

Introduction

Clean labelling is a growing trend in the food sector. As customer awareness of the components used in day-to-day products improves, clean labelling emerges from the desire for better and more nutritious food items with a short, simple, and recognized ingredient list and little processing (1; 2).

Purpose

The purpose of this study was to determine if natural sources of nitrate coupled with nitrate reductase-producing food cultures can ensure microbiological safety and provide protection against *Clostridium* spp. in four new ham formulations.

The influence of these innovative formulations on the human gut microbiota for potential consumers was also examined using HPLC measurement of short-chained fatty acids (SCFAs) and branched-chained fatty acids (BCFAs).

Methods

1. Challenge test with *C. sporogenes* spores

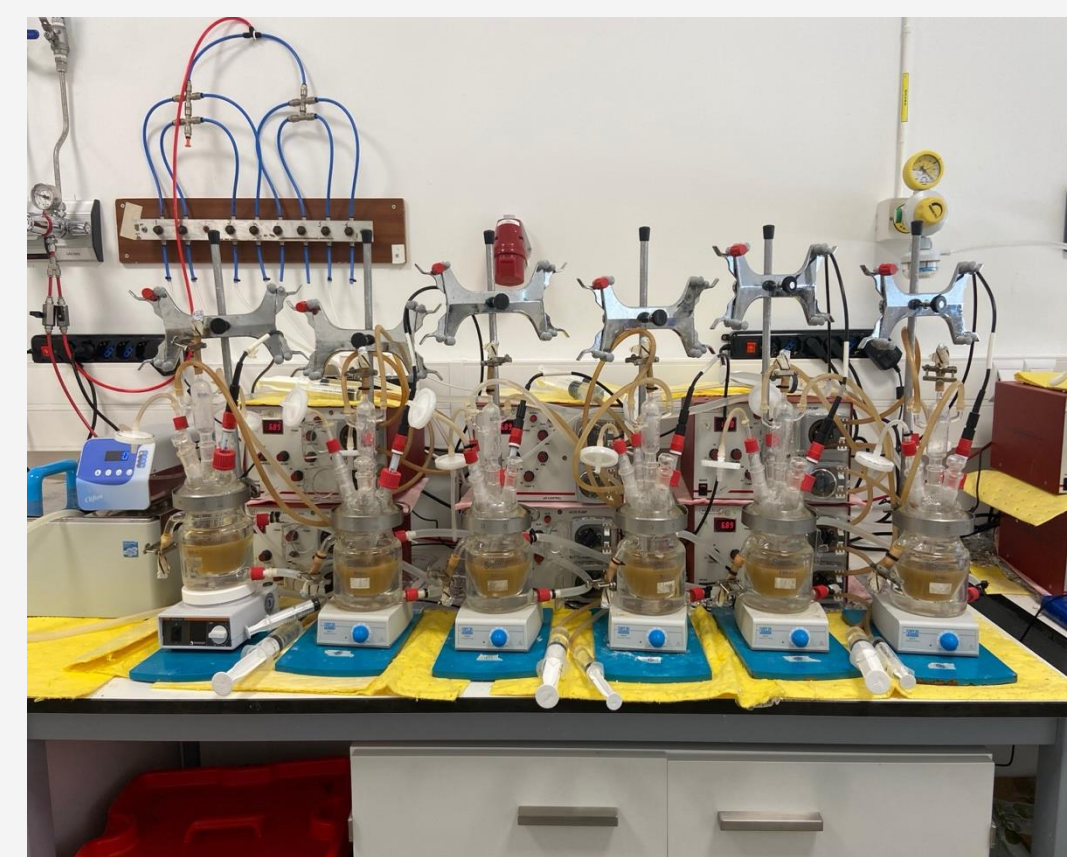


Contamination with clostridial spores

5-week storage period (T0, T7, T14, T21 and T28) under aerobic conditions at 4 °C



2. Impact on the human gut microbiome



In vitro simulated gastrointestinal tract
↓
Colonic fermentation (0h, 24h and 48h)
↓
Sampling

