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Studying and enlightening food microbial ecosystem and microbiome

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Towards new strategies for extending the ground beef shelf-life: the cases of electrolysed water, bioprotective cultures and metataxonomic-based surveillance

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Ground beef is a perishable product with a shelf-life that varies in relation to the initial contamination level and microbiota composition. Meat industries are therefore seeking for new productive approaches capable to limit product losses through a shelf-life maximisation.

We tested on site the applicability of electrolysed water (EW; 100 ppm of free-chlorine) prior to grinding and autochthonous bioprotective bacteria (ABB) in ground beef. The impact of these antimicrobial strategies has been monitored by culture-based approach, sensory tests, metataxonomic and volatilomic analyses. More than a hundred metataxonomic profiles were collected from carcasses after slaughtering up to the end of shelf-life and beyond. Genomic characterisation of the ABB was also conducted to decipher its antimicrobial mechanism.

Pre-grinding immersion of meat trimmings in EW has been ineffective and the following spoilage evolution varied among production runs. Discrimination according to the origin has been further observed within the same production run by metataxonomic analysis in carcasses and ground beef, while microbiological and physical-chemical analysis did not show this fine discriminatory capability. Metataxonomic signatures of a faster spoilage tendency were identified from the original carcasses until the late stages of vacuum storage, while manipulation phases before packaging determined only transient modifications in the ground beef microbiota. These recurrent signatures were the high α -diversity and co-occurrence of *Carnobacterium* and *Pseudomonas*. Moreover, *Lactococcus* (*Lc.*) *piscium* development and the related acetoin production were identified as the main shelf-life endpoint indicators in ground beef, while other *Lactococcus*, dominant in the early stages of vacuum storage, showed the capability to inhibit consortia of spoilage bacteria in vitro. Accordingly, a strain of *Lc. lactis* subsp. *hordniae* has been tested as ABB in ground beef. However, despite possessing genes encoding for several antimicrobial peptides and inhibiting *Listeria monocytogenes* growth in liquid substrate, it did not prevent or slow the spoilage in this solid product.

To conclude, both EW treatment and ABB adjunction apparently did not prolong the ground beef shelf life. Notably, metataxonomic-based profiling in the early stages of production might represent an effective approach to sharply discriminate between batches with faster or slower spoilage tendency.



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