COMPARISON OF CARCASS TRAITS AND MEAT QUALITY OF HYPLUS HYBRID, PUREBRED PANNON WHITE RABBITS AND THEIR CROSSBREDS

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ABSTRACT

The aim of the experiment was to study the influence of the adult weight and that of the selection based on CT (computerizes tomography) measurement on the carcass traits and meat quality. Four different genotypes [PP: purebred Pannon White (n = 84), PH: offspring of Pannon White bucks and Hyplus PS19 does (n = 97); HP: offspring of Hyplus PS59 bucks and Pannon White does (n = 79); HH: offspring of Hyplus terminal cross (n = 77)] were compared. Pannon White rabbits are selected primarily on the basis of body weight gain and carcass traits measured by CT values. In the case of the PS19 females and the PS59 males, selection is based on prolificacy and body weight gain, respectively. The genotype had a significant effect on all performance and carcass traits studied. Rabbits of HP genotype had the highest while those of PP genotype the lowest weight gain (38.9 and 36.6 g/day, respectively; P<0.05). The Pannon White breed had an advantageous influence on the dressing out percentage (PP: 58.0%; PH: 58.7%; HP: 57.7%; HH: 57.6%; P<0.001) and on the ratio of the *m. Longissimus dorsi* to the reference carcass (PP: 11.2; PH: 10.6; HP: 10.3; HH: 10.2%; P<0.001). The fat content of the carcass was lower in the offspring of the PS59 bucks (1.15, 1.16, 0.89 and 0.85% for PP, PH, HP and HH rabbits, respectively; P<0.001). Significant differences were found between the meat samples of progenies of purebred Pannon White and the hybrid terminal cross rabbits in the moisture and fat content of hindleg meat (moisture content: PP: 75.5%, HH: 76.1%, P<0.05; fat content: PP: 2.38%, HH: 1.46%; P<0.001), while the results of the groups HP and PH were not significantly different from the other two genotypes (moisture content: HP and PH: 76.0%; fat content: HP: 1.96%, PH: 1.56%). There were no differences between the experimental groups in the colour and pH of meat. The results of this experiment confirmed that a large body sized male improves the offspring's weight gain and body weight at slaughter. From the point of view of the dressing out percentage and especially the volume of the *m. Longissimus dorsi* the usage of Pannon White genotype is advantageous. Dressing out percentage of the offspring of the early-matured PS19 does and the CT-selected Pannon White bucks is remarkable.

Key words: rabbit, genotype, body weight gain, carcass traits, meat quality.

INTRODUCTION

The productive and carcass traits of rabbit genotypes with different growth rate and selected for different criteria have been studied by several authors (PLA *et al.,* 1996, 1998; PILES *et al.,* 2000). In those experiments the adult weight of the compared lines, breeds or their crosses differed. In our experiment, the adult weight of the Hyplus PS19 females, Hyplus PS59 males and that of Pannon White rabbits was also different. A novel feature of this study was that Pannon White rabbits have been selected with the help of X-ray computerised tomography (CT) in order to improve their carcass traits (Szendro *et al.,* 2004). The aim of the experiment was to compare the weight gain, carcass traits and meat quality of four different genotypes.

MATERIAL AND METHODS

Animals and rearing conditions

Purebred Pannon White (PP, N = 84) and Hyplus hybrid terminal cross (HH, N = 77), as well as crossbred growing rabbits (Hyplus PS59 bucks × Pannon White does: HP, n = 79; and Pannon White bucks × Hyplus PS19 does: PH, n = 97) were included into the experiment. The average adult weight of the genotypes was different (P?: 4.8 kg; P?: 4.4 kg; H? -PS 59-: 5.6 kg; H? -PS19-: 4.1 kg). The PS19 females are characterised by high prolificacy and early maturity, while the PS59 males by high body weight gain but late maturity. Pannon White rabbits are selected with the help of CT to improve their carcass traits on the basis of the cross-sectional area of the *m. Longissimus dorsi* (SZENDRO *et al*., 2004).

