EFFECT OF EXERCISE AND GENDER ON MUSCLE GLYCOGEN CONCENTRATION IN BEEF CATTLE

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High pH beef, which is a concern to New Zealand beef farmers, can be attributed to low muscle glycogen concentration at slaughter (Tarrant 1989). This may arise from inherent low glycogen concentrations or management practices near slaughter which reduce glycogen concentration. While recommendations have been made on management practices to reduce high pH (MRDC 1994) there is no quantitative data on their effects on muscle glycogen concentrations. In this paper we present data on the effects of exercise and the difference between bulls and steers in glycogen concentration in the *longissimus dorsi* muscle (LD).

Forty-three, 18-month-old Hereford-Friesian steers, were weighed and allocated to three groups, six days before the experiment. On the day of the experiment the control group, which had been grazing a small paddock next to the yards, were quietly moved into the yards. The second group (Short) were moved at 4 km/hr over a 2.5km course over flat terrain which ended at the yards. The third group (Long) went twice around the course at 4 km/hour. The steers were bled and a 300mg biopsy sample of the LD was taken immediately after they entered the yards. In a second trial, using Angus cross cattle, 20 steers and 10 bulls which had been grazed together since birth, were weighed and bled, and a biopsy sample was taken from the LD when they were 22 months of age.

Table 1. The effect of gender and exercise on the *longissimus dorsi* muscle glycogen concentration and plasma lactate concentration

	Control	Exercise Short	Exercise Long	Steers	Bulls
Number	13	15	15	20	10
Liveweight (kg)	397 ± 42	397 ± 30	394 ± 43	511 ± 57	549 ± 59
Glycogen (g/100g)	1.63 ± 0.12	1.92 ± 0.11	1.62 ± 0.11	2.14± 0.09	2.03 ± 0.13
Lactate (mmol/L)	0.96 ± 0.15	1.19 ± 0.14	1.55 ± 0.14	1.10± 0.16	1.65 ± 0.21
Creatine kinase (mmol/L)	127 ± 16	157 ± 15	150 ± 15	126 ± 30	260 ± 42

Moderate exercise had no effect on LD glycogen concentration or plasma creatine kinase (CK) concentration but there was a progressive increase ($P<0.05$) in plasma lactate concentration as the distance the steers walked increased up to 5 km (Table 1). Bulls were heavier ($P<0.01$) than steers and had higher ($P<0.05$) plasma lactate and CK concentrations, but there was no difference in LD glycogen concentration. The high mean CK concentration in bulls was largely due to two bulls which had plasma concentrations of 670 to 690 mmol/L.

Moving steers at 4 km/hour (a moderate walk) for 5 km had no effect on LD glycogen concentration although the exercise did increase plasma lactate concentrations. Glycogen concentrations could have been reduced in other muscles but it is the glycogen concentration in the LD muscle which is of primary importance because it is this muscle which is used by the New Zealand meat industry to measure carcass pH. The high pH of the LD muscle, often found in bulls, is not associated with an inherent difference in LD glycogen concentration between bulls and steers. Differences in behaviour between bulls and steers immediately before slaughter could account for the reduced LD glycogen concentration and higher pH often found in bulls (Tarrant 1989). The difference in plasma lactate concentration between bulls and steers was of a similar magnitude to the increase in lactate concentration with increasing exercise. This suggests the bulls were more active over the period before the biopsy sampling, while higher CK concentration in the bulls suggests exertion or muscular damage over the 24 hours before sampling, especially in the two with very high CK concentrations.

MRDC (1994). 'Meat quality: The pH Factor' (MRDC: Wellington, NZ)

TARRANT, P. V. (1989). *Irish J. Food Sci. Tech.* **13**, 1-21.