SENSORY QUALITY OF BEEF PATTIES INOCULATED WITH STRAINS OF CARNOBACTERIUM MALTAROMATICUM WITH POTENTIAL AS BIOPRESERVATIVES

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Abstract – Biopreservation is the use of naturally occurring microorganisms and/or their inherent antimicrobial compounds to extend shelf life and to enhance the safety of foods. The aim of the present study was to perform a sensory evaluation of beef patties inoculated with strains of C. maltaromaticum with potential as biopreservatives. Three different strains of C. maltaromaticum (CM_824, CM_827 and CM_829) isolated from vacuum packaged beef with long shelf life were selected for this study. An untrained panel was requested to make a sensory evaluation of raw and cooked beef patties 8 and 10 days after inoculation with the selected strains at 10⁴ and 10⁶ UFC/g and storage in high O₂ atmosphere. This preliminary study permitted to evaluate the effect of three C. maltaromaticum strains on the sensory quality of beef patties. Strain CM_827 did practically not change the sensory attributes of beef patties. Samples inoculated with strain CM_824 and CM_829 received the worst scores for several of the tested descriptors. Therefore, further research on the biopreservative capacity of C. maltaromaticum should be conducted with strain CM_827.

Key Words – biopreservation, Carnobacterium maltaromaticum, sensory analysis.

I. INTRODUCTION

Biopreservation is a powerful and natural tool to extend shelf life and to enhance the safety of foods by applying naturally occurring microorganisms and/or their inherent antimicrobial compounds of defined quality and at certain quantities [1]. Carnobacterium maltaromaticum is a lactic acid bacterium (LAB), and many LAB associated with meat are known for their bactericidal or bacteriostatic activity against other strains, species or genera of bacteria. Some C. maltaromaticum strains have been reported to produce class I and II bacteriocins, in addition to circular bacteriocins [2]. Bacteriocin production, however, is not a prerequisite for the biopreservative efficacy of Carnobacterium [3]. In this way, the presence of certain LAB adapted to a low temperature could extend the shelf life of meat and improve the microbial stability and safety of this product. Nevertheless, undesired effects of Carnobacterium on food quality have been reported, e.g., the production of a malty/chocolate like aroma due to 3-methylbutanal from the catabolism of leucine [4]. The aim of the present study was to perform a sensory evaluation of beef patties inoculated with potential biopreservative strains of C. maltaromaticum isolated from vacuum packaged long shelf life beef.

II. MATERIALS AND METHODS

Carnobacterium maltaromaticum strains: three different strains of C. maltaromaticum (lab. ref. CM_824, CM_827 and CM_829) isolated from vacuum packaged beef with long shelf life were selected for this study according to their genetic profile (genes coding for the 16S ribosomal RNA). Samples: commercial bovine meat preparation (89 % beef, water, 0.9 % vegetal fibers (bamboo), salt, silicium dioxide, ascorbic acid, sodium acetate and sodium citrate) for the production of beef patties, displaying a shelf life of 8 days, was supplied by a meat plant located in the Walloon region of Belgium. Three meat preparation batches were made, and each batch was inoculated (1 % v/w) with a suspension of the selected strains of C. maltaromaticum at 10⁶ or 10⁸ UFC/mL physiological saline to achieve a final concentration of 10⁴ and 10⁶ UFC C. maltaromaticum/g meat. After
inoculation, portions of 90 g of meat were molded into 2 cm thick beef patties. The beef patties were packaged in PP/EVOH/PP trays (oxygen permeability of 4 cm³/m²·24 h) sealed with a polypropylene film (52 μm thick, oxygen permeability of 110 cm³/m²·24 h) containing a modified atmosphere – 80 % O₂:20 % CO₂ –, and stored up to 10 days at +4 °C (5 days) and +8 °C (5 days).

Sensory analyses: an untrained panel of 7 to 12 members was requested to make a sensory evaluation of raw and cooked samples, 8 and 10 days after inoculation, by scoring each descriptor (appearance, odor, color, tenderness, flavor and juiciness) from 1 (= dislike) to 5 (= like). Cooked samples were grilled (frying top Tecnoinox FTL35E/6/0) until they reached an internal temperature of +75 °C.