PP and HP rabbits were born at the University of Kaposvár while HH and PH rabbits were born on the rabbit farm of Olivia Ltd., at the same time. After weaning at 5 weeks of age, the rabbits born in Kaposvár were transported to the farm of Olivia Ltd.; thus, all the genotypes examined were reared in the same building in groups (7-9 rabbits/cage, littermates together); in cages of 0.64 m^2 basic area, opened at the top and provided with a wooden chewing block and a hay-pocket. The rabbits were fed *ad libitum* (11.8 MJ DE /kg; crude protein: 16%; crude fibre: 17%; ether extract: 3.7%), and drinking water was also available *ad libitum*.

Slaughtering, dissection and meat quality examination

Rabbits were slaughtered at 12 weeks of age – without fasting – at the slaughterhouse of Olivia Ltd. Slaughtering and carcass dividing procedure (after 24 hours chilling at 4°C) were done by the suggestion of BLASCO and OUHAYOUN (1996). The meat was removed from the intermediate part (m. *Longissimus dorsi*, MLD) and from the hind legs (HL). The muscle/bone ratio was calculated from the data of the right hindleg (tendons and cartilages were counted to the bone).

Samples of MLD and HL were taken from the 15 rabbits of average body weight in each group. The pH_u was measured *in situ* in the HL samples (in *m. Biceps femoris)* and in the MLD samples at the level of the 5th lumbar vertebra with INO LAB Level 3 pH meter, using SenTix SP penetration probe. The colour of the MLD was measured with MINOLTA CR-300 Chromameter on its cut surface also at the level of the 5th lumbar vertebra. During the chemical analysis of the minced and homogenised samples, the moisture, protein, fat and ash contents were determined.

Statistical analysis

Data were evaluated by SPSS 10.0 programme package (SPSS FOR WINDOWS, 1999). Productive traits (body weight, body weight gain) were analysed by one-way analysis of variance on the basis of the following model:

$Y_{ij} = \mu + G_i + e_{ij}$

where: μ = population mean, G_i = effect of the genotype (i=1-4), e_{ij} = error

Evaluating the carcass traits and the meat quality parameters, the body weight was included into the model as a covariate:

$Y_{ij} = \mu + G_i + b_1(x_{ij} - z) + e_{ij}$

where: μ = population mean, G_i = effect of genotype (i=1-4), b_1 = regression coefficient, x_{ijk} = individual body weight, z = mean body weight, e_{ij} = error.

Data of the different experimental groups were compared by Bonferroni's test. The effect of gender was not taken into consideration in the statistical analysis.

RESULTS

Growth traits

The growth and carcass traits of rabbits of different genotypes are shown in table 1. At 5 weeks of age, the body weight of groups PP and HP, reared in Kaposvár, was significantly higher than that of HH and PH genotypes, on the rabbit farm of Olivia Ltd. (P<0.05). HP rabbits had the highest while PP had the lowest body weight gain (P<0.05). At 10 weeks of age, group HP had the highest body weight, which differed significantly from that of all the other groups (P<0.05).

Carcass traits

Genotype had significant effect on all of the carcass traits studied. HP rabbits had the highest while group PH the lowest body weight at slaughter (P<0.05).

The dressing out percentage was 1% higher in PH rabbits than in groups HH and HP (P<0.05). The fore part to reference carcass ratio was the highest in group HP and the lowest in group PP. The 1.6% difference obtained between these groups was significant (P<0.05). The ratio of the intermediate part was the highest in PH rabbits and the lowest in group HP; the 1.1% difference was significant (P<0.05). The ratio of the hind part was significantly (P<0.05) lower in PH rabbits than in the other three genotypes.

Table 1: Growth and carcass traits of rabbits of different genotypes.

