

# Sage (*Salvia officinalis* L.) preparations as natural ingredients improving the qualities and safety of meat balls with mechanically separated meat

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**Objectives:** The aim of the study was to assess the effect of sage (*Salvia officinalis* L.) preparations on selected quality features of baked, vacuum-packed meat balls made of chicken thighs meat and mechanically separated meat (MSM, so called "Baader" meat) from chickens during 14 days of storage at  $(+4 \pm 1)^{\circ}\text{C}$ . The quality and safety of meat products belonging to the group of convenience foods and containing MSM require a lot of attention due to their higher susceptibility to oxidative changes and microbiological deterioration. However, the "natural" way to improve the quality and safety of meat and meat products can be the use of plant preparations.

**Materials and Methods:** The raw materials for production of the meat balls were: MSM (more precisely "Baader" meat), chicken thighs meat and pork jowl. In each of three experimental series, five treatments of meat balls: Control—without the addition of sage, SD— with 1.0% dried sage, SEE40—with 2.0% sage ethanol (40%, v/v) extract, SEE70—with 2.0% sage ethanol (70%, v/v) extract, SEO— with 0.1% sage essential oil. The meat balls were packed in vacuum and stored in a cold room. After 1, 7 and 14 days of storage, the value of thiobarbituric acid reactive substances was determined as well as microbiological analyses and sensory evaluations were performed. The microbiological tests included the determination of the number of mesophilic aerobic microorganisms, psychrotrophic bacteria, coliform bacteria, Enterobacteriaceae, enterococci and lactic acid bacteria (LAB). In the evaluation of sensory attributes of meat balls (appearance and colour, aroma and taste), panelists (eight people of both sexes) used 5-point scale. The chemical components in meat balls were determined using the method of near-infrared reflectance transmission.

**Results and Discussion:** With the passage of time, the processes of fat oxidation, the growth of microflora and differences in the sensory quality of meat balls were found to be progressing. Taking into account the entire storage period of meat balls, sage ethanol (70%, v/v) extract slowed down the lipid oxidation processes most effectively. Only a slightly weaker effect was observed when using sage ethanol (40%, v/v) extract. If compared to the Control on day 14, significant ( $P < 0.05$ ) inhibition of the growth of the mesophilic aerobic microorganisms, coliform and Enterobacteriaceae bacteria was found in all treatments with addition of sage preparation. On the last day of storing, a significantly ( $P < 0.05$ ) lower count of enterococci and LABs were found in the treatments: SEE, SEE40 and SEE70. All meat balls were characterized by high sensory acceptance, as evidenced by scores not lower than 4.0 on a 5-point scale. However, the use of essential oil and sage ethanol extracts resulted in deterioration of the sensory properties of chicken meat balls. Significant differences in appearance and color between Control and SEE40, SEE70 and SEO were found only on day 14. Sage essential oil was responsible for a significant deterioration of the flavor of meat balls on days 7 and 14. There was a tendency to reduce the taste scores in products with the addition of sage preparations, and on the last day of storage, the taste of Control was rated significantly the highest among all treatments. The meat balls did not differ significantly ( $P > 0.05$ ) in protein and fat content. The mean protein and fat content was respectively: from 18.3% to 18.5% and from 17.2% to 18.0%. The antioxidant and antimicrobial properties of sage resulted from the presence of various types of bioactive substances [Hać-Szymańczuk et al. 2011, 2014]. Previous studies indicated the possible use of sage preparations for preserving both MSM and convenience meat products [Cegińska et al. 2019, 2021].

**Conclusions:** The results showed that the addition of sage preparations could be a promising strategy for maintaining the key quality characteristics of convenience chicken meat products prepared of MSM. The most effective in slowing down the oxidation processes of lipids and microbial growth was sage ethanol (70%, v/v) extract. However, in order to meet the needs of producers and consumers in obtaining the desired qualities of chicken meat balls, further research on the raw material composition and the use of modern sage preparations necessary.

## References:

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**Key words:** Antimicrobial properties, Antioxidant properties, Meat balls, Mechanically separated meat, Sage