Statistical analysis: Results are expressed as mean ± standard deviation (SD). Experimental data for each response variable was analyzed by ANOVA using the GLM procedure. Whenever necessary, Tukey tests were performed.

III. RESULTS AND DISCUSSION

After 8 days of storage (5 days at +4 °C and 3 days at +8 °C), non inoculated raw samples (blank) were perceived as having the best appearance and color (P < 0.05). The appearance of the samples inoculated with strain CM_827 was similar to the blank. Samples inoculated with strain CM_827 at 10⁴ UFC/g received better scores for the three evaluated descriptors than samples inoculated with strains CM_824 and CM_829. However, the inoculated samples did not differ statistically (Figure 1).

Beef patties inoculated with C. maltaromaticum at 10⁴ UFC/g received scores comparable to those of beef patties inoculated with C. maltaromaticum at 10⁴ UFC/g. In this case, blank was also perceived as having the best color (P < 0.05) (Figure 2).

After 8 days of storage and cooking, non inoculated beef patties received higher scores than inoculated beef patties, but no statistical difference was observed with samples inoculated with C. maltaromaticum at 10⁴ UFC/g (Figure 3).

Samples inoculated with the strain CM_829 at 10⁴ UFC/g received the worst scores for all studied descriptors. For appearance, odor and flavor, beef patties inoculated with the strain CM_829 differed from blank (P <0.05). Samples inoculated with strains CM_824 and CM_827 received scores comparable to the blank. (Figure 4).

After 10 days of storage (5 days at +4 °C and 5 days at +8 °C), samples inoculated with the strain CM_827 at 10⁴ UFC/g received the highest scores, but no statistical difference was found between the analyzed samples (Figure 5). Regarding samples inoculated with C. maltaromaticum at 10⁶ UFC/g, they all received scores lower than the blank, except for beef patties inoculated with strain CM_827, that had a better appearance than the other samples. However, the differences were not statistically significant (Figure 6).

Figure 1. Mean ± SD values of sensory analysis of raw patty samples inoculated with 10⁴ UFC C. maltaromaticum/g after 8 days of storage (5 days at +4 °C and 5 days at +8 °C)

Figure 2. Mean ± SD values of sensory analysis of raw patty samples inoculated with 10⁶ UFC C. maltaromaticum/g after 8 days of storage (5 days at +4 °C and 5 days at +8 °C)
Figure 3. Mean ± SD values of sensory analysis of cooked patty samples inoculated with $10^4$ UFC C. maltaromaticum/g after 8 days of storage (5 days at +4 °C and 3 days at +8 °C)

Figure 4. Mean ± SD values of sensory analysis of cooked patty samples inoculated with $10^6$ UFC C. maltaromaticum/g after 8 days of storage (5 days at +4 °C and 3 days at +8 °C)

Figure 5. Mean ± SD values of sensory analysis of raw patty samples inoculated with $10^4$ UFC C. maltaromaticum/g after 10 days of storage (5 days at +4 °C and 5 days at +8 °C)

Figure 6. Mean ± SD values of sensory analysis of raw patty samples inoculated with $10^6$ UFC C. maltaromaticum/g after 10 days of storage (5 days at +4 °C and 5 days at +8 °C)

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Since after ten days of storage the beef patties were three days beyond the commercial self-life, only appearance, odor and color were evaluated for cooked samples. A decrease in the sensory quality was observed during the last three days of storage. Most of the cooked samples inoculated at $10^4$ UFC/g had a score between 3.0 and 3.5 after seven days of storage. After ten days of storage, most of the scores dropped to between 2.5 and 3.0 (Figure 7).

IV. CONCLUSION

This preliminary study permitted to evaluate the effect of three C. maltaromaticum strains on the sensory quality of beef patties. Strain CM_827 did practically not change the sensory attributes of beef patties. Therefore, further research on the biopreservative capacity of C. maltaromaticum should be conducted with the strain CM_827.

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REFERENCES


