

SHELF-LIFE ASSESSMENT OF A POULTRY AND PORK-BASED SEMI-DRIED FERMENTED AND SMOKED SAUSAGE TREATED BY HIGH HYDROSTATIC PRESSURE

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I. INTRODUCTION

Poultry and pork-based semi-dried fermented and smoked sausage named *Alheira* is a traditional sausage with exquisite sensory characteristics and is much appreciated. This sausage has a short shelf-life due to its intrinsic factors, which do not assure its microbial stability at ambient temperature. A previous study reported optimisation of High Hydrostatic Pressure (HHP) treatment in processing *Alheira*, showing promising results in improving its microbial characteristics, with minimal impact on product oxidation, colour and sensory attributes [1]. The effect of HPP treatment on the shelf life and safety of foods is due to the inactivation of genetic mechanisms of microorganisms and the inhibition of enzymes [2]. HPP efficacy depends on many factors of the food matrix. This work aimed to assess the shelf-life of the poultry and pork-based semi-dried fermented and smoked sausage treated with High Hydrostatic Pressure (HHP) to reach a longer shelf-life and improved safety.

II. MATERIALS AND METHODS

On different production days, three poultry and pork-based semi-dried fermented and smoked sausage (*Alheira*) batches of the same formulation obtained from a local manufacturer were prepared by a traditional manufacturing procedure [1]. Samples sausages (n=54) were processed in a pressure vessel submerged in water as the surrounding pressure-transmitting medium (High-pressure food processor, N.C. Hyperbaric, model Wave 6000/135; Spain) and pressurised under 600 MPa for a holding time of 960 seconds with the initial temperature of the pressure vessel set at 10 °C. Control samples (n=54) were maintained under atmospheric pressure at 5 °C, without HHP treatment. Immediately after treatment, all samples were transported to the laboratory in a cooled container (<5 °C) and stored at 5 °C for 5 months. Sampling for analysis was performed at days 1 (T0), 31 (T1), 61 (T2), 91 (T3), 121 (T4), and 151 days (T5) of storage for control and treated HHP sausages. Microbial determinations were carried out for total mesophilic aerobic (TMA), *Enterobacteriaceae*; lactic acid bacteria (LAB), coagulase negative *Staphylococcus* (CNS), *Clostridium perfringens*, *Listeria monocytogenes* and moulds and yeasts counts according to ISO standards. All counts were expressed as log cfu/g. Thiobarbituric acid reactive substances (TBARS), pH and aw were determined. Control and HPP-treated samples were also assessed for objective colour using L*a*b* CIELAB colour system with a colourimeter (Minolta CR-300, Chromometer, Osaka, Japan) before the package opening. Biogenic amines were determined according to [3]. Statistical analysis of data was performed with SPSS statistic V.26.

III. RESULTS AND DISCUSSION

Alheira is characterised by a low pH (5.3-5.4) and high aw (0.96), which does not allow its storage at ambient temperature. The final product microbiota is characterised by a high level of LAB (8 log cfu/g) and yeasts (6 log cfu/g); these are considered the main groups involved in fermentation along with coagulase-negative *Staphylococcus* group (CNS) (5 log cfu/g). The *Enterobacteriaceae* counts are dependent on the initial contamination of ingredients and good hygiene practices of the

manufacture; this group with the moulds are considered deteriorative microbiota. The shelf-life of this product is limited to 3 months, a short period, due to an excessive metabolite accumulation from LAB and yeasts fermentation, promoting a significant ($p < 0.05$) decrease in pH (4.4-4.2) (Figure 1), and a product discolouration with high values of L^* and a decrease of a^* and b^* . The competition of LAB and yeasts, as well as their metabolites is responsible for the decrease in *Enterobacteriaceae* counts during storage. The intrinsic conditions allow *L. monocytogenes* growth and *Cl. botulinum* toxinogenesis, if the products are not refrigerated. *Alheira* storage under refrigeration presented no spores of *Cl. perfringens*, but the *L. monocytogenes* counts increased. The effect of HHP treatment on this fermented sausage was noticed particularly on *Enterobacteriaceae*, and Yeast counts with a complete reduction (Figure 1). The LAB group and CNS were also affected by this pressure/time binomial, since a significant reduction of 6 and 2.5 log cfu/g was obtained, respectively. Usually, these Gram-positive microorganisms are barotolerant to lower binomial pressure/time applied [4]. In the present study they experienced a substantial reduction. A reduction of all microbiota was noticed with HHP treatment, increasing shelf-life without decreasing the pH. The oxidation was not induced by HHP treatment on the fermented sausage without any relevant changes in TBA values over time compared with the control. Biogenic amines profile presented a low content on final products and during storage. HHP treatment had no significant effect on biogenic amine contents.

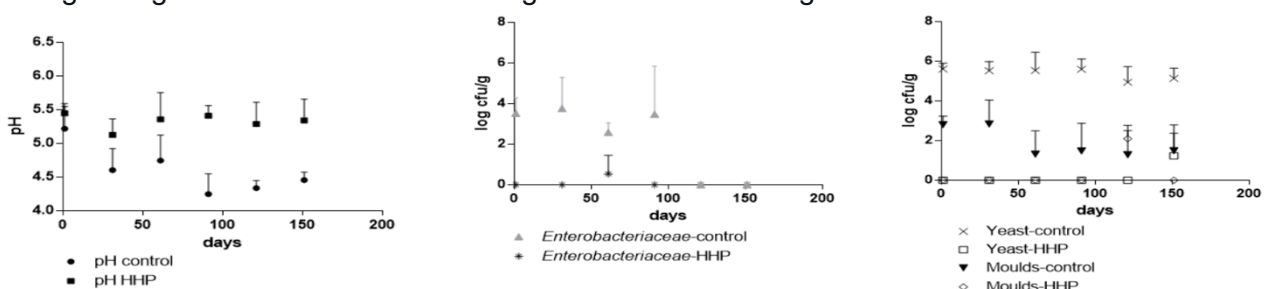


Figure 1. Effect of HHP treatment on pH, *Enterobacteriaceae*, Yeast and Moulds count of a poultry and pork-based semi-dried fermented and smoked sausage (*Alheira*).

IV. CONCLUSION

The HHP treatment 600 MPa for a holding time of 960 seconds at 10 °C allows a shelf-life extension from 3 to 5 months of the poultry and pork-based semi-dried fermented and smoked sausage (*Alheira*) stored at 5 °C. With the HHP treatment, the product's microbial quality and safety level was improved regarding the presence of *Listeria monocytogenes*.

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