

Safety in Plant-Based Meat Alternatives: Microbiological Insights for Quality Assurance



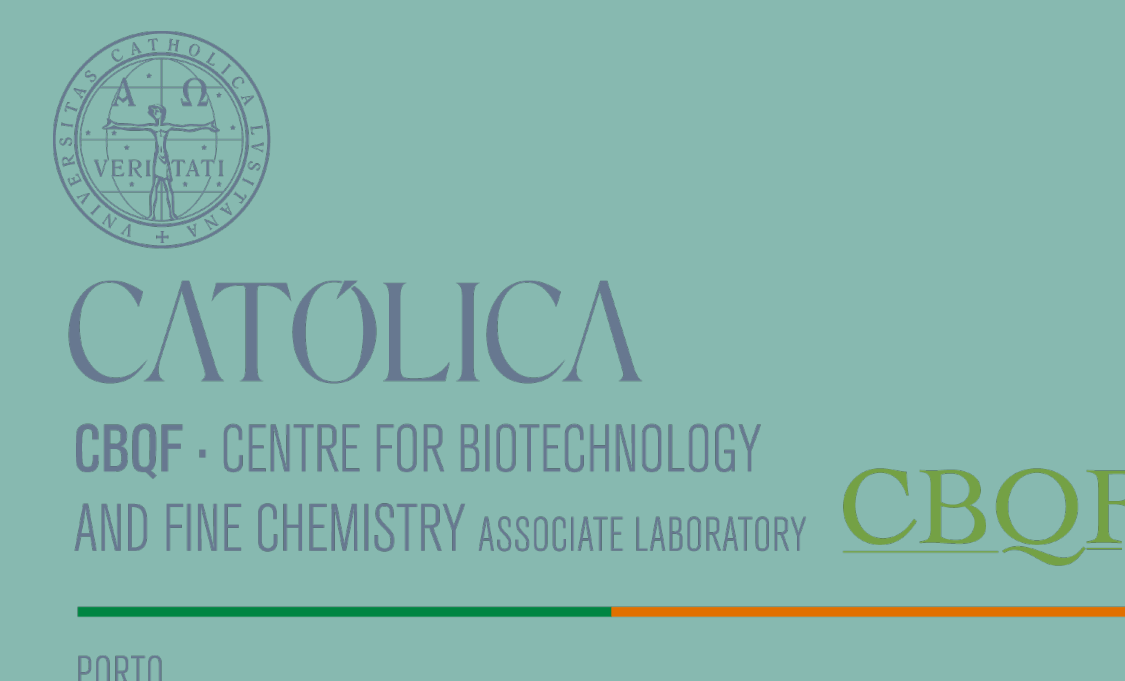
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Introduction

Modern food trends have evolved towards a consumer preference for plant-based products. Plant-based meat analogues have emerged as a promising alternative to traditional cold meats such as ham¹. Health concerns and consumers' search for healthy options with reduced animal protein, fat, salt and cholesterol are the main reasons for the development of these products².

Purpose

- This study aimed to assess the microbial load in a novel sliced plant-based meat analogue. Microbiological analysis was conducted throughout the shelf-life of the product.
- A challenge test with *Clostridium sporogenes* spores and *Listeria monocytogenes* was carried out at 4 °C (refrigeration temperature) and 10 °C (abuse temperature) for 28 days to evaluate pathogen growth on this novel product.

