

Lipid oxidation and sensory characteristics of grass-fed beef: effect of duration of grazing prior to slaughter

A.P. Moloney¹, F. Noci^{1,2}, F.J. Monahan², G.E. Nute³ and R.I. Richardson³

¹Teagasc, Grange Research Centre, Co. Meath, Ireland, Email: amoloney@grange.teagasc.ie, ²University College Dublin, Ireland, ³University of Bristol, Langford, Bristol BS40 5DU, UK

Keywords: grass, beef, sensory characteristics, lipids

Introduction Beef from cattle produced from grass has a higher concentration of fatty acids considered to be beneficial to human health than beef produced from more intensive production systems and this increase in fatty acid concentration is dependant on the duration at pasture prior to slaughter (Noci *et al.*, 2003). Improvements in the fatty acid composition of beef must not impair other quality characteristics of beef. Little information is available on the pattern of change of quality characteristics in grazing animals. The objective of this study was to determine the shelf-life and eating quality of beef from cattle produced from a standard Irish grass silage/concentrates finishing system but allowed to graze grass for different periods prior to slaughter.

Materials and methods Sixty Charolais crossbred heifers (BW = 338 kg) were used. One group was offered a silage/concentrates based diet indoors for 158 days (0 days at grass). One group grazed a predominantly perennial ryegrass pasture for 158 days. Two groups were initially offered a silage/concentrates diet, but grazed the above pasture for 40 and 99 days prior to slaughter after 158 days, respectively. Concentrate and grass allowances were adjusted periodically to achieve a similar mean carcass weight for all treatments. Carcasses were chilled for 48h at 4°C. A sample of longissimus muscle was aged for 14 days and stored frozen prior to lipid oxidation analysis (thiobarbituric acid reactive substances (TBARS)). A similarly-treated sample was used for sensory analysis by a 10 member trained taste panel. Panellists rated cooked steak using 0-100 line scales where low values are low ratings and high values higher ratings for a particular trait. Data were analysed according to a randomised block design.

Results Extending the grazing period increased the concentration of individual long chain n-3 polyunsaturated fatty acids (PUFA), total PUFA and conjugated linoleic acid (CLA) in muscle but did not affect lipid oxidation after 5 or 10 days of retail display. This was likely due to vitamin E supplied by the grass. Beef from 99-day grass fed animals was tougher than beef from animals fed silage/concentrates or grass for 158 days. Extending the grazing period increased the scores for “greasy” and “fishy”. Beef from animals fed silage/concentrates was preferred to beef from 40 or 99-day grass fed animals. There were no differences for juiciness, or for beef, abnormal, bloody, livery, metallic, bitter, sweet, rancid, acidic, cardboard, vegetable/grassy or dairy flavours.

Table 1 Fatty acid (mg/100g tissue), TBARS (mg malonaldehyde/kg) and sensory perception of beef

	Days at grass				SED	P
	0	40	99	158		
C18:3	19.6 ^a	25.4 ^b	30.9 ^c	34.4 ^c	1.86	***
C20:5	5.6 ^a	5.5 ^a	6.4 ^a	7.7 ^b	0.50	***
C22:5	10.1 ^a	9.4 ^a	10.6 ^a	12.7 ^b	0.74	***
CLA	12.3 ^a	12.1 ^a	15.2 ^a	18.4 ^b	1.79	***
PUFA	129.4 ^a	136.7 ^{a,c}	145.6 ^{b,c}	158.4 ^d	6.93	***
Total	2641	2329	2754	2525	177.5	NS
TBARS-10 d	4.06	3.05	4.04	4.04	0.678	NS
Toughness	44.9 ^{ab}	48.8 ^{bc}	52.7 ^c	42.7 ^a	2.16	***
Greasy	10.4 ^a	12.7 ^{ab}	13.1 ^{ab}	14.4 ^b	1.44	*
Fishy	0.7 ^a	3.5 ^b	2.3 ^{ab}	3.3 ^b	1.07	*
Overall liking	22.5 ^b	18.1 ^a	18.8 ^a	19.9 ^{ab}	1.48	*

Figures with different superscripts differ significantly (P<0.05)

Conclusions Increasing the duration of grazing prior to slaughter improved the fatty acid composition, did not affect lipid oxidative stability, had minor effects on flavour but inconsistently influenced the toughness of beef.

Acknowledgements This study was supported by the European Commission (QLRT-2000-31423).

References

Noci, F., A.P. Moloney, P. French & F.J. Monahan (2003). Influence of duration of grazing on the fatty acid profile of M. Longissimus dorsi from beef. *British Society of Animal Science*, 23.