

## **Beyond the Surface: Deciphering *Listeria Monocytogenes* Adhesion and Invasion Dynamics**

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### **Structured Abstract**

**Background:** *Listeria monocytogenes* is a Gram-positive bacterium that is prevalent in the environment. It is the causative agent of Listeriosis which is a severe foodborne illness with high mortality rates that particularly impacts vulnerable populations such as pregnant women, infants, and immunocompromised people. This disease remains a significant public health concern due to its persistence in contaminated foods and its ability to cause outbreaks.

**Methods:** This review examines the complex processes of *L. monocytogenes* adhesion and invasion, focusing on the roles of key virulence proteins such as Internalins (InlA and InlB), listeriolysin O (LLO), and ActA, which facilitate host barrier crossing, intracellular survival, intercellular movement, and immune evasion.

**Results:** The resilience and virulence of the *L. monocytogenes* are thanks to its psychrophilic nature, ability to thrive in various environmental conditions, and stress tolerance mechanisms. Despite progress, significant challenges remain in understanding the mechanism of *L. monocytogenes* in adhesion and invasion. Environmental factors such as temperature, pH, and nutrient availability influence bacterial behaviour, yet their specific roles in adhesion and invasion remain underexplored. There are still gaps in the scientific knowledge of how the environment affects adhesion and invasion ability and the clinical implications of severe Listeriosis in impacted populations.

**Conclusion:** Strengthening food safety protocols and creating focused interventions require addressing these gaps. This review aims to provide insight into the molecular mechanisms that explain the pathogenicity of *L. monocytogenes* to identify possible therapeutic targets for treatment and strategies to improve public health. It is essential to understand how host interactions and bacterial pathogenicity are influenced by environmental conditions to control outbreaks and lower the worldwide burden of Listeriosis. In summary, this review emphasises the significance of further investigation into the adhesion and invasion mechanisms of *L. monocytogenes*. Future studies focusing on integrating environmental and molecular factors can significantly aid in enhancing infection control measures.

**Keywords:** *Listeria monocytogenes*, Adhesion, Invasion, Pathogenicity, Virulence proteins

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