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Effect of divergent selection for the volume of thigh muscles based on computerised tomography on the carcass traits of rabbits (preliminary results)

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ABSTRACT

The aim of the study was to examine the efficiency of the selection based on CT measured thigh muscles with divergent selection method. Does of the first generation selected for high or low muscle volume were inseminated with the semen of similarly selected bucks at the same time. At 12 weeks of age 25–25 rabbits of similar body weight were slaughtered and dissected from both progeny groups (L: progenies of the rabbits selected for low volume of thigh muscles; H: progenies of the rabbits selected for high volume of thigh muscles). The gastrointestinal tract weight and its proportion within body weight were 38 g (P<0.05) and 1.2% (P<0.001) lower in H rabbits compared to L animals. Thus, the dressing out percentage in H rabbits was 2% higher (P<0.001). The proportion of the hind part within reference carcass was 1.2% (P<0.001) higher, while that of the fore part was 0.7% (P<0.05) lower in group H. The weight of hindleg meat in H rabbits was 33 g (P<0.001), while its ratio to reference carcass was 1.2% (P<0.001) higher than in L animals. Data of the experiment confirmed the efficiency of CT based selection for thigh muscles. Increasing the volume of hindleg muscles, the dressing out percentage improved as well. However, beside carcass traits, it would be interesting to study the productive traits of the progenies of the first and second generations selected divergently as well.
(Keywords: rabbit, computerised tomography, thigh muscles, two-way selection, carcass traits)

INTRODUCTION

At the University of Kaposvár the Pannon White rabbits are selected for carcass traits with the help of computerised tomography (CT). Previously, the selection was based on the cross-sectional area of the *m. Longissimus dorsi* (*Szendrő et al.*, 2005). The divergent selection (*Szendrő et al.*, 2005) or data analysis by BLUP and REML methods (*Nagy et al.*, 2006) proved the significant increase in carcass traits due to the selection. Comparing the progenies of Pannon White bucks to that of terminal bucks of different hybrids, higher dressing out percentage, higher amount of *m. Longissimus dorsi* and more muscles on hind legs were achieved in the progenies of Pannon White bucks as a result of CT based selection (*Metzger et al.*, 2006). As the weight of the hindleg meat is 2.3–2.5 times larger than that of the *m. Longissimus dorsi*, the base of the selection was changed in 2004; and since then the volume of thigh muscles has been estimated based on 11–12 CT scans. Divergent selection is one of the commonly used methods for examining the efficiency of the selection (*Baselga* and *Garcia*, 2002; *Pla*, 2004). Previously, the selection based on the *m. Longissimus dorsi* was also proven by divergent selection (*Szendrő et al.*, 1996).

The aim of our study was to examine the efficiency of the selection based on CT measured thigh muscles with divergent selection method.

MATERIALS AND METHODS

Animals

Experiment was carried out at the University of Kaposvár on Pannon White rabbits. One part of the breed was divergently selected for high or low volume of thigh muscles measured by computerized tomography (CT). The animals were weighed at 5 and 10 weeks of age, to calculate the average daily weight gain. Only rabbits showing higher body weight gain than the average (45.0 g for female and 47.6 g for male rabbits) were selected for the CT measurements. The CT scans were taken every 10 mm between *tuber sacrale* and *patella*. On the CT scans the muscle area was measured and the muscle weight was calculated. The estimated thigh weight of rabbits selected for high or low muscle volume was 353 and 309 g, respectively.

Divergently selected does of the first generation were inseminated with the semen of similarly selected bucks at the same time. Progenies (born at the same day) were divided into two groups:

- L: progenies of the rabbits selected for low volume of thigh muscles,
- H: progenies of the rabbits selected for high volume of thigh muscles.

Rabbits were weaned at 35 days of age. After weaning, they were reared in fattening cages made of wire mesh until slaughtering (2–3 rabbits per cage). The rabbit house had 15–16 °C average temperature, a 16L:8D lighting cycle and overpressure ventilation. Animals were fed a commercial diet (10.6MJ/kg DE, 16.0% crude protein, 3.0% ether extract, 16.0% crude fibre) *ad libitum*. Drinking water was available *ad libitum* from nipple drinkers.

