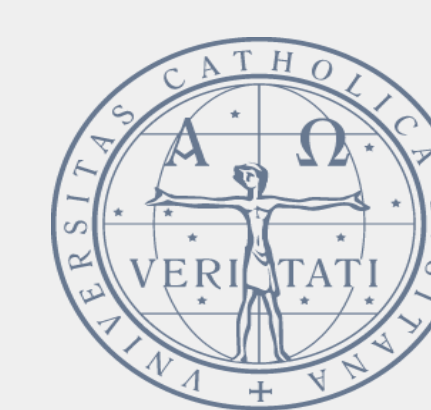


Survival of foodborne pathogens on both traditional and innovative *alheira* matrices

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Introduction & Objective

A vast majority of foodborne illness cases are triggered by the ingestion of foods from animal origin, namely meat and meat products, but also fishery products, eggs and derivatives, milk, and dairy products (Abebe *et al.*, 2020). In 2020, only in Europe, 3,086 foodborne outbreaks were reported by 27 EU Member States, causing more than 20,000 human cases (EFSA and ECDC, 2021). During manufacturing, products might become contaminated with several bacteria such as *Escherichia coli*, *Listeria monocytogenes*, *Salmonella* spp. and *Staphylococcus aureus*. These are among the most common foodborne pathogens responsible for causing disease in humans (Bintsis, 2017). We can determine specific types of bacteria behavior using a microbiological challenge test measuring growth potential. This powerful tool will quantify foodborne pathogens development throughout shelf-life (Russell, 2003). *Alheira* is a traditional, smoked, naturally fermented sausage, produced in the North of Portugal and in the recent years, different formulations of this delicacy have been offered. Ingredients other than pork and/or poultry meats, such as fish, mushrooms, tofu, soy, and vegetables are now introduced in this food product as a way to improve competitiveness through innovation. Previous studies have proven that innovative *alheiras* do not exhibit the typical foodborne microbiological contamination as in traditional products (Azevedo *et al.*, 2020). By this, the main goal of this study was to intentionally contaminate both traditional and innovative *alheira* matrices in order to investigate the behavior of foodborne pathogens throughout shelf-life.

Methods

Several mini samples (± 50 g) were made using three different *alheira* pasta (traditional, codfish and vegetarian, all from the same producer) which were inoculated (using approximately 6.0 log CFU/g) of four foodborne pathogens cocktails separately (*Escherichia coli* ATCC 25922 and O157:H7; *Listeria monocytogenes* NCTC 11994, CECT 911, CECT 936 and CEP 104794; *Salmonella* Enteritidis ATCC 25928, 417536 and 545047; *Staphylococcus aureus* ATCC 29213, 18N (MRSA) and 2037 M1 (MSSA)). Different samples, maintained at 4 °C during all experiment, were taken at days 0, 3, 7, 14, 21, 28 and 60, along product shelf-life, and microbiological analysis were performed according to ISO standards. A control group was used along the entire experiment and duplicates were made.