Trait	Genotype								P
	PP		PH		HP		HH		
	mean	SE	mean	SE	mean	SE	mean	SE	
Number of rabbits	84		97		79		77		
Growth traits									
BW at 5 weeks of age (g)	1096 ^{B}	9.4	1007 ^{A}	9.2	1123 ^{B}	9.4	1036 ^{A}	10.3	***
Body weight gain (g/day)	36.6 ^{A}	0.58	38.0 ^{AB}	0.56	38.9 ^{B}	0.58	38.4 ^{AB}	0.63	*
BW at 10 weeks of age (g)	2304 ^{A}	22.1	2261 ^{A}	21.6	2408 ^{B}	22.1	2304 ^{A}	24.1	***
Carcass traits									
BW at slaughter (g)	2773 ^{B}	28.3	2655 ^{A}	26.4	2923 ^{C}	29.2	2741 ^{AB}	29.6	***
Dressing out percentage (%)	58.0 ^{AB}	0.22	58.7 ^{B}	0.21	57.7 ^{A}	0.24	57.6 ^{A}	0.23	***
Fore part[1] (%)	29.2 ^{A}	0.11	29.9 ^{B}	0.11	30.8 ^{C}	0.12	30.3 ^{B}	0.12	***
Intermediate part[1] (%)	29.1 ^{BC}	0.12	29.2 ^{C}	0.11	28.1 ^{A}	0.13	28.7 ^{B}	0.12	***
Hind part[1] (%)	40.2 ^{B}	0.11	39.5 ^{A}	0.10	40.0 ^{B}	0.12	39.9 ^{B}	0.11	***
MLD[1] (%)	11.2 ^{C}	0.09	10.6 ^{B}	0.09	10.3 ^{AB}	0.10	10.2 ^{A}	0.09	***
HL[1] (%)	26.6 ^{B}	0.11	26.1 ^{A}	0.10	26.6 ^{B}	0.12	26.3 ^{AB}	0.11	**
Perirenal fat[1] (%)	1.15 ^{B}	0.053	1.16 ^{B}	0.051	0.89 ^{A}	0.057	0.85 ^{A}	0.056	***
Meat to bone ratio	2.70 ^{Ab}	0.029	2.78 ^{B}	0.027	2.66 ^{A}	0.031	2.70 ^{AB}	0.030	*

*: P=0.05; **: P=0.01; ***: P=0.001; A, B, C: different letters mark significant differences (P<0.05) between the groups; SE: standard error of mean; BW: body weight; [1] ratio to the reference carcass; MLD: *m. Longissimus dorsi*; HL: hindleg meat; PP: purebred Pannon White; HH: Hyplus hybrid terminal cross; HP: Hyplus PS59 bucks x Pannon White does; PH: Pannon White bucks x Hyplus PS19 does

The MLD was 1% higher in group PP than in group HH (P<0.05). The results obtained for HP genotype were the same as those of group HH, while the value obtained for PH rabbits was 0.4% (P<0.05) higher. The ratio of the HL was the highest in PP and HP rabbits and the lowest in group PH (P<0.05).

Genotypes originating from Pannon White males (PP and PH) had the highest, while those derived from PS59 males (HH and HP) had the lowest ratio of the perirenal fat (P<0.001).

The highest meat/bone ratio was found in group PH and the lowest in group HP (P<0.05). The groups PP and HH not differed significantly from that of either of the two groups mentioned above.

Meat quality parameters

The chemical composition of the MLD of different genotypes was similar. Genotype had no effect on the meat colour and on pH (Table 2).

The moisture content of the HL was 0.6% higher in group HH than in PP rabbits (P<0.05). The values measured in the HP and PH genotypes were similar. The fat content of the HL was the highest in PP rabbits and the lowest in group HH; the 0.92% difference between the groups was significant (P<0.05). No difference was found in the protein and ash content between the genotypes.

Table 2: Some meat quality parameters of rabbits of different genotypes.

