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Original Paper

Influence of the year season and lairage length in the slaughterhouse on the quality of pig meat

Ivan Imrich*, Eva Mlyneková, Juraj Mlynek, Andrej Borsos

Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Sciences, Nitra, Slovak Republic

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The impact of the length of pig housing in the slaughterhouse and the season on the meat quality of pigs was analyzed in the experiment. There were altogether 104 commercial pig hybrids used in the experiment weighing from 100 to 130 kilograms. The acidity of meat was assessed 45 minutes after slaughter in the longest back muscle - pH_1 MLD and the semimembranosus thigh muscle – pH_1 MSM. We found the lower pH1 value in MLD muscle (6.07) compared to MSM muscle (6.22) ($P < 0.05$). The lowest occurrence of PSE meat in MLD and MSM was found out in the pigs slaughtered two hours after arrival to the slaughterhouse. The length of housing lasting for eight hours and more has negatively affected the quality of meat, which resulted in decreasing the average values of pH_1 in MLD ($P < 0.05$) as well as in MSM (statistically insignificant).The lower average values of pH_1 MLD (5.98) were recorded in pigs slaughtered in the summer season compared to the winter period (6.16) ($P < 0.05$). During the summer season, there was a threefold higher occurrence of the PSE meat in MLD muscle than in winter. The season had no impact on the values of pH_1 MSM.

Keywords: acidity, lairage, pork, PSE, season

1 Introduction

The quality of pork is considered a result of the production system including the genetic factors, housing conditions, age, and the weight at slaughter, manipulation and stress (Maiorano et al. 2012). To decrease the occurrence of PSE meat is possible through resistant to stress breeds, considerate transport and handling of pigs before and during slaughter (Martinez-Rodriguez et al., 2011). The lairage time of pigs can have a direct effect on the quality of meat. Many studies comparing lairage duration have shown that a short lairage time (taking shorter than two hours) result in higher occurrence of PSE meat compared to longer lairage time (Marchant-Forde and Marchant-Forde, 2009). The time of the year is also considered a risk factor that affects the values of the meat pH (Perre van de et al., 2010). The aim of the experiment was to determine the influence of the length of pig housing in the slaughterhouse and the season of the year on the quality of pork.

2 Material and methods

In total, 104 commercial crossbred pigs weighing from 100 to 130 kilograms were used in the experiment. Influence of the lairage time expressed in hours as well as particular season of the slaughter on the meat quality was evaluated. The pigs were divided into six groups with the length of 2, 8, 11, 13, 14, and 16 hours of housing. They were divided, according to the season of the year, into two groups: the summer season group and the winter season group. We were monitoring the average daily outdoor temperatures during housing of pigs at a slaughterhouse.

The acidity of meat was assessed 45 minutes after slaughter in the longest back muscles between the next to last and the last thoracic vertebrae (musculus longissimus dorsi, pars thoracis) – pH1 MLD, and the geometric center semimembranosus thigh muscle (musculus semimembranosus) – pH1 MSM. The right side of the carcass was used to perform meat quality measurements. The post

* **Corresponding Author:** Ivan Imrich. Slovak University of Agriculture, Faculty of Agrobiology and Food Resources, Department of Veterinary Sciences, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic. E-mail: ivan.imrich@uniag.sk

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mortem muscle pH was measured using a portable apparatus TITAN x. As PSE meat was characterized the meat in which the pH value fell, 45 minutes after slaughter, below 5.8.

The results were processed in the SPSS 20 Program. The following variables, statistical values, were calculated:
minimum – x_{min}, maximum - x_{max}, arithmetic mean – $\bar{x}$, standard deviation – s, variation coefficient [%]. The differences between groups were tested using the analysis of variance and testing the contrasts using the Scheffe´s test.

3 Results and discussion

Table 1 shows comparison of the meat quality between the musculus longissimus dorsi muscle, pars thoracis (MLD) and the musculus semimembranosus (MSM). The lower average pH_1 value was found in the MLD muscle (6.07) compared to MSM muscle (6.22). This difference was statistically significant ($P < 0.05$). It results from what was mentioned above that a greater acidification occurred in the MLD muscle and there was also recorded a higher occurrence of PSE meat in this muscle (15.38 %) in comparison to the MSM muscle (9.62 %). Tomovic et al. (2014) have similarly found significantly higher ($P < 0.05$) pH1 values in the MSM of the Large White breed than in the MLD. Correu et al. (2013) indicate that the effect of stress depends on the particular muscle. In the moving muscle such as musculus gluteus medius (MGM), the reserves of glycogen are spent during physical exertion of an animal much faster than in MLD so that it comes to minor acidification in MGM after slaughter.

Table 1 Comparison of variational-statistical pH_1 MLD values and pH_1 MSM values

muscle	n	$\bar{x}$	s	x_{min}	x_{max}	in [%]	PSE [%]
MLD	104	6.07[a]	0.28	5.5	6.7	4.61	15.38
MSM	104	6.22[b]	0.33	6.9	6.9	5.31	9.62

[a,b] The main difference is significant on the level of 0.05

The pork quality evaluation results depending on the length of pigs´ housing in the slaughterhouse are shown in the Tables 2 and 3. We have found out that the lowest occurrence of PSE meat in MLD and MSM was observed in the pigs slaughtered two hours after arrival at the slaughterhouse (0.0 %). We have also recorded the highest average values of pH_1 in MLD (6.35) and MSM (6.39) at the two-hour housing.

