



## INFLUENCE OF SEASONS ON INCIDENCE OF DIFFERENT *M. SEMIMEMBRANOSUS* QUALITY OF PIG HALVES OF THREE-RACE HYBRIDS

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### Background

Climate conditions may affect significantly the quality of meat post mortem. Pigs are particularly sensitive to high temperatures (Lengerken and Hennebach, 1980; Church and Wood, 1992). Ludvigsen, according to Briskey (1964) has found pale, soft and exudative (PSE) muscle incidence to be 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, Schepper (1971), in Germany, found PSE and DFD meat incidences to be higher in autumn and winter than in spring and summer. Danica 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.

### Objectives

The objective of this study was to investigate the influence of seasons on quality of halves and meat of three-race pigs determining the incidence of different quality *M. semimembranosus* (RFN, RSE, PSE, DFD) on the basis of technological parameters: pH<sub>i</sub>, pH<sub>u</sub>, WHC and L\* and our criteria for quality estimation (Tomović, 2002; Natalija Džinić et al., 2003, 2004)).

### Materials and methods

The investigations included 43 pigs of three-race hybrids, from the crossbreeding program performed at a farm in Serbia and Montenegro. The pigs were slaughtered and investigated in autumn (n=14), winter (n=13), and spring (n=16). 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, debleded 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<sub>i</sub> was determined on right halves 45 min post mortem, and pH<sub>u</sub> 24 hrs p.m. in *M. semimembranosus* (MSM), caudo-medial part, using the pH-meter ULTRA X, type UX 390, Gronert (Germany) INGOLD penetrating electrode.

Samples (200 – 300 g) taken from the caudo-cranial part (MSM) were used 24 hrs p.m. for the determination of colour, water holding capacity (WHC), marbleness and chemical composition. The color was determined sensorily (1 – very pale; 7 – very dark) and with MOM Color 100 and the color characteristics were expressed in CIE L\*a\*b\* system (Robertson, 1977). WHC was determined by compression method and expressed as % of bound water (Grau and Hamm, 1953). Marbleness was determined sensorily, applying the analytical descriptive test (1 – without marbleness; 10 – very expressed marbleness).

The content of moisture, proteins, free fat and total ash was determined by standard methods (AOAC, 1999).

The incidence of different MSM quality in different seasons was determined on the basis of parameters and criteria for MSM quality: PSE: pH<sub>i</sub><5,8, pH<sub>u</sub><5,4, WHC<50%, L\*>55; RSE: pH<sub>i</sub>=5,8-6,0, pH<sub>u</sub>=5,85-6,2; WHC=50-60, L\*=50-55; RFN: pH<sub>i</sub>>6,0, pH<sub>u</sub>=5,4-5,85, WHC=60-70, L\*=45-50; DFD: pH<sub>u</sub>>6,2, WHC>70, L\*<45).



## Results and discussion

Significantly higher meat yield ( $P \leq 0,01$ ) was found in halves of hybrids in spring (55,83%), compared with meat yield in halves of hybrids in winter (55,06%). However, it was not significantly higher in halves in autumn (55,32%) ( $P > 0,05$ ).

Table 1. Meat yield in halves determined in different seasons by partial dissection

Characteristic	Season			t – test		
	Autumn	Winter	Spring	A – W	A – S	W – S
Mass of halves (kg)	38,28±1,77	40,77±1,88	36,67±2,49	*	NS	NS
Meat yield in halves (kg)	21,18±1,6	22,77±1,41	20,43±1,32	**	NS	**
Meat yield in halves (%)	55,32±2,33	55,06±3,40	55,83±2,61	**	NS	**

<sup>NS</sup> $P > 0,05$  \* $P \leq 0,05$  \*\* $P \leq 0,01$

The investigation of technological characteristics (Table 2) showed that the average  $pH_i$  (6,27) and  $pH_u$  (5,63) measured in MSM of three-race hybrids were significantly higher ( $P \leq 0,01$ ) in autumn compared with the same parameters in winter (6,08 and 5,53), but not in spring. The average  $pH_i$  values of MSM respond to the values of muscles which are potentially of normal quality ( $pH_i > 6,0$ ) (Tomović, 2002). WHC (%) of MSM in autumn was significantly higher ( $P \leq 0,01$ ) compared with values determined in winter, but not compared with results in spring. The lowest WHC value (39,18%) was found in winter. On the basis of criterion for WHC, all investigated MSM are of PSE quality, on the average (WHC < 50%).

