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Introduction and Objectives:
Microbiome engineering is among the most promising technologies for improving microbiological quality of food. The emergence of disruptive technologies taking into account the heterogeneity of food is essential to enable the design of microbial ecosystems of sufficient complexity to provide the desired functions with high robustness. In this work, we have studied the impact of combining multiple biotic and abiotic variables on competition interactions between food bacteria and the pathogen *Listeria monocytogenes*. The results were used to perform statistical classification of microorganisms for ecological engineering of microbial systems for biopreservation purposes.
Materials and Methods:
We have implemented high-throughput multivariate microbial culture competition assays. The explored variables are the microbial diversity (at the intraspecific and interspecific levels), abiotic factors (pH, NaCl and glucose concentration) as well as the time lag and the level of inoculation. The intraspecific variability was investigated within the species *Carnobacterium maltaromaticum*, and the interspecific variability was studied with a set of representative cheese and meat strains.
Results and Conclusion:
The robustness of the inhibitory potency of *C. maltaromaticum* strains was highly variable according to environmental variables. This allowed the selection of robust antagonistic *Carnobacterium maltaromaticum* strains whose anti-*Listeria* properties are little sensitive to fluctuations. Moreover, high throughput experimental designs describing surface response of microbial interactions between food microorganisms and *L. monocytogenes* were used to guide the reasoned assembly of synthetic communities able to inhibit *L. monocytogenes* in a multidimensional space characterizing the physicochemical heterogeneity of the food matrix.

Mots clés : Heterogeneity - Microbiome engineering - Biopreservation - Pathogen.