SLAUGHTER AGE OF 5, 8 & 14 MONTHS ON THE QUALITY OF SHEEP MEAT

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I. INTRODUCTION

In New Zealand, lamb is considered the highest quality sheep meat product and hogget is considered as poorer quality and downgraded [1]. Higher shear force for mutton compared to lamb indicates that meat from older sheep is less tender [2,3]. The shear force of lamb meat increases as slaughter age increases due to reduced collagen solubility [4]. Studies in Australia have shown the acceptability of meat from animals classified as hogget [1]. The aim of this study was to use objective meat quality tests to investigate the differences in meat quality between sheep slaughtered at 5, 8 and 14 months of age and the potential of extending lamb meat classification to include older animals than currently classified.

II. MATERIALS AND METHODS

Romney ram lambs were allocated to 5, 8 and 14 month-of-age slaughter groups, balanced for birth weight, with 20 lambs in each. The sheep were slaughtered and processed following standard commercial procedures in New Zealand. Carcasses were chilled at 4°C for 24 hours. The bone-in, short loin (*Longissimus lumborum)* was collected from each carcass, vacuum-packed and stored at -20 °C. Samples were thawed for 24 hours at 1°C and the loin muscle removed from the bone. The pH of the loin was measured by pH spear (Eutech Instruments, Singapore). A fresh cut was made and after 30 minutes exposure to air the muscle lightness (*L**) and redness (*a**) was measured (Minolta CR-200). Tenderness was assessed by the peak force required to shear 13 x 13 mm cores from 25mm loin steaks cooked in a water bath at 70°C for 90 minutes (Warner-Bratzler device, square blade). Drip loss was measured by suspending a 30 x 30 x 30 mm meat cube on a metal hook in a plastic bag at 1°C and reweighing after 24 hours. Remaining meat was trimmed of fat and visual connective tissue, finely minced (Kenwood MG450, 3 mm hole-plate), vacuum-packed and frozen for intramuscular fat (AOAC 991.36). Total, soluble and insoluble collagen was determined as hydroxyproline using the method of Ablikim et al. [5]. Measurements were analysed using general linear models (PROC GLM, SAS 9.4) with slaughter age as the fixed effect.

III. RESULTS AND DISCUSSION

The pH was higher in the lamb from 5 month old lambs but the same for the sheep slaughtered at 8 and 14 months of age ($P<0.001$; Table 1). The pH was below 5.6 and unlikely to be contributing to variation in meat quality. Meat from young animals is less red than that of older animals due to the increase in myoglobin concentration that occurs in the muscle as an animal gets older [2,6] so, it was not surprising that meat from lambs slaughtered at 5 months old tended to be less red compared to the sheep slaughtered at 8 and14 months of age ($P<0.001$; Table 1). It is possible that greater fat in the muscle contributed to higher lightness values in the meat from 14 month old sheep ($P=0.045$; Table 1). Drip loss after 24 hours was greater in lamb slaughtered at 8 compared to 5 and 14 months of age ($P=0.006$; Table 1). These results are difficult to explain as water holding is influenced by many factors including pH, protein structure and meat composition [3,7].

Total collagen increased as animal got older at slaughter but the soluble proportion declined ($P<0.05$, Table 1). The shear force was lowest for meat from 14 month old sheep and greatest for lambs slaughtered at 8 months ($P<0.001$). Intramuscular fat was greater in the sheep slaughtered at 14 months-of-age ($P=0.003$) but, similar in lambs at 5 and 8 months-of-age (Table 1). Meat from older sheep is tougher due to the

increased level of collagen cross-linking reducing solubility [4]. At 8 months of age the decreased proportion of soluble collagen is likely to be contributing to higher shear force. Unexpectedly, the meat from 14 month old sheep had a lower shear force than the meat from 5 and 8 month old lambs. This suggests that other determinants of meat tenderness have reduced the shear force at 14 months. It is likely that the higher intramuscular fat was having a role [7].

Table 1. Objective meat quality attributes of *Longissimus lumborum* from Romney rams slaughtered at 5, 8 and 14 months-of-age (n=20 per age). Values are the least square mean ± standard error of the mean.

Meat quality attribute	Age at slaughter (month)			P-value
	5	8	14	
pH	5.54 ± 0.02[a]	5.42 ± 0.02[b]	5.45± 0.02[b]	<0.001
*L** (Lightness)	37.76 ± 0.45[b]	39.09 ± 0.45[a]	39.24 ± 0.45[a]	0.045
*a** (Redness)	13.19 ± 0.22[b]	13.34 ± 0.22[b]	15.07 ± 0.22[a]	<0.001
Drip loss after 24h (%)	3.6 ± 0.4[b]	5.7 ± 0.4[a]	4.6 ± 0.4[ab]	0.006
Cooking loss (%)	30.8 ± 0.5	30.8 ± 0.5	29.7 ± 0.5	0.181
Shear force (kgF)	6.87 ± 0.35[b]	7.98 ± 0.35[a]	5.72 ± 0.35[c]	<0.001
Total collagen (g/100g fresh meat) [1]	0.96 ± 0.09[a]	0.87 ± 0.09[a]	0.62 ± 0.09[b]	0.020
Soluble collagen (%)[1]	43.1 ± 4.3[a]	32.2 ± 4.3[ab]	30.6 ± 4.3[b]	0.007
Intramuscular fat (% whole muscle)[2]	2.5 ± 0.3[b]	3.0 ± 0.3[b]	3.8 ± 0.3[a]	0.003

[abc] Within rows, values without superscript or with common superscripts are not significantly different at the P<0.05 level.
[1] Fifteen samples per treatment.
[2] Ten samples per treatment.

IV. CONCLUSION

Meat from hogget classified carcasses (2 permanent incisors in wear) should not be downgraded on the basis of tenderness if sufficient intramuscular fat is present.

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