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EFFECT OF A PRE AND POST RIGOR HIGH INTENSITY ULTRASOUND TREATMENT ON TENDERNESS PARAMETERS OF LAMB *LONGISSIMUS THORASUS ET LUMBORUM.*

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BACKGROUND

Dolatowski (1989) reported that high intensity ultrasound (HIU) tenderised meat, and this has also been suggested by others (Sullivan, 1992; Javanaud and Robins, 1993; Roberts, 1992; Sajas and Gorbatow, 1978). Nishihara and Doty (1958) reported degredation in extracted collagen macromolecules sonicated in solution with high intensity sound in the acoustic region. Roncales *et al* (1993) reported ultrasonic destabilisation of liver lysosomal membranes and sonic activation of proteolysis in extracted lamb skeletal muscle fibres in solution. Similar effects in entire meat would improve meat tenderness but as yet no results have been published. HIU disruption of lysosomes has been reported (Stagni and Bernard, 1968). Treatment of pre-rigor meat with HIU in combination with high temperature conditioning during which lysosomes are more susceptible to disruption (Moeller *et al.* 1976) could potentially enhance this. Mitochondria and sarcoplasmic reticulum decrease in ability to retain calcium ions during rigor development (Dransfield, 1993). Mitochondrial disruption by HIU (Alliger, 1975) and possible sarcoplasmic reticulum disruption could increase calcium release leading to enhanced Calpain II activity, which may be maximal at 20 h post mortem (PM) (Dransfield, 1993).

OBJECTIVES

The aim of this study was to examine the effects of pre- and post rigor HIU treatment on tenderness of fresh meat measured by peak load bite force tenderometry (PLBFT), sensory analysis, SDS PAGE and soluble collagen content (SCC). This experiment was not designed to compare hot and cold boning.

MATERIALS AND METHODS

8 lambs were slaughtered and their *Longissimus thorasis et lumborum* (LTL) muscles excised, 4 carcasses at 2 h PM (hot boned (HB)) and 4 at 24 h PM (cold boned (CB)). Muscles were cut into 11 steaks 2.5 cm thick. HB steaks were held at 13-15°C for 24 h, then aged at 2-4°C, CB steaks were aged at 2-4°C. Steaks from one side of each animal were sonicated with an ultrasound probe (Heat Systems Model XL 2020, freq. 20kHz) which was repeatedly lowered onto one surface of the steak for 15 sec periods exposing the meat to 63W/cm^2 ultrasound. The steaks from the other side was used as a control. HB steaks were treated immediately after boning, CB steaks at 24 h PM. All steaks were then aged in vac-packs for 1, 3 or 7 days and analysed as follows.

Analysis	Steaks/side	Days(PM)	Method	Comment
Bite force tenderometry	3	1, 3, 7	Boccard *et al* (1981) Volodkevich (1937)	Sample preparation
Sensory analysis	4	1, 7	AMSA (1978)	
SDS PAGE	3	1, 3, 7	Wang (1982) Greaser *et al* (1983)	Myofibril extraction Electrophoresis
Collagen Solubility	1	1	Hill (1966) Bergman and Loxley (1963)	Solubilisation Hypro. colour

RESULTS AND DISCUSSION

Ageing improved PLBFT for both HB and CB lamb (P<.05) (Table 1). CB animals differed in tenderness (P<.01) but not HB (P≥.05). HIU treatment did not affect (P≥.05) tenderness of the CB or HB steaks after 1, 3 or 7 days ageing. SCC was not affected (P≥.05) by HIU. CB animals again differed (P<.05) in SCC but HB did not (P≥.05). The design did not allow animal variation to be seperated from HB/CB effects.

Table 1. Bite-force tenderometry and collagen solubility of Lamb LTL

Experiment	Bite force tenderometry					Collagen Solubility			
	Ultrasound treatment PM Time (Days)			Other Factors		Soluble Collagen		Ultrasound treatment	Other Factor
	1	3	7	Anim	Ptt	Trt	(% total)	Significance	Anim
Cold boned	NS	NS	NS	**	*	C T	18.8 19.8	NS	*
Hot boned	NS	NS	NS	NS	**	C T	17.4 17.5	NS	NS

[1] **NS: Non significant; * : P < 0.05; ** P < 0.010**

Sensory analysis tenderness scores were negatively related to PLBFT measures at both 1 ($P<.1$) and 7 ($P<.05$) days PM. Results for sensory analysis are illustrated in star diagrams (the centre of the circle is the lowest possible score and the circumference as the highest) (Figs 1 and 2). Within PTT for both CB and HB LTL, HIU had did not affect ($P\geq.05$) tenderness or any other attribute. For HB LTL ageing improved all attributes ($P<.05$) except overall flavour ($P\geq.05$) (Fig 2). For CB samples only tenderness, overall acceptability and chewiness improved ($P<.05$). However as the meat was from different animals a conclusion of the superiority of the HB regime could not be made. Also the HB meat after 7 days ageing had higher PLBFT values than CB (44.4 vs 35.0 N/cm^2) and lower tenderness scores although the HB meat was initially tougher for both these measurements.

SDS PAGE gels were examined visually and revealed no apparent difference between control and treated samples in the rate of appearance/disappearance of bands. Roncales *et al* (1993) observed a decrease in intensity of an 87 kDa band with simultaneous appearance of an 83 kDa band in fibres sonicated in solution and increased numbers of bands in the 30 kDa region.

Fig 1 Sensory attributes of CB LTL

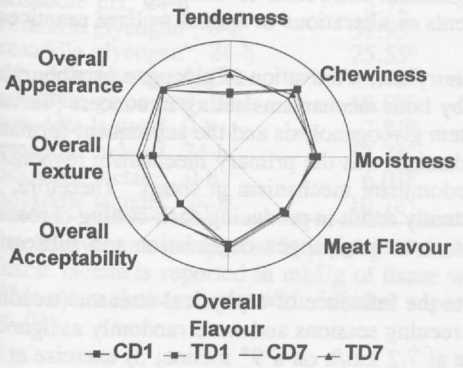
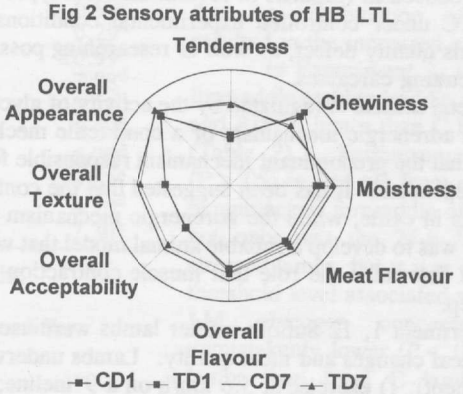


Fig 2 Sensory attributes of HB LTL



CONCLUSION

This method of application of ultrasound did not improve tenderness of HB or CB lamb up to 7 days PM nor was there any indication that it would shorten the ageing time required to reach final tenderness.

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