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INFLUENCE OF POST-MORTEM HANGING METHODS ON BEEF TENDERNESS

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BACKGROUND

Consumers consider the tenderness of beef to be its most important eating quality (Ouali, 1990). Beef tenderness depends on many pre-slaughter factors such as age, sex, breed and diet, and post-slaughter factors including hanging, chilling and ageing. The method by which beef is hung pre-rigor can have the effect of stretching or increasing the tension on certain muscles and may help to reduce rigor-induced shortening of muscle fibres. In general, beef carcasses tend to be suspended from the achilles tendon. This was regarded as economical with chill-space and allowing good air circulation. More recently the aitch bone method has been employed (Hostetler et al., 1972). This involves suspending the side from the pelvis resulting in a greater constraint on many muscles in the loin and hind region thus reducing toughness due to shortening (Herring et al., 1967). Recent findings in the USA have suggested that a new method of carcass suspension known as Tendercut™ may have beneficial effects on the tenderness of round and loin muscles (Wang et al., 1994, 1996). The Tendercut method involves severing bone, ligaments and tendons at specific locations to increase stretch-tension on pre-rigor muscles by utilising the weight of the carcass thus improving tenderness.

OBJECTIVES

The present investigation was designed to compare the above methods of carcass suspension during post-mortem chilling and the development of rigor mortis, which will lengthen or stretch major muscles of the intact bovine carcass and thereby improve their tenderness. The muscles investigated were M. *longissimus dorsi* (L.D.), M *semi membranosus* (SM) and M *gluteus medius* (GM). Tenderness was measured by Warner Bratzler shear force (WBSF), and sensory analysis. Sarcomere length was measured as an indicator of muscle fibre shortening.

METHODS

Twelve heifers of similar grade and size were selected (mean carcass weight 301 ± 24 kg). Eight sides were randomly assigned to each hanging method. Tendercut treatment was implemented approx. 1 hour post-slaughter according to the method of Wang et al. (1994). pH was measured at 1, 3, 6, 9 and 24h post-mortem. The sides were left overnight in the chill and muscles were excised at 24 hours post-mortem. Samples were taken from each of LD, SM and GM at 2 days post-mortem for measurement of drip loss (Honikel, 1987) and sarcomere length (Cross et al., 1981). WBSF (Shackelford et al., 1991) and sensory analysis (AMSA, 1978) were carried out on samples aged for 2, 7 and 14 days at 0-2°C.

RESULTS AND DISCUSSION

Most pronounced results were achieved for SM. Aitch bone suspension gave significantly more tender meat than either achilles or Tendercut hung. This was demonstrated by longer sarcomere length at 2 d post-mortem, lower shear force peak values at 2 and 7 days post-mortem and higher sensory tenderness scores at 2, 7 and 14 days post-mortem (Table 1). LD steaks demonstrated significantly longer sarcomere length for steaks from aitch bone hung sides at 2 days post-mortem. Sensory and WBSF measurements indicated that LD from sides that were hung by the aitch bone method provide more tender beef. For GM, the most tender steaks were obtained from sides that had been aitch bone suspended. Sarcomere length was significantly longer at 2 days post-mortem and sensory tenderness, firmness and texture were significantly improved at 7d post-mortem for GM from aitch-bone hung sides. There was no difference in drip loss or sides yield between the treatments. pH measurements over the first 24hours post-mortem were also unaffected by hanging method indicating that the observed differences in tenderness were most likely unrelated to biochemical changes but were probably induced by prevention of shortening of muscle fibres as proposed by Herring et al. (1967). This can result in faster ageing of beef but not necessarily beef of higher ultimate tenderness. This was also concluded by Bouton et al. (1973) who compared four different hanging methods in sheep and discovered that hanging from the aitch bone gives tenderness values at 2-3 days post slaughter equivalent to 21 days ageing at 0-1°C.

CONCLUSIONS

Under the conditions employed in the present experiment, for LD, SM and GM, aitch bone hanging proved the most effective method of hanging beef sides to ensure improved tenderness of muscles in the loin and round region. Greater stretch of fibres in these muscles was achieved using pelvic suspension as indicated by sarcomere length results. Sensory evaluation and WBSF measurement found many of these differences to be detectable and significant. Implementation of this method of carcass suspension has already begun in some beef producing plants in Ireland and the UK.

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Table 1. Warner Bratzler shear force measurements, sensory tenderness scores and sarcomere length for muscle from sides suspended by achilles, aitch bone and Tendercut methods

Measurement/Carcass treatment	Achilles	Aitch bone	Tendercut	Significance
M. semi membranosus				
WBSF (kg) 2d	7.70	5.89	8.25	P<0.01
WBSF (kg) 7d	7.55	6.61	6.47	P<0.05
WBSF (kg)14d	5.50	4.89	5.47	NS
Sensory tenderness 2d	3.58	5.02	3.97	P<0.05
Sensory tenderness 7d	3.85	5.44	4.04	P<0.01
Sensory tenderness 14d	4.75	5.67	4.44	P<0.05
Sarcomere length (μ) 2d	1.77	2.38	1.88	P<0.001
M. longissimus dorsi				
WBSF (kg) 2d	7.36	6.23	7.00	NS
WBSF (kg) 7d	4.26	4.62	5.27	NS
WBSF (kg)14d	4.47	4.32	4.24	NS
Sensory tenderness 2d	3.75	4.72	4.17	NS
Sensory tenderness 7d	5.36	5.57	5.03	NS
Sensory tenderness 14d	5.63	6.08	5.58	NS
Sarcomere length (μ) 2d	1.74	2.10	2.01	P<0.001
M. gluteus medius				
WBSF (kg) 2d	7.73	6.43	7.46	NS
WBSF (kg) 7d	5.84	4.55	5.06	NS
WBSF (kg)14d	4.19	3.94	4.15	NS
Sensory tenderness 2d	4.02	4.80	3.44	NS
Sensory tenderness 7d	4.25	5.52	4.26	P<0.05
Sensory tenderness 14d	4.58	5.66	4.81	NS
Sarcomere length (μ) 2d	1.61	2.06	1.70	P<0.05

NS = non significant; *P<0.05; **P<0.01; ***P<0.001
* 1= extremely tough, 8 = extremely tender

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