Reduction of nitrite in canned meat products: Consequences for safety and shelf life

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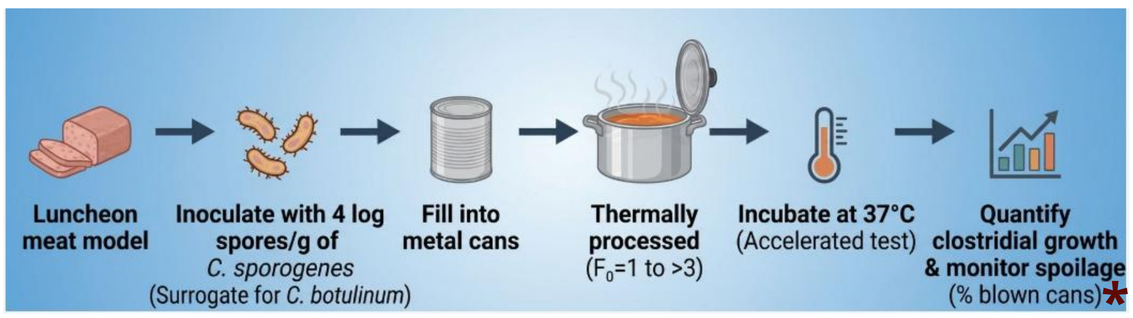
Introduction

- Nitrite is essential for the microbiological stability of shelf-stable canned meats, which may have a shelf life of several years.
- EU legislation effective from October 2025 reduces permitted ingoing nitrite levels from 150 to 120 ppm $NaNO_2$ for products receiving a thermal process of $F_0 \leq 3$ (heat treatment equivalent to 121.1°C for 3 minutes or less), and from 100 ppm to 82 ppm for products with $F_0 > 3$.
- Evidence supporting the microbiological stability of canned meats at these reduced nitrite levels is limited.

Aim

- To assess the effects of reduced ingoing nitrite on microbiological stability and shelf life, and to determine whether organic acids can compensate for lower nitrite levels and enable further reduction.

Methodology



Experimental variables:
- Ingoing $NaNO_2$: 0-150 ppm
- Water-phase salt: 2.2-3.6%
- +/- organic acids
- pH 6.1-6.4
- F_0: 1 to 3.3

*Time to 50% blown cans was recorded as a collective measure of spores surviving heat treatment, lag phase before spore germination, vegetative growth and gas production.

Conclusion and future work

- Reducing nitrite below 82 ppm $NaNO_2$ shortened time to can-swelling. In contrast, the difference between 120 and 150 ppm was small and inconsistent between experimental series, indicating that the reduction has only minor impact on the microbiological stability.
- Organic acids partly compensated for reduced nitrite: 1.5% sodium lactate plus 0.1% sodium acetate at 75 ppm nitrite delayed can swelling beyond that of comparable products with 150 ppm nitrite.
- Further studies should validate reduced-nitrite/organic-acid formulations across product types, heat treatments and long-term storage conditions.

Acknowledgement

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Results

Time to 50% blown cans increased markedly when ingoing nitrite was increased from 0–40 ppm to 75–100 ppm $NaNO_2$. Above 100 ppm, the dose–response relationship was less pronounced. Nitrite at 150 ppm tended to delay can swelling compared with 118–120 ppm; however, the additional effect was small and not consistent across all experimental series (Figure 1). No clear independent effect of water-phase salt (WPS) was observed.

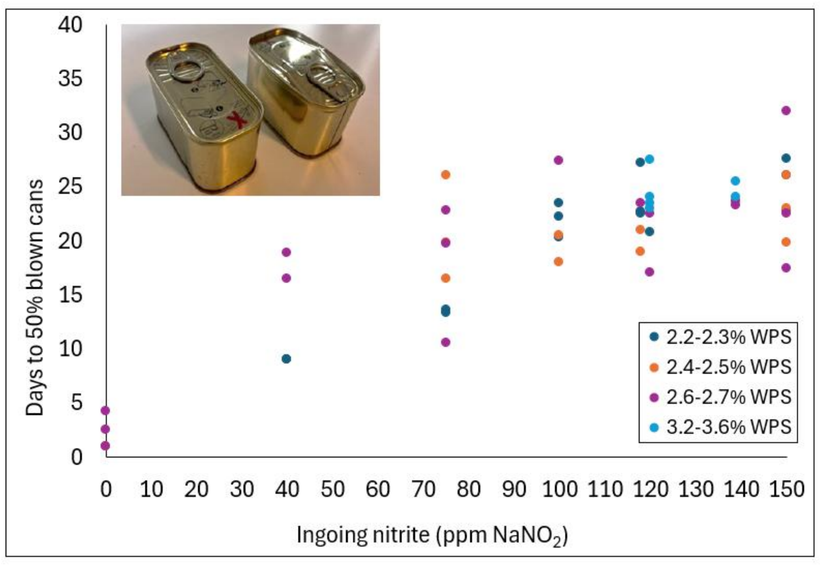

Figure 1. Time to 50% blown cans (days) in 47 series of luncheon meat with pH 6.1–6.4, WPS of 2.2–3.6%, and 0–150 ppm added $NaNO_2$. The cans received thermal treatments with F_0 values ranging from 1.0 to 3.3.

