THE EFFECTS OF INDUCING A VERY FAST CHILLING REGIME ON THE BEEF M. *LONGISSIMUS DORSI* MEDIATED THROUGH BRINE IMMERSION.

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KEYWORDS: Very Fast Chilling (VFC), Cold Shortening, Beef, Tenderness.

BACKGROUND:

Very fast chilling (VFC) of beef has previously been shown to be as tender as controls when induced in ambient temperature at -30^{0}C (Vidal et al. 1995). While no increase in tenderness was detected cold shortening had not occured either. In carrying out this work it was noted that a hard crust of frozen meat and fat formed on the outside. This resulted in problems with sampling at the core (unfrozen meat) as well as temperature gradients between surface and the core. Explanations as to the biochemical events occuring during treatment were difficult. This work examines the use of brine immersion of vac packed *pre rigor* meat as a means of lowering the temperature rapidly and uniformly.

OBJECTIVES:

To assess the effect of a brine induced very fast chill treatment on the beef m.longissimus dorsi and to draw comparisons between the biochemical and physical effects of a brine and air induced very fast chill treatment.

MATERIALS AND METHODS:

Hereford Cross heifers (n=5) aged two years were used in this study. Heifers were slaughtered conventionally dressed and split into two sides. The beef M. *longissimus dorsi* was "hot cut" from each side. Half of each muscle was used as a treatment while the remaining half was used as a control. Treated *longissimus dorsi* were vac packed and placed in a bath containing a 13% w/v NaCl/Water solution. At -9^{0}C . Temperature fall was monitored every 15 minutes using E-LAB thermocouples in conjunction with silicon discs to maintain the seal on entry to the brine. Temperature changes were recorded in the brine and the chill. The control samples were placed at ambient temperature .

pH was measured at 6 hours, 1 day and 7 days *post mortem* on muscle homogenates (Bendall. 1973). Sarcomere lengths were also determined (Cross 1987). Myofibrillar proteins were examined during this storage period using SDS PAGE (Greaser, 1993). After sampling at 6 hours, all samples were re-vacpacked and placed in an incubator at 15^{0}C for 12 hours. Steaks (2.5cm thick) were cut at 1 day *post mortem* (immediately post incubation), and at 7 days post mortem following aging at 4^{0}C. Sensory analysis was performed by an in house eight membered trained taste panel on steaks grilled to an internal temperature of 70°C (AMSA). Panelists were asked to rank the steaks for tenderness, overall texture and overall acceptability using a hedonic scale..

Warner Bratzler Shear force values were taken on 1.25 cm diameter cores cut from 2.5cm steaks cooked to an internal temperature of 70^{0}C using an Instron universal testing machine(Shackleford et al. 1991).

RESULTS AND DISCUSSION:

The core temperature of treated samples reached -0.2^{0}C in treated samples over a 4.5 hour period (Fig. 1). Rates of pH fall in VFC beef were significantly higher by 0.3 of a unit at 6 hours *post mortem*,however at 1 and 7 days there were no detectable differences. Rapid temperature fall may hasten pH fall through the accelerated breakdown of ATP to ADP coupled with contraction (Roncales et al. 1995).

The sarcomere lengths by 6 hours underwent severe shortening and were significantly shorter at 6 hours, 1 day and 7 days *post mortem* (Table 1). Based on these results it is evident that the effect of low temperature induced severe cold shortening in treated samples. In

previous work done (Vidal et al. 1995) in air at -30°C, a frozen crust was formed on the surface of each treated sample which was absent on brine treated samples. This frozen crust could in effect offer protection to the samples from cold shortening via a restraining effect. Studies have shown that the extra restraints imposed by the surface hardening of a partially frozen carcass may be all that is required to overcome the effects of cold shortening(Davey and Garnett. 1980). Shortening may be prevented in beef and lamb if this frozen crust is allowed to form during the early stages of carcass chilling. SDS gel electrophoresis profiles indicated similar degrees of proteolysis between treatment and control samples as shown by the 30kDa band. This finding was similar to VFCair treated samples. Other fast chill studies in air showed a higher degree of proteolysis in treated samples (Roncales. 1995).

Shear force values were significantly higher at 1 day(12.3kg v 7.45kg) and 7 days (10.46kg v 4.72kg) *post mortem* ($p<0.001$) in treated samples (Table 1). Tenderness, overall acceptability and overall texture were also significantly different at 1 ($p<0.001$; $p<0.05$; $p<0.05$, respectively) and 7 ($p<0.001$; $p<0.05$; $p<0.05$, respectively) days *post mortem* (Table 1). This is not unexpected due to severe cold shortening. Avoidance of cold shortening by restraint, aitch bone hanging or electrical stimulation is in progress on VFC beef.

CONCLUSION:

These results demonstrate that mode of temperature reduction is critical in the application of the VFC theory. Temperature reduction below 0°C in 5 hours internally yielded extremely tough meat on aging despite the fact that there was a higher rate of pH fall over 6 hours in treated samples which was similar to that in VFC air treated samples. The frozen crust formed in air cooled meat could have a restraining effect on the sample thus combatting the problem of cold shortening. It is concluded that VFC brine results in cold shortened meat. Its effect on meat, unable to shorten, would be of great interest.

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TABLE 1

	Sarcomere Length (μm)		Shear Force (Kg)		Tenderness (Sensory)[1]	
Time PM	Control	VFC	Control	VFC	Control	VFC
6 hour	1.98	1.22	-	-	-	-
1 Day	1.86	1.30	7.45	12.30	3.20	2.23
7 Day	1.80	1.40	4.72	10.46	5.53	3.88

[1]-Extremely Tender, 1-Extremely Tough

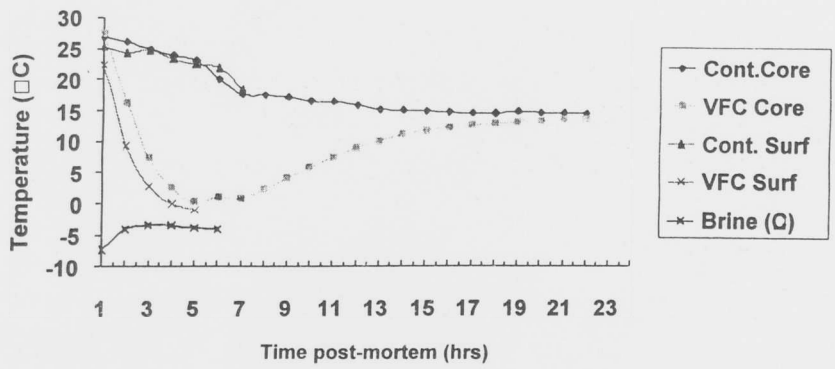

Figure 1: Brine Induced Temperature Fall