EXAMINATION ON THE CARCASS TRAITS OF DIFFERENT RABBIT GENOTYPES

METZGER SZ.[1], ODERMATT M.[2], SZENDRO ZS.[1], MOHAUPT M.[2], ROMVÁRI R.[1], MAKAI A.[2], BIRÓ-NÉMETH E.[1], RADNAI I.[1], HORN P.[1]

[1] Faculty of Animal Science, University of Kaposvar,
7400 Kaposvar, Guba S. str. 40., Hungary,
metzger@mail.atk.u-kaposvar.hu
[2] OLIVIA Ltd., 6050 Lajosmizse, Mizse 94.

ABSTRACT

The aim of this experiment was to study the carcass traits of rabbits when the same maternal stocks were mated with bucks of two well-known hybrids selected for growth traits or with Pannon White bucks selected for carcass traits by CT (computerised tomography). Carcass traits of seven different genotypes were compared (PP: purebred Pannon White, n=60; HP: Hycole bucks x Pannon White does, n=59; PH: Pannon White bucks x Hycole does, n=60; HH: Hycole hybrid terminal cross, n=52; PM: Pannon White bucks x Maternal line does, n=60; ZM: Zika bucks x Maternal line does; n=59; ZH: Zika bucks x Hycole does n=58). The hybrid males generally increased the body weight, since mating the same matenal stock with hybrid or Pannon White bucks, the body weight of the offspring of hybrid males was usually higher than that of the offspring of Pannon White bucks (PP and HP: 2644 and 2758 g, P<0.05; PH and HH: 2616 and 2671 g, NS; PH and ZH: 2616 and 2890 g, P<0.05; PM and ZM: 2539 and 2684 g, P<0.05). The most important carcass traits were advantageous in Pannon White rabbits. Genotype had a significant effect on the dressing out percentage (P<0.001), which was the highest in PM (61.1%) and in PP (60.7%) genotypes, and the lowest in HH rabbits (58.9%; P<0.05). The ratio of the m. *Longissimus dorsi* to reference carcass was also higher in rabbits derived from P males or females (PP: 11.6%, PM: 11.5%, HP: 11.5%, PH: 11.2%, HH: 10.7%, ZH: 10.6%, ZM: 10.8%; P<0.001). Genotype had a significant effect on the fat content of the carcass (P<0.05), it was the lowest in group ZM (1.38%), while the highest in the early-matured genotypes as PM (1.77%) and PP (1.78%) rabbits (P<0.05). Results of the dressing out percentage and the m. *Longissimus dorsi* proved that the selection of Pannon White rabbits based on CT was successful.

Key words: rabbits, genotypes, carcass traits, computerised tomography.

INTRODUCTION

Carcass traits are influenced by the adult weight and the maturity of rabbits (PLA *et al.*, 1996; PILES *et al.*, 2000). SZENDRO *et al.* (2004) proved that the selection for carcass traits based on X-ray computerised tomography (CT) was effective. In our former experiment the carcass traits of Hyplus hybrid, purebred Pannon White rabbits and their crossbreds were compared (METZGER *et al.*, 2004). The aim of this experiment was to investigate the carcass traits of Pannon White (P), Maternal line (M) its official name is Pannon Ka, Hycole (H), Zika (Z) rabbits and their crossbreds.

MATERIAL AND METHODS

Animals and rearing conditions

Seven different genotypes (purebred Pannon White [PP, n=60], Hycole bucks x Pannon White does [HP, n=59], Pannon White bucks x Hycole parent does [PH n=60], Hycole hybrid terminal cross [HH n=52], Pannon White bucks x Maternal line does [PM n=60], Zika bucks x Maternal line does [ZM n=59], Zika bucks x Hycole parent does (ZH n=58) were included into the experiment. The adult weight of the genotypes differed (P?: 4.8 kg; P?: 4.4 kg; H? : 5.5 kg; H?: 4.2 kg; Z?: 5.6 kg; M? : 4.2 kg). The hybrid females are characterised by high prolificacy and early maturity, while the hybrid males by fast growth but late maturity. Pannon White rabbits are selected for body weight gain and for carcass traits with the help of CT on the basis of the cross-sectional area of the m *Longissimus dorsi* (SZENDRO *et al.*, 2004).