Slaughtering and dissection procedure

At 12 weeks of age 25–25 rabbits of similar body weight were slaughtered and dissected according to the method of *Blasco* and *Ouhayoun* (1996). Rabbits were weighed immediately before slaughter, then killed by bleeding after electric stunning. Carcasses were chilled at 4 °C for 24 hours, then the chilled carcasses (together with head, heart, lungs, liver, kidneys, periscapular and perirenal fat) were weighed. The heart, lungs, liver and kidneys, and then the periscapular and perirenal fat were removed then weighed. The head was separated from the carcass and it was cut between 7th and 8th thoracic vertebrae and between 6th and 7th lumbar vertebrae, and thus the fore, intermediate and hind parts were obtained. Subsequently the hindlegs were weighed then deboned, and the meat on the hindlegs (HL) was weighed. The *m. Longissimus dorsi* (MLD) was removed from the intermediate part. The ratio of organs and carcass parts to body weight and to reference carcass weight (fore- intermediate and hind parts with fat depots) was calculated.

Statistical analysis

Experimental data were analysed using Independent Samples t-test of SPSS 10.0 program package (*SPSS* for Windows, 1999).

RESULTS AND DISCUSSION

The gastrointestinal tract weight (*Table 1*) and its proportion within body weight (*Table 2*) were 38 g (P<0.05) and 1.2% (P<0.001) lower in H rabbits, resp. Since this is the main loss during the slaughtering process, the dressing out percentage of group H was 2% higher (P<0.001) compared to L animals (*Table 2*).

Table 1

Effect of divergent selection based on CT measured thigh muscles on the weight of organs and carcass parts in the progenies of the first generation

Traits	Selection		Prob.
	L	H	
	mean ± SD	mean ± SD	
No. of rabbits	25	25	-
Body weight, g	3043 ± 140	3040 ± 162	0.941
Skin, g	444 ± 25.2	442 ± 40.0	0.814
Gastrointestinal tract, g	**561** ± 49.3	**523** ± 41.0	**0.005**
Chilled carcass, g	**1764** ± 93.9	**1826** ± 118	**0.046**
Liver, g	**95.6** ± 14.3	**84.9** ± 13.7	**0.010**
Kidneys, g	**19.9** ± 2.98	**17.7** ± 2.32	**0.005**
Heart and lung, g	24.1 ± 4.61	22.8 ± 3.15	0.230
Perirenal fat, g	29.9 ± 13.9	27.6 ± 11.3	0.529
Scapular fat, g	10.4 ± 4.83	8.96 ± 4.19	0.266
Head, g	**138** ± 7.69	**142** ± 7.84	**0.040**
Fore part, g	439 ± 30.6	449 ± 34.9	0.292
Intermediate part, g	*475* ± 33.6	*495* ± 39.7	*0.063*
Hind part, g	**538** ± 28.3	**579** ± 36.1	**0.000**
m. Longissimus dorsi, g	*205* ± 17.3	*216* ± 20.5	*0.055*
Hindleg meat, g	**405** ± 25.7	**438** ± 31.7	**0.000**

L: progenies of the rabbits selected for low volume of thigh muscles.
H: progenies of the rabbits selected for high volume of thigh muscles.

From the edible organs, the weight of liver and kidneys was 10.7 (P<0.01) and 2.2 (P<0.01) lower in H animals, resp. (*Table 1*). Neither the weight nor the ratio of fat depots changed due to the selection (*Table 1* and *Table 2*).

Examining the weight and the ratio of carcass parts, it can be established that the hind part of H animals improved at the expense of the fore part which is the most bony part within the carcass. The proportion of the hind part within reference carcass was 1.2% (P<0.001) higher, while that of the fore part was 0.7% (P<0.05) lower in group H (*Table 2*). The proportion of the intermediate part within reference carcass did not differ (*Table 2*). The weight of the *m. Longissimus dorsi* was 11g higher (P=0.055) in H rabbits (*Table 1*), however, its ratio to reference carcass did not differ significantly (*Table 2*).

