COLOUR STABILITY IN NEW ZEALAND LAMB MEAT

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I. INTRODUCTION

Consumers judge meat quality by three main sensory properties: appearance, texture and flavor [1] . At the point of sale, consumers are unable to evaluate the odor or feel the texture of the meat without opening the package. Thus, product appearance becomes the most important attribute [2]. A bright cherry-red colour is regarded as superior quality and freshness in lamb or beef, but it is short lived [3]. Surface discolouration is inevitable and is considered unwholesome by consumers. As a result, surface–discoloured meat cuts are ground to low-value products, such as ground beef; or discarded before microbial safety is compromised. We need to understand the mechanism underlying meat colour stability. This is especially important for the New Zealand meat industry which relies on high-value chilled products that are shipped and sold overseas.
Multiple factors affect the stability of meat colour. Endogenous factors include the breed, age, sex, handling systems, diet, pH, source, presence and amount of antioxidants, lipid oxidation and mitochondrial activity [2]. Exogenous factors include the presence of ligands (e.g. oxygen), storage, packaging environment, display condition (temperature, lighting and relative humidity) and microbial load, and can be manipulated during the production of meat. Therefore, endogenous biochemical factors are critical to meat colour stability [3] [4]. There is no single factor that is entirely responsible for meat discolouration, rather it is a combination of several acting on the state of myoglobin. This study aims to compare meat from lamb sires selected for different colour stability in their offspring and elucidate the biochemical pathway of meat colour stability. If the biochemical basis can be identified and related to lamb sires, then the colour stable sire groups could be used to maximize the value of New Zealand meat through solving or minimizing the discolouration issues of long term chilled lamb products.

II. MATERIALS AND METHODS

The offspring of 10 terminal sires (5 colour stable and 5 colour labile) were selected based on historical colour breeding values and used for the study. A total of 100 pasture-fed ram lambs of from AgResearch Woodlands, born in March 2016, weighing between 16kg and 25kg, ultimate pH<5.8 and genotyped were selected. The lamb loins were excised, trimmed of subcutaneous fat, vacuum packed and aged at 1.5°C±1°C for 8 weeks. The loins were then cut across the grain into 3cm thick slides, placed on a clear plastic tray and wrapped with PVC food film (15µm). The samples were displayed in a chiller set at 4-6°C under continuous lightning at 900 Lux. Three colour measurements of the samples were taken through the PVC film using a Minolta Model CR-400 chromameter, to obtain L* (Lightness), a* (Redness) and b* (Yellowness) values. The chromameter was calibrated with a standard white tile (Y=92.8, x=0.3160, y=0.3323) using D65 10 Deg (Illu/Obs) [5]–[7]. Measurements were taken at a specific time daily until day 6. Hue or hue angle was calculated manually using the equation (arctangent (b*/a*)) [8]. Statistical analysis of the data was carried out using 2- way ANOVA Repeated Measures in Minitab 17 Statistical Software [9]. The sire breed and the interaction between sire and retail display time (sire x display time) were assigned as the fixed factors and the colour measurements were the dependent variables. Least square means were calculated and considered to be significantly different if P≤0.05.

III. RESULTS AND DISCUSSION

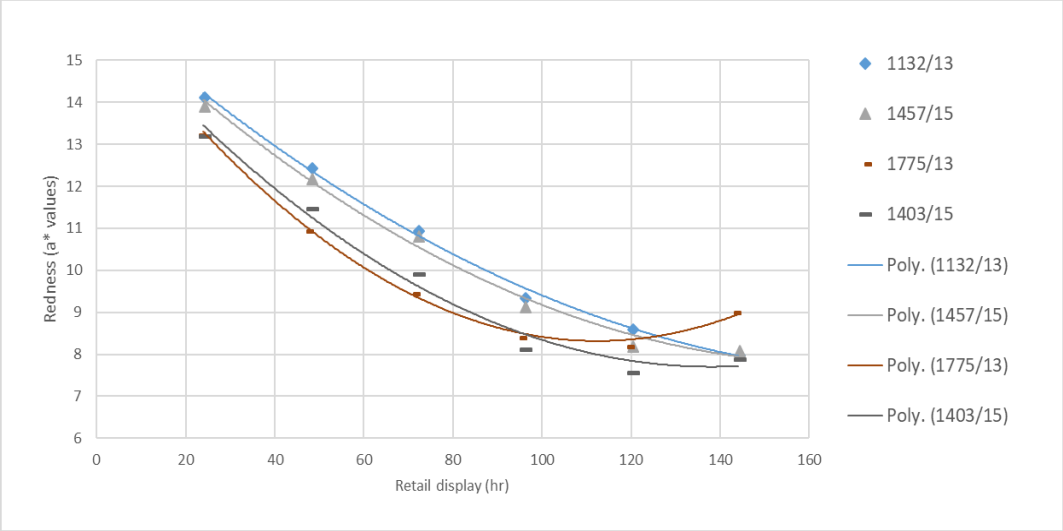

Figure 1 Measurement of redness (a*-value) during retail display

Figure 1 shows that the sire groups that had higher a*-values at 24 hours remain higher throughout the retail display. The post-hoc analysis showed that a* values of sire groups 1132/13 and 1457/15 were similar and significantly higher than sire groups 1775/13 and 1403/15. With that, we classified sire group 1132/13 and 1457/15 as the colour stable group; whereas sire group 1775/13 and 1403/15 as the colour labile group.

IV. CONCLUSION

Results from this initial study are consistent with there being a sire effect for lamb meat colour stability. The samples were further processed for proteomic, metabolomic and lipidomic analysis.

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