Researches Concerning Body Development of Carpatina Purebreds and Boer Crossed Goats

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Abstract
Researches were carried out at the Institute of Research and Development for Sheep and Goat Breeding from Palas - Constanta, situated in Eastern Romania. A comparative study was implemented concerning body development of four adult goat genotypes, as follows: Carpatina purebreds (n=25) and 74 crossbred goats, with different gene inputs from the South African Boer breed, F_1 Boer x Carpatina, R_1 Boer x (Boer x Carpatina) and R_1 Carpatina x (Carpatina x Boer). In order to evaluate the body development of the adult goats from the four genotypes, several body measurements were taken, following aspects such as the animal's height and body length, width and circumference measurements, with the purpose to calculate indices which to define the hindquarter's muscling indexes. Results have shown that between the Carpatina goats and those with 25% input genes from the Boer breed, the differences regarding the body weight and muscling indexes were not significant ($p>0.05$). F_1 Boer x Carpatina crossbreeds had the body width and the hindquarters muscling indexes significantly higher ($p\leq0.001$) in both does and bucks, when compared to Carpatina. R_1 goats having 75% input genes from the Boer breed had significantly higher ($p\leq0.001$) body measurements when concerning the hindquarters muscling indexes, compared to Carpatina purebreds. Results suggest that Boer back-crossing the indigenous Carpatina has the potential to increase both quantity and quality of the goat meat production.

Keywords: body measurements, body weight, Boer, Carpatina, crossbreeding.

1. Introduction

The orientation and the development of breeding goats for the meat production was determined by the requirement of light meat from the food market, there being policies of implementing a diet nutrition, limited in fats and especially saturated lipids. During the last years there was noticed a raise in the interest for the goat meat which, according to the made studies [1] assures proteins with biological value and healthy fats due to a high proportion between the saturated and unsaturated fat acids and a low content of cholesterol. It was stated that this meat has the fat content lower with 50-65% besides beef, lower with 42-59% besides lamb meat with 25% besides venison; also, the quality of fat is better, respectively, the content of the saturated fat acids is lower with 40% besides chicken, without skin, and the comparisons made with beef, pork or lamb reveal the fact that it has with 85, 110 and respectively 90% fewer saturated fat acids.
The research developed in China [2] regarding the ideal content in amino acids, comparatively to the FAO norms showed the following: the meat of the half-bred from F_1 Boer x Yellow Nanjiang local breed, contains essential amino acids, arginine, methionine, threonine in significantly bigger

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quantities besides the norms indicated by FAO, and the content of essential amino acids, histidine, isoleucine and lysine represent 90% besides FAO norms. All these, correlated to the low quantity of fats, the lower content of saturated fat acids with small quantity of fats, low content of saturated fat acids and low quantity of cholesterol (by some research even lack of cholesterol) make from the goat meat (especially that from the half-bred with Boer breed) a valuable, dietetic product, recommended in the human alimentation.

In the west countries there is an orientation of the goat breeding for the meat production, here being applied programs of genetic improvement of the goat effectives for increasing the meat production, the practical solution which is generally proposed being that of crossbreeding the local breeds with imported improving breeds for the meat production.

We can certainly state that the goat meat industry is continuously ascending but nowadays there are a few breeds that are specialized for the meat production [5-8]. Taking these into consideration, under the name of „meat goat" we can also include some combinations between other goat breeds (for milk or wool) and breeds that are specialized for meat as Boer breed, Spanish Goat, Tennesse, Nubian and Pygmy.

2. Materials and methods

The researches were made on an effective of 25 adult goats from Carpathian breed comparatively to 92 hybrid goats of Boer x Carpathian in three variants (25% Boer, 75% Carpathian; 50% Boer, 50% Carpathian; 75% Boer, 25% Carpathian) belonging to ICDCOC Palas Constanţa.

