Carnobacterium maltaromaticum as a bioprotective culture against spoilage bacteria in cooked ham

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Introduction: Brochothrix spp. and Pseudomonas spp. can contaminate meat and accelerate spoilage during refrigeration. Carnobacterium is one of the most predominant lactic acid bacteria (LAB) in long shelf life meat. This study assessed the bioprotective potential of Carnobacterium maltaromaticum against Brochothrix thermosphacta and Pseudomonas fluorescens in sliced cooked ham.

Methods: Strains: pool of C. maltaromaticum (CM_B824, CM_B827 and CM_B829), P. fluorescens (ATCC 13525) and a pool of B. thermosphacta (ATCC 11509; s109 and s153 isolated from beef).

Ham was inoculated with C. maltaromaticum (6 log CFU/g) and spoilage bacteria (4 log CFU/g) and assigned to the treatments: 1-Negative control (NC-saline solution 2%); 2-CM; 3-CM+BT; 4-BT; 5-CM+PF; 6-PF. Inoculation was performed by immersion during 10 min (NC, CM, BT, and PF); with an additional time of 10 min for CM+BT and CM+PF. All treatments were left to rest for 10 min to allow inoculum absorption and drying. Slices were packaged in modified atmosphere containing 66%/4%/30% O2/N2/CO2, respectively, and stored for 10 days at 4°C, followed by 18 days at 8°C. Analyses were performed at 0, 5, 10, 19 and 28 d of storage as follows:

Microbiological: BT was counted on supplemented STAA and PF on supplemented Pseudomonas Agar Plate incubated at 25°C for 24 h; CM count was estimated by the difference of counts on PCA (same conditions) and the other media;

Physical chemical: instrumental color was assessed using a Colorimeter CR-410, CIE L*a*b*, D65, 25 mm diameter aperture, 0o observation) and pH using a Knick 765 pHmeter.

Statistical analysis: effect of treatment, storage time and the interaction was analyzed using Multi-Way ANOVA and means were compared by Tukey´s test ($P<0.05$).

Results: Microbiological: B. thermosphacta and P. fluorescens populations were affected by storage time and temperature abuse, whereas C. maltaromaticum population remained stable during storage conditions. C. maltaromaticum showed significant inhibitory effect on both spoilage bacteria. In the presence of C. maltaromaticum, B. thermosphacta growth in cooked ham during 28 days of storage was ~1 log CFU/g (CM Δ 1.75 log CFU/g and CM+BT Δ 2.11 log CFU/g) lower than without C. maltaromaticum inoculation (NC Δ 2.71 log CFU/g and BT Δ 3.56 log CFU/g). P. fluorescens population also showed lower increase during storage in the presence of the C. maltaromaticum. Notwithstanding, C. maltaromaticum count (CM) during storage was not influenced by the presence of B. thermosphacta (CM+BT) or P. fluorescens (CM+PF) ($P>0.05$).

Physicochemical: pH decreased in all treatments during storage, however values showed low variation (<0.2). Storage time and treatment (by day28th) showed no effect on the luminosity and redness of cooked ham. Yellowness was affected, although differences were low and would not affect the appearance of the product, since ΔE* (color disparity) was <3.

Conclusion: C. maltaromaticum can reduce the spoilage population and minimally affect the physicochemical characteristics of cooked ham. The results support the potential use of C. maltaromaticum as a bioprotective culture in meat products.

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