QUALITY DIFFERENCES BETWEEN HERBAGE- AND CONCENTRATE-FED BEEF ANIMALS.

M.T. Mooney[1], P. French[2], A.P. Moloney[2], E. O'Riordan[2] and D.J. Troy[1]

[1]Teagasc, National Food Centre, Dunsinea, Castleknock, Dublin 15, Ireland.
[2]Teagasc, Beef Production Centre, Grange, Dunsany, Co. Meath, Ireland.

INTRODUCTION

Meat quality is highly variable. The variability of meat quality originates from many pre- and post slaughter sources. The main variable trait that influences consumer perception of meat is tenderness (Ouali, 1990). To control the variability in meat tenderness many pre-slaughter techniques have been applied including selection of breed, sex and age, dietary manipulation and welfare and handling procedures. Pre-slaughter dietary manipulation can have significant effects on measurable aspects of meat quality, the most important of which are tenderness, flavour and colour (Larick et al., 1987; Larick and Turner, 1990). In particular, it has been reported that grain-finished cattle produce more tender beef than their grass-fed counterparts (Larick et al., 1987).

OBJECTIVES

The aim of this study was to measure the differences in quality attributes of beef from cattle finished on a high concentrate diet when compared with similar cattle grazing a perennial ryegrass pasture.

MATERIALS AND METHODS

Steers (n=11/treatment, mean bodyweight=567kg) of similar size and grade were offered unsupplemented pasture or concentrates ad libitum, together with 1kg barley straw, for 100 days prior to slaughter. Animals were slaughtered at a commercial facility and right hand side *M. longissimus dorsi* (LD) was excised for all measurements. Temperature was monitored for 24 hours immediately post-slaughter, pH was measured at 1-8h, 24h and 48h post-mortem. Samples for sarcomere length measurement (Cross et al., 1980) and compositional analysis were taken at two days post-mortem. Drip loss determination (Honikel, 1987) was carried out at two days post-mortem. Steaks were taken at 2, 7 and 14d post-mortem for sensory analysis (AMSA, 1978), Warner Bratzler shear force (Shackelford et al., 1991) and cook loss measurements. Colour was measured using Hunter Lab (Strange et al., 1974) at 14 days post-mortem.

RESULTS AND DISCUSSION

Warner Bratzler shear force values decreased over the conditioning time in steaks from both treatments (Figure 1; Table 1). Steaks from animals fed *ad lib* concentrates were more tender at 2, 7 and 14 days post-mortem than steaks from animals fed herbage alone although not significantly so. These trends were supported by data from sensory analysis (Table 1) which showed increasing tenderness with ageing and more tender steaks at 2, 7 and 14d for concentrate-fed animals, the 14d value being significantly higher. The rate of pH fall of muscle from concentrate-fed animals within 24 hours post-mortem was faster than that of muscle from grass-fed animals, (Figure 2) with values at 4, 6 and 8h post-mortem showing significant differences between the two groups of animals. This agrees with the findings of O'Halloran et al., (1997) who showed that "fast-falling" pH generally indicates greater post-mortem proteolytic activity and results in more tender meat. The reason for this increased rate is unknown. The difference may be due to the variation caused by the different diets. In the case of the animals fed *ad lib.* concentrates, the animals had a higher cold carcass weight than the grass-fed animals (Table 1). This resulted in higher fat cover and higher intramuscular fat (Table 1). LD temperature monitored for the first 24h post-mortem demonstrated a slower rate of fall for concentrate-fed animals than for grass-fed (data not shown). This may explain the differences in rate of pH fall in terms of the theory put forward by May et al.,(1992) who proposed that higher cover and intramuscular fat may lead to a slower temperature fall within the muscle. This in turn may lead to an increased rate of pH fall and concomitant increase in proteolysis. Muscle from concentrate-fed animals also showed higher but not statistically significant sensory scores for flavour and overall acceptability at 2, 7 and 14d post-mortem and lower scores for chewiness at these times (data not shown). Sensory analysis showed that steaks from animals fed *ad-lib* concentrates were more juicy at 2 and 7d ageing but not significantly so (data not shown). Muscle from concentrate-fed animals had lower drip loss and higher Hunter Lab measurements and significantly longer sarcomere length than steaks from animals finished on herbage (Table 1).

CONCLUSION

Muscle composition was affected by diet. Higher fat cover and higher intramuscular fat were produced from concentrate-finished animals. The quality attributes as measured by mechanical and sensory methods were higher in steaks from these animals. The possible reasons for this are the higher intramuscular fat; the faster rate of pH fall concomitant with greater proteolysis; larger sarcomere lengths and slower rate of chilling. Further work is required to establish the effects of diet on the important criteria.

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Figure 1: Warner Bratzler shear force (kg) for steaks from steers fed a diet of herbage or ad libitum concentrates for 100 days pre-slaughter.

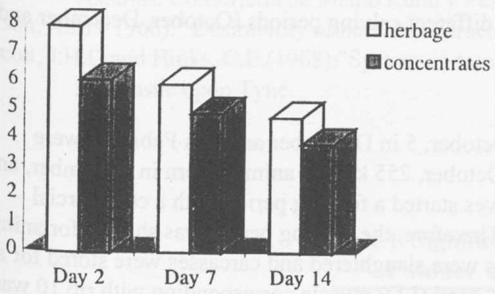

Figure 2. The pH decline for the first 48h post-mortem of bovine *M. longissimus dorsi* from animals fed a diet of herbage or ad libitum concentrates for 100 days pre-slaughter.

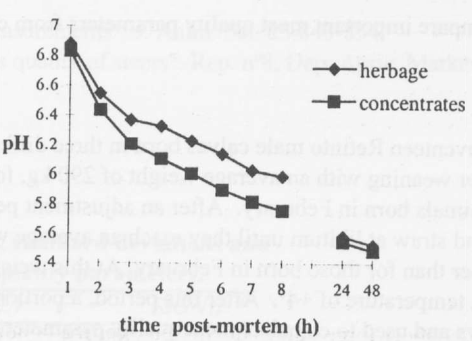

Table 1: Quality measurements for steaks from steers fed a diet of herbage or ad libitum concentrates for 100 days pre-slaughter.

	Grass diet	Concentrate diet	s.e.d.	Significance
WBSF (kg) 2d	7.95	6.09	1.15	ns
WBSF(kg) 7d	5.94	4.92	0.67	ns
WBSF (kg) 14d	4.78	3.85	0.53	ns
[a]Tenderness 2d	3.53	4.35	0.52	ns
[a]Tenderness 7d	4.76	5.19	0.36	ns
[a]Tenderness 14d	5.19	6.15	0.45	*
Sarcomere length (μm)	1.68	1.78	0.05	*
Drip loss (%)	2.73	2.13	0.33	ns
Hunter L	34.25	34.88	0.21	ns
Hunter a	13.92	14.64	0.65	ns
Hunter b	7.29	7.72	0.47	ns
% fat	2.32	4.42	0.63	**
% moisture	73.65	71.67	0.53	**
Cold carcass weight (kg)	328	374	2.58	***

ns = non significant; *P<0.05; **P<0.01; ***P<0.001

[a] 1= extremely tough, 8 = extremely tender

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