Effect of combination of essential oils and bacteriocins on the efficacy of gamma radiation against *Salmonella Typhimurium* and *Listeria monocytogenes*

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Abstract

**Purpose:** Using essential oils (EO) alone or combined EO with nisin to enhance the lethality of *Salmonella Typhimurium* and *Listeria monocytogenes* to γ irradiation treatment.

**Materials and methods:** Cell suspension or inoculated carrots (10⁶ colony forming unit (CFU)/ml) of *L. monocytogenes* or *Salmonella Typhimurium* were treated with carvacrol and mountain savory EO alone or treated by the combined EO plus nisin and were irradiated at different doses. The radiation dose required to reduce bacterial population by 90% (D₉₀ value) and the relative sensitivity (RS) of treated bacteria to irradiation were calculated.

Foodborne illnesses, but the most important foodborne illnesses are caused by foodborne pathogenic bacteria. According to the Public Health Agency of Canada, each year 11–13 million of Canadians suffer from foodborne illnesses. In the US, the government estimates that the number of illnesses caused by consumption of contaminated food is about 76 million cases per year (Tauxe 2001). Of these 76 million cases, there are 325,000 hospitalizations and 5,000 deaths (Mead et al. 1999). *Listeria monocytogenes* and *Salmonella Typhimurium* are among the most concerning food pathogens causing serious food diseases. *Salmonella Typhimurium* can cause hemolytic uremic syndrome or rec-