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## Antibacterial effects of *Cuminum cyminum* essential oil and *Nigella sativa* extract in the encapsulated form on the growth of *Listeria monocytogenes* in Feta cheese

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### Abstract

*Listeria monocytogenes* is one of the food-borne pathogens in milk and dairy products which is concerned a major health problem. Natural additives like essential oils and herb extractions are used as a suitable alternative for synthetic preservatives to preserve and extend the shelf life of food products. In this study antimicrobial effect of encapsulated *Cuminum cyminum* essential oil and *Nigella sativa* extract with different concentration ۱% and ۶% respectively, on the growth of *L. monocytogenes* were evaluated in Feta cheese at ۴°C and ۱۵°C temperatures during the ۰, ۲۴, ۴۸ and ۷۲ h of storage. Compositional analysis by GC-MS indicated that the predominant components were Benzaldehyde and phenylpropanol for *Cuminum cyminum* essential oil, and Dodecane and Undecane; N-UNDECANE; ۱۱۲۰-۲۱-۴ For *Nigella sativa* extract. The results showed that in the control group, *L. monocytogenes* grew rapidly during storage at ۴°C and ۱۵°C. However, in treated group with *Cuminum cyminum* encapsulated essential oil, ۳ log reductions in the population of bacteria observed after ۷۲ hours. Also, using of encapsulated *Nigella sativa* extract caused more reduction in the growth of bacteria compared to its non-encapsulated form ( $P < 0,05$ ). These results indicated a stronger antibacterial activity of both *Cuminum cyminum* essential oil and *Nigella sativa* extract in an encapsulated form to inhibit the growth of *L. monocytogenes* in cheese which can be used as antimicrobial and preservative for cheese.

**Keywords:** Essential oils, Extract, Encapsulation, *Cuminum cyminum*, *Nigella sativa*, *Listeria monocytogenes*