PE1.19 Effect of CT-based selection on meat pHu, water holding capacity, and L*a*b* colour in the rabbit 152.00

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***Abstract* - The aim of the study was to compare the meat quality of different rabbit genotypes. Maternal (M; n=15, adult weight /AW/ 4.0-4.5 kg, selected for number of kits born alive), Pannon White (P; n=50, AW: 4.3-4.8 kg), and Large body line (L; n=15, AW: 4.8-5.4 kg) (P and L were selected for carcass traits based on CT /Computer tomography/ data) rabbits were analysed. Rabbits were slaughtered at 11 wk of age. The pHu and L*a*b* colour were measured on *Biceps femoris* (BF) and on *Longissimus dorsi* (LD) muscles, whereas the water holding capacity (WHC) was measured on the hind leg (HL) and LD meat. The pHu, WHC, and L*a*b* colour of LD were unaffected by the selection programme. The HL meat of P rabbits exhibited significantly lower WHC (P<0.00l) than M and L rabbits and BF; pHu was also lower than that of M rabbits (P<0.05). This study revealed that CT-based selection slightly affected the WHC of the rabbit meat.**

***Index Terms* - Rabbit, Adult weight, CT-based selection, Meat quality.**

I. INTRODUCTION

Live performance and slaughter traits of growing rabbits are affected by several factors; one of the most important is adult weight [1]. The larger type rabbits show higher growth intensity [2] [3] [4] and consume more feed. Recent results have proven that carcass traits can be improved efficiently by Computer Tomography (CT)-based selection [5] [6]. Specifically, selection for the average cross-sectional area of the M. *Longissimus dorsi* and for the hind leg muscle volume increased the ratio of the middle part of the carcass, the slaughter yield, and the ratio and the weight of the hind part of the carcass. Concurrently, the amount of the perirenal fat decreased [6].

The aim of this study was to assess the effectiveness of CT-based selection on meat quality of two rabbit genotypes compared to a genotype selected for the number of kits born alive.

II. MATERIALS AND METHODS

Three rabbit genotypes were compared: M=Maternal line: selected for number of kits born alive; adult weight /AW/: 4-4.5 kg; P=Pannon White: selected for weight gain and carcass traits by CT /Computer tomography/ measurement since 1993; AW: 4.3-4.8 kg; L=Large body line: selected for weight gain and carcass traits measured by CT since 2006; AW: 4.8-5.4 kg. The rabbits were weaned at 5 wk of age and reared in pairs up to commercial slaughter age (11 wk). At slaughter, the hind leg (HL) and *Longissimus dorsi* (LD) meat was dissected on 15 rabbits each of M and L genotype, and on 50 rabbits of P genotype.

At 24 h *post mortem*, meat colour was assessed on the surface overlying raw LD and *Biceps femoris* (BF) muscles. A Minolta CR100 chromameter (Minolta, Osaka, Japan) was set to the L* (lightness), a* (redness), b* (yellowness) scale [7]. Values corresponded to the average of two measurements at each sample. The pHu was measured in situ on both LD and BF using a combined Ingold electrode (406 M3). The Water Holding Capacity (WHC) was expressed by thaw loss (%) and cook loss (%) determination on HL and LD meat. Thaw loss was determined by weighing the frozen and thawed meat samples after leaving the meat overnight at 4 °C. In order to determine the cook loss, HL and LD were individually packed in sealed bags and cooked in a water bath (core temperature 80 °C; [8]). Meat quality traits were evaluated by means of one-factor ANOVA using the SPSS 11.5 software package.

III. RESULTS AND DISCUSSION

The meat of P-genotype rabbits (having been selected for carcass traits for a longer period of time) resulted in lower WHC than M and L genotypes, with significant differences among genotypes in the HL meat. Specifically, thaw loss, cook loss, and total loss of HL meat of P rabbits were 0.95%, 21.9% and 22.8%, respectively (Table 1). Cook and total losses of M (18.8 and 19.5%) and L rabbits (19.7 and 20.3%) were significantly lower (P<0.001). These findings are related to differences in the meat proximate composition of the three rabbit genotypes: the meat of P-genotype rabbits contained more water, protein, and lower lipids than M and L genotypes [9].

