

DYNAMIC OF BODY WEIGHT EVOLUTION OF CARPATHIAN KIDS GOAT AND KIDS BREED GOAT (♂SAANEN X ♀CARPATHIAN) FROM BIRTH TO WEANING

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Abstract

The application of modern goat breeding systems implies the addition of the classical methods used to improve the genetic potential with methods of appreciation of the hereditary base and their productive capacity. The purpose of this paper was to highlight the particularities of the evolution of the body weight from birth to the weaning of the kids goat Carpathian and kids goat breeds (Saanen male and Carpathian female), established according to three main factors: parturition type, the sex of the kid goat and the status physiology of the mother goats. The study was conducted in a farm in the Trascău mountains area, locality Rimetea, county of Alba, during January-June 2019, where we monitored daily: the body weight and sex of kids goat at birth, type of birth and the age of the parturients. The working method consisted of daily monitoring and weighing the kids goat studied with an electronic scale with an accuracy of: 5 g (0.5 g-10 kg); 10 g (10-50 kg). The obtained results have been statistically processed, being beneficial in making faster and more efficient decisions in the selection and improvement process.

Key words: body weight, Carpathian goat, daily average gain, goat breeds (Saanen male and Carpathian female).

INTRODUCTION

In Romanian agriculture goat breeding have a great economic importance, especially in mountainous and hilly areas where goats are raised, by improving their productivity through genetic selection and breeding (Răducuță et al., 2007).

The Carpathian goat is a traditional breed of goats raised in most farms in Romania, being largely influenced by the climatic conditions of the breeding areas and represents 80% of the goat herd raised in Romania (Vlaic et al., 2016; Bacilă, 2014).

Analyzing the morphs-productive level of a nucleus of goats from the Carpathian breed, it was established that it is extremely heterogeneous, there being no selection procedure, which led to the decrease of number of animals on the farm (Dărăban, 2008).

The Carpathian goat is considered to be a breed with low performance, but nevertheless has a very good resistance and adaptability. The

studies relive that performance of Carpathian goat have an modest production levels, with milk production from 220 to 350 kg/lactation, prolificacy of 130-160% and daily average gain for goats kids from 90 to 110 g/day (Pădeanu, 2001; Voia et al., 2010).

The Saanen breed is increased in purebred in largest farms, while in small farms it is increased for used to cross with the native Carpathian breed to improve milk production and the conformation of the udder (Kusza et al., 2018).

An improvement program is necessary from the goat populations in Romania in order to increase the productive parameters of goats (Cighi, 2007).

The Research and Development Institute for Sheep and Goat Breeding Palas has started a project to improve milk production in local goat populations by crossing with the best specialized breeds during the years 2006-2010 presented in Table 1 (ICDCOC Palas, 2010).

Table 1. The main morpho-productive indices for Carpathian breed and for cross-breed

	<i>Weight at birth (kg/head)</i>	<i>Weight at 28 days (kg/head)</i>	<i>Total average gain in first month (kg/head)</i>	<i>Daily average gain in first month (g/head)</i>	<i>Weight at 56 days (kg/head)</i>	<i>Total average gain in 28-56 days (kg/head)</i>	<i>Daily average gain in second month (g/head)</i>	<i>Total average gain at birth- to 56 days (kg/head)</i>	<i>Average gain to birth - to 56 days (g/head)</i>
Saenen x Carpathian	2.73	7.32	4.68	167	11.19	3.85	138	8.46	151
Carpathian	2.64	6.79	4.07	146	10.40	3.49	125	7.76	138
Difference ± between cross-breed and Carpathian goat									
Absolute values	+0.09	+0.53	+0.61	+21	+0.79	+0.36	+13	+0.7	13
%	+3.41	+7.81	+8.63	+14.38	+7.59	+10.3	+10.4	+9.0	+9.42

In the case of Saenen goats, their age and type of birth are significant on the weight birth kid goat ($P < 0.01$, $P < 0.05$). The type of birth and the sex of the product are significant for the weight at weaning and the growth rate of the kid goat ($P < 0.01$). The average birth weight recorded values of 3.06 kg, respectively 12.91 kg average weight at weaning (Duygu, 2010). During lactation period (56 days) the cross-breed goats kids achieved an total average gain and an average daily gain higher by 9% and 9.42% compared to the Carpathian kids, respectively, proving a better conversion capacity of milk (ICDCOC Palas, 2010).

