

# Application of *Zataria multiflora*, *Satureja hortensis*, essential oil and their combination against total viable bacteria and *Listeria monocytogenes* in minced beef packaging

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## Abstract

Application of natural preservatives is demand of consumers and human nutritionists so have important role in the growing consumption of red meat. In this study for increase of minced beef meat shelf life at 4 °C, the preservative effect of *Zataria multiflora* essential oil at 0.25%, 0.5%, or 1%, and *Satureja hortensis* essential oil at 0.25%, 0.5%, or 1%, and their combination against total viable bacteria (TVB) and *Listeria monocytogenes* was examined in minced beef meat packaging. Application of minced beef meat with *Zataria multiflora* essential oil at 0.5% and 1% showed stronger preservative activity against TVB and *L. monocytogenes* than treatment with *Satureja hortensis* at the same concentration. Most treatments showed stronger inhibitory activity against the TVB and pathogen at 8 °C than at 4 °C. The *Zataria multiflora* essential oil at 1% in 4 °C and 8 °C was able to store minced meat until 7 and 8 days but *Satureja hortensis* at same concentrations preserved minced meat until 5 and 6 days. and stored TVB under 7 log cfu/g until 10 days at 4 °C and also decreased the population of *L. monocytogenes* below the official limit of the European Union set at 2 log cfu/g, during storage at 4 °C in the same period without any major organoleptic changes.

## Introduction

Many food products are perishable by nature and require protection from spoilage during their preparation, storage and distribution to give them desired shelf-life. Because food products are now often sold in areas of the world far remote from their production sites, the need for extended safe shelf-life for these products has also expanded. Improvements in the cold distribution chain have made international trade of perishable foods possible, but refrigeration alone cannot assure the quality and safety of all perishable foods.

Plant essential oils and their components are known to exhibit antimicrobial activities, and many applications for controlling the growth of foodborne pathogens and food spoilage microorganisms have been developed using these essential oils as natural food preservatives. In general, higher concentrations of essential oils are required in foods than in laboratory media; accordingly, the practical application of essential oils is restricted, since the addition of high concentrations of the oils causes undesirable flavor changes in the food product. *Zataria multiflora* Boiss. is a plant belonging to the Lamiaceae family that geographically grows only in Iran, This plant has the local name of Avishan Shirazi (in Iran) and is extensively used as a flavor ingredient in a wide variety of food in Iran. The main constituents of the essential oil of this plant are phenolic compounds. Study the potential of *Satureja hortensis* antimicrobial activity against a wide range of clinic and plant-associated microorganisms such as bacteria, yeast, and fungi species. In recent years, multiple drug/chemical resistance in both human and plant pathogenic microorganisms have been developed due to indiscriminate use of commercial antimicrobial drugs/chemical commonly used in the treatment of infectious diseases.

## Materials and methods

The plants, *Zataria multiflora* and *Satureja hortensis* were collected from the National Botanical Garden of Iran during May and June 2003. The fresh leaves were hydrodistilled for 90 min in full glass apparatus. The oils were isolated using a Clevenger-type apparatus. The extraction was carried out for 2 h after a 4-h maceration in 500 ml of water. The oils were stored in dark glass bottles in a refrigerator until use.

Of all the solvents tested, such as ethanol, methanol, acetone, butanol and diethyl ether, methanol was selected as the diluting agent for the oils as it did not exhibit antilisterial activity. Oil dilutions of 0.25%, 0.5% and 1% were made with methanol. These dilutions were used in antilisterial analysis. Undiluted oil was taken as dilution. This solvent also served as control. Diluted oil was spray on minced meat and mixed completely. 10 samples of minced meat were bought from shops and transferred to the lab in cold chain and analyzed for total viable bacteria (TVB) and *Listeria*, 4 samples which was *Listeria* positive selected for test.

## Results and discussion

Air-dried herbal parts of *Z. multiflora* and *S. hortensis* were subjected to hydrodistillation using a Clevenger apparatus and the pale yellow-colored essential oil was obtained (yield 2.8% v/w). The results obtained by GC–MS analysis of the essential oil of *Z. multiflora* had twenty-five compounds were identified, representing 99.78% of the total oil. Oil yield was 2.3% (v/w). The oil profile exhibits thymol as the main compounds were carvacrol (33.65%), p-cymene (7.72%),  $\gamma$ -terpinene (3.88%) and  $\beta$ -caryophyllene (2.06%). Carvacrol (41), and for *Satureja hortensis* three main compounds were identified were Carvacrol (39%),  $\gamma$ -terpinene (30%) and p-cymene (7%).

Ten samples were analyzed for TVB and listeria only in 4 samples we found listeria and so these 4 samples used for assessment of antibacterial activity of these essential oils.

Most treatments showed stronger inhibitory activity against the TVB and pathogen at 8 °C than at 4 °C. The *Zataria multiflora* essential oil at 1% in 4 °C and 8 °C was able to store minced meat until 7 and 8 days but *Satureja hortensis* at same concentrations preserved minced meat until 5 and 6 days. and stored TVB under 7 log cfu/g until 10 days at 4 °C and also decreased the population of *L. monocytogenes* below the official limit of the European Union set at 2 log cfu/g, during storage at 4 °C in the same period without any major organoleptic changes.

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