P and M does were inseminated at the University of Kaposvár, while H does were inseminated at the rabbit farm of Olivia Ltd., at the same day. Therefore, PP, HP, PM and ZM genotypes were born in Kaposvár, while HH, PH and ZH genotypes were born in Olivia farm at the same time. After weaning at 5 weeks of age, all the rabbits were transported to the rabbit 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. 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 and dissection procedure

At 12 weeks of age all of the rabbits were weighed. Sixty rabbits (equally from both genders) of the average ± 0.3kg body weight were selected randomly from each genotype and were slaughtered without fasting at the slaughterhouse of the Olivia Ltd. Slaughtering and carcass dividing procedure (after 24 hours chilling at 4°C) were done by the suggestion of BLASCO and OUHAYOUN (1996). Head, carcass parts (fore-, intermediate- and hind part) and perirenal fat were weighed; meat of the intermediate part (m. *Longissimus dorsi* – MLD) and that of the hind legs (HL) was removed.

Statistical analysis

Experimental data were evaluated by one-way analysis of variance using the SPSS 10.0 programme package (SPSS FOR WINDOWS, 1999). 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; while evaluating the carcass traits 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=1-7), b_1 = regression coefficient, x_{ijk} = individual body weight, z = mean body weight, e_{ij} = error

RESULTS

Results are shown in Table 1. Genotype had significant effect on the body weight at slaughter (P<0.001). Body weight of ZH rabbits was the highest and it differed significantly from all of the other genotypes (P<0.05). It was followed by group HP. Body weight of PP, PH, HH and ZM rabbits was similar, while that of group PM was the lowest.

Genotype had a significant influence on the chilled carcass weight (P<0.001), which was the highest in PP and PM rabbits, while the lowest in group HH (P<0.05). Offspring of P does had higher carcass weight (1619 g) than that of H does had (1586 g), independently of the bucks. Although, carcass weight of group ZH was average (1608 g); but, mating M does with P or Z bucks the offspring of P males had 32 g higher carcass weight (P<0.05).

Dressing out percentage was also influenced by the genotype (P<0.05). This trait was the highest in groups PM and PP, while the lowest in HH genotypes. The 1.8-2.2% differences obtained between these groups were significant (P<0.05). Result of the offspring of P males was 0.8 or 0.7% higher than that of the offspring of H males in case of P or H does, respectively. Similar relations can be found in the offspring of M does, where the dressing out percentage of PM rabbits was 1.6% higher than that of ZM rabbits (P<0.05).

Genotype had a significant effect on the weights and the ratios of carcass parts (P<0.001) – except the ratio of the hind part to reference carcass. Weight of the fore part was the highest in group ZH, while the lowest in group PH; the 14 g difference obtained between the groups was significant (P<0.05). Ratio of the fore part to reference carcass was the highest in the offspring of Z males (on the average of 30%), followed by the rabbits of H and M does, while it was the lowest in the progeny of P does. Both the weight and the ratio of the intermediate part were higher in rabbits originated from P males or females (PP, HP, PH and PM: 434, 429, 421 and 429 g; and 31.4, 31.4, 31.2 and 31.0 %, respectively), while in this trait the origin from Z bucks was disadvantageous (ZM and ZH: 410 and 417 g; and 30.3 and 30.7%, respectively). Weight of the hind part was the highest in groups PP and PM, while the lowest in groups PH and HH; the 20 g difference was significant (P<0.05).

Table 1. Effect of genotypes on the body weight and carcass traits of different rabbit genotypes

