Antimicrobial Effect of *Salvia officinalis* L. against Selected Group of Bacteria Isolated from Chickens Meat

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Abstract

The effect of *Salvia officinalis* L. essential oil as well as vacuum packaging in extending the shelf life of fresh chicken's breast meat stored at 4 °C was investigated. In a preliminary experiment *Salvia officinalis* L. essential oil were used at concentrations 2% v/w while vacuum packaging. Microbiological properties of fresh chicken breast meat were monitored over a 16 days period. For this experiment three groups were used. First group was control with air packaging second was with vacuum packaging condition and was treated with essential oil on the surface of fresh chicken breast meat. From the microbiological indicators in this experiment total count of bacteria and coliform bacteria were observed. The total count of bacteria on the meat after killing animals was 2.97 log cfu.g^{-1} and number of coliform bacteria was 0.33 log cfu.g^{-1}. The total count of bacteria on the chicken breast meat after 4, 8, 12 and 16 days gradually increased. The same number of coliform bacteria in extending self-life gradually increased. The highest number of both groups of microorganisms was in the control group with air condition and lowest number of both bacterial groups was in the group with salvia essential oil treatment.

Keywords: antimicrobial effect, essential oil, chicken's meat, total count of bacteria, coliform bacteria

1. Introduction

The concept of 'succession' of spoilage-related microbial groups i.e. Ephemeral/Specific Spoilage Organisms (E/SSO), was only recently taken into consideration [1-8]. Recently, in fact, several studies have focused on meat with the aim of describing the diversity of the spoilage associated microbial populations in response to different storage conditions [8-12]. The storage temperatures as well as the different applied treatments such as addition of preservatives, vacuum pack (VP) and modified atmosphere packaging (MAP) were found to affect the microbial association such as ESOs of the product and consequently the spoilage process [7, 8, 13-16].

The characterization of the spoilage microbiota not only at species but also at strain level is also an important issue that has been increasingly taken into account recently. This approach could potentially play a pivotal role in the understanding of meat spoilage as different strains of the same species may have different spoilage activities or can be differently affected by storage conditions [14, 17, 18]. Hence, the study of bacterial physiology could be of help in understanding the spoilage occurrence and dynamics.

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Salvia, the largest genus of *Lamiaceae*, includes about 900 species, widespread throughout the world. Some members of this genus are of economic importance since they have been used as flavouring agents in perfumery and cosmetics. Sage (*Salvia officinalis* L.) has been redited with a long list of medicinal uses: e.g. spasmolytic, antiseptic, astringent [19-21]. Some of the phenolic compounds of plants belonging to this genus have also shown excellent antimicrobial activity as well as antioxidant capacity [22, 23]. Consequently, the corresponding extracts have been widely used to stabilize fat and fat-containing foods [24].

Based on the above, the present study was undertaken with the aim to determine the effect of vacuum packaging VP combined with salvia essential oil on microbiological properties of chicken's breast meat samples stored at 4 °C.

2. Materials and methods

The experiment was implemented in the local poultry station (Hydinaren a.s., Zamostie). The tested chickens were Ross 308. At the end of the fattening period (day 42) were chickens slaughter for analysis. To evaluate the microbiological properties was taken breast muscle (*musculus pectoralis major*) without skin of each experimental group.

The treatments of chicken fillets examined in the present study were the following: Air-packaged (C, control samples on air), vacuum-packaged (VP) and VP with EDTA–with salvia (S) essential oil 2% v/w.

Salvia essential oil (Calendula, Nova Lubovna, Slovakia) was added to the chicken breast meat surface (two sides) of each sample using a micropipette so as to achieve a 2% v/w final concentration of EO.

Approximately 10 g (10 cm^2) of the chicken breast meat samples (of uniform area) was sampled using sterile scalpels and forceps, immediately transferred into a sterile stomacher bag, containing 90 ml of 0.1% physiological solution (pH=7.8), and homogenized for 60 s in a Stomacher at room temperature. Sampling was carried out at predetermined time intervals namely: 0, 4, 8, 12 and 16 days.

Microbiological analyses were conducted using standard microbiological methods. Total viable counts (TVC) were determined using plate count agar (PCA, Merck, Germany), after incubation for 3 days at 30 °C. For members of the family *Enterobacteriaceae*, a 1.0 ml sample was inoculated into 10 ml of molten (45 °C) violet red bile glucose agar (Oxoid, UK). After setting, a 10 ml overlay of molten medium was added and samples incubated at 37 °C for 24 h. The large colonies with purple haloes were counted All plates were examined for typical colony types and morphology characteristics associated with each growth medium.

Data from each replication were averaged and log transformed (microbiological analysis). Results of microbiological analyses are reported as mean values standard deviation (S.D). Differences in mean log CFU/g among treatments or storage times were determined by the Students t-test (significance was defined at $P<0.05$).

3. Results and discussion

Changes in total count of bacteria of the chicken fillets stored both in air (control) and under VP conditions and subjected to the various combined antimicrobial treatments are presented in Fig. 1. The initial Total Viable Count (TVC) of chicken fillets of ca. 2.96 log $CFU.g^{-1}$ (day 0), indicates acceptable quality given the limit of acceptability for poultry products of 10^7 $cfu.g^{-1}$ [25]. Statistical significant differences on total viable count in all days of storage were found between the group with salvia essential oil and control group with air packaging and salvia essential oil and vacuum packaging group ($P\leq0.05$).