On this effective the following works were made:

- Individual weightings;
- Body measurements;
- Establishing certain format and constitutional indicators;
- Differentiating the values of the characters of the hybrids besides the Carpathian per sexes, statistical processing of the data and interpretation of the differences through Fisher test;
- Individual weighting of the bucks and goats was with a mechanical weighing machine with a precision of ± 1 kg;
- Measurements of length and height were made with the zoometry machine;
- the measurements of width and depth were made with the compass;
- the measurements of the perimeters were made with the tailor's ribbon.

The following indicators were used:

Indicator of lateral body format:

$$I.l. = \frac{\text{oblique length of trunk}}{\text{height at top}} \times 100$$

(by Al. Furtunescu, 1958), [3]

Indicator of compactness:

$$I.c. = \frac{\text{thoracic perimeter}}{\text{oblique length of trunk}} \times 100$$

(by Al. Furtunescu, 1958), [3]

Indicator of bone system:

$$I.os. = \frac{\text{perimeter of shinbone}}{\text{thoracic perimeter}} \times 100$$

(by Al. Furtunescu, 1958)[3]

Indicator of mutton leg compactness:

$$I.c.j. = \frac{\text{width at the cox-femoral articulations}}{\text{length of mutton leg}} \times 100$$

(by E. Laville, 2002) [4]

Indicator of mutton leg muscularity:

$$I.m.j. = \frac{\text{perimeter of mutton leg}}{\text{length of mutton leg}} \times 100$$

(by G. Vicovan 2014, unpublished data)

- The oblique length of trunk was measured with the zoometry between the humeral-scapular articulation and the buttock point;
- The thoracic perimeter was measured with the ribbon immediately on the back of the shoulders;
- The perimeter of shinbone was measured with the ribbon at the right anterior leg in the middle of the shinbone;
- The width at the cox-femoral articulations was measured with the compass between the cox-femoral articulations;
- The perimeter of mutton leg was measured with the ribbon passing over the knee articulation and over the buttock point;
- The length of mutton leg was measured with the ribbon on the internal part of the right posterior

leg, between the Ischia -pubian Ischia and middle of the tibia - metatarsi articulation.