Results

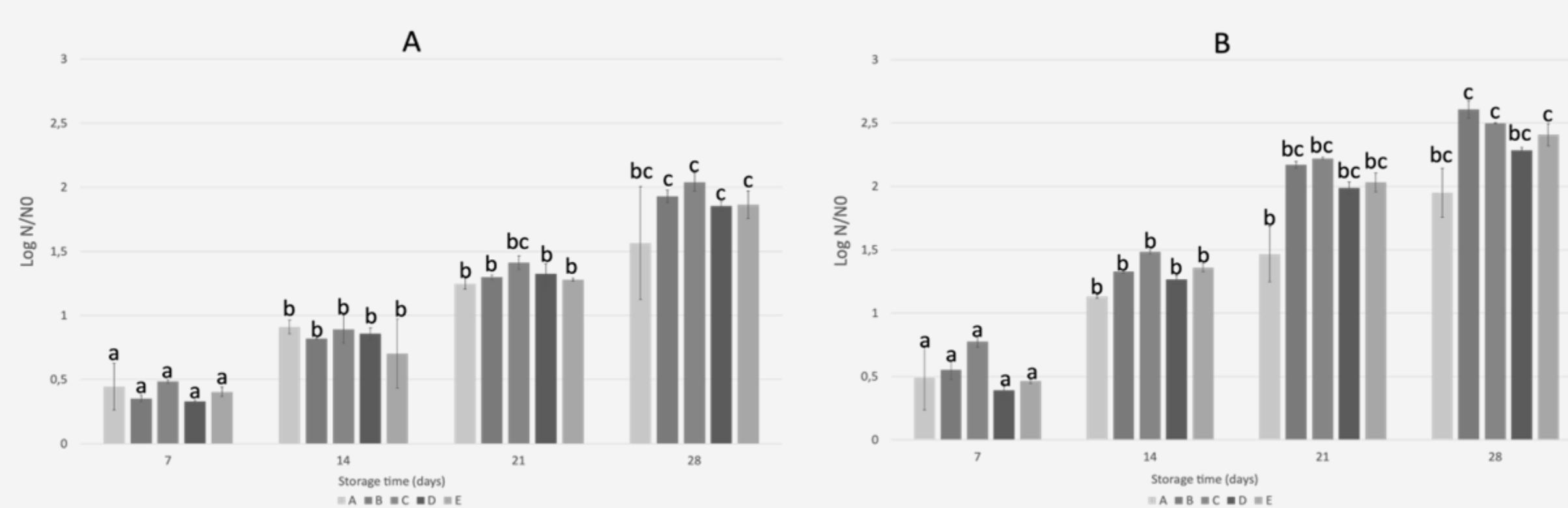


Figure 1. Challenge test with *C. sporogenes* spores at 4 °C (A) and 10 °C (B). Equivalent lower-case letters mean no significant differences between each sample ($p > 0.05$).

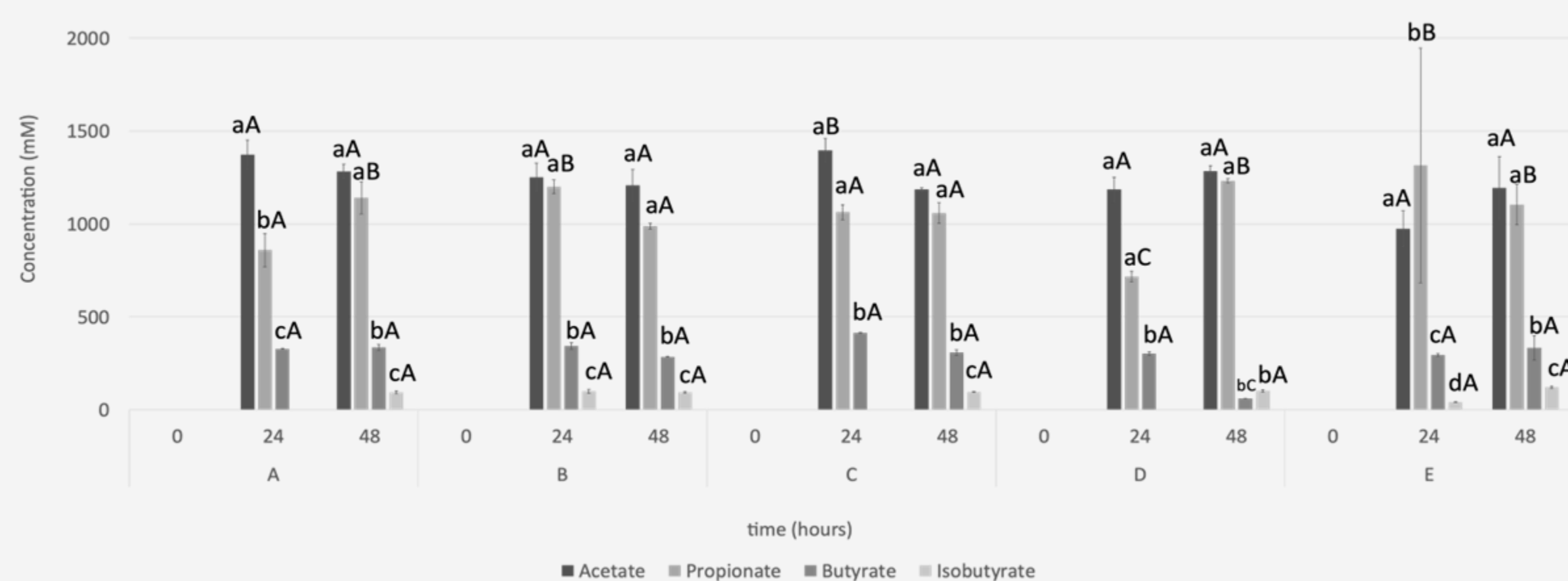


Figure 2. SCFAs and BCFA (Isobutyrate) concentration throughout 48 h of colonic fermentation. Equivalent lower-case letters mean no significant differences between each time point ($p > 0.05$). Equivalent upper-case letters mean no significant differences between each condition ($p > 0.05$).

1. Challenge test with *C. sporogenes* spores

- There were no significant differences ($p < 0.05$) in spore germination between the ham formulations and the control at both temperatures.
- A 2 log and 2.5 log cycle difference was observed between day 0 and day 28 at 4 °C and 10 °C respectively.

2. Impact on the human gut microbiome

- The SCFA levels did not differ significantly ($p < 0.05$) from the control hams throughout the 48-hour fermentation period.

Conclusion

- Both factors analysed point to the future use of this technology in the meat industry, taking into account customer preferences and the need for healthier and more natural ingredients in everyday meals.
- Future research into the storage of hams under changing atmospheric conditions is essential, as this may have an impact on spore germination.

References

1. Delgado-Pando, G., Ekonomou, S. I., Stratakos, A. C., & Pintado, T. (2021). Clean Label Alternatives in Meat Products. *Foods* (Basel, Switzerland), 10(7), 1615. <https://doi.org/10.3390/foods10071615>
2. Yong, H. I.; Kim, T. K.; Choi, H. D.; Jang, H. W.; Jung, S.; Choi, Y. S. Clean Label Meat Technology: Pre-Converted Nitrite as a Natural Curing. *Food Sci. Anim. Resour* 2021, 41(2), 173–184, doi: <https://doi.org/10.5851/kosfa.2020.e96>

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