EVALUATION OF MUSCLE GLYCOGEN LEVEL ANTE- AND POST MORTEM AND PH POST MORTEM AS PREDICTORS OF BEEF MEAT QUALITY

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BACKGROUND AND OBJECTIVES

Utilisation of values defining rate of muscle metabolism and meat quality prediction such as pH and color has been proposed as having potential as a basis for prediction of ultimate beef meat quality in general and tenderness in partial (Marsh et al., 1987; Jeremiah et al., 1991). Different methods and values for evaluation of changes ante- and post mortem muscle metabolism, especially intracellular pH, and glycogen level were used (Vogel et al., 1985; Lawrie, 1985; Zemanova et al., 1987; Uhrin, 1990). Recently Shackelfordt et al. (1994) refused three-hour post mortem muscle pH as an accurate indicator of tenderness in carcass beef.

In light of the partially contradictory results of the studies on using biophysical and biochemical values of muescle as predictors ultimate beef meat quality the present study was conducted to evaluate the relationship of muscle glycogen level ante- and post mortem and pH post mortem to some technological meat quality values using two groups of bulls with different conditions of keeping before slaughter.

MATERIAL AND METHODS

Twenty crossbred bulls (F_1 and Slovak improved spotted bulls) with live weights approx. 550 kg were used in this study. Experimental animals (tying housed) were divided into two groups, the group (A) loosely housed (during night at slaughterhouse) untill killed and group (B) tying housed (during night at slaughterhouse) untill killed. Just before slaughter, biopsy samples (approx. 1 g) of semitendinosus muscle were obtained using efficient non-stress spring loaded biopsy instrument (Biotech, Nitra). Samples of longissimus dorsi muscle were also taken after slaughter (1h, 3h and 48h) directly frozen in liquid nitrogen for glycogen analyses (Dreiling et al., 1987). After slaughter (1h, 3h and 48h) pH was also measured in the longissimus muscle (13th rib) using a probe type combined electrode and portable pH meter (Radelkis, Hungary). Cooking loss values ($g.100\ g^{-1}$) were estimated after cooking in distilled water and share force values ($kg.cm^{-2}$) were assessed using Warner-Bratzler instrument (WBV). Mean values, standard deviation and simple correlation were calculated using Statgraphics PC program.

RESULTS AND DISCUSSION

As follows from the results (Tab.1) of glycogen level just before slaughter (ante mortem) and early post mortem (1h and 3h) we received significant differences ($P<0.05$) of glycogenolysis between the experimental groups. The level of the glycogen approx. 36 $umol.g^{-1}$ as the boundary value for DFD meat quality prediction (Lawrie, 1985, Zemanova et al., 1987) was also supported by the results from our experiment. The coefficient of correlation between pH_3 and technological meat quality values (pH ultimate, cooking loss and tenderness) were low and not significant ($P>0.05$). In the present experiment pH_{48} was a more accurate indicater for cooking loss and also for WBV ($r = -0.88$ and 0.45, $P<0.05$). what is in agreement with previously results introduced by Jeremiah et al. (1991) and Shackelfordt et al. (1994). More highly correlations ($P<0.01$) we received between glycogen level (ante mortem, 1h and 3h post mortem) and technological meat quality values such as pH ultimate ($r = -0.60$, -0.79 and -0.90) and cooking loss ($r = 0.69$, 0.80 and 0.86). Correlations with WBV ($r = 0.46$ and 0.46) were also significant ($P<0.05$). It was shown the glycogen level (ante- and early post mortem) as a good predictor for some ultimate technological meat quality values of carcass beef. The experiment continues to evaluate carly prediction values within a normal ($pH_{48}<6.2$) beef meat quality.

CONCLUSIONS

Early post mortem pH (3h) was not an accurate indicator of ultimate technological meat quality of bulls. Glycogen level ante mortem (biopsy) and early post mortem (1h and 3h) was good predictor for ultimate pH (48h) and cooking loss but lower predictor of tenderness for carcasses of bulls at different condition of housing before slaughter.

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Table 1 Simple Statistics of pH, glycogen, cooking loss and share force by bulls with tying housed (A = 12) and loosely housed (B, n = 8) until killed

Values	A			B			Signific.
	$\bar{x}$	$s_{\bar{x}}$	v %	$\bar{x}$	$s_{\bar{x}}$	v %	
pH_1	6,56	0,064	3,39	6,47	0,097	4,26	NS
pH_3	6,27	0,091	5,04	6,53	0,381	5,83	NS
pH_{48}	5,73	0,069	4,22	6,63	0,095	2,53	*
Glycogen ante mortem	59,03	3,486	20,43	36,53	1,382	10,70	**
Glycogen 1h p.m.	56,93	3,540	21,57	21,79	2,150	27,90	**
Glycogen 3h p.m.	54,70	2,667	16,88	15,53	1,521	27,68	**
Glycogen 48h p.m.	17,84	1,223	23,75	15,89	2,998	18,86	NS
Cooking loss	44,30	2,115	4,77	32,41	1,108	9,67	**
Share force	3,34	0,897	26,87	2,62	0,368	39,76	NS

*P<0,05; **P<0,01

Glycogen (umol.g^{-1}); Cooking loss (g.100 g^{-1}); Share force (kg.cm^{-2});

$\bar{x}$ - Mean; $s_{\bar{x}}$ - Standard deviation; v % - Coefficient of variation