3. Results and discussion

In table 1 it is presented the body weight of goats depending on the category and breed.
From the table it is observed the hybrid R_1 bucks (75% Boer, 25% Carpathian) had the average body weight of 72.43 kg/head besides 52.33 kg/head at Carpathians, the difference being very significant.
The same thing is noticed also in the case of the R_1 hybrid goats (75% Boer, 25% Carpathian) which had the average body weight of 50.95 kg/head besides only 37.54 kg/head at the Carpathian goats, the difference between them being very significant.
In table 2 there are presented the main body dimensions at bucks depending on breed and the significance of the difference between them.
Differentiation besides Carpathian, were for width at shoulders (a) $p < 0.05$ (R_1 Boer besides Carpathian), width at cox-femoral articulations (b) $p < 0.001$ (F_1 Boer and R_1 Boer besides Carpathian) and perimeter of thoraces (c) $p < 0,05$ (R_1 Boer besides Carpathian).
From the table it result that at the hybrid F_1 bucks (50% Boer, 50% Carpathian) the width at shoulders was significantly bigger than that of the Carpathian ($p < 0.05$). Also, the width at the Cox - femoral articulations at the F_1 hybrids (50% Boer, 50% Carpathian) and R_1 (75% Boer, 25% Carpathian) was very significant besides their contemporaries from Carpathian breed.
From the same table it is noticed that the value of the perimeter of thoraces at the R_1 hybrids (75% Boer, 25% Carpathian) was bigger than that of Carpathian bucks, the difference being significant ($p < 0.05$).
In table 3 the main body dimensions at goats depending on breed the differences between them and their significances are presented.
Differentiation besides Carpathian: Width at shoulders (a) $p < 0.001$ F_1 Boer besides Carpathian; Width at cox-femoral articulations (b) $p < 0.001$ F_1 and R_1 besides Carpathian; depth of thoraces (c) $p < 0.05$ F_1 besides Carpathian; Width of thoraces (d) $p < 0.001$ F_1 besides Carpathian
Perimeter of thoraces (e) $p < 0.001$ F_1 besides Carpathian; Perimeter of shinbone (f) $p < 0.001$ F_1 besides Carpathian.
From the table it results that the width at shoulders at the R_1 hybrid goats (75% Boer, 25% Carpathian) was bigger than Carpathian, the difference being very significant ($p < 0.001$).
From the same table it is noticed that the width at cox-femoral articulations at the F_1 and R_1 hybrid goats was bigger than the Carpathian goats, the differences being very significant ($p < 0.001$).
At R_1 hybrid goats the width of thoraces was bigger than that of the Carpathian goats, the difference being significant ($p < 0.05$).
At the F_1 hybrid goats the width of thoraces was bigger than that of the Carpathian contemporaries, the difference being very significant ($p < 0.001$).
Also, the F_1 hybrid goats the perimeters of thoraces and shinbone bigger than the Carpathians, the differences being very significant ($p < 0.001$).
In table 4 the main body dimensions at bucks depending on breed the differences between them and their significances are presented.
Differentiations besides Carpathian: The indicator of lateral body format (a) $p < 0.05$ R_1 besides Carpathian; The indicator of mutton leg compactness (b) $p < 0.001$ F_1 and R_1 besides Carpathian; The indicator of mutton leg muscularity (c) $p < 0.001$ R_1 besides Carpathian.
From the table resulted the fact that only at the R_1 hybrid bucks (75% Boer, 25% Carpathian) the indicator of lateral body format had a bigger value comparatively to the contemporaries from Carpathian breed, the difference being very significant ($p < 0.05$).
Regarding the indicator of mutton leg compactness, the F_1 hybrids (50% Boer, 50% Carpathian) and the R_1 hybrids (75% Boer, 25% Carpathian) this having bigger values besides Carpathian , the differences being very significant ($p < 0.001$).
Regarding the indicator of mutton leg muscularity only the R_1 bucks (75% Boer, 25% Carpathian) had a bigger value of the indicator besides Carpathian, the difference being very significant.
In table 5 the body indicators at goats depending on breed the differences between them and their significances are presented.
Differentiations besides Carpathian were the indicator of mutton leg compactness (a) $p < 0.001$ F_1 and R_1 besides Carpathian.

The indicator of mutton leg muscularity (c) $p < 0.001$ F_1 and R_1 besides Carpathian.

From the table it is noticed the fact that both F_1 and R_1 hybrids are different from Carpathian goats regarding the indicator of mutton leg muscularity, differences from the Carpathian goats being very significant for both indicators ($p < 0.001$).

Table 1. The body weight of the adult goats depending on the category and breed

Breed (genome structure)	Category	n	X ± sx	V %	Differentiation besides Carpathian breed	
					± %	Signification
Carpathian	Bucks	3	52.33 ± 3.9290	13.01	-	-
	Goats	18	37.54 ± 2.4192	27.05	-	-
Boer 25% Carpathian 75%	Bucks	4	50.25 ± 4.3084	17.15	- 3.97	p > 0.05
	Goats	4	33.75 ± 1.7017	10.08	- 11.04	p > 0.05
Boer 50% Carpathian 50%	Bucks	7	62.29 ± 5.5494	21.50	+ 30.5	p > 0.05
	Goats	53	42.43 ± 1.3764	23.61	+ 11.83	p > 0.05
Boer 75% Carpathian 25%	Bucks	7	72.43 ± 2.6891	9.82	+ 35.75	p < 0.001
	Goats	19	50.95 ± 2.4369	20.85	+ 34.29	p < 0.001

