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Morphological and functional characterization of *Carnobacterium maltaromaticum* isolated from vacuum-packed beef with long shelf life

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INTRODUCTION

A temperature near the freezing point of meat (~ −2 C), associated with vacuum packaging allows the preservation of this product up to several months, which makes possible the meat trade across the planet without resorting to freezing.

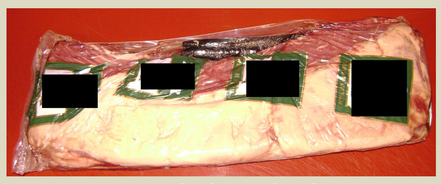
***Carnobacterium maltaromaticum* is a lactic acid bacterium (LAB), and many LAB are known for their bactericidal or bacteriostatic activity against other strains, species or genera.**

In this way, the presence of certain lactic acid bacteria adapted to a low temperature on fresh meat could extend the shelf life and improve the microbial stability and safety of this product.

OBJECTIVE

To perform a morphological and functional characterization of *Carnobacterium maltaromaticum* with a potential bioprotective effect isolated from vacuum-packaged beef with long shelf life.

MATERIALS AND METHODS



Longissimus dorsi
Australian origin
commercial shelf life = 140 days

Isolation of *Carnobacterium maltaromaticum*

Morphological, biochemical and microscopic profiles and comparison to two reference strains: macroscopic and microscopic observations, Gram staining, catalase and oxidase tests, API 50 CH and API ZYM galleries.

Influence of different atmospheres on growth of *C. maltaromaticum* (on a sterile meat model)

irradiated (sterile) minced pork meat	**inoculation** *C. maltaromaticum* 10^5 CFU/mL (1% v/w)	**Packaging (d0)** 1) 100 % N_2 2) 70 % O_2 : 30 % CO_2 3) 30 % O_2 : 70 % CO_2	**storage (7 d)** 1) +4 ˚C 2) +8 ˚C 3) +12 ˚C	**counting (d7)** PCA +25 ˚C days 0, 3 and 7

Microbiological stability of commercial beef inoculated with *C. maltaromaticum*

commercial vacuum packed *psoas major* 16 days after slaughter	**inoculation** *C. maltaromaticum* 10^5 CFU/mL (1% v/w)	**vacuum-packaging (d0)**	**storage (7 d)** −1 ˚C	**packaging (d7)** 1) 100 % N_2 2) 70 % O_2 : 30 % CO_2	**storage (7 d)** +4 ˚C	**Counting (d14)** total viable count (TVC) lactic acid bacteria (LAB) *Enterobacteriaceae* (EB) *Pseudomonas* sp. (PS) *Brochothrix thermosphacta* (BT)

RESULTS

Morphological, biochemical and enzymatic profiles

⇨ **Similar profiles to two reference strains: LMG 11393 and LMG 22902**

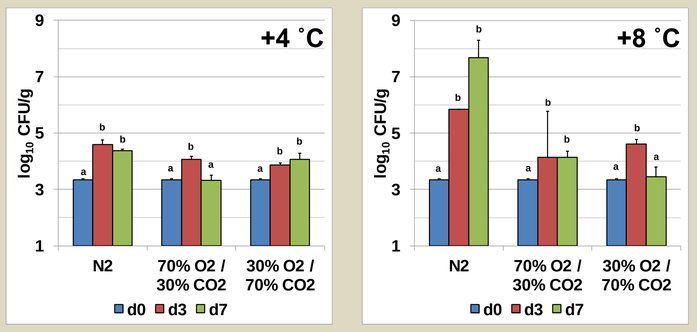
⇨ **Colonies:** circular, convex, entire, ø < 1 mm, smooth, translucent, unpigmented and odorless

⇨ **Cells:** Gram positive bacillus arranged in pairs, catalase and oxidase negative

⇨ **Substrates:** glycerol, D-ribose, D-galactose, D-glucose, D-fructose, D-mannose, D-mannitol, methyl-α-D-mannopyranoside, methyl-α-D-glucopyranoside, N-acetylglucosamine, amygdalin, arbutin, esculin ferric citrate, salicin, D-cellobiose, D-maltose, D-lactose, D-melibiose, D-saccharose, D-trehalose, gentiobiose, D-turanose and potassium gluconate

⇨ **Enzymes:** esterase (C4), esterase lipase (C8), valine arylamidase, acid phosphatase, naphthol-AS-BI-phosphohydrolase and β-glucosidase

Influence of different atmospheres

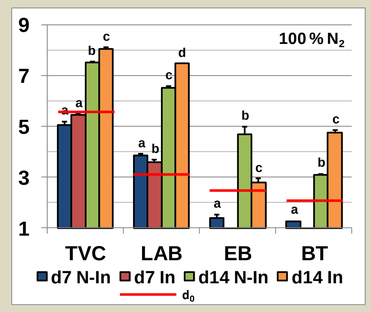


⇨ **+4 ˚C:** low growth of *C. maltaromaticum*

⇨ **+8 ˚C:** the atmosphere without oxygen (100 % N_2) allowed *C. maltaromaticum* to reach a higher concentration

⇨ **+12 ˚C:** the 70 %-CO_2 atmosphere produced a partial bacteriostatic effect on *C. maltaromaticum*

Microbiological stability of beef inoculated with *C. maltaromaticum*



N-In: non inoculated In: inoculated

⇨ inoculum inhibited the growth of *Enterobacteriaceae* and favored the growth of *B. thermosphacta*

⇨ CO_2 inhibited growth of *Enterobacteriaceae* and *B. thermosphacta*: no effect of inoculum

⇨ **For both atmospheres**: No effect of inoculum on TVC and LAB. Reduction of *Pseudomonas* sp. (data not shown)

CONCLUSIONS

⇨ **Morphological, biochemical and enzymatic profiles of the isolated strain similar to two reference strains**

⇨ **Slower growth of *C. maltaromaticum* under 70 % O_2:30 % CO_2 and 30% O_2:70% CO_2**

⇨ **Antimicrobial effect of *C. maltaromaticum* against *Enterobacteriaceae* under N_2**

⇨ **Perspectives: genotypic characterization of *C. maltaromaticum* and evaluation of its potential bioprotective effect**

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