Methods

1. Microbiological analysis throughout shelf-life



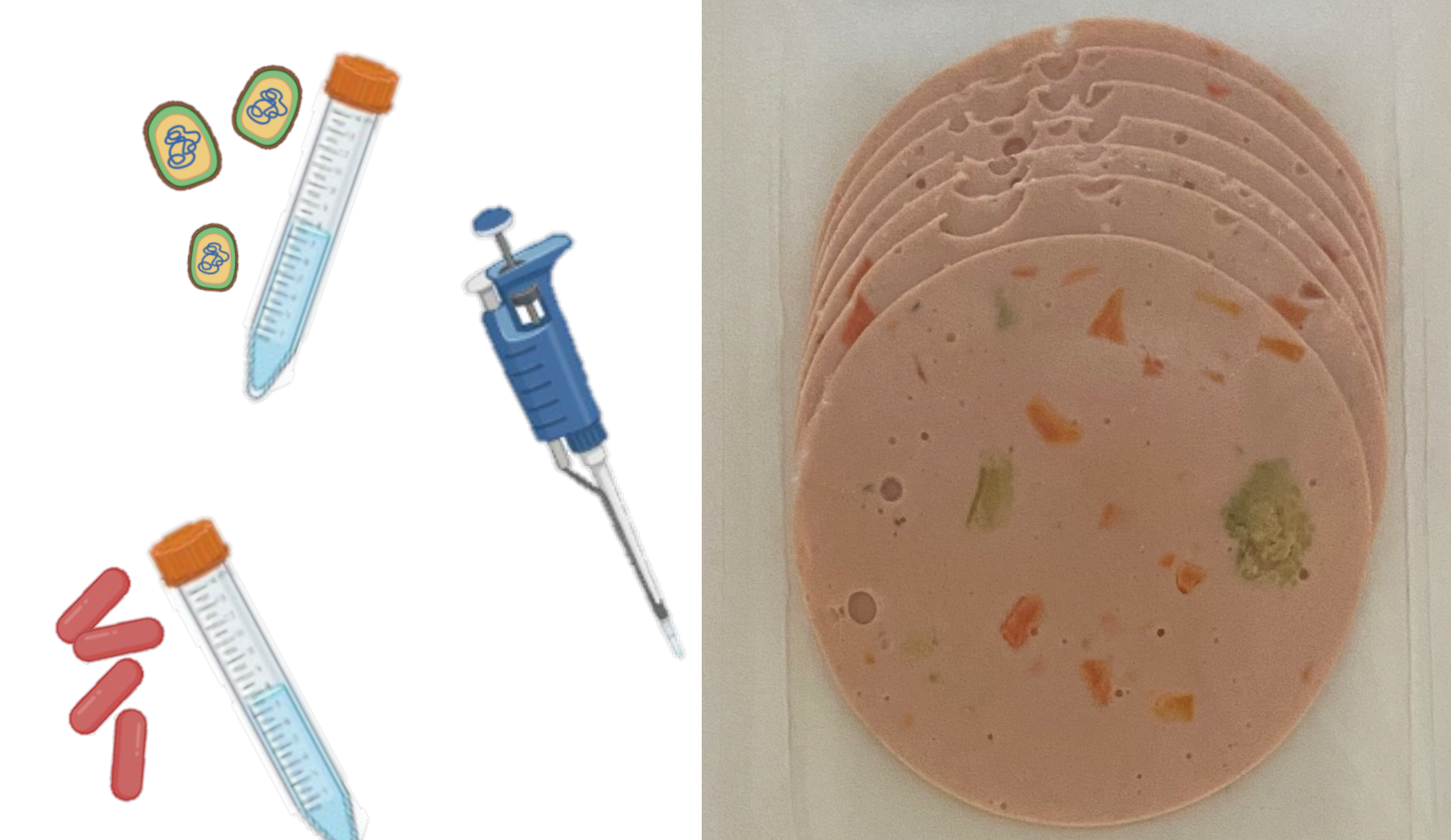
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- Weekly sampling;
- 28-day storage time;
- Storage at refrigeration temperature (4 °C);
- Parameters tested: Total Viable Count (TVC), Lactic Acid Bacteria (LAB), *Enterobacteriaceae*; *Clostridium* spp. and *L. monocytogenes* counts

2. Challenge test with *C. sporogenes* spores and *L. monocytogenes*

Artificial contamination with clostridial spores and *L. monocytogenes* vegetative cells

5-week storage period (T0, T7, T14, T21 and T28) under aerobic conditions at 4 °C and 10 °C.