Table 2. The main body dimensions at bucks

Dimension (cm)	Breed							
	25% Boer - 75 % Carpathian (n=4)		50% Boer – 50% Carpathian (n-7)		75% Boer – 25% Carpathian (n-7)		Carpathian (n-3)	
	X ± sx	V%	X ± sx	V%	X ± sx	V%	X ± sx	V%
Height at back	67.75 ± 2.015	5.95	69.21 ± 0.554	2.12	68.79 ± 0.950	3.66	69.67±1.922	4.78
Height at croup	67.25 ± 2.056	6.12	69.50 ± 1.367	5.21	68.92 ± 1.236	4.75	68.00 ± 1.527	3.84
Length of trunk	68.00 ± 0.736	4.33	78.57 ± 2.169	7.31	79.36 ± 1.950	6.50	72.33 ± 1.453	3.48
Width at shoulders	21.13 ± 0.515	4.88	24.79 ± 0.730	7.80	26.21 ± 0.829 (a)	8.38	22.50 ± 1.443 (a)	11.11
Width at cox-femoral articulations	20.00 ± 1.020	10.21	26.07 ± 0.882 (b)	8.96	25.57 ± 0.902 (b)	8.66	21.17 ± 1.166 (b)	9.55
Depth of thoraces	30.13 ± 1.161	7.71	34.00 ± 0.994	7.74	35.43 ± 1.355	10.12	34.50 ± 4.536	22.78
Width of thoraces	23.13 ± 1.390	12.02	28.21 ± 1.051	9.86	29.50 ± 0.534	4.79	27.00 ± 1.732	11.11
Perimeter of thoraces	88.75 ± 4.015	4.54	95.00 ± 3.007	8.38	100.29±2.699 (c)	5.33	90.33 ± 0.666 (c)	1.28
Perimeter of shinbone	10.38 ± 0.473	9.12	10.50 ± 0.327	8.25	10.07 ± 0.276	7.27	10.83 ± 0.881	14.10

Table 3. The main body dimensions at goats depending on breed

Specification	Breed			
	25% Boer – 75% Carpathian	50% Boer –50% Carpathian	75% Boer – 25% Carpathian	Carpathian
Indicator of lateral body format (I.l.)	100.37	113.52	115.37 (a)	103.82 (a)
Indicator of de compactness (I.c.)	130.51	120.91	126.37	124.88
Indicator of bone system (I.os.)	11.70	11.05	10.04	11.98

Table 4. The main body indicators at bucks depending on breed

Specification	Breed			
	25% Boer – 75% Carpathian	50% Boer –50% Carpathian	75% Boer – 25% Carpathian	Carpathian
Indicator of lateral body format (I.l.)	100.37	113.52	115.37 (a)	103.82 (a)
Indicator of de compactness (I.c.)	130.51	120.91	126.37	124.88
Indicator of bone system (I.os.)	11.70	11.05	10.04	11.98
Indicator of mutton leg compactness (I.c.j.)	75.82	93.81 (b)	114.21 (b)	72.18 (b)
Indicator of mutton leg muscularity (I.m.j.)	186.69	204.25	251.49 (c)	186.94 (c)

Table 5. The main body indicators at goats depending on breed

Specification	Breed			
	25% Boer – 75% Carpathian	50% Boer – 50% Carpathian	75% Boer – 25% Carpathian	Carpathian
Indicator of lateral body format (I.l.)	111.16	111.97	112.34	111.16
Indicator of de compactness (I.c.)	115.62	116.19	119.27	116.81
Indicator of bone system (I.os.)	10.74	10.30	9.78	10.23
Indicator of mutton leg compactness (I.c.j.)	69.23	78.76 (a)	90.55 (a)	67.84 (a)
Indicator of mutton leg muscularity (I.m.j.)	184.61	198.30 (b)	210.79 (b)	176.13 (b)

4. Conclusions

From the obtained data it results that the body development at the F_1 hybrids (50% Boer, 50% Carpathian) especially at R_1 (75% Boer, 25% Carpathian) fact that allows them to be exploited successfully for the meat production.

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