Reducing ingoing nitrite below 82 ppm $NaNO_2$ shortened the time to 50% blown cans. However, sensory-acceptable concentrations of organic acids partly compensated for the reduced nitrite level. In the example shown in Figures 2–3, addition of 1.5% sodium lactate and 0.1% sodium acetate to luncheon meat containing 75 ppm ingoing nitrite delayed can swelling beyond that observed in comparable products containing 150 ppm nitrite.

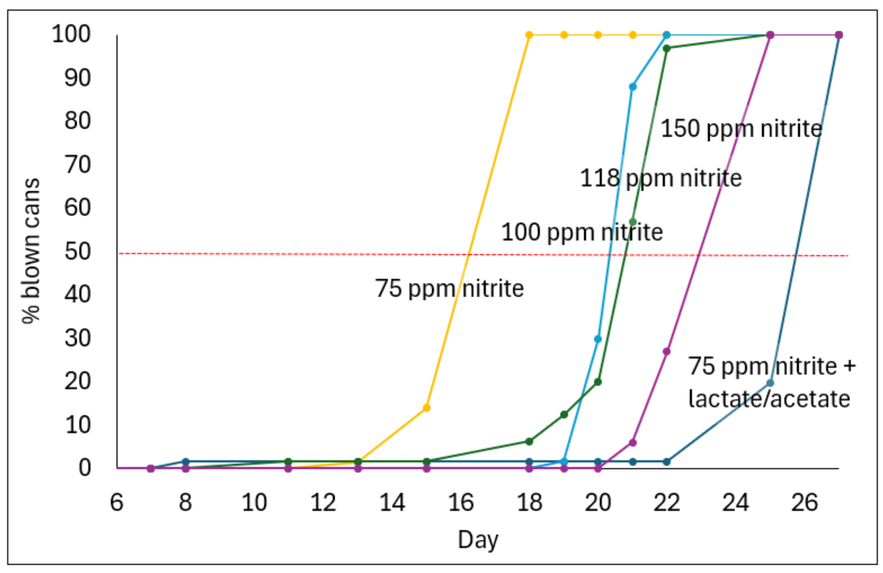

Figure 2. Time to can-swelling in five series of luncheon meat containing 2.7% WPS and 75–150 ppm added $NaNO_2$. One 75 ppm $NaNO_2$ series additionally contained lactate and acetate. Products were subjected to a thermal treatment of F_0 = 1. The dotted line represents 50% blown cans.

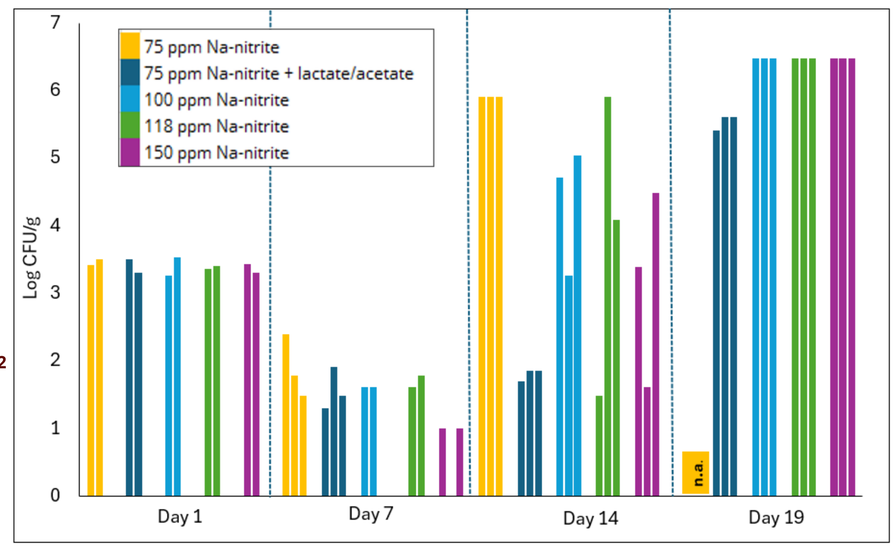

Figure 3. Anaerobic plate counts (Reinforced Clostridial Medium) in luncheon meat with 2.7% WPS and 75 – 150 ppm ingoing $NaNO_2$ receiving a thermal treatment of F_0=1. n.a.= not analysed.