Results and Discussion

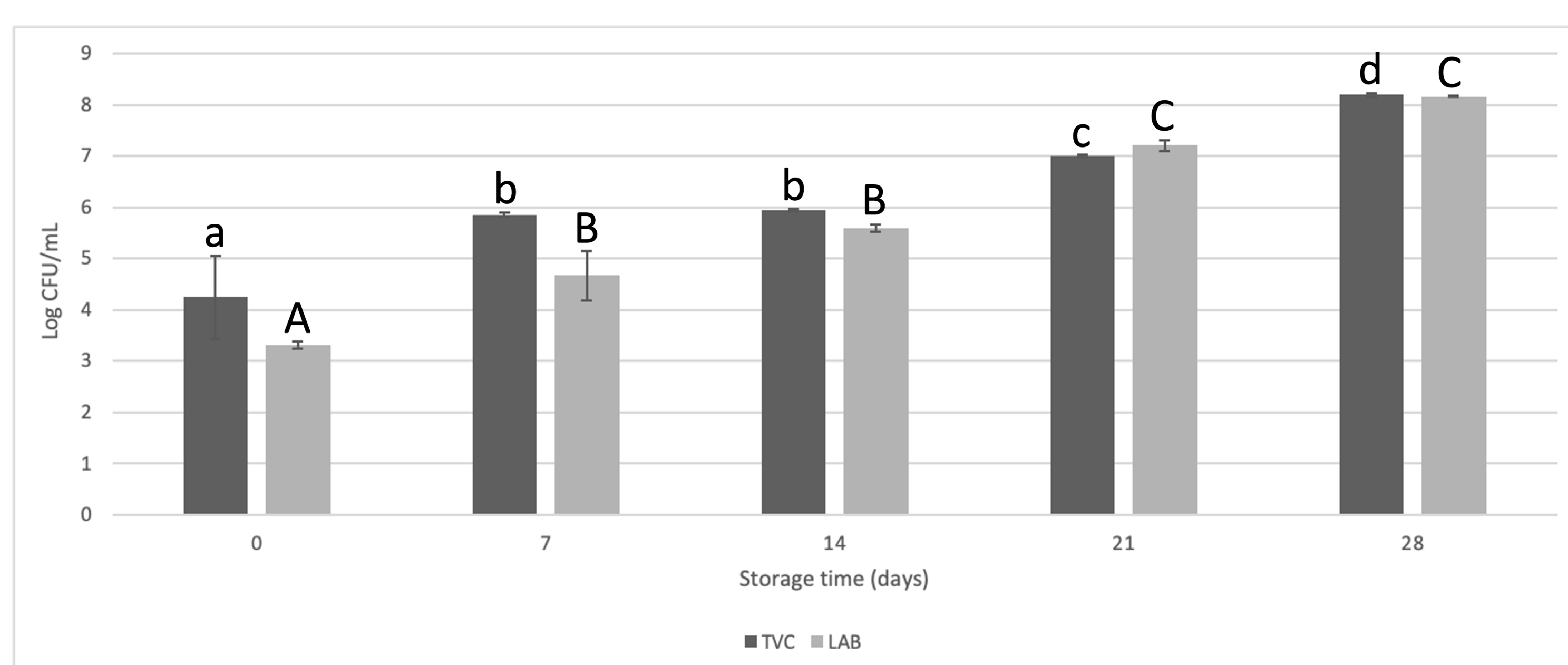
