HANDLING LAMBS PRIOR TO SLAUGHTER AFFECTS LOIN pH AND GLYCOGEN CONCENTRATION, BUT NOT TENDERNESS

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Consistency of eating quality of lamb is an issue that the lamb industry is addressing through processing, management and genetic pathways (Pethick *et al*. 2002). After slaughter, glycogen within the muscle is converted to lactic acid, leading to a decrease in muscle pH. If glycogen stores are depleted prior to slaughter through stress or removal from feed, less lactate can be produced after slaughter and the ultimate pH (pHu) of muscle will be higher than when glycogen stores are adequate (Gardner *et al*. 2001). A pHu of 5.7 - 6.0 can be associated with tougher meat. This paper extends results of Starbuck *et al*. (2002) by testing the hypothesis that the loin glycogen content at slaughter and muscle tenderness will increase following increased time between handling and slaughter.

In 2000, 501 first-cross lambs were split into 4 groups by stratified randomisation based on liveweight, sire, sex and birth type. Prior to the first slaughter, all lambs were weighed, structurally assessed and returned to ryegrass/white clover pasture. From this point, lambs had 1, 3, 8 or 10 days recovery before being yarded again, kept off feed for 24 h and transported for slaughter at a commercial abattoir. Carcasses were electrically stimulated (90 s, 1130 V peak, 2 A) within 60 min of slaughter. Muscle samples were collected from the caudal end of a loin immediately after stimulation, frozen in liquid nitrogen and stored at –20^{o}C. Samples were trimmed of fat and connective tissue, and homogenised (Ultraturax) in HCl (30 mM). Glycogen content was estimated from the sum of glucose and lactate concentrations present in the loin (modified from Gardner *et al*. 2001). Glucose concentration was measured with a hexokinase kit (ThermoTrace; Noble Park). Lactate was assayed with a lactate kit (Sigma-Aldrich; Castle Hill). Ultimate pH of the loin between the 12th and 13th rib was measured 26 h after slaughter. Tenderness of the sample was assessed as described by Hopkins and Thompson (2001), after aging at 4^{o}C for 5 days.

Table 1. Effect of time after handling on ultimate pH, glycogen content and shear force of lamb loins.

Days recovery	N	Ultimate pH	Glycogen (mg/g tissue)	Shear force (kgF)
1	121	$5.77^{a} \pm 0.008$	$0.556^{a} \pm 0.011$	$3.31^{a} \pm 0.087$
3	125	$5.77^{a} \pm 0.008$	$0.640^{b} \pm 0.011$	$3.08^{b} \pm 0.086$
8	126	$5.70^{b} \pm 0.008$	$0.668^{b} \pm 0.011$	$3.30^{a} \pm 0.084$
10	129	$5.60^{c} \pm 0.008$	$0.665^{b} \pm 0.011$	$3.00^{b} \pm 0.084$

Values within columns with different superscripts are significantly different ($P<0.05$)

There were significant effects of time after handling on total glycogen concentration in the loin, pHu and tenderness of the loin (Table 1). Glycogen concentration of the loin increased between 1 and 3 days recovery time, with no change in pHu. However, pHu was lower after 8 and 10 days of recovery, and there was only a small, non-significant increase in glycogen. Conversely, there was an increase in toughness of the loin between 3 and 8 days recovery. These results indicate that repletion of muscle glycogen after handling is only 1 factor influencing pHu, and that the relationship between pHu, glycogen content and tenderness is not clear. The combined effects of electrical stimulation and 5 days aging may have masked the relationships.

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