Parameter	Genotype								P
	PP		PH		HP		HH		
	mean	SE	mean	SE	mean	SE	mean	SE	
Number of samples	15		15		15		15		
m. Longissimus dorsi (MLD)									
L*	57.5	0.67	57.7	1.20	57.7	1.41	56.5	0.72	NS
a*	4.15	0.33	3.78	0.59	4.00	0.69	3.86	0.35	NS
b*	3.00	0.21	3.74	0.38	2.76	0.45	3.51	0.23	NS
pH_u	5.65	0.021	5.66	0.037	5.60	0.044	5.70	0.022	NS
Hindleg meat (HL)									
Chemical composition (%):									
Moisture	75.5 ^{A}	0.15	76.0 ^{AB}	0.26	76.0 ^{AB}	0.31	76.1 ^{B}	0.16	**
Protein	20.9	0.097	21.1	0.17	20.7	0.21	21.1	0.11	NS
Fat	2.38 ^{B}	0.15	1.56 ^{AB}	0.28	1.96 ^{AB}	0.33	1.46 ^{A}	0.17	***
Ash	1.17	0.024	1.23	0.042	1.16	0.050	1.19	0.026	NS
pH_u (*m. Biceps femoris*)	5.89	0.030	5.89	0.053	5.71	0.063	5.89	0.032	NS

**: P=0.01; ***: P=0.001; A, B, C: different letters mark significant differences (P<0.05) between the groups; SE: standard error of mean; NS: not significant; BW: body weight; [1] ratio to the reference carcass; MLD: *m. Longissimus dorsi*; HL: hindleg meat; PP: purebred Pannon White; HH: Hyplus hybrid terminal cross; HP: Hyplus PS59 bucks x Pannon White does; PH: Pannon White bucks x Hyplus PS19 doe

DISCUSSION

The body weight gain of rabbits have higher adult weight is better (PILES *et al.,* 2000), that is why PS59 males improved the body weight gain of HP rabbits as well as the body weight at 10 weeks of age and at slaughter.

The carcass traits are basically determined by the adult body weight, the maturity at slaughter and the different growth rate of the organs and tissues (CANTIER *et al.*, 1969). Similarly to our results, numerous experiments prove that at the same age the later matured, larger sized breeds have poorer dressing out percentage and lower fat content (PLA *et al.*, 1996).

In our experiment the ratios of the carcass parts changed in agreement with the data reported in the literature (PLA *et al.,* 1996; PILES *et al.,* 2000). Since, as a result of the development of the tissues, the ratio of the fore (bony) part was higher, while that of the intermediate and hind part was lower in rabbits of higher adult weight. The ratio of the intermediate part was the highest in rabbits derived from Pannon White males, and in PP rabbits the MLD had an outstandingly high ratio. These results are explained by the selection done with the help of X-ray computerised tomography (CT). The Pannon White rabbits has been selected on the basis of the cross-sectional area of the MLD for three years (SZENDRO *et al.,* 2004). The cross-sectional area of MLD, determined *in vivo* by CT between the 2nd and 3rd and between the 4th and 5th lumbar vertebrae, is positively correlated to the most important carcass traits (SZENDRO *et al.,* 1992). This can play an important role in the higher dressing out percentage of PH and PP genotypes.

According to the data of the literature, meat samples of the larger sized, later matured breeds contain less fat (PLA *et al.,* 1996). Occasionally, the fat content of HL decreased as a result of selection for body weight (PILES *et al.,* 2000). This effect cannot be demonstrated in the MLD, a muscle of lower fat content. Similarly to our results, the most studies found that neither the genotype nor selection for body weight gain or body weight had influence on the pH of rabbit meat (PLA *et al.,* 1996; PILES *et al.,* 2000). The adult weight and the different growth rate could influence the meat colour occasionally (PILES *et al.*, 2000), however, similarly to the results of PLA *et al.*(1996), in our study no difference was found in this trait. On the basis of these results, no definite correlations can be established between the genotype and the meat colour.

CONCLUSIONS

According to the results of this experiment, large body size males are suitable for increasing the body weight gain. However, as at the slaughterhouses rabbits are usually slaughtered at a similar body weight, the rabbits are younger and less mature, therefore their dressing out percentage decreases. Selection by CT on the basis of the cross-sectional area of the MLD can markedly increase its volume, as well as the ratio of the intermediate part and the dressing out percentage. From the point of view of the dressing out percentage, crossing of the PS19 does with the CT-selected Pannon White bucks is the most advantageous.

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