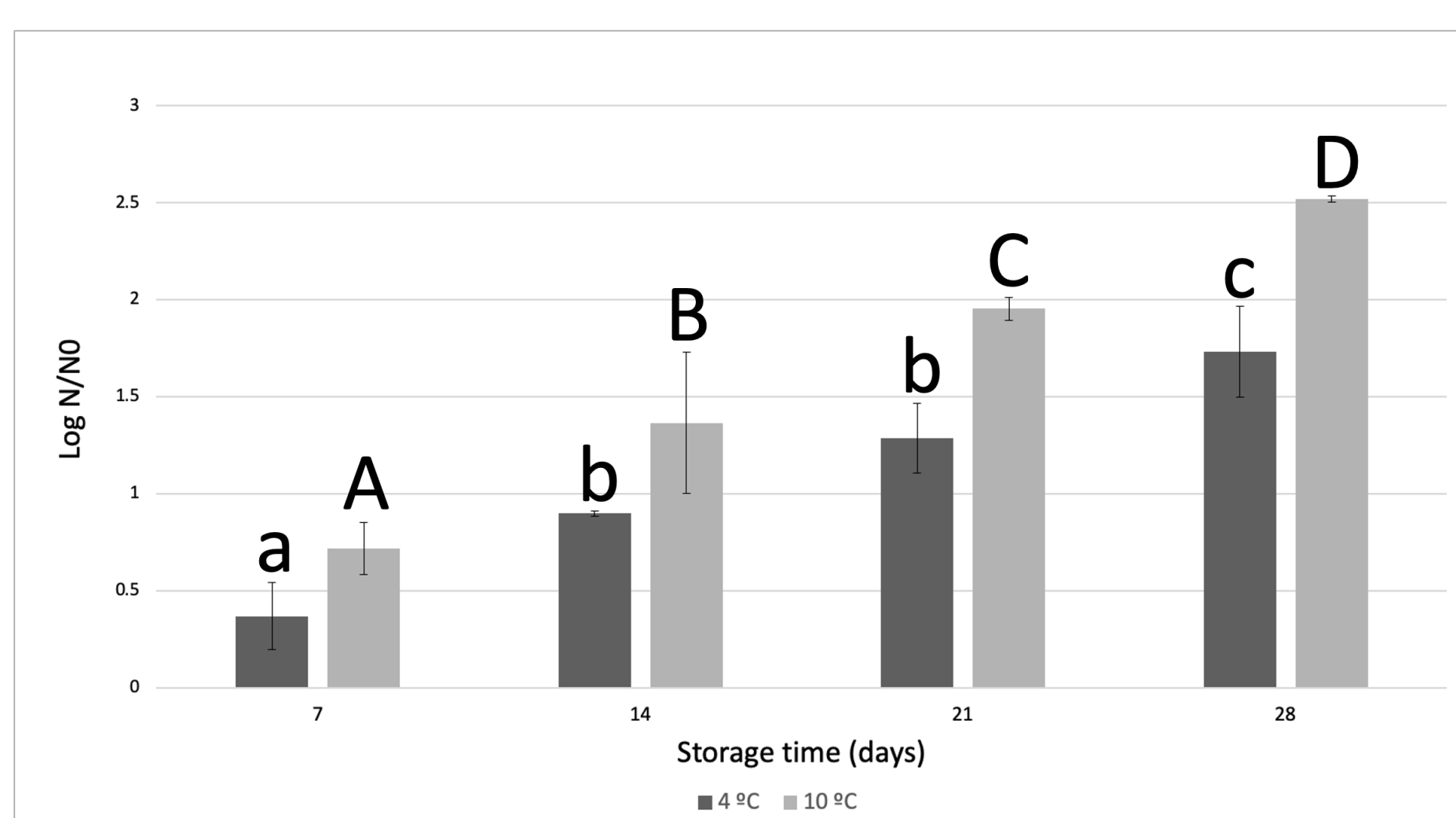


