

DYNAMICS OF POSTMORTAL pH VALUE AND LACTIC ACID CONTENT VARIATIONS IN THE MUSCLES OF PIGSŠimek J.¹, Vorlová L.², Malota L.², Steinhäuser L.¹¹Department of Meat Hygiene and Technology, University of Veterinary and Pharmaceutical Sciences, Brno, Czech Republic²Department of Biochemistry and Biophysics, University of Veterinary and Pharmaceutical Sciences, Brno, Czech Republic**Background**

One of the significant postmortem changes is the lowering of pH in muscle due to the accumulation of lactic acid. A normal pH decline pattern in pork muscle is represented by a gradual decrease from approximately pH 7.4 in living muscle to a pH of about 5.6 to 5.7 within 6 to 8 hours post mortem, and then to an ultimate pH (reached at approximately 24 hours post mortem) of about 5.3 to 5.7 (HEDRICK, 1994). Lactic acid is formed from glycogen during anaerobic glycolysis. The conversion of glycogen to lactic acid will continue until a pH is reached when the enzymes effecting the breakdown become inactivated. The pH value of a meat is not only determined by the presence of acids and bases, but also by the presence of strong ions. In chicken and pork muscles with similar lactate levels may have a different pH value. Differences in buffering capacity may explain these differences in pH (VAN LACK, 2001).

Objectives

The objectives of this research was to evaluate the variations of pH value and lactic acid content in the course of post mortal changes in the muscles of pigs and compare differences between muscles and between right and left side of carcass.

Methods

A total of 4 pigs slaughtered in a commercial abattoir were chosen for this experiment. A parts of *M. longissimus lumborum et thoracis* (MLLT) behind the last rib and *M. semimembranosus* (SM) from each side of carcasses were taken. The muscles were stored at 4°C. The pH value was measured after 30 minutes, 1, 6, 12, 24, 36 and 48 hours following the slaughter. In the same time (immediately after pH value measurement) a sample of muscle (approx. weight 100 g) for lactic acid content determination was taken. The sample was frozen in liquid nitrogen (-196°C) and stored at -85°C until analyses. The pH value was measured using Sentron Argus pH-meter with ISFET probe. The concentration of lactic acid was determined on the basis of enzymatic reaction using commercial kits (BOEHRINGER MANNHEIM). All the data was statistically analysed.

Results and discussion

Average values of pH and lactic acid content in MLLT in each time are given in Table 1. The decrease of pH until 24 hours after slaughter was more intensive in the left side than in the right (Fig. 1). The lowest pH value was in 36 hours (5.52) in the right side and 48 hours (5.48) in the left. Values of pH early post mortem (until 12 hours) were more variable. There were not significant differences in pH value between right and left side of the carcasses. The increase of lactic acid content was similar in both sides (no significant differences). Maximal content was 24 hours after slaughter (9.88 and 9.83 g/kg). The decrease is seen in 48 hours. The variations in the lactic acid content were higher than in the pH values. Values of pH and lactic acid content for SM are given in Table 2. The pH values 30 minutes and 1 hour after slaughter are similar to MLLT. The decrease is slower and the lowest values were found in 48 hours (5.68 and 5.79) and were higher than in MLLT. The variations among values were higher too. Differences between sides were not significant. Differences between right and left side in lactic acid content were insignificant. The increase of lactic acid (Fig. 2) was similar to MLLT, but the amount of lactic acid was lower. The highest content was found 48 hours after slaughter in the right side and 24 hours post mortem in the left (but the decrease of amount until 48 hours was not high).

The course of the decrease of pH was typical. The fast decrease until 6 hours correspondent with published data (STOIER, 2001). The decrease within the following hours was slower. The lowest pH value was reached in 48 hours after slaughter. It does not correspondent with literature, where it is shown, that the value of pH ultimate is reached in 24 hours post mortem. Differences between right and left side of the carcasses was not found. But significant differences ($P < 0.01$) were seen between muscles. These differences 1 hour after slaughter were not high. That is important for identification of defect meat, when we can use both muscles for measurement. The increase of lactic acid was very fast by 12 hours post mortem. Other increases were slower. The concentration was increased by 24 hours after slaughter (except SM has not been described yet. Differences between sides were not found. Significant differences ($P < 0.01$) were between muscles.

The pH value is not only influenced by the presence of acids and bases. For this reason we counted correlation coefficients for pH value and lactic acid content. Correlation coefficients were different. They were for MLLT 0.87 ($P < 0.01$) and for SM 0.78 ($P < 0.01$). This mean, that pH value in MLLT is more influenced by the lactic acid than in SM. It is probably given by the presence of the compounds that affect the buffering capacity.

