

Effect of postmortem vacuum-packaged time on meat quality during chilled storage

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Introduction: Hot-fresh meat is popular with Chinese consumers for many years and is essentially in pre-rigor stage (Toohey & Hopkins, 2006; Zhang & Hou, 2020). At present, the hot-fresh meat is generally sold without package at Chinese market, which brings some problems of short shelf life and rapid quality deterioration. The pre-rigor meat will complete the rigor and enter into post-rigor stage when ATP depletes (Huff-Lonergan, Zhang & Lonergan, 2010). Biochemical processes and structural changes of pre-rigor state muscle influence the meat quality (Kim, Luc & Rosenvold, 2013). Vacuum packaging (VP) is a conventional technology to maintain meat quality and extend shelf life. A previous study reported that packaging rapidly for fabricated cuts is necessary to maintain higher metmyoglobin-reducing ability rather than exposed to air some hours (Lawrence & Kropf, 2018). However, there are few reports on postmortem packaged time affecting muscle changes. This study aimed to explore the effect of VP packaged at different postmortem times on lamb meat quality during chilled storage.

Materials and Methods: Fourteen 7-month old lambs with an average weight of 27.98 ± 2.26 kg (hot-carcass), same genetic background (Tail Han sheep \times Mongolian sheep crossbred sheep) and from same farm were selected at a commercial slaughterhouse. Lamb Longissimus thoracis et lumborum muscle was hot-boned within 45 min postmortem and cut into three parts evenly. The 81 samples were randomly vacuum packaged at 1, 6, 12, 24 and 48 h postmortem (namely VP-1h, VP-6h, VP-12h, VP-24h, VP-48h respectively, air packaging (AP) as control) after connective tissue and visible fat was trimmed and evenly cut. The Purge loss, pH and shear force were measured after opening packages at collecting time of 1, 6, 12, 24, 48, 96, 168 h postmortem, remaining samples were snap frozen in liquid nitrogen and transferred to laboratory storing at -80°C for further biochemical analysis, involving the glycogen and lactate content, protein thiols content and the activity of calpain-1.

Results: Results showed that there was no significant difference for shear force in all groups after 24 h storage except for VP-1h group, which had a significant decrease after reaching to the maximum and had a lower shear force compared to other groups during storage ($P < 0.05$). The pH decline was delayed when vacuum packaged at 1, 6, 12 h postmortem ($P < 0.05$). Lamb meat in VP-1h group appeared the highest protein oxidation, while VP-6h group had the lowest oxidation level. Calpain-1 was activated and autolyzed at early postmortem, but it was slower for proteolytic-activity exhibited in AP lamb meat compared with those packaged in VP. The proteolytic-activity in meat of VP-6h group, similarly to AP, was lower than the other groups packaged at 1, 12, 24, 48 h postmortem time. The purge loss was highest in VP-48h group, and was lowest in VP-1h group.

Conclusions: In conclusion, the lamb meat quality is different when using VP at different postmortem time points. The earlier VP at postmortem, the slower glycolysis rate is. Besides, VP lamb meat packaged at 1 h postmortem could inhibit the cold shortening and had a higher tenderness and water holding capacity.

Acknowledgements and Financial support statement: This study was financially supported by the "National Agricultural Science and Technology Innovation Program (CAAS-ASTIP-2020-IFST-03)" and "National Key R&D Program of China (International Cooperation Project between China and New Zealand, Project No. 2018YFE0105700)".

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