MATERIALS AND METHODS

The study was conducted in a farm, individual enterprise Cătălin Avram, in the Trascău mountains area, Rimetea, county of Alba, during January - June 2019, on Carpathian kids goat and cross-bred (Saenen male and Carpathian female) kids goat.

In order to assess the main characteristics regarding the morphological particularities of the kids goat, in relation to the type of birth and their sex, the body weights were determined by daily weighing, highlighting the weight at birth, at 28 days and at 56 days.

Measurements were made in the morning, every day, usually at the same time, using an electronic scale an accuracy of: 5 g (0.5 g-10 kg); 10 g (10-50 kg).

After birth, the goat kids were individualized: in the first 7 days of life with a Tyvek bracelet applied around the neck on which was inscribed the identification number of the mother and the type of birth (single, twin,

triplet). After the first 7 days of life, the goat kid was individualized by a blind ear tag with the identification number of the mother goat. The growth evolution was estimated using the following growth indices:

- Growth energy (E);
- Growth rate: absolute (A) and relative(R);
- Growth intensity (I);
- Growth factor (F);

Growth energy represents the overall growth potential from birth to adult stage. The growth rate, absolute and relative, represents the average body mass accumulation recorded by the animal between two determinations (1) and (2).

The increase in body mass over a certain period of time (t) is growth intensity (3). The growth factor is the mass achieved in a given growing period (Mt) of the final animal mass (Mf) expressed as a percentage (4) (Dărăban, 2006).

$$A = \frac{M_2 - M_1}{t} \quad (1);$$

$$R = \frac{M_2 - M_1}{M_1} * 100 \quad (2);$$

$$I = \frac{M_2 - M_1}{M_2 + M_1} * 2 * 100 \quad (3);$$

$$F = \frac{Mt * 100}{Mf} \quad (4).$$

Where:

M_1 = body mass at t_1 (kg);

M_2 = body mass at t_2 (kg);

M_t = body mass accumulation in a period of time (kg);

M_f = final body mass (kg);

t = time period between t_1 and t_2 (days);

The obtained data were centralized and statistically processed with Excel program and GraphPad, T test and ANOVAs test was used to calculate the significance of the differences between the kids goat weigh.

RESULTS AND DISCUSSIONS

The analysis of the concentration of ruminal microflora in the fattening systems of small ruminants indicates differentiated values on the fattening phases, a large number of bacteria in the growth phase after which they register a decrease in the finishing phase, these being correlated with the accumulation of body mass (Mireşan et al., 2008).

The Carpathian goat analyzed in this study (N = 150) and the analyzed cross-breed goat (Saanen male and Carpathian female) (N = 70) were raised at the same farm, so they benefited from the same climatic conditions and the same type of food. From all parturients we identified simple birth, twin birth, triplet birth (Figure 1).

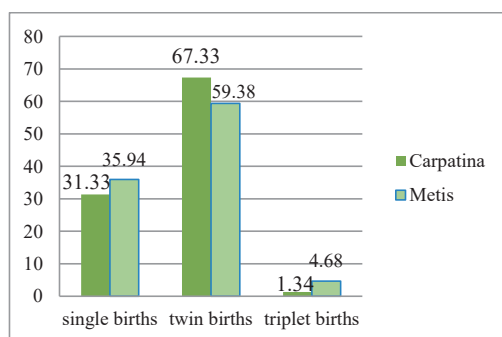


Figure 1. Number of single, twin, triplet births (%) for Carpathian goat and ♂Saanen x ♀Carpathian goat

Twin births are predominant for Carpathian goats, but also for cross-breeds goats. The literature reports in a study conducted on the Carpathian breed a percentage of 56.6% single births, 33.3% twin births, 6.6 triple births and 3.3% quadruple births (Răducuță et al., 2007).

The high percentage of female products represents an advantage for the farm because the selection can be made much more rigorously, but also males obtained annually have an economic advantage for the farm because they accumulate body mass in relatively less time than females.

The number of female kids goat reported in this study for breed and cross-breed was higher than of males, predominantly for Carpathian breed than for cross-breed (Figure 2).



Figure 2. Percentage ratio of females (F) and males (M) for Carpathian and SaanenxCarpathian kids goat

Regarding the intensity of the growth kids goats, the same increasing trend is observed for the breeds and the cross-breeds, with similar values, having an average daily increase of 120.10 g for the Carpathian breed and 121.15 g for the ♂Saanen x ♀Carpathian cross-breeds in the 56 days (Figure 3).

