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Monitoring dynamics in bacterial competition by Imaging Mass Spectrometry.

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Abstract

Microbial competition is a mechanism that occurs when two or more microbial species compete for ecological niches to support their survival and growth (Hibbing et al. 2010). Different factors can contribute to the outcome of microbial competition, such as molecules exchanged between the competing organisms for the regulation of cell densities and the initial spatial configuration of the microbe–microbe interaction. Specifically, production of compounds that kill or limit the growth of competing strains or species can promote niche monopolization (Gonzalez et al. 2011). The released compounds include secondary metabolite antibiotics, bacterial peptides or low-molecular-mass organic compounds. In that sense, it is very important to develop tools that could capture metabolic interactions between two or more bacterial populations. Imaging Mass Spectrometry (IMS) enables the visualization of both spatial and temporal production of a huge number of metabolites from a single bacterial species and can observe the effects of multiple microbial signals in an interspecies interaction without using tags or labels (Yang et al. 2009). This technique has the potential to be used for identification of novel metabolites and peptides that were previously undetected by other analytical methods. In this work, a combination of IMS and LC-MS/MS was used to study the competition between Listeria monocytogenes (LM) and Lactococcus lactis (LAC) to investigate the metabolic profile of each bacterium in the interacting microbial colonies. IMS analysis revealed several interesting compounds during interaction of microbial colonies. At least six compounds are uniquely expressed during the interaction between LM and LAC. These results could be useful to setup new molecular strategies in the control of bacterial species for a better food safety.

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