S2P19.WP

EFFECT OF BREED AND SIRE ON MEAT QUALITY OF YOUNG BULLS IN RELATION TO PRE-SLAUGHTER BEHAVIOUR AND PLASMA CONSTITUENTS

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INTRODUCTION

Some beef breeds have a more easier handling than others and variations within breeds could reflect the variation between animals. Hearnhaw and Morris (1984) found significant differences in temperament among calves sired by *Bos indicus*, but not amongst the *Bos taurus* sired breeds.

Likely active or dominant behaviour of bulls could be linked to genetic factors through hormones. The possibility of determining the relationships of these factors with meat quality is important in order to improve this quality by proper management.

The objective of this work was to study the influence of breed and sire on the pre-slaughter behaviour, cortisol concentration and creatine kinase (CK) activity in plasma and on meat quality.

MATERIAL AND METHODS

A total of 67 Brown Swiss and 37 Pirenaico bulls were studied from spring 1991 to spring 1992. Among them 41 Brown Swiss bulls were descendant from four known sires and 21 Pirenaico bulls were descendant from three known sires. The bulls were fed on concentrates or concentrates supplemented forage diets. Bulls reached slaughter weight of 480kg at about 13 months of age. Then animals were loaded for transport to the abattoir 10km away.

Measurements of plasma cortisol concentration and CK activity were made using blood samples collected at the farm one day before slaughter and during exsanguination at slaughter. Mounting behaviour activity of the mixed bulls as active or dominant and passive or dominated were observed during the 16 hours of waiting time in the abattoir. The pH at 24 hours (pHu), the toughness by shear force value at seven days of aging and the meat palatability by a trained sensory panel for tenderness, juiciness and flavour, were measured on samples of *longissimus* muscle.

Plasma cortisol concentration was determined by radioimmunoassay and CK activity was determined on an autoanalyser Technicon RA-500.

Meat samples were segregated into two groups: pH6.0 and pH>6.0, and a comparative study was made relating to the factors. A phenotypic correlation matrix was estimated between variables studied. Breed and sire nested to breed were the factors estimated in the analysis of variance of the bulls, whose parent were known.

RESULTS AND DISCUSSION

No significant effect of breed and sire on mounting behaviour, cortisol concentration, CK activity, pHu, toughness and

palatability traits of meat were observed (Table 1).

Cortisol concentration and CK activity at slaughter raised on average 60% and 365% respectively of the live level, in both breeds.

Live cortisol concentration was positively correlated ($r=0.35$; $P<0.001$) with slaughter cortisol concentration, but no correlation was found between cortisol concentration at slaughter and CK, pHu, toughness, palatability traits or pre-slaughter behaviour (Table 2). Plasma cortisol concentration was not related to meat quality traits, because sometimes the elevation in plasma cortisol values is insufficient to lead the production of dark cutting meat (Tume and Shaw, 1992).

Slaughter CK activity was positively correlated ($r=0.41$; $P<0.001$) with pHu and with the number of active mountings ($r=0.35$; $P<0.01$) and negatively correlated ($r = -0.32$; $P < 0.001$) with meat toughness, but no correlation was found with sensory scores for tenderness, juiciness or flavour. The frequency of mounting of the bulls was positively correlated ($r=0.65$; $P<0.001$) with pHu of the meat. However pHu was not correlated with the number of times that bulls had been mounted. Meat with pHu>6.0 belonged to the more active bulls (Table 3) which mounted 67 times, significantly different from the passive behaviour bulls that just mounted nine times during the waiting period. The bulls of both behaviours had been mounted the same number of times. Results agree with Moran *et al.* (1992) who concluded that animals that are mounted do not produce dark-cutters. The CK activity at slaughter was higher, ($P<0.001$) 3,938 UI/l for the active bulls with pHu>6.0 meat, than 1,566 UI/l for the passive animals with pH6.0 meat. However cortisol concentration at farm and at slaughter were not different for the two groups of bulls segregated by the pHu meat. The mean cortisol value at farm for these bulls (14.6ng/ml) corresponds to levels of unstressed animals (Herd, 1989; Tume and Shaw, 1992). Although the mean cortisol value at slaughter for these bulls (23.0ng/ml) was lower than levels of stressed animals (44.6ng/ml) transported 200km to abattoir (Tume and Shaw, 1992) probably owing to the little stress produced by the transport to the abattoir that was 10km away.