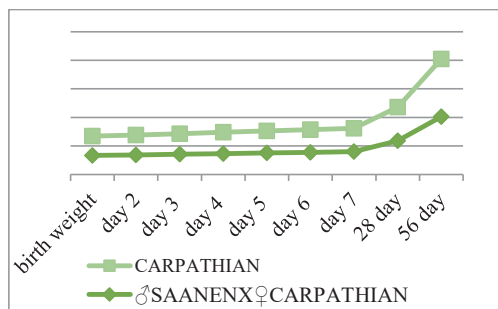


Figure 3. Daily average gain (0-56 days) for Carpathian and ♂Saanen x ♀Carpathian

During a lactation period (56 days) the cross-breed kids goat achieved a total weight gain and an average daily gain higher by 9% and 9.42% compared to the Carpathian kids goats, proving a better capacity to convert milk to body mass (ICDCOC Palas, 2010).

The birth weight of goats kids, the coefficient of variation, the minimum and maximum values and the significance of the statistical differences registered in 2019, for Carpathian breeds and cross-breeds Saanen x Carpathian are shown in the table below (Table 2).

Table 2. The average birth weight (kg), the coefficient of variation, the minimum and maximum values, confidence interval and the significance of the statistical differences recorded for Carpathian goat and ♂Saanen x ♀Carpathian goat according to the type of birth and sex of goat kids (kg)

n	CARPATHIAN			♂SAANEN x ♀CARPATHIAN		
	47	101	2	23	44	3
type birth	single	double	triple	single	double	triple
MIN	3.14	2.4	2.76	2.83	2.36	2.85
MAX	4.67	3.97	2.86	4.98	4.45	3.35
MEAN	3.936	3.138	2.81	3.715	3.188	3.037
SD	0.3687	0.3567	0.07071	0.5572	0.4717	0.273
CI 95%	3.828 - 4.044	3.068 - 3.209	2.175-3.445	3.474-3.956	3.045-3.332	2.358-3.715
V%	9.367%	11.37%	2.516%	15.00%	14.80%	8.990%
p value	<0.0001		****	0.0003		***
n	30		120	26		44
sex	M		F	M		F
MIN	2.89		2.4	2.43		2.36
MAX	4.67		4.35	4.98		3.98
MEAN	3.912		3.252	3.577		3.224
SD	0.5294		0.4245	0.6842		0.4127
CI 95%	3.715-4.110		3.175-3.328	3.3-3.853		3.098-3.349
V%	13.53%		13.05%	19.13%		12.80%
p value	<0.0001		****	0.0089		**

ns - p<0.5; *p>0.5;**p>0.1; ***p>0.01; M - male; F - female; V - coefficient of variation; CI - confidence interval; MEAN - average; SD - standard deviation.

Birth weight was influenced by the type of birth and the sex of the products, because was significant differences between the Carpathian breed and the Saanen and Carpathian cross-reed.

Birth weight recorded higher values for crossbreeds, with significant differences depending on the type of birth, a higher birth weight is recorded by kids goats resulting from single birth, then from twin birth and triple birth.

In addition to the factors studied, growth technology, maintenance level and microclimatic factors influence the growth and development of the kids goats from birth to weaning. The coefficient of variation recorded higher values for cross-breed goats than Carpathian goats.

The sex of kids goat significantly influenced the weight at birth, males birth weigh was more

influnced than females, but also males obtained by cross-breeding had a higher birth weight than males obtained from the Carpathian breed. The kids goats from simple birth have a better growth rate (Pascal et al., 2011).

The average value of weights, absolute growth rate (A), relative growth rate (R), growth intensity (I) and growth coefficient (F) in the first 28 days were analyzed because the maternal factor has a special importance in this period. The same parameters mentioned above were analyzed for a broader view of the results (Table 3).

Between day 28 and day 60, the influence of the maternal factor decreases even more compared to the first 28 days of life. Accumulation of body mass after the 28th day is obtained by consuming goat milk and additional feed (Călin et al., 2015).

