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COMMUNICATION

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ABSTRACT

This study was performed on 87 randomly selected carcasses of castrated pigs, slaughtered at approximately 100 kg live weight in 2 abattoirs from east Croatia. Important meat quality traits were measured on the samples of *musculus longissimus dorsi*: initial and ultimate pH values (pH_{45} and pH_{24}), meat colour and drip loss. Samples were further differentiated into 5 groups on the base of meat quality conditions. Results show that 14.66%, 32%, 40%, 10.67% and 2.66% of the *longissimus dorsi* muscles belonged to PSE, RSE, RFN, PFN and DFD conditions respectively. The highest correlations were observed between ultimate pH value, drip loss and meat colour. Interpolated threshold value for ultimate pH was 5.69. It is suggested to verify the values used for differentiation of meat according to quality on a larger sample.

Key words: Pork, *Longissimus dorsi* muscle, Meat quality traits, Differentiation

Introduction

The quality of pork is a constant issue which occupies the mind of many scientists for a long time. Together with the development of different methods aimed at measuring and quantifying the pork quality, various systems for differentiation of pork according to quality evolved. These differentiations are mainly based upon the measurements of pH decline rate, ultimate pH values, water holding capacity, muscle colour, firmness, marbling etc. Pork is often differentiated into quality conditions such as: pale, soft, exudative (PSE); reddish-pink, firm, nonexudative (RFN or normal) and dark, firm, dry (DFD) pork. Sellier and Monin (1994) described PSE meat having pH_{45} less than 5.8; pH_{24} less than 5.5, drip loss more than 5% and colour - CIE L* more than 50. Other authors used different criteria. For example, Kauffman *et al.* (1992) and Warner *et al.* (1997) used drip loss >5% to differentiate PSE meat; Joo *et al.* (1999) set up drip loss threshold values for PSE meat to be >6%. Forrest (1998) reported that when pH_{24} is 5.5 or lower, nearly 99% of the pork is PSE; while van Laack (2000) used pH_{24} less than 5.7 as the indicator of PSE meat. Kauffman *et al.* (1992) suggested two additional quality conditions: RSE (reddish-pink, soft, exudative) and PFN (pale, firm, non-exudative) with their own threshold values of measured indicators. The aim of the present paper is to examine the relation between important meat quality traits and to determine certain threshold values in order to differentiate investigated pork *longissimus dorsi* muscles according to quality conditions.

Material and methods

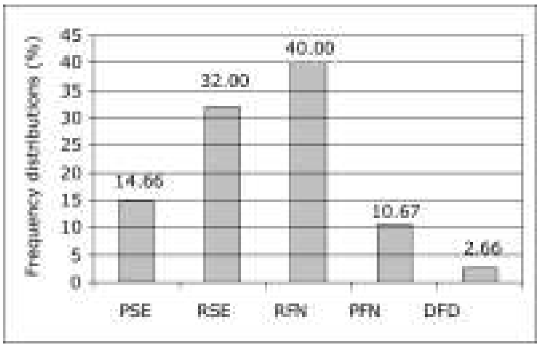
This study was performed on 87 randomly selected carcasses of barrows, slaughtered at approximately 100 kg live weight in two abattoirs from east Croatia. At the slaughter line, 45 minutes after sticking, initial pH values were taken at the *longissimus dorsi* muscle of primarily processed swine carcasses. After 24 hours of cooling, ultimate pH values and colour of *m. longissimus dorsi* were measured. Water holding capacity was expressed as drip loss and determined by the method described by Kauffman *et al.* (1992); the colour of meat was measured by "Minolta CR-300" device at *m. longissimus dorsi* cut after 15 minutes of blooming and presented as CIE L* values. The measurements of pH_{45} and pH_{24} were carried out by digital pH-meter "Mettler MP 120-B". Statistical analysis was performed using STATISTICA (6.0) for Windows program. Descriptive statistics and multiple correlation analysis procedures were used. Threshold value for ultimate pH was calculated using linear equation y=a+bx, where y=drip loss, a=intercept, b=slope and $x=pH_{24}$. Figure was produced using Microsoft Excel 2002.

Results and conclusions

Meat quality traits of investigated pigs are presented in table 1. Although the mean values of initial and ultimate pH values respected the reference values for "normal" meat, it is obvious that drip loss is to some extent higher than proposed by some authors (Sellier and Monin, 1994; Kauffman *et al.*, 1992; Warner *et al.*, 1997).

Better view at the meat quality of investigated *longissimus dorsi* muscles was obtained when samples were distributed into meat quality condi-

Figure 1. Differentiation of pork *longissimus dorsi* muscle into quality conditions according to Kauffman *et al.* (1992).



tions as presented on figure 1. This distribution shows that 14.66% and 32% of the samples expressed PSE and RSE condition, respectively. These groups are characterized by ultimate pH values less than 6, excessive drip loss (>5%) and CIE-L* values higher than 50 in case of PSE and 42-50 for RSE meat. RFN meat (called "normal") was represented with 40% of the muscle *longissimus dorsi* samples (pH_{24}>6; drip loss <5% and CIE-L* 42-50). PFN condition of the meat can be viewed as meat with paler colour, but other traits quite desirable (pH_{24}>6; drip loss <5%; CIE-L* >50). To these condition 10.67% of the samples were classified. Only 2.66% of the pork was distributed into DFD condition of the meat (pH_{24}>6; drip loss <5% CIE-L*<42). For the meat processing industry this classification is more of use than the differentiation of meat on the base of only one parameter, because it gives the basis for better decisions about the further purpose of examined pork muscles. However, larger sample should be taken in consideration in order to draw more general conclusions than in this study. A good exam-

Table 1. Descriptive statistics for meat quality traits of investigated pork samples.