	Genotype														
Traits	PP		HP		PH		HH		ZH		PM		ZM		P
	mean	SE	mean	SE	mean	SE	mean	SE	mean	SE	mean	SE	mean	SE	
Number of rabbits	60		59		60		52		58		60		59		
Body weight and weight of body parts, g															
BW at slaughter	2644 ^{B}	21.5	2758 ^{C}	21.7	2616 ^{AB}	21.5	2671 ^{BC}	23.1	2890 ^{D}	21.9	2539 ^{A}	21.5	2684 ^{BC}	21.7	***
Chilled carcass	1628 ^{C}	6.46	1610 ^{BC}	6.57	1595 ^{AB}	6.51	1577 ^{A}	6.91	1608 ^{ABC}	7.22	1631 ^{C}	6.79	1599 ^{AB}	6.48	***
Fore part	398 ^{ABC}	2.56	396 ^{AB}	2.61	394 ^{A}	2.59	395 ^{AB}	2.74	408 ^{C}	2.87	406 ^{BC}	2.70	406 ^{BC}	2.57	***
Intermediate part	434 ^{C}	3.01	429 ^{BC}	3.06	421 ^{ABC}	3.03	412 ^{A}	3.21	417 ^{AB}	3.36	429 ^{BC}	3.16	410 ^{A}	3.02	***
Hind part	528 ^{C}	2.78	516 ^{AB}	2.83	510 ^{A}	2.81	504 ^{A}	2.98	513 ^{AB}	3.11	524 ^{BC}	2.93	515 ^{AB}	2.79	***
MLD	160 ^{C}	1.90	157 ^{BC}	1.93	151 ^{AB}	1.91	144 ^{A}	2.03	144 ^{A}	2.12	159 ^{C}	1.20	141 ^{A}	1.91	***
HL	370 ^{D}	2.47	355 ^{B}	2.52	353 ^{AB}	249	343 ^{A}	2.65	355 ^{B}	2.76	367 ^{CD}	2.60	357 ^{BC}	2.48	***
Perirenal fat	24.7 ^{B}	1.19	23.3 ^{AB}	1.21	23.6 ^{AB}	1.20	22.5 ^{AB}	1.27	22.8 ^{AB}	1.33	24.6 ^{B}	1.25	19.0 ^{A}	1.19	*
Dressing out percentage, %	60.7 ^{BC}	0.22	59.9 ^{AB}	0.23	59.6 ^{A}	0.23	58.9 ^{A}	0.25	59.7 ^{AB}	0.25	61.1 ^{C}	0.24	59.5 ^{A}	0.22	***
Ratio to reference carcass, %															
Fore part	28.7 ^{A}	0.14	29.0 ^{AB}	0.14	29.2 ^{AB}	0.14	29.7 ^{BCD}	0.15	29.9 ^{CD}	0.16	29.3 ^{BC}	0.15	30.1 ^{D}	0.14	***
Intermediate part	31.4 ^{C}	0.14	31.4 ^{C}	0.15	31.2 ^{BC}	0.14	30.9 ^{ABC}	0.15	30.7 ^{AB}	0.16	31.0 ^{BC}	0.15	30.3 ^{A}	0.14	***
Hind part	38.2	0.15	37.8	0.15	37.9	0.15	37.9	0.16	37.8	0.16	37.9	0.15	38.2	0.15	NS
MLD	11.6 ^{C}	0.12	11.5 ^{C}	0.12	11.2 ^{BC}	0.12	10.7 ^{AB}	0.12	10.6 ^{A}	0.13	11.5 ^{C}	0.12	10.8 ^{AB}	0.12	***
HL	26.7 ^{C}	0.13	26.0 ^{AB}	0.13	26.2 ^{ABC}	0.13	25.7 ^{A}	0.14	26.1 ^{ABC}	0.15	26.6 ^{BC}	0.14	26.4 ^{BC}	0.13	***
Perirenal fat	1.78 ^{B}	0.08	1.68 ^{AB}	0.09	1.72 ^{AB}	0.09	1.65 ^{AB}	0.09	1.62 ^{AB}	0.09	1.77 ^{B}	0.09	1.38 ^{A}	0.08	*

*: P=0,05; **: P=0,01; ***: P=0,001; NS: not significant

A, B, C: different letters mark significant differences (P<0.05) between genotypes.

BW: body weight

PP: purebred Pannon White, HP: Hycole bucks x Pannon White does, PH: Pannon White bucks x Hycole does, HH: Hycole hybrid terminal cross, PM: Pannon White bucks x Maternal line does, ZM: Zika bucks x Maternal line does; ZH: Zika bucks x Hycole does.

MLD: m. *Longissimus dorsi*; HL: hindleg meat

Genotype had a significant effect on the weight and the ratio of the MLD and HL (P<0.001). The origin from P males and/or females was definitely advantageous in case of MLD and HL. The weight and the ratio of the MLD were the highest in PP and PM genotypes, while the lowest in groups HH, HZ and ZM; the 13-16 g and 0.7-1% differences obtained between the genotypes were significant (P<0.05). The weight and the ratio of HL were also the highest in PP and PM rabbits, while the lowest in HH genotypes; the differences obtained between these groups (25 g and 1%) were significant in all cases (P<0.05).

Both the weight and the ratio of the perirenal fat were significantly influenced by the genotype (P<0.05). The lowest results were found in group ZM, while the highest in groups PM and PP. The 5.6 g and 0.4% differences obtained between these genotypes were significant (P<0.05). Results of the other groups not differed significantly from genotypes mentioned above.

DISCUSSION

Carcass traits are basically influenced by the adult body weight and the maturity at slaughter (DALLE ZOTTE, 2002). Slaughtering the rabbits at the same body weight the later matured, larger sized breeds or lines have poorer dressing out percentage than that of the smaller sized ones (PLA *et al.*, 1996). This is partly due to the different growth rate of the organs and tissues (CANTIER *et al.*, 1969). Our results confirmed literature data (DALLE ZOTTE, 2002), since the dressing out percentage was found the highest in the offspring of early matured Maternal line does and smaller sized Pannon White bucks.