Table 2. Effect of seasons on technological quality of *M. semimembranosus*

Characteristic	Season			t – test		
	Autumn	Winter	Spring	A – W	A – S	W – S
$pH_i$	6,27±0,22	6,08±0,24	6,06±0,31	**	NS	**
$pH_u$	5,63±0,11	5,53±0,07	5,53±0,15	**	NS	**
WHC (%)	44,55±7,9	39,18±6,73	41,64±7,27	**	NS	**
Marbleness	4,44±1,44	3,00±1,07	3,33±0,98	**	NS	*
Colour (sensory)	3,57±0,77	2,99±0,52	3,54±0,75	**	NS	**
$L^*$	53,15±2,49	51,39±2,49	51,02±3,41	**	**	NS
$a^*$	10,99±2,93	9,86±1,14	4,28±4,29	*	**	*
$b^*$	13,81±1,26	8,97±1,02	7,33±1,87	**	**	NS
Moisture (g/100g)	76,09±0,36	75,92±0,41	75,56±0,71	**	*	**
Protein (g/100g)	21,65±0,35	22,14±0,39	22,35±0,44	**	**	**
Free fat (g/100g)	1,12±0,26	0,72±0,22	0,85±0,31	**	*	**
Total ash (g/100g)	1,18±0,05	1,24±0,22	1,24±0,2	**	NS	NS

The color – lightness  $L^*$  – of MSM was also determined (Table 2). It was found that the investigated MSM were significantly lighter in autumn ( $L^*=53,15$ ) compared to winter (51,39%) and spring ( $L^*=51,02$ ). According to our criteria for  $L^*$ , the investigated MSM were of PSE characteristics, on the average, in all investigated seasons. The moisture content of MSM in autumn was significantly ( $P \leq 0,05$ ) and highly significantly ( $P \leq 0,01$ ) higher (76,09) compared to winter, e.g. spring. The sensory assesment showed that the



average color of MSM was significantly lighter ( $P \leq 0,01$ ) in autumn (3,57), compared to winter, however not significantly lighter compared to spring. The average grade for marbleness of MSM in winter (3,0) was significantly lower ( $P \leq 0,01$ ) and ( $P \leq 0,05$ ) compared to autumn, e.g. spring. The differences in protein content of MSM in different seasons are significant ( $P \leq 0,01$ ), however, it was also found that the protein content was higher than 21% in all MSM samples. This is an important finding, since this aim has to be fulfilled in contemporary breeding of pigs (Vidović, 1999).

The analysis of average technological quality of MSM of three race hybrids, in different seasons, confirmed that the seasons affect the quality of meat.

On the basis of criterion for  $pH_i$ , it was found (Table 3), that the highest potential incidence of PSE characteristics of MSM was in spring, 31,25%, and significantly lower in autumn (7,7%). Further, on the basis of criterion for  $pH_u$ , all investigated MSM were of RFN quality in winter, 7,2% of MSM were of RSE quality in autumn, and 6,7% of MSM were of DFD characteristics in spring. According to criterion for  $L^*$ , it was found that the highest incidence of PSE characteristics in MSM was in spring (50%), and the highest incidence of RSE characteristics of MSM, 64,3%, was found in autumn. The obtained results further show that according to criterion for WHC, all MSM in winter were of PSE quality, e.g. 81,2% and 71,6% in spring and autumn, respectively.

Table 3. Effect of seasons on incidence of different meat quality of *M. semimembranosus* in halves of three race hybrids

Parameters	Quality	Season		
		Autumn	Winter	Spring
$pH_i$	PSE (%)	0	7,7	31,25
	RSE (%)	21,4	23,1	12,5
	RFN (%)	78,6	69,2	56,25
$pH_u$	PSE (%)	0	0	0
	RSE (%)	7,2	0	0
	RFN (%)	92,8	100	93,3
	DFD (%)	0	0	6,7
$L^*$	PSE (%)	28,6	15,4	50,0
	RSE (%)	64,3	46,2	37,5
	RFN (%)	7,1	30,7	12,50
	DFD (%)	0	7,7	0,0
WHC	PSE (%)	71,6	100	81,2
	RSE (%)	21,3	0	12,5
	RFN (%)	7,1	0	6,3
	DFD (%)	0	0	0

## Conclusions

The highest average meat yield in halves of three-race hybrids was found in spring (55,83%), and the lowest in winter (55,06%) ( $P \leq 0,01$ ). The investigated MSM, in all seasons, were on the average of PSE and RSE quality regarding criteria for WHC e.g. color  $L^*$ , respectively. The highest incidence of normal quality 100% (according to criterion for  $pH_u$ ) and 30,7% (criterion for  $L^*$ ) was in winter. The incidence of MSM of normal (RFN) quality was 7,1%, according to criteria for color  $L^*$  and WHC in autumn. In spring, 12,5% and 6,3% of MSM were of normal quality, according to criteria for color  $L^*$  and WHC, respectively. According to criterion for color  $L^*$ , the highest incidence of PSE quality (50%) was found in spring. According to criterion for WHC, 100%, 81,2% and 71,6% of MSM was of PSE quality, from carcasses of pigs slaughtered in winter, spring and winter, respectively.



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