Table 3. Variation of growth indices calculated according to type of birth, kids goat sex for Carpathian goat and ♂Saanen x ♀Carpathian goat to birth et 28 days and to birth at 56 days

Trait	n	W (kg)	A (g)	R (%)	I (%)	F (%)		
							X ± sX	X ± sX
		V%	V%	V%	V%	V%		
CARPATHIAN	0-28 days	150						
	birth type	S	47	7.211±0.57	117±18.98	84.3±18.01	58.78±8.47	45.27±4.97
				7.97	16.23	21.37	14.41	10.99
		D	101	6.51±0.66	120±20.04	108.9±21.76	69.88±9.22	54.61±5.16
	T			10.21	16.64	19.98	13.19	9.99
		2	6.16±0.23	229.4±5.933	118.9±2.92	74.57±1.15	54.32±0.62	
			3.79	4.97	2.45	1.54	1.13	
	Level of segnificance			****	ns	****	****	****
	sex	M	30	7.32±0.67	121.5±19.56	89.11±21.17	60.95±9.74	46.51±5.64
				9.12	16.1	23.76	15.98	12.13
F		120	6.58±0.647	118.8±19.63	104.4±23.14	67.84±10.04	50.45±5.68	
			9.84	16.53	22.17	14.8	11.26	
Level of segnificance			****	**	ns	***	***	
♂SAANEN X ♀CARPATHIAN	0-28 days	70						
	birth type	S	23	7.1±0.57	120.8±8.05	93.16±15.58	63.19±7.25	47.91±4.20
				7.99	6.66	16.72	11.48	8.77
		D	44	6.60±0.45	121.8±7.69	109.7±19.80	70.33±8.08	51.90±4.40
	T			6.88	6.31	18.05	11.49	8.48
		3	6.23±0.096	113.9±8.75	106±16.54	69.06±7.30	51.26±4.10	
			1.55	7.68	15.59	10.58	7.99	
	Level of segnificance			***	ns	**	**	**
	sex	M	26	6.91±0.69	119.1±7.08	96.89±21.02	64.65±9.10	48.69±5.12
				10.09	5.94	21.7	14.08	10.52
F		44	6.65±0.41	122.3±8.19	108.3±17.84	69.86±7.36	51.67±4.02	
			6.19	6.69	16.46	10.54	7.79	
Level of segnificance			ns	ns	*	*	**	
CARPATHIAN	0-56 days	150						
	birth type	S	47	10.53±0.98	117.8±16.47	169.3±29.21	91.05±8.39	62.45±3.94
				9.28	13.98	17.25	9.22	6.32
		D	101	9.91±1.05	120.9±17.82	218.9±41.22	103.6±9.36	68.13±4.098
	T			10.63	14.74	18.83	9.03	6.02
		2	10.11±0.46	130.3±9.47	259.9±25.41	112.9±4.82	72.15±1.97	
			4.55	7.27	9.78	4.27	2.73	
	Level of segnificance			**	ns	****	****	****
	sex	M	30	10.82±1.08	123.3±18.21	180.4±39.3	93.81±10.43	63.69±4.79
				10.02	14.77	21.79	11.11	7.53
F		120	9.93±0.98	119.3±17.11	209.8±43.91	101.3±10.42	67.08±4.64	
			9.89	14.35	20.93	10.29	6.91	
Level of segnificance			****	ns	**	***	***	

Trait	n	W (kg)	A (g)	R (%)	I (%)	F (%)		
		X ± sX	X ± sX	X ± sX	X ± sX	X ± sX		
		V%	V%	V%	V%	V%		
0-56 days	70							
♂SAANEN X ♀CARPATHIAN	birth type	S	23	10.48±0.66	241.7±16.11	186.4±31.12	95.83±8.39	64.68±3.86
				6.31	6.67	16.7	8.76	5.97
		D	44	10.01±0.53	243.6±15.35	219.4±39.57	103.8±8.79	68.23±3.81
			5.3	6.3	18.04	8.48	5.59	
	T	3	9.41±0.26	227.7±17.74	212.1±33.25	102.5±8.25	67.70±3.663	
			2.78	7.79	15.68	8.05	5.41	
Level of significance			***	ns	**	**	**	
sex	M	26	10.25±0.77	238.3±14.19	193.8±42.02	97.38±10.24	65.34±4.59	
			7.48	5.96	21.68	10.51	7.03	
	F	44	10.08±0.52	244.7±16.34	216.7±35.63	103.3±8.04	68.05±3.49	
			5.19	6.68	16.44	7.78	5.13	
Level of significance			ns	ns	*	**	**	

ns - p<0.5; *p>0.5;**p>0.1; ***p>0.01; X - average; sx - standard deviation; V - coefficient of variation; S - single; D - twin; T - triple; M - male; F - female; W - body weight; A - absolute growth rate; R - relative growth rate; I - growth intensity; F - growth factor.

