

INFLUENCE OF SEASONS ON PIG HALVES AND MEAT QUALITY (*M. longissimus dorsi*) OF THREE-RACE HYBRIDS

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Abstract: According to the results of partial dissection method it was concluded that there was difference, but not statistically significant, between meat yield of three-race hybrids at autumn (57.4%), comparing to meat yield at winter (56.3%) and spring (55.8%). The investigation of technological parameters (pHi, pHu, WHCu and L*value) and sensory properties (colour and marbling) showed that meat (*M. longissimus dorsi*) quality processed at autumn was RSE (Reddish-pink, Soft, Exudative) quality, and that meat (*M. longissimus dorsi*) quality processed at winter was of PSE (Pale, Soft, Exudative) quality.

Key words: three-race hybrids pig, halves quality, meat quality, seasons

Introduction

Meat quality is a result of complex and delicate biochemical processes which occur in animal muscles after slaughtering. A number of factors influence the courses and intensity of post mortem changes in muscles, and these factors can be divided in two primary groups. This means that changes of muscle quality, and quality of meat depends on genetics (endogenous factors), and are activated by the impacts of environment (exogenous factors) (Rede and Petrović, 1997).

Climate conditions may significantly affect the quality of meat post mortem. Pigs are particularly sensitive to high temperatures (Lengerken and Hennebach, 1980; Church and Wood, 1992). According to Briskey (1964) Ludvigsen has found that incidence of pale, soft and exudative (PSE) muscle is higher in warmer periods. Patricia Barton-Gade (1971), in Denmark, found more PSE meat in summer and autumn, than in winter. Krzeczio *et al.* (2001) were investigating different HAL genotypes in different seasons and pointed to higher incidence of PSE meat in spring-summer compared to autumn-winter. However, Scheper (1971), in Germany, found PSE and DFD meat incidences to be higher in autumn and winter than in spring and summer. Manojlović and Rahelić (1978) found almost two times higher incidence of PSE meat in the period when the

climate factors are changing, e.g. spring and autumn than in summer and winter. Okanović et al. (1992) showed that the highest incidence of PSE meat, regarding total mass of ham, is in spring. Warriss (1991) found greater water loss, and more pale *M. longissimus dorsi* in pigs carcasses slaughter when $t > 18.3^{\circ}\text{C}$, comparing to muscles of carcasses slaughter when $t < 18.3^{\circ}\text{C}$. Džinić et al. (2003) reported higher incidence of PSE meat (according to quality criterion $\text{pH}_i < 5.8$) non-depending on genotype of three-race hybrids at spring (31.25%), than at winter (7.7%). The investigated *M. semimembranosus*, of three-race hybrids, at autumn, winter and spring were on the average of PSE quality regarding criteria for WHC e.g. and RSE regarding criteria for colour L^* .

Therefore, the objective of this study was to investigate the influence of seasons on quality of halves and meat of three-race pigs determining the meat yield (%) and incidence of different *M. longissimus dorsi* (MLD) quality (RFN, RSE, PSE, DFD) on the basis of technological parameters: pH_i , pH_u , WHC and L^* and own criteria for quality estimation (Tomović, 2002; Džinić et al., 2003, 2004).

Materials and Methods

The investigations included 75 pigs of three-race hybrids, from the crossbreeding program performed at a farm in Serbia. The pigs were slaughtered and investigated in autumn ($n=31$), winter ($n=29$), and spring ($n=25$). The pigs were fed standard feed during fattening, and heads of approximately uniform age and mass were transported to the slaughterhouse. After a night rest, the pigs were stunned, bled and processed by the standard technological procedure.

Meat yield (%) was determined by partial dissection method (Walstra and Merkus, 1996) of cooled left halves.

The pH_i was determined on right halves 45 min post mortem, and pH_u 24 hrs p.m. in *M. longissimus dorsi* (MLD), caudo-medial part between 3rd and 4th rib, using the pH-meter ULTRA X, type UX 390, Gronert (Germany) INGOLD penetrating electrode.

Samples (200 – 300 g) taken from the caudo-cranial part (MLD) were used 24 hrs p.m. for the determination of colour, water holding capacity (WHC), and marbling. The colour was determined sensorial (1 – very pale; 7 – very dark) and with Minolta Chroma Meter CR-400. The colour characteristics were expressed in CIE $L^*a^*b^*$ system (Robertson, 1977). WHC was determined by filter paper press method and expressed as cm^2 (Grau and Hamm, 1953). Marbling was determined sensorial, applying the analytical descriptive test (1 – without marbling; 10 – very expressed marbling).

The obtained results were statistically processed, and arithmetic mean ($\bar{x}$), standard deviation (σ) and significance of difference between means (t-test) (Hadživuković, 1991) were determined (calculated).

The incidence of different MLD quality in different seasons was determined on the basis of parameters and criteria for MLD quality:

PSE (Pale, Soft, Exudative): $pH_i < 5.8$, $pH_u < 6.2$, $WHC > 12\text{cm}^2$, $L^* > 50$;

RSE (Reddish, Soft, Exudative): $pH_i < 5.8$, $pH_u < 6.2$; $WHC = 10\text{-}12\text{cm}^2$, $L^* = 43\text{-}50$;

RFN (Reddish, Firm, Non-exudative): $pH_i > 5.8$, $pH_u < 6.2$, $WHC = 10\text{-}5\text{cm}^2$, $L^* = 43\text{-}50$;

PFN (Pale, Firm, Non-exudative): $pH_i < 5.8$, $pH_u < 6.2$, $WHC = 10\text{-}5\text{cm}^2$, $L^* > 50$;

DFD (Dark, Firm, Dry): $pH_u > 6.2$, $WHC > 5\text{cm}^2$, $L^* < 43$.