CT-based selection affected the rheological parameters L*a*b* colour and pHu of HL meat more than that of LD meat (Tables 1 and 2). In Spain [10], [11], [12], rabbits were selected for litter size, and the early mature two maternal lines (A and V) were similar to our M line, while the late mature paternal line, selected for weight gain (R), was similar to our L rabbits. Similarly to our results, Pla *et al.* [10] did not find pHu differences in the LD and HL muscles of divergent lines. In contrast, Pla *et al.* [11] found higher pHu values in the BF and LD muscles, while Hernández *et al.* [12] measured higher pHu in the LL muscle in the R line than in the A or V lines.

Table 1
Effect of genotype on WHC of hind leg meat and on L*a*b* colour and pHu of M. *Biceps femoris.*

	Genotype				
	Maternal	Pannon	Large	*P*	SE
Rabbits, No.	15	50	15		
Thaw loss, %	0.73[ab]	0.95[a]	0.61[b]	0.090	0.10
Cook loss, %	18.8[b]	21.9[a]	19.7[b]	*P*<0.001	0.38
Total loss, %	19.5[b]	22.8[a]	20.3[b]	*P*<0.001	0.41
L* (lightness)	50.6	50.2	49.8	0.401	0.42
a* (redness)	4.03	4.07	3.58	0.056	0.27
b* (yellowness)	-4.83[b]	-3.43[a]	-4.05[ab]	0.026	0.33
pHu	5.98[a]	5.82[b]	5.95[ab]	0.095	0.05

SE = standard error; [a, b] = *P<0.05*

In a related study, Pannon White rabbits were subjected to CT-based divergent selection in two generations, and the meat quality attributes were determined in the HL and LD muscles (Szendrő, unpublished results). The volume of the hind leg muscle was measured by CT, and then after regressing the weight of the hind leg muscle on body weight, the rabbits showing the highest positive and negative residuals were selected. Plus ("+") or minus ("-") selected does of the first and second generations were mated with similarly selected bucks at the same time. The second generation ("--" *vs* "++") provided differences in the moisture loss of the LD (drip loss: 2.42 % *vs* 2.92 %, resp.; P<0.001; thaw loss: 6.35 % *vs* 8.49 %, resp., P>0.05). Moreover, the first generation ("-" *vs* "+") showed lower LD muscle fat content ("-": 5.33 %DM *vs.* "+": 4.24 %DM), indicating that selection for muscle mass affects not only the proximate composition of the muscle, but also its WHC. CT-selection was found to affect also the total DM content of the LD ("-": 26.1 % *vs* "+" 25.3 %DM), and this effect was detected in amplified form in the second generation ("--": 26.2 % vs "++" 24.8 %). [11] & [12] did not find differences in the WHC of the LD muscle of differently selected lines, while the cook loss of the BF muscle in the V line was lower than those of the A and V lines.

The BF muscle of P rabbits exhibited significantly lower pHu (P<0.05) and higher yellowness than those of the non CT-selected M genotype, whereas the L genotype (selected for carcass traits for a shorter period of time) showed intermediate pHu and b* values. In terms of meat color (L*, a*, b*), LD provided no differences among differently selected lines [10], [11], while the BF of the R line showed lower L* values [10].

Table 2
Effect of genotype on WHC, L*a*b* colour and pHu of M. *Longissimus dorsi.*

	Genotype				
	Maternal	Pannon	Large	*P*	SE
Rabbits, No.	15	50	15		
Thaw loss, %	5.30	6.95	6.32	0.096	1.28
Cook loss, %	21.5	22.3	21.6	0.888	0.64
Total loss, %	26.8	29.2	28.0	0.282	1.56
L*	54.2	54.2	55.2	0.911	1.39
a*	2.52	3.16	3.04	0.119	0.20
b*	2.27	4.30	3.88	0.256	0.33
pHu	5.72	5.66	5.66	0.115	0.02

SE = standard error

As an interesting further point, Mézes *et al.* [13] investigated the oxidative stability of "-" and "+" rabbits. Results of HL musculature confirm our findings, namely, that the higher muscle volume in the "+" group led to an expressed sensitivity towards non-enzymatic *in vivo* lipid peroxidation as assessed by malondialdehyde determination.

Although maximizing growth potential by selection is an important goal in ensuring an economically viable rabbit industry, it has the undesirable effect of increasing adult body weight, thus making the animals less mature at market weight [14]. This finding support our results which clearly indicate that increased muscle volume is linked to compromised meat quality. Our results suggest that selection for the increase of HL muscle weight decreased the perirenal fat depot size, while both drip loss and thaw loss increased (Szendrő, 2006, unpublished). These results agree with those of [15], who investigated meat characteristics and reported a weak negative correlation between the fat content of LD and HL and pH, cook loss and lightness (L*); in contrast, a positive relationship with WHC was found. Differences between the M and L lines in our study did not fully agree with data in literature, which may be explained by the fact that the L line is undergoing CT selection for the HL muscle volume. Thus, adult bodyweight (early or late mature) was not the only difference between the two populations. These results support our findings that CT-based selection may affect meat quality.