Since the selection was based on the volume of thigh muscles, thus, the development of hindleg muscles in the progenies of divergently selected groups had main importance. The results proved our expectations, since the weight of hindleg meat in H rabbits was 33 g (P<0.001) (*Table 1*), while its ratio to reference carcass was 1.2% (P<0.001) (*Table 2*) higher than in L animals.

Table 2

Effect of divergent selection based on CT measured thigh muscles on the proportion of organs and carcass parts in the progenies of the first generation

Traits	Selection		Prob.
	L	H	
	mean ± SD	mean ± SD	
Ratio to body weight, %			
Skin	14.6 ± 0.63	14.5 ± 0.96	0.763
Gastrointestinal tract	**18.4** ± 1.19	**17.2** ± 1.15	**0.001**
Chilled carcass (Dressing out percentage)	**58.0** ± 1.42	**60.0** ± 1.47	**0.000**
Ratio to reference carcass weight, %			
Perirenal fat	1.99 ± 0.90	1.70 ± 0.67	0.212
Scapular fat	0.69 ± 0.32	0.56 ± 0.26	0.138
Fore part	**29.4** ± 1.24	**28.7** ± 1.16	**0.049**
Intermediate part	31.8 ± 1.13	31.8 ± 1.22	0.945
Hind part	**36.1** ± 1.00	**37.2** ± 0.83	**0.000**
m. Longissimus dorsi	13.8 ± 1.01	13.9 ± 1.00	0.690
Hindleg meat	**27.1** ± 1.02	**28.2** ± 0.64	**0.000**

L: progenies of the rabbits selected for low volume of thigh muscles.
H: progenies of the rabbits selected for high volume of thigh muscles.

Previously, the selection of Pannon White rabbits based on the cross-sectional area of *m. Longissimus dorsi* (*Szendrő et al.*, 2005). The cross-sectional area determined *in vivo* by CT between the 2nd and 3rd and between the 4th and 5th lumbar vertebrae (L-value) was positively correlated to the dressing out percentage and to the weight of the meat on loin and on hindlegs (r=0.65-0.67) (*Szendrő et al.*, 1992). Comparing the carcass traits of the progenies of bucks selected divergently on L-value, *Romvári* (1996) established that the dressing out percentage improved (in the progenies of '-' sel, '+' sel and '++' sel bucks: 62.3, 63.1 and 64.1%, resp.), the weight of the intermediate part increased (in the progenies of '-' sel, '+' sel and '++' sel bucks: 430, 433 and 452g, resp.), while the gastrointestinal tract weight decreased (in the progenies of '-' sel, '+' sel and '++' sel bucks: 379, 364 and 356g, resp.) due to the response to selection. The efficiency of the selection based on L-value is proven by the yearly 1.65% genetic trend (*Nagy et al.,* 2006).

The correlation between CT measured and weighed (during slaughter) hindleg meat was close (r=0.71) (*Szendrő et al.*, 2005). Our results proved the efficiency of selection, since the weight of hindleg meat was significantly higher in H animals compared to L rabbits. Due to the increased weight and ratio of hindleg meat in H rabbits, the proportion of hind part within carcass as well as dressing out percentage also increased in this group. Thus, the most meaty part increased due to the selection, which is advantageous.

Our results prove that the efficiency of CT based selection for thigh muscles is similar to that of for L-value (*Szendrő et al.*, 1996; *Szendrő et al.*, 2005; *Nagy et al.*, 2006). Since the weight of hindleg meat is 2.3–2.5 times larger than that of *m. Longissimus dorsi*, thus, the meat production of growing rabbits could improve to a greater extent in case of similar genetic trend was found in L-value.

CONCLUSIONS

Data of the experiment confirmed the efficiency of CT based selection for thigh muscles. Increasing the volume of hindleg muscles, the dressing out percentage improved as well. The proportion of hind part within carcass increased at the expense of the fore (the most bony) part in the progenies of the rabbits selected for high volume of thigh muscles, which is advantageous. Since both the weight and the ratio of gastrointestinal tract were significantly lower in H rabbits, it would be interesting to study not only the carcass traits but also the productive traits in the progenies of the first and second generations selected divergently.

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