findings of Cengiz *et al.*[4].

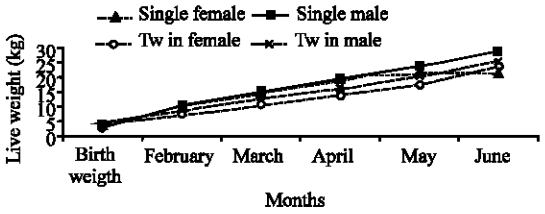

Fig. 1: Live weight curve of kids during the trial

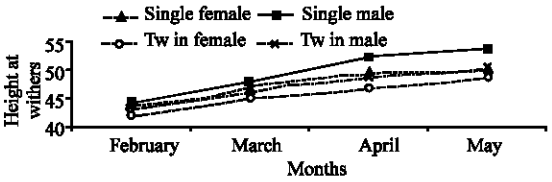

Fig. 2: Height at withers curve of kids during the trail

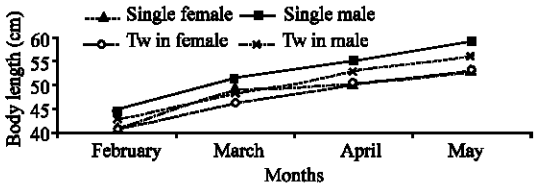

Fig. 3: Body length curve of kids during the trail

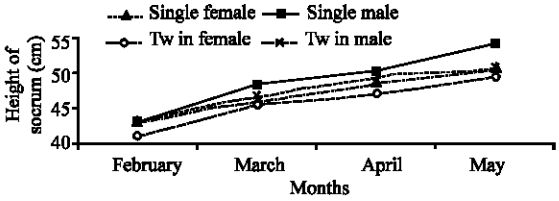

Fig. 4: Height of socrum curve of kids during the trail

As can be seen from Table 4, body length for birth type was found only in 4th month significantly ($p<0.05$). A linear increase was observed on body length in twin and single males. Similar patterns were also observed in height at withers and live weight. Another noticeable finding is that single female kids had a faster growth rate than twin females until second month however, after second month body length of single females keep going stabilized and caught the twins on the fourth month Fig. 3. Body length values were found higher than Cengiz *et al.*[4] and lower than by Cagraş *et al.*,[3].

Height of socrum found only in fourth month significantly as in body length ($p<0.05$). Only single males were separated from others in terms of height of socrum. Twin females and single males showed irregular but continuous increase during the experiment. It is evident that single females and twin males have a similar growth curves Fig. 4.

Table 4: HAW, BL, WTHJ, HO and CD of kids in different ages

Months	Sex	Birth	n	Height at withers $\bar{X} \pm S_{\bar{x}}$	Body length $\bar{X} \pm S_{\bar{x}}$	Width through hip joints $\bar{X} \pm S_{\bar{x}}$	Hearth girth $\bar{X} \pm S_{\bar{x}}$	Height of sacrum $\bar{X} \pm S_{\bar{x}}$	Chest depth $\bar{X} \pm S_{\bar{x}}$
1.	M	T	16	43.34±0.58	43.03±0.58	12.06±0.18	49.28±0.90	43.43±0.54	16.00±0.33
		S	5	44.30±1.11	44.60±1.16	12.00±0.68	51.40±2.15	43.20±1.77	16.00±0.70
	F	T	9	41.83±0.82	41.00±1.31	11.50±0.58	47.22±0.87	41.22±0.54	15.22±0.40
		S	4	44.25±1.65	41.25±0.47	12.37±0.23	50.50±2.06	43.25±0.75	16.62±0.37
2.	M	T	16	46.56±0.59	48.65±0.89	14.09±0.13	58.40±1.03^{ab}	46.90±0.64	19.34±0.26^{ab}
		S	5	47.60±1.20	51.60±1.57	14.60±0.18	62.20±2.81^{a}	48.50±1.26	20.60±0.40^{a}
	F	T	9	45.11±0.87	46.44±1.01	13.44±0.46	54.55±1.35^{b}	45.77±0.43	18.50±0.45^{b}
		S	4	47.00±1.08	49.50±1.84	15.00±1.06	62.50±1.92^{a}	46.00±1.47	18.75±0.85^{b}
3.	M	T	16	48.62±0.44^{bc}	52.90±1.09	16.06±0.44	65.03±1.06	49.62±0.58	22.75±0.51
		S	5	52.20±1.31^{a}	55.20±2.41	16.80±1.01	68.00±2.96	50.40±1.02	23.40±0.67
	F	T	9	46.77±0.52^{c}	50.44±1.41	14.66±0.68	61.77±2.18	47.11±0.63	21.22±0.59
		S	4	49.50±1.65^{b}	50.50±1.55	16.12±0.77	68.25±2.78	48.75±1.79	22.75±0.47
4.	M	T	16	50.43±0.56^{b}	56.25±1.03^{ab}	15.56±0.47	70.31±1.41	50.93±0.56^{b}	23.37±0.38^{ab}
		S	5	53.80±1.31^{a}	59.00±2.42^{a}	16.10±1.24	70.00±2.73	54.20±1.28^{a}	24.60±0.74^{a}
	F	T	9	48.66±0.60^{b}	53.11±0.69^{b}	14.33±0.40	64.66±1.06	49.55±0.53^{b}	21.77±0.49^{b}
		S	4	50.25±1.84^{b}	53.25±1.37^{b}	14.75±0.47	68.75±2.83	50.75±1.88^{b}	23.75±0.47^{a}