The values obtained are comparable to those presented by the Palas Sheep and Goat Breeding Research and Development Institute, with the mention that the goat studied in this paper had significantly higher values at birth weight. Goat kids from a single birth accumulated significantly higher body mass than goats kids from multiple birth. The kids goat male have a significantly higher body mass than kids goat females; Carpathian kids had superior results then cross-breed kids.

CONCLUSIONS

The improvement of current breeding and exploitation technologies have as a starting point the adaptive reaction of animals to the environmental conditions in which they live. Whatever the growing system are, a valuable biological material adds value to the farm, through a rigorous selection and improvement of genetic material.

The study of Carpathian kids goat and cross-breed kids goat provides us an informational basis for progress, because some of the studies showed the heterogeneity of the Carpathian breed.

Breed, type of birth, sex of kids goat, maintenance and feeding conditions have an important impact regarding the birth weight and weaning weight of the kid goat.

The data obtained are characteristic of the breed and cross-breed, resulting are compatible with those presented in the literature.

REFERENCES

- Bacila, V. (2014). *Technical Informative Bulletin*, No.1, Ministry of Agriculture and Sustainable Development – National Agency for Breeding and Reproduction in Animal Husbandry “Prof.dr. G.K. Constantinescu” (ANARZ), București.
- Călin, I., Răducuță, I., Dărăban, S., Vlad, I., Prișecanu, H., Pascal, C., Padeanu I. (2015). Research On Quantitative Skills in Meat Production Direction at Youth Goats from Carpathian Breed in Relation with the Rearing System. *Agriculture and Agricultural Science Procedia*, 6, 191–196.
- Cighi, V. (2007). Study on the main body conformation traits of a Carpathian goat population. *Bulletin USAMV- CN*, 63–64.
- Dărăban, S. (2006). *Sheep breeding technology*. Cluj-Napoca, RO: Risoprint Publishing House, pp. 70-75.
- Dărăban, S. (2008). The morpho - productive characteristics of a Carpathian breed goat nucleus, bred in Toplita locality, Harghita county. *Bulletin UASVM Animal Science and Biotechnologies*, 65, 1–2.
- Duygu, I. (2010). Reproduction performance of Saanen goats raised under extensive conditions. *African Journal of Biotechnology*, 9(48), 8253–8256.
- I.C.D.C.O.C. Palas., (2008). Improving milk production in goat populations by crossing with the best specialized breeds. *Research report, Sector Stage Project V*, Constanța.
- Kusza, S., Toma, L., Ilie, D., Sauer, M., Padeanu, I., Gavojdian D. (2018). Kompetitive allele specific

- PCR (KASP™) genotyping of 48 polymorphisms at different caprine loci in French Alpine and Saanen goat breeds and their association with milk composition, *PeerJ*, 6, e4416.
- Mireșan, V., Răducu, C., Dărăban S. (2008). Research concerning the ruminal microflora in intensive fattening young sheep. *Bulletin UASVM Animal Science and Biotechnologies*, 65(1-2).
- Pascal, C., Pădeanu, I., Călin, I., Daraban, St., Nacu, G. (2011). Researches related to meat yield aptitudes of Carpatina breed reared in Romania - *Lucrări Științifice, Seria Zootehnie*, 55, 328–331.
- Pădeanu, I. (2001) Sheep and goat breeding technology. Timisoara, RO: Mirton Publishing House, pp. 373–375.
- Răducuță, I., Marmandiu, A., Stanciu, M., Cristian, C. (2007). The evolution of livestock, milk and goat cheese production in the European countries. *Acta Universitatis Cibiniensis, Agricultural Sciences*, 1 (7), 127–134.
- Răducuță, I., Marmandiu, A., Cristian, C., Grigoraș, G., Iftimie N. (2007). Research regarding the morpho-productive parameters to the Carpathine goat breed from Slobozia-Ialomița area. *Acta Universitatis Cibiniensis, Agricultural Sciences*, 1(7), 121–126.
- Vlaic, A., Odagiu, A., Vlaic, B., Dărăban, S., Coșier, V., (2016) Biometric Approach of Carpatina Goats Reared in South Romania Climate, *ProEnvironment*, 9, 192–196.
- Voia, S., Pădeanu, I., Daraban, S., Mot, T., Dronca, D., Pet, I., Gavojdian, D., Ivan, M. (2010). Study Regarding Goat Milk Composition and the Growth Rate in Kids of Carpatina Goat Breed. *Animal Science and Biotechnologies*, 43(2), 324–327.