Results

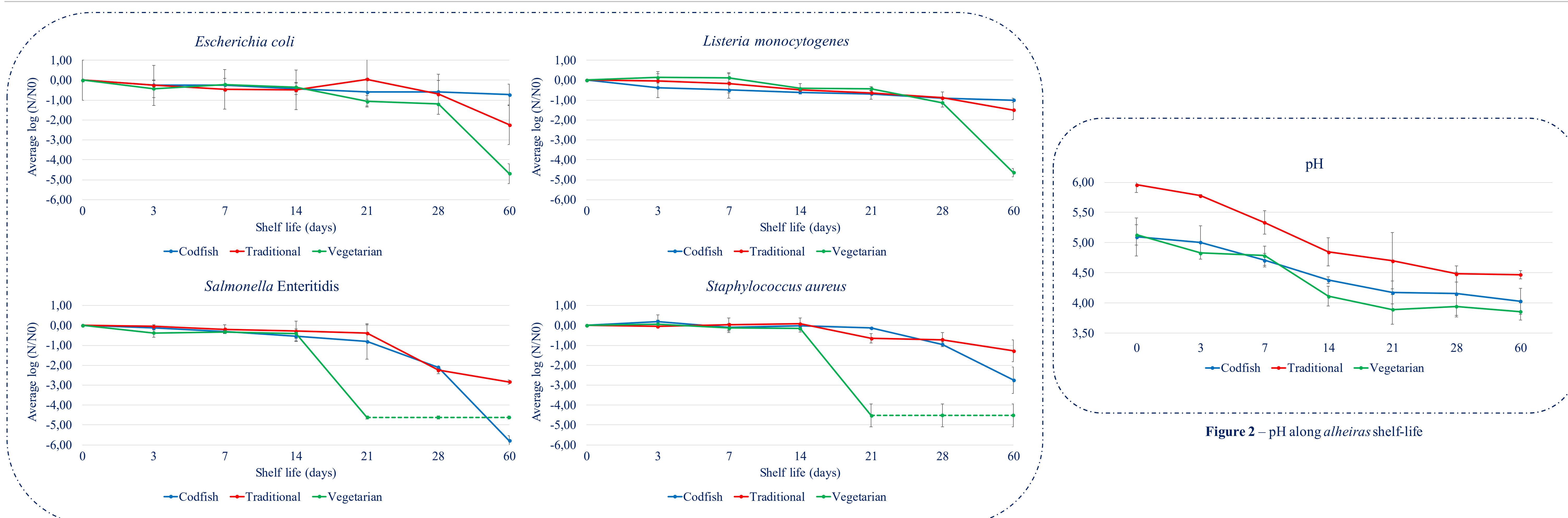


Figure 1 – Different foodborne pathogens behavior along *alheiras* shelf-life

- Between day 28 and day 60, *Escherichia coli* suffered a considerable reduction in vegetarian *alheira* (below the detection limit of the enumeration technique) despite in the other two *alheira* types it was still present (5.5 and 3.9 log CFU/g in codfish and traditional *alheira*, respectively)
- Related to *L. monocytogenes*, at day 60 counts were found to be below the detection limit of the enumeration technique in vegetarian *alheira* unlike the other two *alheira* types (4.7 and 4.2 log CFU/g in codfish and traditional *alheira*, respectively)
- At day 21 and 60, *Salmonella* Enteritidis counts were found to be below the detection limit of the enumeration technique in vegetarian and codfish *alheira*, respectively. In traditional *alheira*, *Salmonella* counts also suffered reduction after 21 days (2.8 log CFU/g)
- At last, *St. aureus* counts remained constant until day 14, after which we noticed that this pathogen was no longer found in vegetarian *alheira*, and after 28 days a reduction also occurred in traditional and codfish *alheira* (2.9 and 5.0 log CFU/g, respectively)
- It is notorious that traditional *alheira* presents a higher pH when comparing to their innovative homologous. Nevertheless, pH values decreased along time in all the tested products

Conclusions

- Target pathogens demonstrated to have different behaviors in different *alheira* matrices
- Vegetarian *alheira* has proven to have unique characteristics that conditionate foodborne pathogens survival in some way since all pathogens decreased to levels below the limit of detection of the technique at the end of shelf-life
- As expected, low temperature together with low pH have great influence in bacterial decrease along *alheiras* shelf-life

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References

- Abebe, E., Gugsu, G., Ahmed, M., 2020. Review on Major Food-Borne Zoonotic Bacterial Pathogens. *J. Trop. Med.* 2020, 1–19. <https://doi.org/10.1155/2020/4674235>
- Azevedo, I., Barbosa, J., Albano, H., Teixeira, P., 2020. Non meat-based *alheiras* – a safer novel trend? *Food Control* 113, 107177. <https://doi.org/10.1016/j.foodcont.2020.107177>
- Bintsis, T., 2017. Foodborne pathogens. *AIMS Microbiol.* 3, 529–563. <https://doi.org/10.3934/microbiol.2017.3.529>
- EFSA and ECDC 2021. The European Union One Health 2020 Zoonoses Report. *EFSA J.* 19. <https://doi.org/10.2903/j.efsa.2021.6971>
- Russell, A.D., 2003. Challenge testing: principles and practice. *Int. J. Cosmet. Sci.* 25, 147–153. <https://doi.org/10.1046/j.1467-2494.2003.00179.x>