According to literature data (PLA *et al.*, 1996) slaughtering the rabbits at the same body weight the fore part is usually lower, the intermediate part is similar, while the hind part is higher in rabbits of lower adult weight. In our experiment the ratio of the fore part changed in agreement of the data reported in the literature, since it was higher in rabbits originated from larger sized hybrid bucks. This is explained by the fact that the fore part is the most bony part of the carcass and the bone is one of the earliest matured tissues (CANTIER *et al.*, 1969). Contrary to the results found in the literature in our experiment significant differences were obtained in the weight and the ratio of the intermediate part between the genotypes. Ratio of the intermediate part was higher in rabbits derived from Pannon White parent(s). Similar relation could be obtained in the weight and the ratio of MLD. These results can be explained by the CT selection. 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 2^{nd} and 3^{rd} and between the 4^{th} and 5^{th} lumbar vertebrae, is positively correlated to the most important carcass traits (SZENDRO *et al.,* 1992). METZGER *et al.* (2004) found similar results comparing Pannon White and Hyplus genotypes.

As a result of the selection for improving the body weight gain or the body weight the volume of the perirenal fat decreases (PILES *et al.*, 2000). The reason of this is the later development of fat tissue (CANTIER *et al.*, 1969). Results of our experiment confirmed literature data (DALLE ZOTTE, 2002), since the volume of the fat depot was higher in the offspring of smaller sized Pannon White bucks than in that of larger sized hybrid males.

CONCLUSIONS

The adult weight and the maturity at slaughter influenced most of the carcass traits (dressing out percentage, fore part or fat depot). Results of this experiment proved that the selection of Pannon White rabbits based on CT was successful. In the breeding stock selected by the cross-sectional area of the m. *Longissimus dorsi* and in their offspring the weight of the MLD improved and in connection with this the muscle development was higher in other body parts (HL). Thus, the weight of the intermediate and hind parts was also higher. Dressing out percentage of the offspring of the early-matured M does and the CT-selected Pannon White bucks is remarkable.

ACKNOWLEDGEMENT

The research was supported by project no. NKFP 4/034/2001.

REFERENCES

BLASCO A., OUHAYOUN J. 1996. Harmonization of criteria and terminology in rabbit meat research. Revised proposal. *World Rabbit Sci.* **4(2)**:93-99.

CANTIER J., VEZINET A., ROUVIER R., DAUZIER L. 1969: Allométrie de croissance chez le lapin (*Oryctolagus cuniculus*). 1-Principaux organes et tissus. *Ann. Biol. Bioch. Biphys.* **9**: 539.

DALLE ZOTTE A. 2002. Perception of rabbit meat quality and major factors influencing rabbit carcass and meat quality. *Livest. Prod. Sci.* **75(1)**: 11-32.

METZGER SZ., ODERMATT M., SZENDRO ZS., MOHAUPT M., ROMVÁRI R., MAKAI A., BIRÓNÉ NÉMETH E., RADNAI I., SIPOS L. 2004. Comparison of carcass traits and meat quality of Hyplus hybrid, purebred Pannon White rabbits and their crossbreds. *8th World Rabbit Congress, Puebla City, Mexico.*

PILES M., BLASCO A., PLA M. 2000. The effect of selection for growth rate on carcass composition and meat characteristic of rabbits. *Meat Sci.* **54**: 347-355.

PLA M., HERNÁNDEZ P., BLASCO A. 1996. Carcass composition and meat characteristics of two rabbit breeds of different degrees of maturity. *Meat Sci.* **44(1-2)**: 85-92.

SPSS FOR WINDOWS 1999. VERSION 10.0, COPYRIGHT SPSS INC.

SZENDRO ZS., HORN P., KÖVÉR GY., BERÉNYI E., RADNAI I., BIRÓNÉ NÉMETH E. 1992. In vivo measurement of the carcass traits of meat type rabbits by X-ray computerised tomography. *J. Appl. Rabbit Res.* **15**: 799-809.

SZENDRO ZS., ROMVÁRI R., ANDRÁSSY-BAKA G., METZGER SZ., RADNAI I., BIRÓ-NÉMETH E., SZABÓ A., VÍGH ZS., HORN P. 2004. Selection of Pannon White rabbits based on computerised tomography. *8th World Rabbit Congress, Puebla City, Mexico.*