MILD HEAT TREATMENT IMPROVES COLOUR OF DARK BEEF *LONGISSIMUS THORACIS*

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I. INTRODUCTION

Colour is the most important pre-purchase quality trait of meat, because consumers use it as an indicator of quality and freshness at the point of sale. Beef carcasses are downgraded when the loin has a high ultimate pH (pHu > 5.7), which often corresponds to dark non-compliant meat colour. The majority of research aiming at reducing the incidence of dark cutting has focused on practices that result in increasing muscle glycogen prior to slaughter. This present work however took a different approach and re-examined the role of muscle structure in determining meat colour, and further investigated whether interventions could be used to manipulate muscle structure to improve meat colour.

II. MATERIALS AND METHODS

Beef cube rolls (*Longissimus thoracis*) were collected from a local abattoir. The carcasses were chilled, and the left and right sides quartered between the 13th and 14th vertebrae. After 30 min blooming, the exposed surface was assessed by a qualified AUS-MEAT grader for meat colour (AMC), pH and rib fat (mm) as per the chiller assessment recommendations [1]. Carcasses were selected based on having an AMC ≥ 5 (dark non-compliant meat) and pH ≥ 6.0. Cube rolls were treated after 96 hours post mortem. A total of 20 cube rolls, (right and left loins from 10 animals) were randomized into treatment groups. Ten cube rolls were subjected to a mild heat treatment (45 °C for 5 hours) whereas the other 10 cube rolls were kept as unheated controls. The heated cube rolls and controls were allocated to two storage times, 0 and 24 days (5 pairs for each storage time). All samples were assessed for colour, texture, and microbiological quality (total viable count (TVC) and lactic acid bacteria (LAB)) as described in AMPC report [2]. Steaks cut from each primal were placed in a retail display cabinet (4 °C) and objectively assessed for colour by untrained consumers (using a 10 point scale where 10 was highly acceptable) over a five day period. Two way analysis of variance (ANOVA) was used for comparison between treatments using Genstat 15th edition.

III. RESULTS AND DISCUSSION

The mild heat treatment of dark beef cube rolls induced lightening of the muscle (Fig. 1) and increased both lightness (*L**) and redness (*a**) of the steaks compared to the control, untreated sample (Fig. 2) over 5 days of retail display. This improvement in the visual appearance led to a slightly higher consumer acceptability of heat treated steaks (at 0 and 24 days storage) compared to controls (at day 0 of retail display). However, by day 5 of retail display, the consumer acceptability of heated steaks was lower than control steaks, despite higher *L** and *a** values throughout the retail display (Fig. 2). Besides improving colour, heating the cube rolls had a significant impact on the tenderness by reducing the peak force (from 63.8 N in the control samples to 53.0 N in the heated samples $P \leq 0.05$) at day 0; however there was no significant improvement in tenderness of the heated samples after 24 days of storage. There was additional drip loss (0.5 and 1.0 %) in the heat treated cube rolls during vacuum storage for 0 and 24 days, respectively ($P \leq 0.05$). The heat treatment did not impact on the microbiological quality of the cube rolls, as there were no significant differences ($P > 0.10$) in TVC or LAB counts in the control and heated samples at both day 0 (2.5-2.9 $\log_{10}$ cfu/cm^2) and day 24 (5.9-6.8 $\log_{10}$ cfu/cm^2) of storage. Hence with this intervention, meat colour can be improved without jeopardising microbial shelf life. These results suggest that mild heat treatment may be sufficient to induce lightening of the dark muscle and this colour change is likely due to the modification of myoglobin form and the change in muscle structure impacting on the light scattering properties of dark meat.

Figure 1. Control and heated beef *longissimus thoracis* steaks on the first day of retail display after the whole cube roll had been stored for 0 and 24 days.

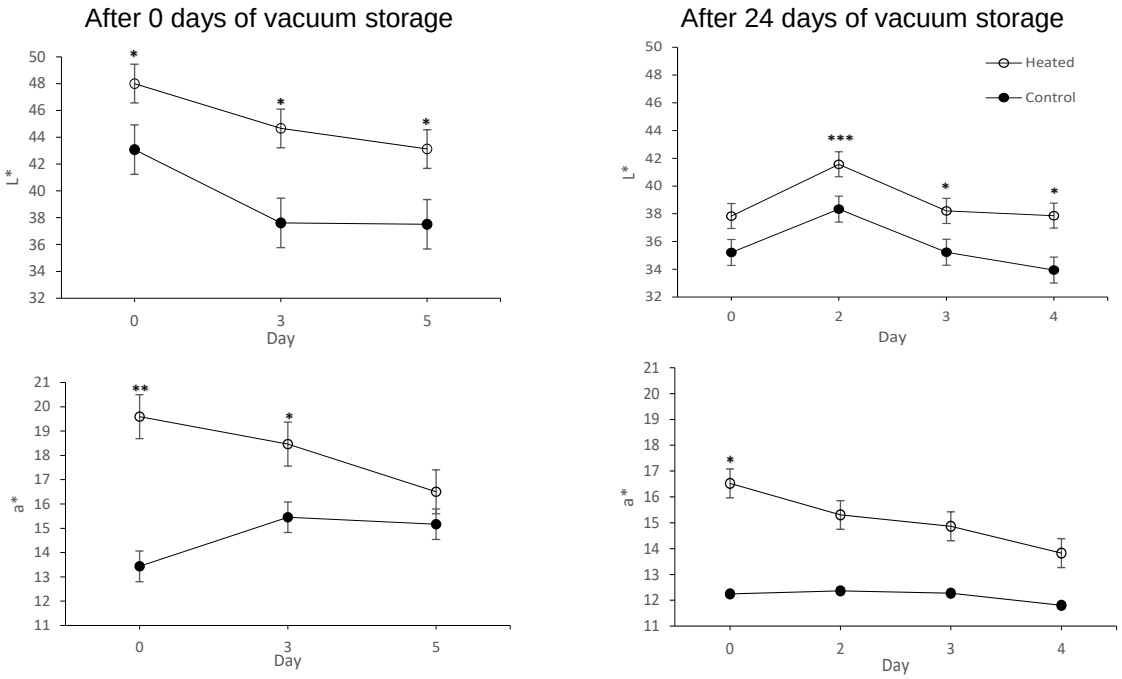

Figure 2. Colour parameters lightness (L*) and redness (a*) values of control and heated beef *longissimus thoracis* steaks at retail display (0-5 days) after whole cube rolls were stored chilled in vacuum packaging for 0 and 24 days after heating. * $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$, (n = 5).

IV. CONCLUSION

A mild heat treatment intervention was developed for improving the colour of post rigor dark beef cube rolls. We hypothesize that the heat treatment promotes both chromatic (myoglobin form) and achromatic (light scattering) mechanisms of colour development, resulting in lightening of the muscle. This provides the meat industry with a method to improve the colour of post rigor dark primals, without compromising the microbial shelf-life.

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