Results and Discussion

Numerical higher, but not significantly higher, meat yield ($P > 0.05$) was found in halves of three-race hybrids in autumn (57.4%), compared with meat yield in halves of hybrids in winter (56.3%), and in spring (55.8%).

Table 1. Meat yield in halves of three-race hybrids determined in different seasons by partial dissection

Characteristic	Season			t – test		
	Autumn	Winter	Spring	A – W	A – S	W – S
Mass of halves (kg)	39.2 ± 2.2	39.9 ± 2.4	36.6 ± 2.9	NS	NS	NS
Meat yield in halves (kg)	21.2 ± 2.4	22.5 ± 2.3	26.4 ± 1.6	NS	NS	NS
Meat yield in halves (%)	57.4 ± 5.3	56.3 ± 4.8	55.8 ± 4.6	NS	NS	NS

NS - $P > 0.05$

The investigation of technological characteristics (Table 2) showed that the average pH_i (6.04) measured in MLD of three-race hybrids were significantly higher in autumn compared with the same parameters in winter (5.86) ($P \leq 0.05$), and in spring (5.82) ($P \leq 0.001$). Difference in average pH_i measured in winter and spring are not significant ($P > 0.05$). The average pH_i values of MLD respond to the muscles of potentially normal quality ($pH_i > 5.8$) (Honikel, 1999). Determined differences in average values of WHC of MLD in different seasons (12.98; 13.47;

15.66cm² in autumn, winter and spring, respectively) are not significant ($P>0.05$). On the basis of criterion for WHC, all investigated MLD are of PSE quality, on the average ($\text{WHC}>12\text{cm}^2$). Average grade for marbling of MLD in autumn (3.11) is higher ($P\leq 0.05$) than in winter (2.10). Differences in marbling of MLD in autumn-spring and winter-spring are not significant.

The sensory assessment showed that the MLD was significantly lighter in winter (2.91), comparing to colour in autumn (4.27) ($P\leq 0.001$), and spring (3.28) ($P\leq 0.05$). The colour – lightness L^* – of MLD was also determined with Minolta Chroma Meter (Table 2). It was found that the investigated MLD were significantly lighter in winter ($L^*=53.79$) compared to autumn (50.38) and spring ($L^*=53.16$). According to criteria for L^* , the investigated MLD were of RFN quality characteristics in autumn, and of RSE in winter and spring. The significantly higher ($P\leq 0.001$) a^* value (8.79) was determined in MLD of three-race hybrids in spring, comparing to autumn and winter, and the significantly higher ($P\leq 0.001$) b^* value (8.25) was determined in winter comparing to other seasons.

Table 2. Effect of seasons on technological quality of *M. Longissimus dorsi*

Characteristic	Season			t – test		
	Autumn	Winter	Spring	A – W	A – S	W – S
pH _i	6.04 ± 0.31	5.86 ± 0.28	5.82 ± 0.25	*	**	NS
pH _u	5.80 ± 0.28	5.48 ± 0.08	5.51 ± 0.23	**	**	NS
WHC (cm ²)	12.98 ± 2.87	13.47 ± 1.35	15.66 ± 1.53	NS	NS	NS
Marbling	3.11 ± 1.64	2.10 ± 0.31	2.38 ± 0.98	**	NS	NS
Colour (sensory)	4.27 ± 1.36	2.91 ± 0.61	3.28 ± 0.58	**	**	*
L^*	50.38 ± 4.33	53.79 ± 3.38	53.16 ± 2.99	**	*	NS
a^*	8.41 ± 1.81	8.47 ± 2.25	8.79 ± 1.29	NS	**	**
b^*	7.79 ± 2.04	8.25 ± 0.85	5.43 ± 0.92	**	**	**

NS $P>0.05$; * $P\leq 0.05$; ** $P\leq 0.001$

The analysis of average technological quality of MLD of three race hybrids, in different seasons, confirmed that the seasons affect the meat quality (Warriss, 1991; Džinić et al., 2003, 2004).

Conclusion

The highest average meat yield in halves of three-race hybrids was found in autumn (57.4%), and the lowest in spring (55.8%) ($P>0.05$). The investigated MLDs, in all seasons, were on the average of PSE quality regarding criteria for WHC. According to criteria for L^* the MLD were of »normal« colour in autumn, and of RSE quality characteristics in winter and spring.

On the basis of parameters (pH_i , pH_u , L^* and WHC_u) and criteria for the evaluation of technological meat quality, it was found that the MLD of three-race hybrids in autumn on average corresponded to RSE quality characteristics, and to PSE quality characteristics in winter and spring.

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Uticaj godišnjeg doba na kvalitet polutki i mesa (*M. longissimus dorsi*) svinja trorasnih hibrida

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Rezime

Metodom parcijalne disekcije utvrđen je numerički, ali ne i značajno veći ($P>0,05$) prinos mesa u polutkama trorasnih hibrida svinja u jesen (57,4%), u poređenju sa prinosom mesa u zimu (56,3%) i proleće (55,8%),

Na osnovu rezultata ispitivanja tehnološkog (pH_i , pH_k , SVV_k , svetloća - L^* ,) i senzornog (boje_k i mramoriranosti) kvaliteta mesa može se zaključiti da prosečan kvalitet proizvedenog mesa (*M. longissimus dorsi*-MLD), u jesen odgovara CMV (crveno-ružičast, mek, vodnjikav) kvalitetu, a da je kvalitet MLD hibrida svinja u zimskom i prolećnom periodu prosečnih BMV (bled, mek, vodnjikav) svojstava.

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