IV. CONCLUSION

It can be concluded that the effect of CT-based selection was evident in rabbits of different AW slaughtered at the same age. This study revealed that CT-based selection for the average cross-sectional area of the M. *Longissimus dorsi* and for the hind leg muscle volume could also affect the rheological parameters of the rabbit meat.

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REFERENCES

[1] Dalle Zotte, A. (2002). Perception of rabbit meat quality and major factors influencing the rabbit carcass and meat quality. *Livestock Production Science, 75*, 11-32.

[2] Metzger, Sz., Odermatt, M., Szendrő, Zs., Mohaupt, M., Romvári, R., Makai, A., Biró-Németh, E., Sipos, L., Radnai, I., & Horn, P. (2006). Examination on the carcass traits of different rabbit genotypes. *World Rabbit Science*, *14*, 107-114.

[3] Ramon, J., Gómez, E. A., Percho, O., Rafel, O., & Baselga, M. (1996). Feed efficiency and post weaning growth of several Spanish selected lines. *In Proceedings of 6th World Rabbit Congress* (Vol. 2, 351-353), Toulouse, France.

[4] Larzul, C., & Rochambeau, H. (2004). Comparison of ten rabbit lines of terminal bucks for growth, feed efficiency and carcass traits. *Animal Research*, *53*, 535-545.

[5] Szendrő, Zs., Romvári, R., Nagy, I., 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. *In Proceedings of 8th World Rabbit Congress* (pp. 175-180), Puebla, Mexico.

[6] Szendrő, Zs., Metzger, Sz., Romvári, R., Szabó, A., Locsmándi, L., Petrási, Zs., Nagy, I., Nagy, Z., Biró-Németh, E., Radnai, I., Matics, Zs., & Horn, P. (2008). Effect of divergent selection based on CT measured hind leg muscle volume on productive and carcass traits in rabbits. *In Proceedings of 9th World Rabbit Congress* (pp. 249-253), Verona, Italy.

[7] CIE, Commission Internationale de l'Eclairage (1976). Official Recommendations on Uniform Colour Spaces, Colour Differences Equations and Metric Colour Terms. Supplement n. 2, CIE Publication n. 15. Colorimetry. Paris, France.

[8] Ouhayoun, J., & Dalle Zotte, A. (1996). Harmonization of muscle and meat criteria in rabbit meat research. *World Rabbit Science*, *4*, 211–218.

[9] Dalle Zotte, A., Fornasier, B., Matics, Zs., Gerencsér, Zs., & Szendrő Zs. (2009). Effect of adult weight and CT-based selection on rabbit meat quality. *Italian Journal of Animal Science*, (in press).

[10] Pla, M., Hernández, P. & Blasco, A. (1996). Carcass composition and meat characteristics of two rabbit breeds of different degrees of maturity
. *Meat Science, 44, 1-2, 85-92.*

[11] Pla, M., Guerrero, L., Guardia, D., Oliver, M.A., Blasco, A. (1998). Carcass characteristics and meat quality of rabbit lines selected for different objectives:I. Between lines comparison. *Livestock Production Science, 54, 115-123*.

[12] Hernàndez, P., Ariño, B., Grimal, A., & Blasco, A. (2006), Comparison of carcass and meat characteristics of three rabbit lines selected for litter size or growth rate. *Meat Science, 73* 645-650.

[13] Mézes, M., Balogh, K., Fébel, H., Matics, Zs., Fricska, M., Szabó, A.& Szendrő Zs. (2009). Effects of divergent selection for hind leg muscle volume on its lipid peroxide and glutathione redox status, and fatty acid composition in growing rabbits. *World Rabbit Science, 17, 15-19.*

[14] Gondret, F., Larzul, C., Combes, S. & de Rochambeau, H. (2005). Carcass composition, bone mechanical properties, and meat quality traits in relation to growth rate in rabbits. *Journal of Animal Science, 83*, 1526-1535.

[15] Hernández, P., Pla, M. & Blasco, A. (1998). Carcass characteristics and meat quality of rabbit lines selected for different objectives:II. Relationships between meat characteristics. *Livestock Production Science, 54, 125-131*.

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