

## P-01-28

**Oxygen concentration can be halved in modified atmosphere packaging to improve eating quality** (#516)Maddison Corlett<sup>1, 2</sup>, Graham Gardner<sup>1, 2</sup>, Liselotte Pannier<sup>1, 2</sup>, Khama Kelman<sup>1, 2</sup>, Robin Jacob<sup>3</sup>, David Pethick<sup>1, 2</sup><sup>1</sup> Australian Cooperative Research Centre for Sheep Industry Innovation, Armidale, Australia; <sup>2</sup> Murdoch University, School of Veterinary and Life Sciences, Murdoch, Australia; <sup>3</sup> Department of Primary Industries and Regional Development, South Perth, Australia**Introduction**

Colour is crucial to consumer acceptability of fresh red meat [1]. Modified atmosphere packaging, typically containing 80% oxygen and 20% carbon dioxide, is currently used in Australian supermarkets to extend shelf life. This high oxygen concentration promotes a cherry red meat colour that lasts longer than overwrap packaging [2]. However, a reduction in the eating quality of lamb and beef has been reported for high oxygen MAP [3, 4]. An alternative is vacuum skin packaging (VSP), however, this method has no oxygen in the packaging causing the meat to appear dark purple and is considered less attractive to consumers. Corlett et al. (2018) found that MAP packaging containing a lower oxygen concentration with 40% oxygen, 20% carbon dioxide and 40% nitrogen caused the meat to have a similar redness to high oxygen (80%) MAP meat [5]. However, it is unknown whether a lower oxygen concentration will improve the eating quality of lamb in MAP. We hypothesised that consumer overall liking scores for lamb meat will be highest for VSP as it contains no oxygen (0%), lower for 40% oxygen MAP, and lowest for 80% oxygen MAP as it contains the most oxygen of all three packages.

**Methods**

Lambs (n = 72) were selected from the Meat and Livestock Australia Genetic Resource Flock from Kirby, New South Wales. The male castrate and female lambs were the progeny of Merino dams crossed with Maternal and Merino sires. Lambs were slaughtered at a commercial abattoir and carcasses were subjected to medium voltage electrical stimulation post dressing. Two *longissimus lumborum* (loin) and two *semimembranosus* (topside) samples were collected from each carcass 24 hours post-slaughter, vacuum packaged, and stored at 2°C for 10 days. Afterwards, each muscle was sliced into five 15mm thick samples, and placed into one of six treatment groups. Treatments consisted of three oxygen concentrations (0%, 40% and 80%) and two simulated retail display periods (3 or 8 days) at 2°C. Afterwards, samples were frozen at -20°C for subsequent sensory testing. Untrained consumers (n=480) assessed overall liking, using a 100 score scale (100 being most preferred), of six samples following the protocol previously published by Thompson et al. [6], each muscle eaten by 10 consumers. Overall liking scores were analysed using a linear mixed effect models (SAS Version 9.1) with fixed effects for muscle (loin, topside), oxygen concentration (0%, 40%, 80%), display time (3, 8 days), sire type (Merino, Maternal), and sex (female, male). Animal identification within sire identification, and consumer

within eating quality session were included as random terms.

**Results**

Overall liking scores varied between different muscles, oxygen concentrations and display time (Figure 1).

Consumers generally scored samples under 40% oxygen lower than 0% oxygen samples but higher than 80% oxygen samples. The exception to this was for the topside samples which showed no difference between 40% and 80% oxygen after 8 days retail display. Likewise, during the short retail display period of 3 days, scores from 40% and 80% oxygen loin samples were not different to 0% oxygen samples (P>0.05). The lower eating quality of 80% oxygen samples may be linked to the high oxygen content promoting oxidation, and inhibiting calpain, and/or promoting protein cross-linking which increases meat toughness [7]. The 40% oxygen may have reduced the negative impact on tenderness, and increased overall liking scores compared to 80% oxygen samples. These findings align well with our hypothesis that overall liking scores will be highest for VSP as it contains no oxygen (0%), lower for 40% oxygen MAP, and lowest for 80% oxygen MAP as it contains the most oxygen of all three packages.

**Conclusion**

The 40% oxygen samples could not provide the industry with a packaging format that provides the eating quality experience of 0% oxygen (VSP). However, 40% oxygen has been shown previously to provide an appealing bright red colour compared to VSP samples. The 40% oxygen samples also tended to have better consumer overall liking scores than 80% oxygen with the latter currently being used by retail supermarkets in Australia. These results provide the sheepmeat industry with evidence that reducing the oxygen concentration in MAP mixtures to 40% reduces the detrimental impact on eating quality and still maintains the red meat colour.

**References**

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2. Kim, Y., Stuart, A., Black, C., Rosenvold K. (2012). Effect of lamb age and retail packaging types on the quality of long-term chilled lamb loins. *Meat Science*, 90(4), 962-966.
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## Notes

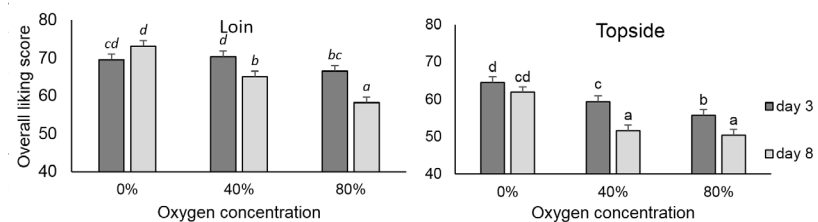
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**Figure 1.** The effect of muscle, display time and oxygen concentration on overall liking scores. Within a cut, the different letter annotations demonstrate significant differences ( $P < 0.05$ ) across display times and the packaging types.

## Notes