THE EFFECT OF ELECTRICAL STIMULATION AND TENDERSTRETCHING ON COLOUR AND OXIDATION TRAITS OF ALPACA (Vicugna pacos) MEAT

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I. INTRODUCTION

The combination of tenderstretching (TS) with medium voltage electrical stimulation (ES) during alpaca carcase processing has been proposed as the best method for maximising product tenderness, consistency and eating quality [1]. To date, the potential additive effects of these combined treatments on alpaca meat colour and oxidative traits have not been considered. While alpaca undergoes minimal colour change and oxidation during retail display [2], electrical stimulation may alter lipid oxidation, fresh colour and colour stability of the meat through changes to pH and rigour temperature of the carcase [3]. Since colour influences consumer perception of raw meat quality and rancid odours override all other perceptions of quality [4], it is important to consider any potential impacts on product quality when combining electrical stimulation and tenderstretching for best practice alpaca carcase processing.

II. MATERIALS AND METHODS

Thirty-six castrated male huacaya alpacas were slaughtered two months apart (n = 18 animals per processing) at a commercial abattoir on the south coast of NSW, Australia. Treatments were applied to carcase sides in a 2 x 2 factorial arrangement (n = 18 sides per treatment), and included 1) Achilles hung (AH) + no ES; 2) AH + ES; 3) TS + no ES; and 4) TS + ES. Stimulation was applied using a portable STIMTECH medium voltage electrical stimulation unit (~300 V, 600 mA peak current, 68 ms pulse interval and 1000 µs pulse width), with carcase sides tenderstretched through suspension by the pelvic bone for the duration of chilling.

At 24 h post-slaughter, a 3 cm muscle sample was collected from the *longissimus thoracis* (LT) for subsequent colour stability analysis and assessment of thiobarbituric acid reactive substances (TBARS). An additional 30 cm was removed from the *longissimus lumborum* (LL) for later sensory analysis. For retail colour stability analysis, a fresh surface was cut from 5 day aged LT, overwrapped with 15 µm PVC film and placed under simulated retail display. After 40 minutes bloom time, the initial (0 h) measure was taken using a Hunter Lab Mini Scan, followed by measurements at 24, 48 and 72 h. Lipid oxidation was determined via the TBARS assay previously described [5], using 1 g of frozen LT and LL subsampled from pre and post retail colour display and sensory samples. Sensory analysis followed methods described previously [6] and occurred across 6 tasting sessions using a total of 86 untrained consumers (n *grill samples* = 680). Consumers were asked to rank samples from 0 – 100 for tenderness, juiciness, flavour and overall liking.

Colour stability and TBARS data were analysed separately using Linear Mixed Models (LLMs) in Genstat (18th edn.). Fixed effects included Stimulation, Hang method and a Stimulation × Hang interaction, as well as an additional term for display time for retail simulation. Carcase, Side nested within Carcase and Kill day were included as random terms. For the determination of oxidation effects on consumer responses, separate LMMs for each of the 4 sensory traits were fitted in R, with fixed effects of Stimulation and Hang, a linear covariate for TBARS and cofactors of Side, Kill day and Sample order. Predicted means, standard errors and P–values were extracted from all models.

III. RESULTS AND DISCUSSION

Product colour changed (P < 0.001) across the retail display period, with significant increases in L*, a* and b* values from 0 – 24 hr, followed by a gradual decline thereafter (Figure 1). This follows trends previously

reported for alpaca [2]. Stimulation also altered retail colour, with both L* and b* being greater for ES (39.0 ± 1.15 and 16.0 ± 0.35 for *L** and *b** respectively) than for non- ES (37.9 ± 1.15 and 15.4 ± 0.35 *L** and *b** respectively) product. This confirms alpaca responds to retail display similarly to other red meat species, while retaining unique colour parameters [2].

Stimulation increased product oxidation. However, this was not detected by consumers, with TBARS values having no effect on sensory responses (*P* = 0.142, 0.948, 0.169, 0.294, 0.145 for tenderness, juiciness, flavour, overall liking and overall rating, respectively). This is likely due to overall TBARS values for the current study being very low, in particular being well below the 3 mg MDA/kg minimum threshold for oxidation to negatively affect lamb eating quality [7].

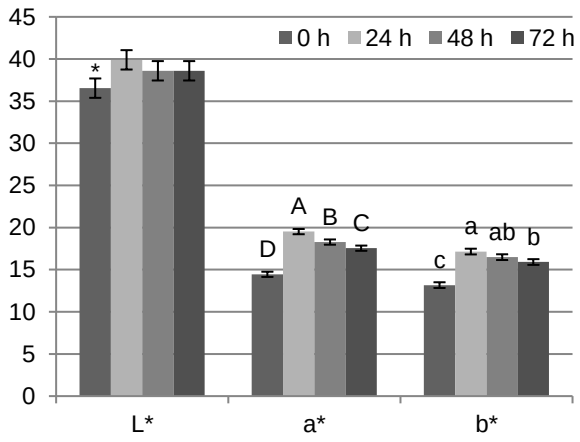

Figure 1. Changes to lightness (*L**), redness (*a**) and yellowness (*b**) colour parameters of the alpaca *longissimus thoracis* during simulated retail display. Measurements were taken at 0, 24, 48 and 72 h.

IV. CONCLUSION

Tenderstretching did not affect alpaca colour or oxidation traits. Stimulation altered retail colour, without negatively affecting colour stability. While ES increased lipid oxidation, this was not detected by consumers. Combined ES and TS during processing does not adversely impact alpaca meat colour or oxidative traits.

Table 1. The effect of medium voltage electrical stimulation and hang method on thiobarbituric acid reactive substances (TBARS) in the alpaca *longissimus thoracis*.

	Stimulation		Hang	
	Yes	No	Tenderstretch	Achilles Hung
TBARS (mg MDA/kg)				
Pre-display	1.00 ± 0.09^{b}	0.81 ± 0.09^{a}	0.87 ± 0.09^{a}	0.94 ± 0.09^{a}
Post-display	1.25 ± 0.07^{b}	1.05 ± 0.07^{a}	1.15 ± 0.08^{a}	1.15 ± 0.08^{a}
Pre-sensory	0.84 ± 0.13^{b}	0.69 ± 0.13^{a}	0.77 ± 0.13^{a}	0.76 ± 0.13^{a}

ACKNOWLEDGEMENTS

This project was funded by AgriFutures Australia and Illawarra Prime Alpaca. The authors would like to thank the NSW DPI technical staff (Matthew Kerr, Jordan Hoban) for their assistance; Associate Professor Peter Thomson, the University of Sydney, and Dr. Remy van de Ven, NSW DPI, for their statistical advice; and the staff of Milton district meats for their assistance.

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