CONCLUSION

Results of this study indicate that Pirenaico or Brown Swiss breed and sire do not affect cortisol concentration and CK activity of the bulls. Cortisol, as an indicator of stress, did not seem to be correlated with meat quality when the transport of the bulls to abattoir is a short trip. The active mounting bulls showed more CK activity and produced meat with pHu>6.0 which affected its toughness and palatability traits.

ACKNOWLEDGEMENTS

This work was supported by INIA Programa Ganadero 3.1 Proyecto no. 8527 and by the Universidad de Zaragoza.

REFERENCES

HEARNSHAW, H., and MORRIS, C.A. 1984. Genetic and environmental effects on a temperament score in beef cattle. *Aust. J. Agric. Res.* 35:723-733.

HERD R.M. 1989. Serum cortisol and "stress" in cattle. *Aust. Vet. J.* 66:341-342.

MOHAN RAJ, A.B., MOSS, B.W., RICE,D.A., KILPATRICK, D.J., McAUGHEY, W.J., and McLAUCHLAN W. 1992. Effect of mixing male sex types of cattle on their meat quality and stress-related parameters. *Meat Sci.* 32:367-386.

TUME, R.K., and SHAW, F.D. 1992. Beta-endorphin and cortisol concentration in plasma of blood samples collected

during exsanguination of cattle. *Meat Sci.* 31:211-317.

Table 1. Means for cortisol concentration and CK activity in live and post-stunned bulls, pH and sensory meat characteristics according to breed.

	Breed		
	Brown Swiss	Pirenaico	S.E.D.
N	41	21	
pH	6.03	5.94	0.124
Tenderness score	58.5	55.5	2.05
Juiciness score	56.1	54.2	2.38
Flavour score	65.2	62.7	1.81
Toughness, kg	13.3	13.7	1.43
Cortisol live, ng/ml	11.4	14.0	1.61
Cortisol abattoir, ng/ml	18.4	22.0	3.54
CK live, UI/l	392.8	488.2	222.86
CK abattoir, UI/l	1,946	2,125	1,032.0
Active mounting, n	29.9	43.9	11.32
Passive mounting, n	36.5	34.9	8.21

Sensory traits were assessed on a hundred-point scale.
Breed or sire (breed) were not significantly difference for all variables.

Table 2. Correlation coefficients between behaviour, sensory traits and serum enzymes of 104 bulls.

	pHu	Cortisol farm	Cortisol abattoir	CK farm	CK abattoir
Cortisol, farm	-0.14ns				
Cortisol, abattoir	-0.03ns	0.35***			
CK, farm	-0.19ns	0.08ns	0.05ns		
CK, abattoir	0.41**	0.04ns	-0.13ns	0.13ns	
Tenderness	0.15	-0.22*	-0.08ns	-0.10ns	0.08ns
Juiciness	0.11	-0.16ns	-0.14ns	-0.08ns	0.11ns
Flavour	-0.04ns	-0.19*	-0.16ns	-0.04ns	-0.06ns
Toughness	-0.45***	0.01ns	0.17ns	0.04ns	-0.32**
Active mounting	0.65***	-0.05ns	0.02ns	-0.22*	-0.35**
Passive mounting	-0.03ns	0.07ns	0.01ns	0.01ns	-0.04ns

	Tender-ness	Juici-ness	Flavour	Tough-ness	Active mounting
Juiciness	0.85***				
Flavour	0.29**	0.35**			
Toughness	-0.13	-0.13ns	-0.24**		
Active mounting	0.04ns	-0.01ns	-0.12ns	-0.29**	
Passive mounting	-0.12ns	-0.01ns	0.06ns	0.15ns	-0.06ns

* P<0.05; ** P<0.01; *** P<0.001.

Table 3. Means for blood constituents concentration in live and post-stunned bulls and pre-slaughter behaviour according to pHu classification.

	N	pHu>6.0 51	pHu<6.0 53	S.E.D
pHu	104	6.50	5.65	0.048***
Cortisol live, ng/ml	100	13.7	14.6	1.96
Cortisol abattoir, ng/ml	99	22.3	23.0	2.68
CK live, UI/l	89	253.7	463.9	96.07*
CK abattoir, UI/l	85	3937.9	1566.5	716.76**
Active mounting, n	82	67.4	8.5	6.73**
Passive mounting, n	82	33.2	39.0	8.27

* P<0.05; ** P<0.01; *** P<0.001.