INFLUENCE OF EMERGING PRESERVATION TECHNOLOGIES ON THE SPOILAGE PATTERN OF A COOKED MEAT AND BREAD-BASED SAUSAGE

Ana. F. Borges[1], Luís Patarata[2,3], T., Krivorotova[4,5], Maria J. Fraqueza[1,3 *]

[1]CIISA - Centre for Interdisciplinary Research in Animal Health, Faculty of Veterinary Medicine, Associate Laboratory for Animal and Veterinary Sciences (AL4AnimalS), University of Lisbon, Lisbon, Portugal

[2]CECAV - Animal and Veterinary Research Center, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal

[3] AL4AnimalS Associate Laboratory for Animal and Veterinary Sciences

[4]Department of Chemistry and Bioengineering, Vilnius Gediminas Technical University, Vilnius, Lithuania.

[5]Department of Polymer Chemistry, Vilnius University, Vilnius, Lithuania

*Corresponding author email: mjoaofraqueza@fmv.ulisboa.pt

I. INTRODUCTION

The spoilage of meat products is a complex multifactorial phenomenon that involves the activity of the spoilage microbiota, chemical and physical modifications, particularly lipid oxidation, and the interaction between them [1]. *Alheira* is a meat product made with shredded cooked pork, chicken meat, and wheat bread moistened in the meat cooking broth. After filling, it is slightly smoked and dried. [2]. The cooking of meat significantly reduces the microbiota. However, it is further manipulated after the cooking, resulting in a product with a diversified microbiota that includes high lactic acid bacteria (LAB) counts, which have a paradigmatic effect once it contributes to product acidification, which is usually well accepted when limited. Among the technologies available to reduce spoilage microbiota, encapsulated bacteriocins and high hydrostatic pressure (HHP) have been successfully applied to meat products. Due to its selective effect on the microbiota, the result might be a dysregulation of the microbial ecosystem with unpredictable consequences. We aimed to understand the effect of encapsulated bacteriocin and its combination with HPP on the sensorially detected spoilage pattern of Alheira.

II. MATERIALS AND METHODS

Three independent batches of alheiras were produced, as described by Borges et al. [3], and vacuum vacuum-packaged. We designed the experiment with three factors: one control, one supplemented with an encapsulated bacteriocin [4], and another with the encapsulated bacteriocin and further submitted to an HPP treatment (600 MPa, 960 s; N.C. Hyperbaric, Wave 6,000/135; Spain). The *alheiras* were stored at 5°C for four months. Freshly prepared and at the end of each month of storage, the samples were withdrawn and frozen to use a reverse design for sensory analysis. A consumer group was recruited (n=80, 33% men, aged from 18 to 69 years old) to perform a Rate All That Apply (RATA). The vocabulary included to describe the spoilage was fermented, alcohol, rancid, spoiled and putrid to evaluate aroma, acid taste, and fermented and rancid for the flavour dimension. A yes/no question asking about the intention to consume was used. For each characteristic, the consumers were asked to indicate if it was present and, if it was, to rate its intensity on a five-point scale [5]. Binary logistic regression was used to evaluate, for each treatment, which characteristics influence the consumption intention based on freshness (XlStat, Addinsoft, Paris).

III. RESULTS AND DISCUSSION

The profile of sensory deterioration (table 1) of control alheiras is characterised by the spoiled aroma and acid taste, which reduces consumption intention (OR=0.544; OR=0.749, respectively). When we use encapsulated bacteriocins, the two sensory attributes, spoiled aroma and acid taste, also had a significative impact on the reduction of the consumption intention, with reduction dimensions similar to

the control. In this group of samples, the acidic aroma was a favourable sensory trait, increasing consumption intention (OR=1.217). Similarly, when the alheiras treated with encapsulated bacteriocins were HPP treated, a similar sensory trait emerged as favourable to the consumption intention, the fermented aroma (OR=1.346). The rancid aroma only contributed to the lower consumption intention in samples simultaneously treated with encapsulated bacteriocin and HPP.

Table 1 Logistic regression model for the spoilage sensory attributes of alheira (control and HHP-treated).

Variables	**β**	**SE**	**p**	**Odds ratio**	**95% CI**
Control					
Spoiled aroma	-0.609	0.292	0.037	0.544	0.307-0.964
Acid taste	-0.289	0.121	0.006	0.749	0.592-0.949
Encapsulated bacteriocin					
Acidic aroma	0.196	0.089	0.027	1.217	1.023-1.448
Spoiled aroma	-0.913	0.335	0.006	0.401	0.208-0.773
Acid taste	-0.302	0.123	0.014	0.739	0.581-0.941
Encapsulated bacteriocin + HHP					
Fermented aroma	0.297	0.151	0.050	1.346	1.001-1.812
Rancid aroma	-0.439	0.209	0.036	0.645	0.428-0.972

IV. ICONCLUSION

The use of encapsulated bacteriocins to control the spoilage microbiota slightly affected the sensory spoilage of alheira. Still, the two main determinants of the reduction of acceptability – the spoiled aroma and acid taste had a similar trend. Acidic and fermented aroma had a positive effect on encapsulated- and HPP-treated alheiras. These results stress the importance of understanding spoilage processes, which could result in different sensory traits that could be favourable for the consumers' acceptance of the product.

ACKNOWLEDGEMENTS

Authors thank projects UIDB/00276/2020 (CIISA), UIDB/CVT/00772/2020 (doi:10.54499/UIDB/00772/2020) (CECAV) and LA/P/0059/2020 (Lab4Animals), supported by National Funds through FCT-Foundation for Science and Technology. We also thank the support of University of Lisbon and *Fundação para a Ciência e Tecnologia* (SFRH/BD/139628/2018).

REFERENCES

1. Fraqueza M, Patarata L: **Fermented Meat Products: From the Technology to the Quality Control**. In *Fermented Food Products*. Edited by Sankaranarayanan A, Amaresan N, Dhanasekaran D. CRC Press; 2020:197–237.
2. Patarata L, Judas I, Silva JA, Esteves A, Martins C: **A comparison of the physicochemical and sensory characteristics of alheira samples from different-sized producers**. *Meat Sci* 2008, **79**.
3. Borges A, Cozar A, Patarata L, Gama L, Alfaia C, Fernandes M, Fernandes M, Vergara-Perez H, Fraqueza M, Fernandes MJ: **Effect of high hydrostatic pressure challenge on biogenic amines , microbiota , and sensory profile in traditional poultry- and pork-based semidried fermented sausage**. *J Food Sci* 2020, doi:10.1111/1750-3841.15101.
4. Krivorotova T, Cirkovas A, Maciulyte S, Staneviciene R, Budriene S, Serviene E, Sereikaite J: **Nisin-loaded pectin nanoparticles for food preservation**. *Food Hydrocoll* 2016, **54**:49–56.
5. Meyners M, Jaeger SR, Ares G: **On the analysis of Rate-All-That-Apply (RATA) data**. *Food Qual Prefer* 2016, **49**:1–10.