With respect to *Enterobacteriaceae* (Fig. 2), considered as a hygiene indicator, [26], the initial (day 1) counts were 0.3 log $cf.g^{-1}$ indicative of good quality chickens meat. On day 8 of storage *Enterobacteriaceae* genera reached 4.11 log $cfu.g^{-1}$ in control samples. Statistical significant differences on number of *Enterobacteriaceae* genera after all days of storage were found among all tested group ($P\leq0.05$). With respect to VP, present results are in accordance with those of Soldatou et al. [27] and Sheridan et al. [28]. The presence of CO_2 levels above 40% in packs limited the growth of *Enterobacteriaceae* according to Berruga et al. [29] and Garout et al. [30]. With regard to the use of EOs, present results are in agreement with those of Chouliara and Kontominas [31] and Chouliara et al. [32] for chicken meat.

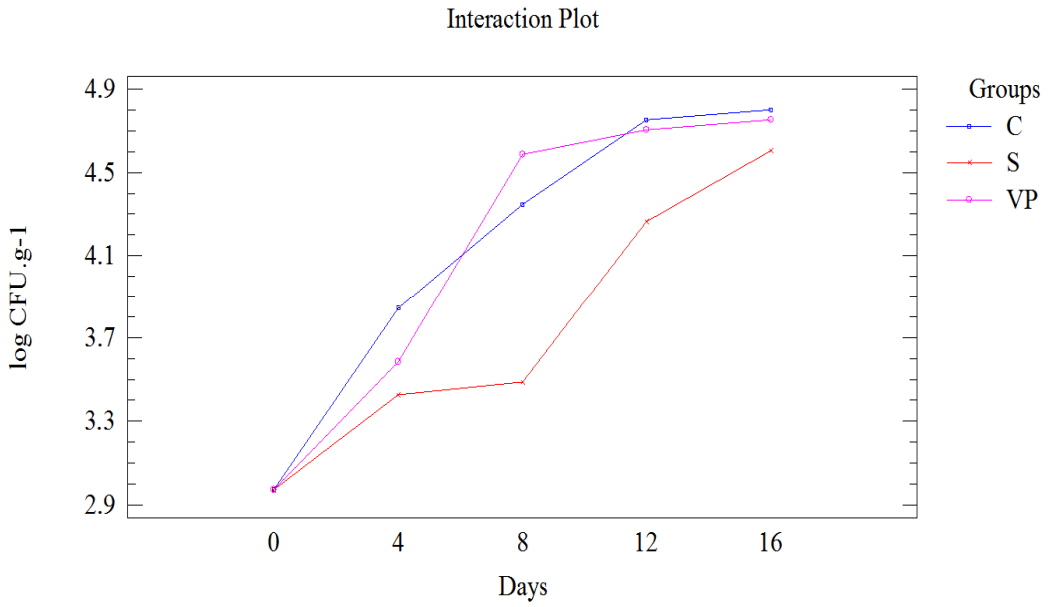

Figure 1. Changes (log CFU.g^{-1}) in population of Total count of bacteria in chicken breast meat samples stored in air (C); stored under vacuum (VP); with EDTA and salvia oil stored under vacuum (S).

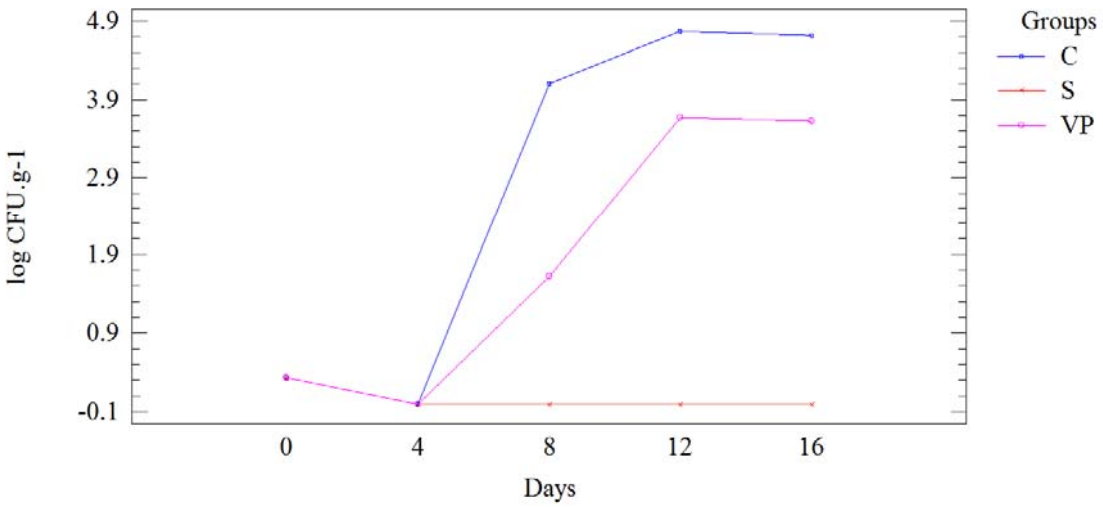

Figure 2. Changes (log CFU.g^{-1}) in population of *Enterobacteriaceae* genera in chicken breast meat samples stored in air (C); stored under vacuum (VP); with EDTA and salvia oil stored under vacuum (S).

4. Conclusions

Of the antimicrobial combination treatment examined in the present study, the use of treatment, EDTA–salvia oil (VP+S) were the most effective against the growth of total viable count and *Enterbacteriaceae* genera. Based on microbiological (TVC data) analyses, treatment VP+R produced a shelf-life extension of 12-16 days, as compared to the control samples.

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