Unraveling the role of oleic acid in Listeria monocytogenes cold adaptation by transcriptomic analysis

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Title:

Unraveling the role of oleic acid in *Listeria monocytogenes* cold adaptation by transcriptomic analysis

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Abstract:

Listeria monocytogenes is one of the main microbiological hazards to be considered in refrigerated ready-to-eat foods. Low temperature preserves food safety by reducing pathogen growth. However, *L. monocytogenes* is able to grow at low temperature by changing its membrane lipid composition. We have recently shown that *L. monocytogenes* grows faster at low temperature when the medium is supplemented with exogenous unsaturated fatty acids (eUFA) which are incorporated into the bacterial membrane. No significant differences in growth rate were observed at 37°C. A transcriptomic analysis on 4 culture conditions with or without oleic acid at 5°C or 37°C was performed to understand the involvement of oleic acid in cold adaptation of *L. monocytogenes* at molecular level. Differential gene expression analysis was performed using R-studio. 1164 genes were differentially up- or down-regulated (Log2 Fold Change >1 or <-1). The clusters of Gene Ontology with the most differentially expressed genes were inorganic ion transport and metabolism, chemotaxis and cell motility, fatty acid synthesis, amino acid synthesis, plasma membrane proteins and transport proteins. Several genes involved in fatty acid metabolism (*fabK*, propionate CoA transferase) or transport (ABC transporters) are upregulated when oleic acid is present at 5°C but not at 37°C and downregulated at 5°C without oleic acid. In contrast, genes involved in the synthesis of branched fatty acid precursors (*ilv* and *leu* genes) and in the initiation module of the fatty acid synthesis (*acc* genes) were only upregulated at 5°C but no significant differences were observed with or without oleic acid. Chemotaxis and flagellar genes are upregulated in the presence of oleic acid at 5°C but not at 37°C. Hence, the upregulation of the large operon starting with *che*AY, a two-component system, implies that *L. monocytogenes* could sense an oleic acid related stimulus at 5°C. Besides, genes involved in iron metabolism (*fhuC*, *tatA,* ...) are downregulated when oleic acid is present at 5°C but not at 37°C and upregulated at 5°C without oleic acid. Overall, oleic acid could counterbalance the effect of low temperature on the expression of these genes. These results will be shortly deepened by RT-qPCR with other eUFA and further studies will be implemented to understand this regulatory mechanism.

Keywords: *Listeria monocytogenes*, low temperature, oleic acid, transcriptomic analysis

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