EFFECT OF CARCASS WEIGHT AND CARCASS FATNESS ON BEEF COLOUR

Zgur S., Cepin S., Cepon, M.
Zootechnical Department, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia

Background

Colour is regarded as one of the most important intrinsic quality indicator of beef, pork and chicken for European consumer (Glitsch, 2000). Meat colour depends on quantity and the chemical state of the myoglobin. Concentration of myoglobin increases with animal age (Lawrie, 1970) and so the meat gets darker. On the other hand with increased age and live weight the animals get fatter and so the content of intramuscular fat also increases. Marbling gives meat lighter colour.

Objectives

The aim of the study was to test the influence of carcass weight and carcass fat percentage on meat colour in Simmental and Brown bulls.

Material and methods

Simmental (n=424) and Brown (n=315) bulls originated from progeny testing stations. Brown bulls were fed with grass and maize silage supplemented with concentrates, and Simmental bulls were fed with maize silage and concentrates. Bulls were slaughtered at subjectively evaluated optimal fatness. 24 hours after slaughter colour and pH were measured on cross section of *longissimus dorsi* muscle between rib 7 and 8 of the right carcass side with Minolta chroma meter CR300. Colour measurements were performed in triplicates and the average values were used for statistical analysis. After that carcass side was dissected into lean, fat, tendon and bone. Statistical analysis was performed by GLM procedure (SAS, 1989) for each breed. Date of the slaughter was included in the model as fixed effect, and carcass side weight, carcass fat percentage and pH24 as covariables. Quadratic terms of independent variables were first included in the model and tested for significance. As they were not statistically significant, they were dropped from the model.

Results and discussion

Simmental bulls were slaughtered at average carcass side weight 165 kg (table 1). Brown bulls attained 10 kg lower carcass sides weight at slaughter with similar variability. At this weight Simmental and Brown bulls reached the same percentage of carcass fat. Also the average pH24 values were the same for both breeds. The average pH24 values were normal. Some animals with higher pH24 values exibited dark, firm and dry meat. The results were very similar, even if the animals with higher pH24 than 6 were omitted from the analysis, so we performed analysis on the whole data set. Simmental bulls exhibited slightly lighter meat with higher redness and yellowness than Brown bulls. This difference could reflect the differences in nutrition ratio and/or breed differences. Page et al. (2001) found slightly darker meat in dairy-type cattle.

With selected model we could explain between 59 and 68 % of total variability in CIE L*, a* and b* values. Date of slaughter had significant effect on meat colour in Simmental and Brown bulls as well (table 2). This confirms the importance of animal handling before slaughter on post mortem glycolitic process and development of normal meat quality and meat colour. Also Jones et al. (1989) Murray (1989) and Pem et al. (1994) established significant effect of climatic factors at slaughtering on meat colour. pH24 is regarded as the most important indicator of postmortem glycolysis and had significantly effected meat colour in both breeds (table 2). With increased pH24 CIE L*, a* and b* values decreased. Negative simple correlations between pH and CIE L*, a* and b* values were reported by Page et al. (2001). Carcass side weight effected only CIE a* and b* values in Simmental bulls, but exhibited no effect on meat colour in Brown bulls. Linear regression coefficients for CIE a* and b* values for Simmental bulls were positive (table 3), so with increased carcass side weight redness and yellowness also increased. Low simple correlations between carcass weight and meat colour were found also by Page et al. (2001). The correlation between carcass weight and carcass fat percentage was higher in Simmental (r=0.23) than in Brown breed (r=0.13). Percentage of carcass fat effected meat colour in Simmental and Brown bulls as well. In Brown bulls L*, a* and b* values increased with increased carcass fat percentage, but in Simmental bulls only a* and b* values increased with increased carcass fat percentage. Influence of carcass fat percentage was not significant on CIE L* value. Page et al. (2001) reported increased L*, a* and b* values with increased fat thickness. Fiems et al. (2000) reported that correlation between meat lightness and different fat depots was different for double-muscled and non-double-muscled Belgian Blue bulls. Often it is difficult to distinguish among different effects, because they are usually even correlated.

