Eating Quality of Aged Pork Loins is reduced in High Oxygen Modified Atmosphere packaging compared to Vacuum Packaging

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Introduction: High oxygen modified atmospheric packaging (hiOxMAP) enhances initial meat colour but impacts eating quality of beef, lamb, and pork. HiOxMAP also results in fatty acid and protein oxidation causing rancidity, poor flavour, reduced tenderness and water holding capacity (WHC). HiOxMAP is still used for pork in major Australian supermarkets, despite negative impacts on products. The aim of this study was to investigate the effects of hiOxMAP on pork quality over time, compared to vacuum packaging (VAC) and make recommendations for the Australian pork industry.

Materials and methods: Twenty-four pork loins (12 carcasses) were obtained 24 hrs postmortem, cut into 4 cm-long chops, randomly allocated to one of the 11 treatments: 0 days ageing (control), VAC or hiOxMAP for 1, 5, 10, and (VAC only) 15 and 20 days or the combined packaging of VAC for 10 days followed by hiOxMAP for 5 days, and VAC for 10 days followed by hiOxMAP for 10 days. Chops were placed in a retail display case for the ageing period. On each sampling day, pH; colour parameters lightness (L*), redness (a*), and yellowness (b*); oxy/metmyoglobin ratio (defined as the ratio of reflectance at 630 nm to the reflectance at 580 nm (R630nm/R580nm); Warner Bratzler shear force (WBSF); lipid oxidation (TBARS), and protein oxidation (carbonyl and free thiol contents) were measured. All parameters were analysed by restricted maximum likelihood (REML) in GENSTAT (18th Edition).

Results: In hiOxMAP, the most notable change in colour parameters over the 10 day display period was the continuous increase in L* and reductions in a* and R630/580. The a* and R630/580 were significantly lower while L* was significantly higher for chops in hiOxMAP compared to chops in VAC at days 5 and 10. Together, these results suggest hiOxMAP yields paler pork with increased browning. While a reduction in WBSF was observed for both packaging methods up to 5 days, the WBSF significantly increased for samples in hiOxMAP between days 5 and 10, suggesting that retail display of pork in hiOxMAP beyond 5 days resulted in toughening. At days 5 and 10, the TBARS and carbonyl content values were significantly lower while the free thiol content was significantly higher in VAC compared to hiOxMAP, indicating that hiOxMAP lead to increased lipid and protein oxidation. The carbonyl content values of the combination packaging treatments (VAC for 10 days followed by hiOxMAP for either 5 or 10 days) were lower than their hiOxMAP only equivalents (5 or 10 days without VAC). Protein oxidation has been linked to increased protein cross linking (toughening), reduced tenderisation (less calpain activity) and lower colour stability.

Conclusion: HiOxMAP negatively impacted the quality of Australian pork. Prepackaging with VAC for 10 days prior to hiOxMAP may improve quality by reducing protein oxidation. We recommend that the Australian pork industry primarily use VAC. If hiOxMAP is used, combination packaging of VAC and hiOxMAP is recommended. A limit of 5 days in hiOxMAP is recommended for Australian pork due to elevated lipid and protein oxidation. HiOxMAP should be restricted to cuts with a high turnover rate on market shelves.

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