Table 2 Comparison of variational-statistical pH_1 MLD values in relation to lairage time

Lairage	n	$\bar{x}$	s	x_{min}	x_{max}	in [%]	PSE[%]	Temperature[°C]
2	16	6.35[b]	0.21	6.0	6.7	3.31	0.00	-0.9
8	16	6.06[a]	0.22	5.6	6.4	3.63	18.75	16.7
11	18	5.85[a]	0.27	5.5	6.6	4.62	38.89	20.1
13	21	6.09[ab]	0.25	5.5	6.5	4.11	9.52	0.2
14	16	6.04[a]	0.21	5.6	6.3	3.48	12.50	25.3
16	17	6.05[a]	0.30	5.6	6.6	4.96	11.74	2.0

[a,b] The main difference is significant on the level of 0.05.

The length of eight hour housing and longer has negatively affected the quality of meat, which resulted in decreasing the average values of pH_1 in MLD as well as in MSM. The differences in the average values of pH_1 MLD depending on the length of housing were statistically significant ($P < 0.05$). We have not found statistically significant differences between the average values of pH_1 MSM. The greatest occurrence of PSE meat in MLD (38.89 %) was recorded in the group of pigs that had been housed for 11 hours. We assume that such a high occurrence of the PSE meat in the named group was caused, except for the length of housing, due to a high environmental temperature during

housing. The greatest occurrence of PSE meat in MSM (23.81 %) was recorded at the housing length of 13 hours. Zhen et al. (2013) compared the groups of pigs with the length of housing taking 0, 3, 8, and 24 hours before slaughter. They found out that a three hour length of housing had led to a reduced level of cortisol in blood, minor loss of water by dripping, and to a delayed degradation of glycogen in the muscles in comparison with other groups. According to Vrba et al. (2010), the most suitable length of housing in order to decrease the occurrence of the qualitative meat deviations is up to 1.5 hour. Similarly, van de Perre et al. (2010) recommend that a pre-slaughter housing period would take, in relation to PSE meat prevention, within the range of two to four hours in the summer season and less than two hours in the winter season.

Table 3 Comparison of variational-statistical pH_1 MSM values in relation to lairage time

Lairage	n	$\bar{x}$	s	x_{min}	x_{max}	in [%]	PSE[%]	Temperature[˚C]
2	16	6.39	0.29	5.9	6.9	4.54	0.00	-0.9
8	16	6.28	0.33	5.4	6.7	5.25	6.25	16.7
11	18	6.20	0.31	5.4	6.7	5.00	5.56	20.1
13	21	6.12	0.39	5.4	6.7	6.37	23.81	0.2
14	16	6.14	0.29	5.6	6.7	4.72	12.50	25.3
16	17	6.23	0.27	5.5	6.5	4.33	5.88	2.0

Not significant differences

Lower average values of pH1 MLD (5.98) were recorded in pigs slaughtered in the summer season in comparison with the winter season (6.16) (Table 4). This difference was statistically significant ($P < 0.05$). In the summer season, there was also observed a threefold higher occurrence of PSE meat (24%) in the MLD muscle. In accordance with our results, Guardia et al. (2004) indicate a two-fold higher risk of PSE meat in the summer season compared to the winter.

Table 4 Comparison of variational-statistical pH_1 MLD values in relation to the season of the year

Season	n	$\bar{x}$	s	min	max	in[%]	PSE[%]	Temperature[˚C]
S	50	5.98^{a}	0.25	5.50	6.60	4.18	24.00	20.7
W	54	6.16^{b}	0.28	5.50	6.70	4.55	7.41	0.4

S – summer, W – winter, ^{a,b} The main difference is significant on the level of 0.05.

Table 5 Comparison of variational-statistical pH_1 MSM values in relation to the season of the year

Season	n	$\bar{x}$	s	min	max	in[%]	PSE[%]	Temperature[˚C]
S	50	6.21	0.31	5.40	6.70	4.99	8.00	20.7
W	54	6.23	0.34	5.40	6.90	5.46	11.11	0.4

S – summer, W– winter

As far as the season of the year is concerned, the differences in the values of pH_1 MSM were not statistically significant. Unlike the MLD muscle, we have observed a higher occurrence of PSE meat in MSM in winter (11.11 %). In contrast to our findings, Gajana et al. (2013) recorded the highest occurrence of PSE meat in the autumn season and the lowest one in spring.

4 Conclusions

The results of our experiment have confirmed that the quality of pig meat is influenced by the environmental conditions they face before slaughter. The risk of PSE meat in MLD was one and a half

times higher compared to MSM. An important role in the formation of qualitative meat variations is played by the length of housing at a slaughter house. The results of our experiment showed that the most suitable housing period was two hours. It is particularly important to create favorable conditions for pigs in the summer season, which is at higher environmental temperatures. Our results have shown that the risk of PSE meat in MLD may be up to three times higher in the summer season.

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