Figure 1. Microbiological analysis throughout shelf-life. Equivalent lower-case and upper-case letters mean no significant differences between each time point ($p > 0.05$).

1. Microbiological analysis throughout shelf-life:

- At the end of the storage period, an increase in TVC at 30 °C (4 log cycles), and in counts of LAB (5 log cycles) was observed.
- It should be noted that *Enterobacteriaceae*, *Clostridium* spp. or *L. monocytogenes* were not found throughout the storage period;
- Results demonstrate the potential for an extended shelf-life of the meat analogue, as TVC was below 6 log cycles, a common limit for ready-to-eat sliced foods.

A



B

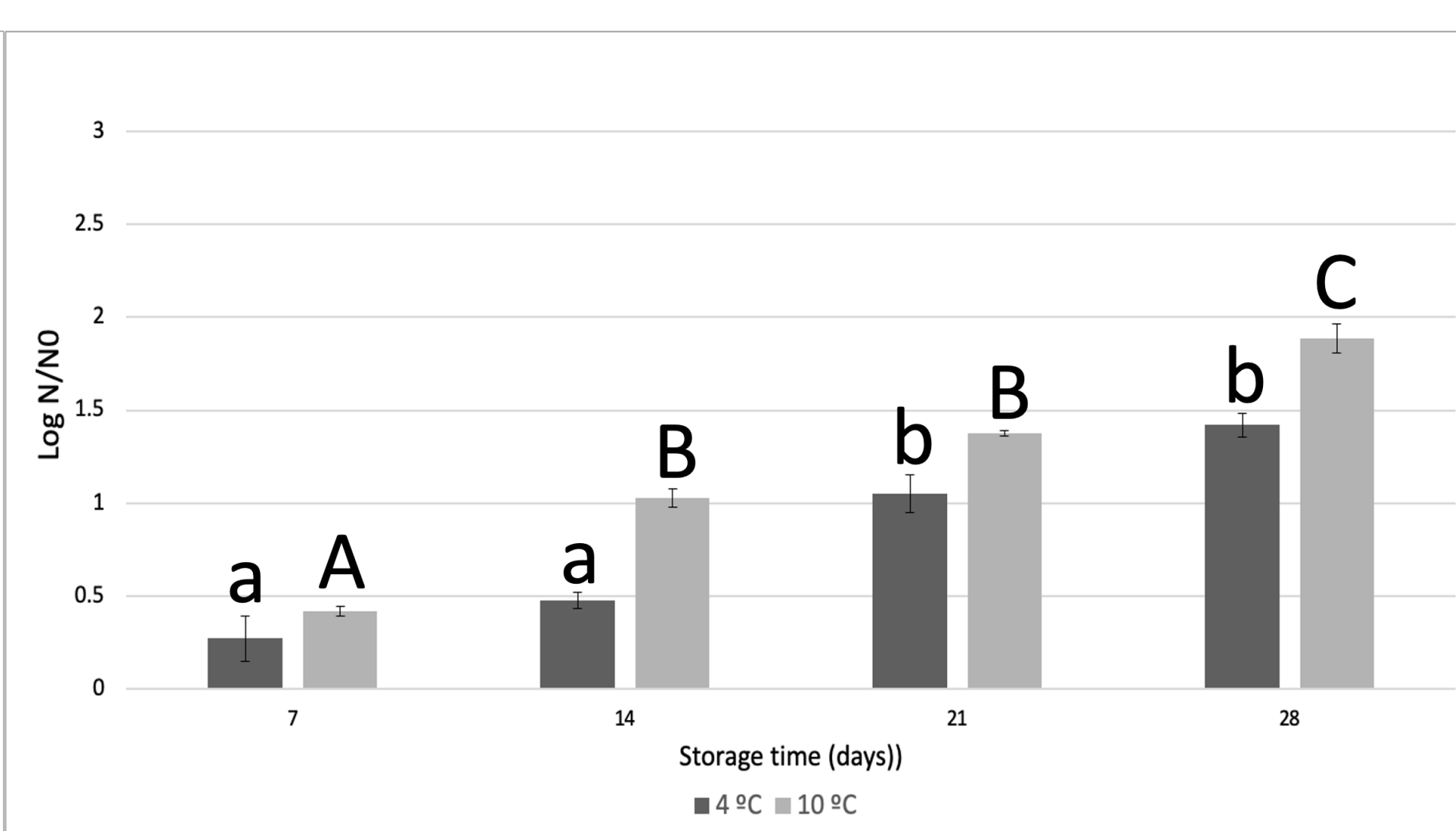


Figure 2. Challenge test with *L. monocytogenes* at 4 °C and 10 °C (A) and *C. sporogenes* spores at 4 °C and 10 °C (B). Equivalent lower-case and upper-case letters mean no significant differences between each sample ($p > 0.05$).

2. Challenge test with *C. sporogenes* spores and *L. monocytogenes* vegetative cells throughout shelf-life:

- For *C. sporogenes* spores, differences were also observed between the temperatures tested. After 28 days, at 4 °C, there was an increase of 1.4 logarithmic cycles and at 10 °C, an increase of 1.9 logarithmic cycles;
- For *L. monocytogenes*, differences were observed between the temperatures tested. After 28 days, at 4 °C, there was an increase of 1.7 logarithmic cycles and for 10 °C, an increase of 2.5 logarithmic cycles

Conclusions and significance

- Globally, the food industry has become more complex, and there is a growing need for higher-quality meat analogues. Food companies have to find a balance between producing affordable, healthy and nutrient-dense foods while maintaining the organoleptic characteristics and microbiological safety of the products.
- Future work on challenge testing with storage under modified atmosphere conditions would be important to be carried out due to its possible impact on the germination of the spores.

References

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