Conclusions

- The lowest pH value was reached in 48 hours post mortem.
- Maximal content of lactic acid was found in 24 hours after slaughter and the amount is tended to decrease in 48 hours.
- Differences between the sides of the carcasses were not found.
- Significant differences between muscles were found.
- Correlation coefficient for pH and lactic acid content was higher for *M. longissimus lumborum et thoracis* than for *M. semimembranosus*.

Pertinent literature

HEDRICK, H.B. et al. Principles of meat science. Third edition. 1994.

LAWRIE, R.A. Lawrie's meat science. Sixth edition. 1998.

STOIER, S. et al. The effect of stress during lairage and stunning on muscle metabolism and drip loss in Danish pork. Meat Science 59 (2001), p.127-131

VAN LACK, R.L.J.M. – KAUFMANN, R.G. – GREASER, M.L. Determinants of ultimate pH of meat. Future of Meat: Congress proceedings of the 47th ICoMST August 26th-31st, 2001 Kraków, Poland, 2001. p. 22 – 26

This research was supported by the Ministry of Education, Youth and Sports of the Czech Republic, grant No. 162700005.

Table 1. pH values and lactic acid content in MLLT.

		Time post mortem, h						
		0.5	1	6	12	24	36	48
pH	right side	6.29±0.17	6.26±0.31	5.99±0.22	5.92±0.19	5.72±0.14	5.52±0.10	5.53±0.16
	left side	6.34±0.22	6.27±0.32	5.89±0.11	5.68±0.18	5.66±0.16	5.50±0.09	5.48±0.07
lactic acid, g/kg	right side	5.96±0.75	6.76±0.92	8.33±1.29	9.64±0.75	9.88±0.61	x	9.38±0.39
	left side	5.71±0.92	7.38±0.39	8.37±1.16	9.61±0.87	9.83±0.92	x	9.49±0.43

Table 2. pH values and lactic acid content in SM.

		Time post mortem, h						
		0.5	1	6	12	24	36	48
pH	right side	6.23±0.13	6.34±0.31	6.14±0.24	5.95±0.16	6.02±0.22	5.99±0.17	5.68±0.03
	left side	6.33±0.06	6.31±0.17	6.10±0.18	6.02±0.16	6.00±0.11	5.92±0.10	5.79±0.26
lactic acid, g/kg	right side	4.92±1.05	5.69±0.75	6.55±0.54	7.42±0.71	7.78±0.71	x	8.08±0.63
	left side	5.05±0.90	5.57±0.72	6.40±0.62	7.52±0.55	8.28±0.88	x	8.24±0.48

Fig.1. The decrease of pH post mortem

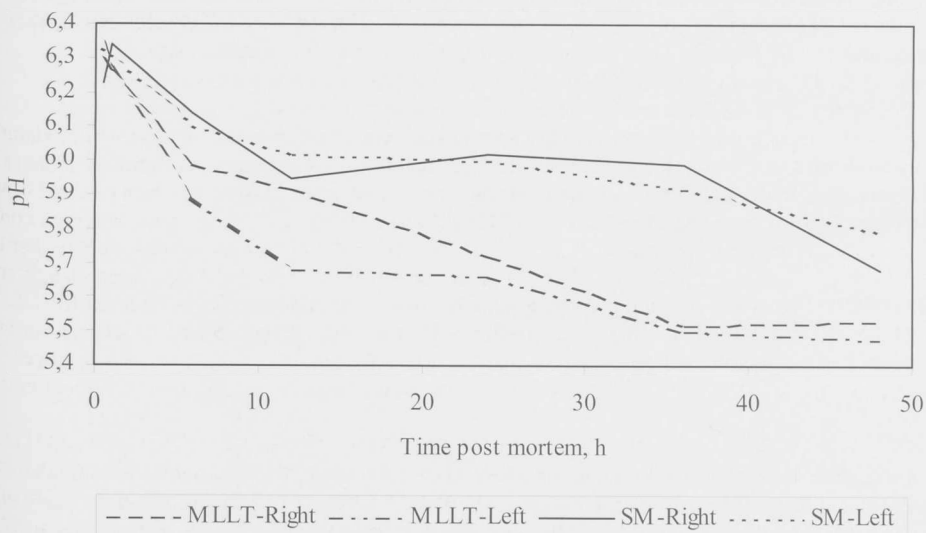


Fig.2. The increase of lactic acid post mortem

