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EFFECT OF OXYGEN ON THE OXIDATION OF TWO DIFFERENT MAP RETAIL PORK MEAT PRODUCTS

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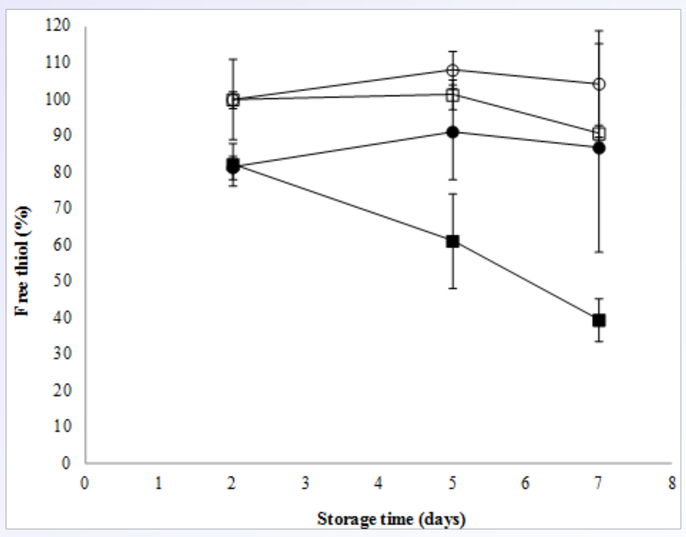
Background & Aim

MAP is widely used in the packaging of retail pork meat products in order to preserve a bright red colour and to extend retail shelf life. The use of high-oxygen (70-80%) MAP allows the development of a desirable red colour on the product surface. However, oxygen is also known to initiate lipid- and protein-oxidation that result in the deterioration of sensorial and nutritional value of the product. In addition to different processing, fresh meat retail products can also originate from muscles with different physiological characteristics. The aim of this study was to investigate the development of lipid- and protein-oxidation during storage of two different retail meat products, i.e. pork chops and mince, packed in either anoxic (0%) or high-oxygen (80%) MAP.

Protein Oxidation



Mince: □: 0% O_2 ■: 80% O_2 Chops: ○: 0% O_2 ●: 80% O_2

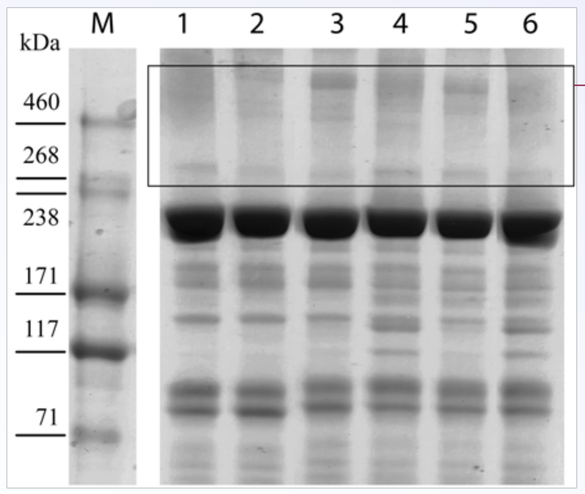
Anoxic MAP: There is only a negligible effect of storage time on the mince free-thiol values. Similarly, protein oxidation in pork chops remains stable, as the thiol-group levels do not change considerably over the storage period.

High-oxygen MAP: While free-thiol levels are retained in chops, the loss of free thiol content in the mince is much higher, reaching approximately 60% for the high-oxygen MAP samples at Day 7.

The effect of high-oxygen compared to anoxic MAP on meat protein can already be observed after two days of storage, for both types of products.

Materials & Methods: *Samples were homogenized in Tris buffer solution. The homogenate was centrifuged and free-thiol concentration was determined fluorimetrically (Ex/Em of 490/520 nm) on a filtrate of the supernatant, using the Amplite fluorimetric Thiol Quantification kit (ATT Bioquest, USA). Results were expressed as percentage of thiol content of samples stored for two days in 0% O_2, representing 100% of the scale.*

Protein profile



1-3: **Chops**: Day 2, 0% O_2; Day 7, 0% O_2; Day 7, 80% O_2
4-6: **Mince**: Day 2, 0% O_2; Day 7, 0% O_2; Day 7, 80% O_2

SDS-PAGE

The rectangle marks the high molecular-weight area.

The electrophoretic separation of protein from the samples on 3-8% TA gels reveals different protein-band patterns between products, and between O_2 concentrations. The appearance of high-molecular weight protein above the MyHC band in samples stored in high-oxygen MAP has been attributed to the cross-linking of myosin.

Western Blotting

The intensity of the chemiluminescence signal suggests higher prevalence of Slow/Type I fibres in the mince.

Materials & Methods: *Protein was electrophoretically separated on a NuPAGE 3-8% Tris-Acetate gel. For Western Blotting, bands were transferred to a PVDF membrane and blocked overnight with 5% milk solution in TBS. The membrane was incubated for 1 hour with the mouse monoclonal antibody BA-F8 (DSHB, USA) and detection was performed using chemiluminescence signal.*

MAP should be individualy optimised for different meat products

Lipid Oxidation

TBARS (µmol MDA equiv. / Kg meat)			
Sample	Day	Oxygen level in MAP	
		0%	80%
Mince	2	1.4 ± 0.1	1.4 ± 0.4
	5	1.1 ± 0.3	1.2 ± 0.2
	7	2.0 ± 0.3	3.4 ± 0.6
Chops	7	1.4 ± 0.2	2.4 ± 0.4

Mince: An increase of secondary oxidation products (TBARS) becomes apparent by storage day 7 in both anoxic and high-oxygen MAP, but was more pronounced at 80% O_2.

Chops: High-oxygen MAP appeared to further increase TBARS.

The mince lipid content (10.9% ± 1.1) was much higher than in the chops (2.5% ± 0.7), which may explain the higher level of secondary lipid oxidation products in the former.

Comparing the two products after 7 days of storage, lipid oxidation was lower in chops compared to the mince.

Materials & Methods: *Samples were homogenized in TCA solution. A filtrate of the mixture was incubated with 2 mM TBA for 40 min. at 100 °C. Following incubation, absorbance at 532 nm was measured and the results were expressed as mg MDA/Kg of sample.*

Conclusions

- The use of high-oxygen MAP does not affect considerably the oxidative stability of pork chops during seven days of storage.
- In contrast, oxidative changes were observed for minced pork as early as two days of storage, when using high-oxygen MAP.
- The discrepancy of oxidative stability between product types may be attributed to differences in processing methods (mincing vs. whole cut), lipid content (10.9 % in the mince vs. 2.5 % in the chops), and perhaps also muscle physiology and fibre-type composition.
- These factors may impact oxidative stability and must be examined in conjunction with the O_2 concentration in-package. MAP should be optimised for different meat product types.

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