Reformulation of dry sausages with natural plant extracts prevents oxidation even in the absence of nitrates

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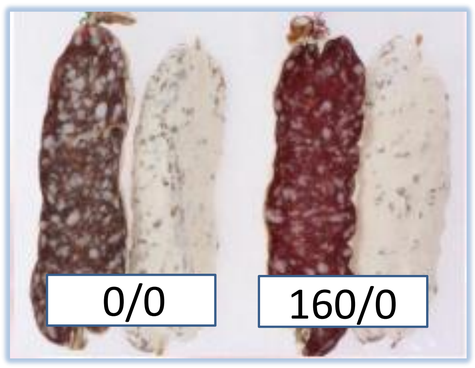
Background & objective

Dry sausages are part of French gastronomy and represent 8% of the total food consumed weekly in France. Reducing people's exposure to nitrites, nitrates and nitroso compounds is a public health issue. Therefore, reformulation provides technological leverage to reduce or even exclude nitrite/nitrate inputs in processed meats. Known for their antioxidant and anti-nitrosating properties, polyphenols can be provided by plant byproducts like grapeseed or olive pomace from olive oil extraction. Nitrite/nitrate in dry-fermented pork sausages/salamis can be replaced through formulation with a grapeseed/olive pomace mixture, while controlling microbiological safety, albeit with possible color or taste alteration. Preliminary studies have defined an acceptable concentration from a sensory point of view, set at 6 mM eq gallic acid. The aim of the present study was to investigate different sources of polyphenols, alone or in combination with nitrates, to highlight possible synergistic effects on oxidation and prevention of nitrosation.

Materials and Methods

Seven types dry sausages were manufactured using fruit extract, green tea or polyphenol-rich olive/grape extracts combined or not with nitrate (160 ppm)

Dry sausages making:
87% of porcine shoulder meat + 13% of porcine back fat.
Grinding at 6 mm diameter and stuffing in porcine casings of 55 mm diameter.
Addition of 160 mg/kg $NaNO_3$ and/or 6 mM polyphenol extracts: green tea GT, olive grape OG, fruit cocktail FC.
Flavoring with 1.50 g/kg of ground grey pepper
Starters 0.15 g/kg : *Lactobacillus sakei, Staphylococcus carnosus, Staphylococcus xylosus* (Lallemand, France)
Addition of dextrose and lactose (5.50 g/kg and 6.00 g/kg, respectively) to acidify the sausages during the fermentation step.
After drying, weight loss is 44%, similar whatever the formulation
pH is comprised between 5.1 and 5.2




Fruit Cocktail (FC)


Olive & Grape (OG)


Green Tea (GT)

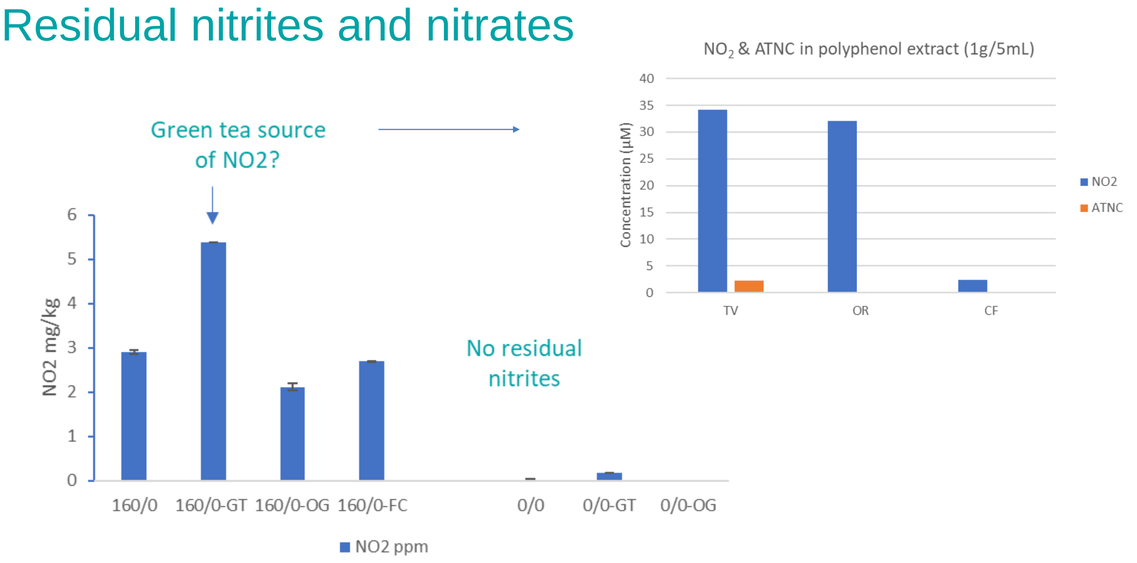
Added nitrate 160 ppm (160/0)	160/0 ; 160/0 - GT ; 160/0 – OG ; 160/0 - FC
Without nitrate (0/0)	0/0 ; 0/0 - GT ; 0/0 - OG

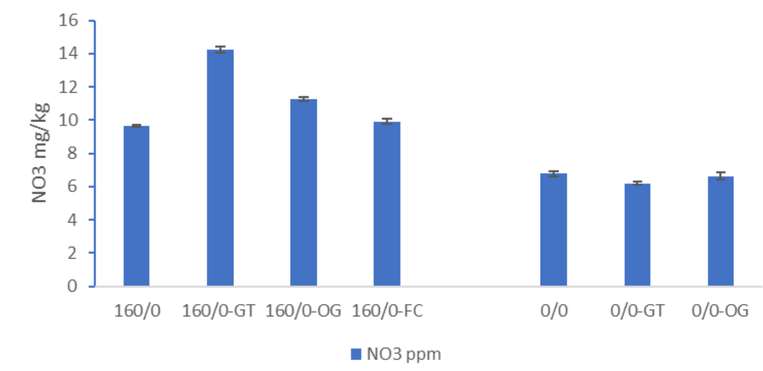
Biochemical characterization
Lipid oxidation, Iron nitrosylation, residual nitrites, residual nitrates, nitrosothiols, non-volatile nitrosamines (Keuleyan et al., 2022).