Trait		Mean	Standard Deviation	Min.	Max.
pH_{45}		6.11	0.28	5.43	6.62
pH_{24}		5.63	0.17	5.41	6.46
CIE-L*		46.49	4.09	35.65	55.79
Drip loss	%	5.23	1.99	1.45	10.18

ple for this is the work of Cassens *et al.* (1992) who found more than 50% of the *m. gluteus medius* to be RSE and only 15% was "normal" (RFN) in the survey of 14 pork processing plants in USA.

The manners used to differentiate pork muscles into quality conditions may vary considerably depending on the methods used, but also on the measuring instruments, pig population (breed, genotype, etc.) slaughter conditions and other factors of influence. Nevertheless, many authors reported ultimate pH values as the most convincing predictor of meat quality expressed as the ability to withhold water which is difficult to measure at the slaughter plants; this is due to high correlation between pH_{24} and WHC (Forrest, 1998; van Laack, 2000). Ultimate pH value used to differentiate PSE meat from other conditions according to those authors varies between 5.5 and 5.7. Correlation coefficients calculated for measured quality traits in this trial are shown in table 2. It is obvious that the highest correlations observed were between ultimate pH value and drip loss as well as CIE-L* values as the measure of brightness (paleness). Similar results are reported by Otto *et al.* (2004), while Eikelenboom *et al.* (1995) and Kralik *et al.* (2002) reported to some extent higher correlation than in current study between pH_{24} and Minolta L* and water holding capacity. Kušec *et al.* (2003) found significant correlation between initial pH, ultimate pH value and WHC in the meat samples from the Duroc sired pig carcasses, while results found for the samples originated from Pietrain sired carcasses resembled those presented here.

The relation between ultimate pH value and drip loss was described by linear equation: Drip loss = 33.6728 – 5.04*pH_{24}. Interpolated threshold value of ultimate pH was 5.69. Although interpolated ultimate pH was close to the value reported by van Laack (2002) it should be verified on a larger sample in order to draw more general conclusions due to different reports from other authors.

Table 2. Correlation coefficients for meat quality traits of *longissimus dorsi muscle* of investigated pig carcasses (n=87).

Traits	pH_{45}	pH_{24}	Drip loss (%)
pH_{45}	-		
pH_{24}	0.088 n.s.	-	
Drip loss (%)	-0.133 n.s.	-0.406**	-
CIE- L*	-0.031 n.s.	-0.392**	0.384**

REFERENCES

CASSENS, R.G., KAUFFMAN, R.G., SHERER, A., MEEKER, D.L., 1992. Variations in pork quality: a 1991 U.S.A. Survey. Proc. 38th Int. Congr. Meat Sci. & Technology, Clermont Ferrand, France, pp 237-240.

EIKELENBOOM, G., VAN DER WALL, P.G., DE VRIES, A.G., 1995. The significance of ultimate pH for pork quality. Proc. 41st Int. Congr. Meat Sci. & Technology, San Antonio, USA, pp 654-655.

FORREST, J.C., 1998. Line speed implementation of various pork quality measures. Home page address: http://www.nsif.com/Conferences/1998/forrest.htm.

JOO, S.T., KAUFFMAN, R.G., KIM, B.C., PARK, G.B., 1999. The relationship of sarcoplasmic and myofibrillar protein solubility to colour and water-holding capacity in porcine longissimus muscle. Meat Sci. 52:297-297.

KAUFFMAN, R.G., CASSENS, R.G., SHERER, A., MEEKER, D.L., 1992. Variations in pork quality. NPPC Publication, Des Moines, U.S.A. pp 1-8.

KRALIK, G., KUŠEC, G., GUTZMIRTL, H., PETRIČEVIĆ, A., GRGURIĆ, D., 2002. Correlation between meat color and some indicators of carcass and meat quality of pigs. Acta Agr. Kapos. 6:253-258.

KUŠEC, G., KRALIK, G., PETRIČEVIĆ, A., GUTZMIRTL, H., GRGURIĆ, D., 2003. Meat quality indicators and their correlation in two crosses of pigs. Agric. Conspec. Sci. 68:115-120.

OTTO, G., ROEHE, R., LOOFT, H., THOELKING, L., KALM, E., 2004. Comparison of different methods for determination of drip loss and their relationships to meat quality and carcass characteristics in pigs. Meat Sci. 68:401-409.

SELLIER, P., MONIN, G., 1994. Genetics of pig meat quality: A review. J Muscle Foods 5:187.

VAN LAACK, R.L.J.M., 2000. Determinants of ultimate pH and quality of pork. Home page address: http://www.nppc.org/Research/00reports/99-129-Laack.htm.

WARNER, R.D., KAUFFMAN, R.G., GREASER, M.L., 1997. Muscle protein changes post mortem in relation to pork quality traits. Meat Sci. 45:339-352.