Review

The impact of environmental stress on *Listeria monocytogenes* virulence

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**Abstract**

*Listeria monocytogenes*, a significant food-borne pathogen, must defy a variety of conditions encountered in the food environment and during the infection process. In reaction to adverse conditions, the bacteria significantly change their metabolism, inducing a stress response which is mediated by a range of alternative sigma factors. The extent of the response to stress was shown to vary in the *L. monocytogenes* population. According to recent evidence a major *L. monocytogenes* alternative sigma factor, designated sigma B ($\sigma^B$), regulates some virulence genes in response to stress, which supports an older hypothesis that stress-resistant strains should be more pathogenic. The induction of $\sigma^B$-dependent genes may also be important from the point of view of food hygiene. It seems that stress response activation can paradoxically enhance resistance to agents used in food preservation. Therefore, monitoring the expression of $\sigma^B$-dependent genes can serve as a useful marker to assess the innate resistance of *L. monocytogenes* strains. This knowledge will allow the design of new methods with sequential preservation steps that could inactivate the bacteria without inducing their stress response.

**Key words:** *Listeria monocytogenes*, sigma B, stress response, virulence

**Health threats related to *Listeria monocytogenes***

*Listeria monocytogenes* is an ubiquitous Gram-positive bacterium widespread in the environment (Roche et al. 2003). It was described for the first time in 1926 in Cambridge as a cause of infections in rodents (Swaminathan and Gerner-Smidt 2007). This pathogen causes about 28% of all deaths from food-borne diseases in the USA (Garner et al. 2006) and is capable of causing mild infections such as gastroenteritis in immunocompetent individuals and severe infections, such as meningitis, encephalitis, septicemia, and abortion, in immunocompromised individuals, elderly people, pregnant women, and neonates (McGann et al. 2007). The consequences of ingesting $10^6$ to $10^{11}$ CFUs in healthy people are usually restricted to febrile gastroenteritis, whereas in immunocompromised individuals the effect can be much more serious, manifesting in symptoms of listeriosis (Vazquez-Boland et al. 2001). The incidence of listeriosis ranges from 0.1 to 11.3 per 1 million people in different countries (Swaminathan and Gerner-Smidt 2007). The majority of human listeriosis (99%) is food-borne (Nightingale et al. 2005), and the main foods involved in *L. monocytogenes* transmission are soft cheeses, dairy products, seafood, salads, smoked fish, sausages, and ready-to-eat food (RTE) (Vazquez-Boland et al. 2001). In 2005, the European Union established a regulatory limit for *L. mono-