Literature

Fiems, L.O., S.De Campeneere, S. De Smet, G. Van de Voorde, J.M. Vanecker, Ch.V.Boucque. 2000. relationship between fat depots in carcasses of beef bulls and effect on meat colour and tendernes. Meat Science, 56, p. 41-47.

Glitsch, K. 2000. Consumer perceptons of fresh meat quality: cross-national comparison. British Food Journal,102, 3, p. 177-194.

Jones, S.D.M., A.K.W.Tong. 1989. Factors influencing the commercial incidence of dark cutting beef. Canadian Journal of Animal Science, 69, p. 649-654.

Lawrie, R. A. 1970. Fleischkunde. München, BLV Verlagsgeselschaft, 236 s.

Murray, A.C. 1989. Factors affecting beef colour at time of grading. Canadian Journal of Animal Science, 69, 2, p. 347-355.

SAS 1989. SAS/ STAT User's, Version 6. Cary, NC, USA, SAS Institute Inc.

Page, J.K., D.M. Wulf, T.R. Schwotzer . 2001. A survey of beef muscle color and pH. Journal of Animal Acience, 79, p.678-687.

Pem, V., S. Čepin, S. Žgur, D. Škorjanc. 1994. The influence of pre slaughter treatment on meat properties in hifers. V: 40th International Congress of Meat Science and Technology ICoMST, The Hague, Netherlands. Meat 40-fies the quality of life. W-2.05.

Table 1: Simple statistics for some carcass traits and meat colour

	Simmental					Brown				
	n	Means	SD	Min	Max	n	Means	SD	Min	Max
Weight of carcass side, kg	424	165	12	135	228	315	155	12	128	196
Carcass fat, %	424	11.84	2.26	5.13	21.37	315	11.84	2.86	5.55	19.82
	424	5.59	0.22	5.12	7.25	315	5.60	0.24	5.00	6.70
CIE L*	424	38.37	3.31	26.06	47.42	315	37.76	2.93	29.48	44.93
a*	424	24.04	3.53	12.03	35.31	315	22.54	2.65	14.45	28.51
b*	424	12.42	2.16	4.42	21.37	315	11.76	1.76	5.53	15.47

Table 2: P-values for fixed effect date of slaughter, and covariables carcass side weight, carcass fat percentage and pH 24 hours post mortem

	Simmental			Brown		
	CIE L*	a*	b*	CIE L*	a*	b*
Date of slaughter	>0.000	>0.000	>0.000	>0.001	>0.000	>0.000
pH 24	>0.000	>0.000	>0.000	>0.000	>0.000	>0.000
Weight of carcass side, kg	0.715	>0.000	0.001	0.156	0.892	0.725
Carcass fat, %	0.127	0.013	0.045	0.001	>0.000	>0.000
R^2	0.64	0.67	0.68	0.67	0.59	0.67

Table 3: Linear regression coefficients for carcass side weight, carcass fat percentage and pH 24 hours post mortem (b±SEE)

	Simmental			Brown		
	CIE L*	a*	b*	CIE L*	a*	b*
Weight of carcass side, kg	-0.0038 ±0.0104	0.0470 ±0.0106	0.0214 ±0.0064	-0.0237 ±0.0166	0.0020 ±0.0149	-0.0031 ±0.0089
Carcass fat, %	-0.07316 ±0.0478	0.1222 ±0.0487	0.0589 ±0.0292	0.1885 ±0.0570	0.1842 ±0.0511	0.1520 ±0.0304
pH 24	-8.84560 ±0.7246	-9.7588 ±0.7378	-6.3960 0.4427	-5.3764 ±0.7357	-5.9520 ±0.6606	-4.0392 ±0.3928