GRASS-BASED SUCKLER BULL BEEF PRODUCTION: MUSCLE COLOUR AND FIBRE COMPOSITION

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Abstract – Growth, and muscle colour, fibre type and metabolic profile were measured in late-maturing breed sired suckler bulls finished on pasture or indoors and slaughtered at 19 months of age. When compared to bulls finished indoors and offered a high concentrate-ration, the carcass weight of grazing bulls was lower, their carcasses were leaner and their *longissimus thoracis* muscle was similar in lightness but less red and had a lower glycolytic metabolism. It is concluded that muscle colour was not impaired by producing bulls at pasture but that their low carcass fat cover would not meet the current requirements of premium markets for bull beef.

Key Words – Ultimate pH, carcass fat classification, carcass weight, cattle

I. INTRODUCTION

Grazed grass is the cheapest feedstuff in temperate climates [1] but there are no data available on the effect on muscle colour of grazing of bulls prior to slaughter. There is increasing consumer interest in "grass-fed" beef. Grazing of steers prior to slaughter may result in darker muscle, not desired by the consumer, but the data are equivocal [2]. Bulls are more efficient than steers but are more stress sensitive and bull production tends to be based on high energy rations fed indoors. We hypothesized that "grass-fed" suckler bull beef could be produced that would have a similar colour to that from suckler bulls finished indoors.

II. MATERIALS AND METHODS

Late-maturing breed sired bulls (live-weight 425 kg, s.d. 35.2; initial age 390 d, s.d. 39.2), previously offered grass silage *ad libitum* + 2 kg of a barley-based concentrate daily were blocked on sire breed and assigned at random within block (n = 15/ treatment) to either grazed grass only for 200 d (G0), grazed grass for 100 d, then housed and offered concentrates + grass silage *ad-libitum* (G0AL) or concentrates + grass silage *ad-libitum* indoors for 200 d (AL). Bulls rotationally grazed *Lolium perenne*-dominant swards to a target post-grazing sward height of 4.5 cm; rotations were managed such that there were no bulls in the paddock immediately adjacent. The average space allowance was 180-300 and 2.5m^2/animal when at pasture and indoors, respectively. At 19.3 months of age, animals were transported without mixing of treatment groups and slaughtered immediately upon arrival at a commercial abattoir. Post-slaughter (without electrical stimulation), carcasses were weighed and classified [3]. At 1 h post-mortem samples were collected from the *longissimus thoracis* (LT) muscle close to the 10th rib and frozen in liquid nitrogen pending analysis of muscle fibre composition and metabolic enzyme activity [4, 5]. At 48 h post-mortem, a section of the LT muscle was removed, vacuum packaged for 24 h and then pH and colour (after 1 h exposure to air in darkness at 4^{o}C, wrapped with oxygen-permeable PVC film) were measured. Data were subjected to analysis of variance with block and treatment as main effects.

III. RESULTS AND DISCUSSION

Carcass weight was higher ($P < 0.05$) for AL than G0AL which in turn was higher than G0, reflecting the energy density of the diets (Table 1). Carcass fat score, which is an important criterion of acceptance in many markets and must be ≥6 (on 1-15 scale), was lower ($P < 0.05$) for G0 than G0AL or AL, which did not differ. Therefore, G0 carcasses would not be acceptable in premium markets for Irish beef. Muscle pH was higher ($P < 0.05$) for G0 than G0AL or AL but all values were within the 'normal' pH range (i.e. 5.4 – 5.8) [6] indicating that bulls did not experience pre-slaughter stress-related loss of glycogen. Muscle lightness (L*) was not affected by pre-slaughter diet and no carcasses were deemed "dark cutters" by abattoir personnel. Muscle redness (a*) (and saturation), glycolytic

enzyme activity and the activity of the oxidative enzyme cytochrome c oxidase were lower ($P < 0.05$) for G0 than for G0AL and AL, which did not differ. Muscle fibre type distribution was not affected by bull production system.

Table 1 Carcass and muscle characteristics of sucker bulls slaughtered after 200 days at pasture (G0), 100 days at pasture followed by 100 days indoors and offered concentrates (G0AL) or 200 day indoors and offered concentrates (AL)

Variable	G0	G0AL	AL	SED	Significance
Carcass weight (kg)	364[a]	399[b]	437[c]	14.6	***
Fat score (1-15)	4.9[a]	7.5[b]	7.4[b]	0.40	***
Longissimus thoracis					
pH	5.62[a]	5.53[b]	5.51[b]	0.027	**
L*	45.2	45.8	45.5	0.83	NS
a*	12.5[a]	14.2[b]	15.2[b]	0.55	***
Saturation	16.5[a]	18.6[b]	19.4[b]	0.68	***
Hue	40.3	40.1	38.5	0.99	NS
Glycolytic enzyme activity[1]					
LDH	4884[a]	5434[b]	5267[b]	152.9	**
PFK	516[a]	842[b]	770[b]	50.4	***
Oxidative enzyme activity[1]					
ICDH	4.9	4.6	4.4	0.34	NS
COX	53.0[a]	94.7[b]	92.7[b]	8.30	***
CS	27.9	25.9	24.6	2.63	NS
Fibre type profile (%)					
MyHC I	16.3	18.3	20.2	1.57	NS
MyHC IIA	46.4	40.2	43.9	5.63	NS
MyHC IIX	33.4	36.6	35.9	6.47	NS

[1]µmol/min/g of protein. LDH = lactate dehydrogenase; PFK = phosphofructokinase; ICDH = isocitrate dehydrogenase; COX = cytochrome c oxidase; CS = citrate synthase.

IV. CONCLUSION

Bull carcasses from long-term grazing did not achieve the current market specification (≥6 on 1-15 scale) for fat score. When managed to avoid pre-slaughter stress, long-term grazing of bulls resulted in some changes in LT metabolism that were not reflected in colour.

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