Statistical analysis
ANOVA and Tukey *post-hoc* tests performed on variables (Jamovi software). Data with nitrate (160/0) analysed separately from those without nitrate (0/0)

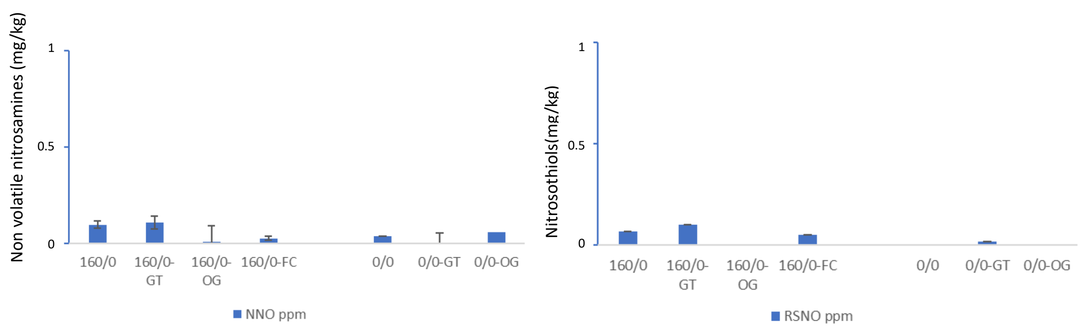
Results

Residual nitrites and nitrates

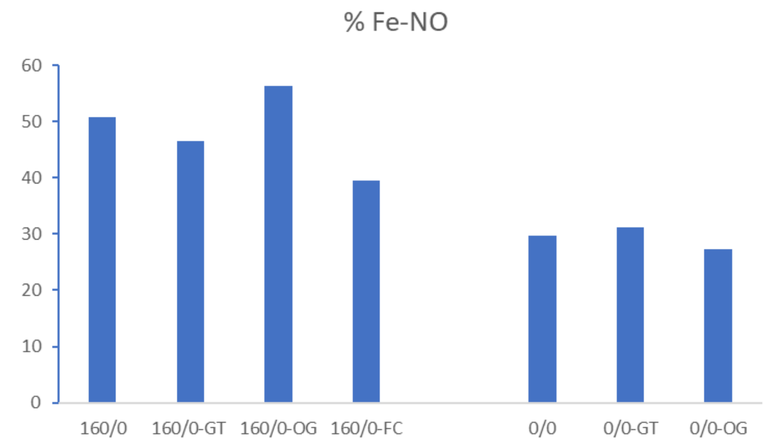




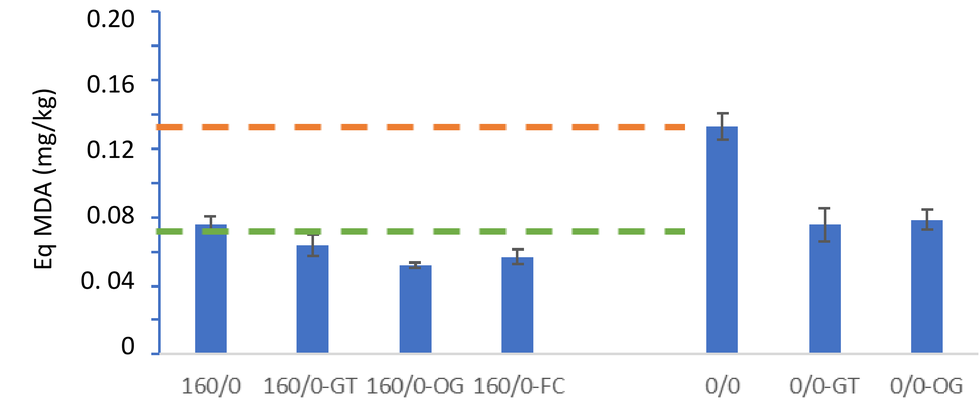
Absence of nitrosamines NNO and nitrosothiols RSNO



Less formation of Fe-NO in absence of NaNO3



Strong reduction of lipid oxidation in dry sausage formulated with plant extracts



Conclusions

- Dry sausages did not contain meaningful amount of harmful nonvolatile nitrosamines, which is a public health result worth mentioning.
- Replacing nitrates in dry sausages is possible with 6 mM plant extract (green tea and olive grape), with limited lipid oxidation.
- The combination with nitrates highlighted a synergistic action on lipid oxidation, therefore ensuring better preservation of the food product.
- Further investigations are planned to evaluate how the polyphenol extracts protect against oxidation and nitration in digestive conditions, which are known to increase oxidation and the release of NO.
- Possible synergistic action of polyphenols with lower nitrite levels must be investigated in greater depth.

References
Papuc, C.et al. (2017). Reviews in Food Science and Food Safety 16:96-123
Aquilani, C. et al (2018). Meat Science 145: 389–398
Di Nunzio, M. et al (2022). Int. J. Mol. Sci., 23: 12555.

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