^{a,b} Least square means in same month rows at birth type column with different alphabets are statistically significant ($p<0.05$)

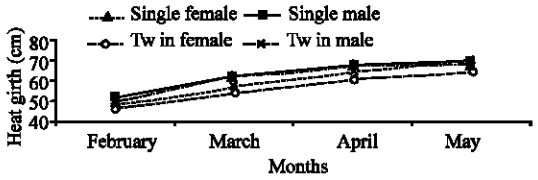

Fig. 5: Heart girth curve of kids during the trail

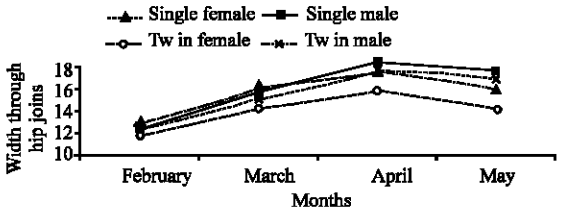

Fig. 6: Width through hip joints curve of kids during the trail

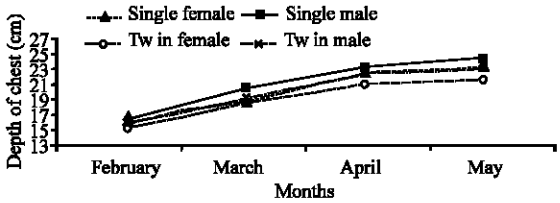

Fig. 7: Chest depth curve of kids during the trail

When birth type factor examined for heart girth, statistical significance ($p<0.05$) were found only in second month Table 4. Twin females showed lower development in comparison to the others during the trial period Fig. 5.

Another remarkable point was that twin males took place in crossing group between twin females and single males and females. The results of the study were higher than those reported by Cengiz *et al.*[4] and for the 4th month are consistent with those reported in the literature Cagraş *et al.*,[3].

There were no statistical differences for width through hip joints among all sexes and birth type ($p<0.05$). All kids showed a regular increase until third month however, a notable decrease was observed in April for all kids Fig. 6. This result may have a relation with weaning shock.

Statistical differences of chest depth on birth type were found only in second and fourth month ($p<0.05$). All groups that were undertaken, showed a linear increase in chest depth until third month, but after third month a constant progress took place for all kids Fig. 7. The results of the present study for fourth month were lower than by Cagraş *et al.*[3] and higher than the findings of Cengiz *et al.*[4] for first and third months.

CONCLUSION

The results obtained that, single males had shown a higher growth rate than twin males and both birth type for females. The single female kids were more affected from weaning shock than the others, however this trouble can be improve by better feeding and management techniques. It is obvious that the highest growth rate was observed between first and second months for all groups in all interested characters. WTHJ was affected negatively immediately afterwards weaning for all groups. The highest weight gain was observed between birth and first month except twin females which has shown the highest weight gain between 4 and 5th months. It must be considered that feeding and raising animals from birth to weaning is very important to avoid the weaning shock which must be worth of investigation in the future. The

obtained results indicates that to improve the genetic potential of Cukurova and Taurus crossbred goats, Saanen breed gave us very important tips in terms of growth and development.

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