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ANTIOXIDANT AND ANTIBACTERIAL ACTIVITIES OF GRAPE SEED EXTRACT IN LARD

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Introduction

Oxidation of lipids in meat and meat products causes change of the functional and sensory characteristics, and decrease of shelf life. Synthetic antioxidants, such as BHT, BHA, and propyl gallate, have been utilised to extend the shelf life of product by retarding the development of rancidity. However, their use in food products is under great consideration for toxicological reasons, and thus interest in the natural ones steadily increases. The antioxidant properties of many herbs and spices are reported to be effective in retarding the process of lipid peroxidation in food (1, 2). In recent years, the use of grape seed extract has begun to become popular as a nutritional supplement that also has antioxidant activity. These extracts contain a heterogeneous mixture of monomers, oligomers, and polymers formed by subunits of flavan-3-ol (3). With regard to their pharmacological properties, these phenols have shown themselves active, against the oxidation of the low-density lipoproteins, at the same time as they appear to demonstrate anticarcinogenic, antimutagenic, and antimicrobial activity (4, 5). Inhibition of development of thiobarbituric acid reactive substances in dark poultry meat with pre- and post-mortem use of grape seed extract has been published (6).

Objectives

The aim of this study was to evaluate and compare the antioxidant and antimicrobial effectiveness of the grape seed extract and BHT added to lard.

Methodology

The lard used came from crossbreed pigs, live weight about 110 kg. After slaughtering the animal and sectioning of the meat, the lard, still attached to the skin, was sectioned off in blocks and stored at –24°C until further processed in the laboratory. Lard was allowed to taw overnight at 4°C. The skin was removed and the lard was cut into cubes before being ground in a food processor. After the addition of grape seed extract or BHT, lard was mixed with a hand-held utensil.

Samples were prepared without any addition (control), with addition of 0.01 % BHT, 0.01 and 0.7 % of grape seed extract (w/w).The samples were stored in stoppered glass jars at 4°C. Experiment lasted for 35 days. MDA quantities were determined on 0, 3, 6, 9,

12, 15, 25, 30 and 35 day; peroxide values on 0, 12, 30 and 35 day, while the microbiological analyses were done on 0, 6, 11, 20 and 33 day.

Malondyaldehyde (MDA), a major degradation product of lipid peroxides, was used as a marker for assessing the extent of lipid peroxidation. The determination of MDA was performed according to the method of Botsoglou et al. (7). Also, for the evaluation of the ability of antioxidants to inhibit lipid oxidation the peroxide value was determined, according to the A.O.C.S. Official Method Cd 8-53.

For the microbiological analysis, the sample was homogenized in a 2 % sodium citrate solution. Dilutions were prepared in a physiological solutions and the appropriate culture media were employed for the determination of Salmonelae sp, Staphylococcus aureus, Clostridium, Proteus sp, E. coli, molds, total count, and lipolytic microorganisms. The methods used, were according to the Regulation (8).

Experiment was conducted twice, with all measurements made in triplicate.

Results & Discussion

Maximum permitted level of BHT in lard is 0.01 % according to Regulations of Serbia and Montenegro, as well as of USDA. Grape seed extract on that level was checked for its activity, as well as in significantly higher concentration.

The results of MDA content of the lard samples are shown in Fig.1. During the first 9 days of experiment MDA content of all samples was low and unchanged. On the 15. day of experiment MDA content of control sample achieved 0.951 ppb, while MDA content of all spiked samples maintained initial and constant values within 35 days. The significance of these findings is that the grape seed extract, like BHT added to the lard was capable of maintaining MDA values below 0.1 ppb throughout the 30 – day study, whereas the MDA value of lard control sample exceeded 0.2 ppb by 6 days. Abilities of grape seed extract at both concentrations to retard lipid oxidation were not different from that of BHT. Furthermore, no difference between the activities of grape seed extract at both concentrations was noticed. MDA test is an indicator of late oxidative changes of lipids, and it pointed out only the difference between the control and spiked samples. The main products of lipid autooxidation during the initial stage of the process are hydroperoxides. Thus, the peroxide value indicates the early oxidative changes. Peroxide values are given in meqO_{2}_/kg of lard (Fig.2). At 12. day peroxide value was 6.2 for the lard control sample, and reached 23.5 on 35. day. Peroxide value for the lard sample containing 0.01 % grape seed extract was 0.5 and 1.7, at 12 and 35. day, respectively. In the samples containing BHT and grape seed extract at 0.7 %, the value was 0. It is obvious that the BHT and the grape seed extract at 0.7 % inhibited the formation of hydroperoxides comparing to the lard control sample.

Within 35 days, there is no growth of any pathogen bacteria and molds. Total count (Fig.3) and lipolytic bacteria count (Fig.4) are given in log_{10}_CFU/g. Total count and lipolytic bacteria count rapidly increased in control sample at 11. day. Total bacteria count increased in lard sample containing BHT at 33. day of experiment. Lard samples containing grape seed extract, maintained low values of total and lipolytic bacteria count throughout the experiment. The grape seed extract has high content of total phenolics, which are active against bacteria (5, 9).

Conclusions

Results of this study show that grape seed extract added to lard, like BHT can retard lipid oxidation in lard, as well as it may be exploitable as antibacterial agens to prevent the deterioration of lard by bacteria.

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Tables and Figures

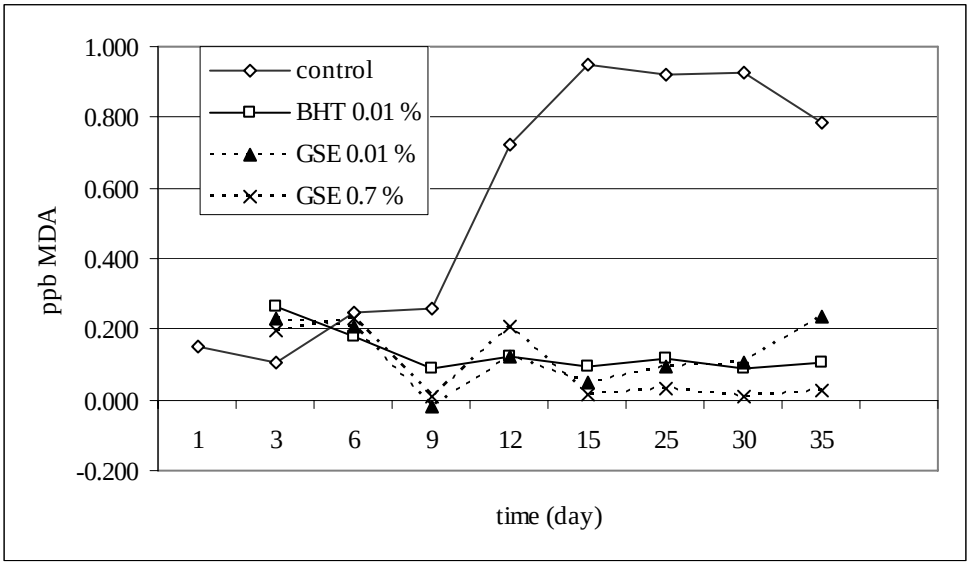

Figure 1. Evolution of the MDA value in lard samples. GSE- grape seed extract.

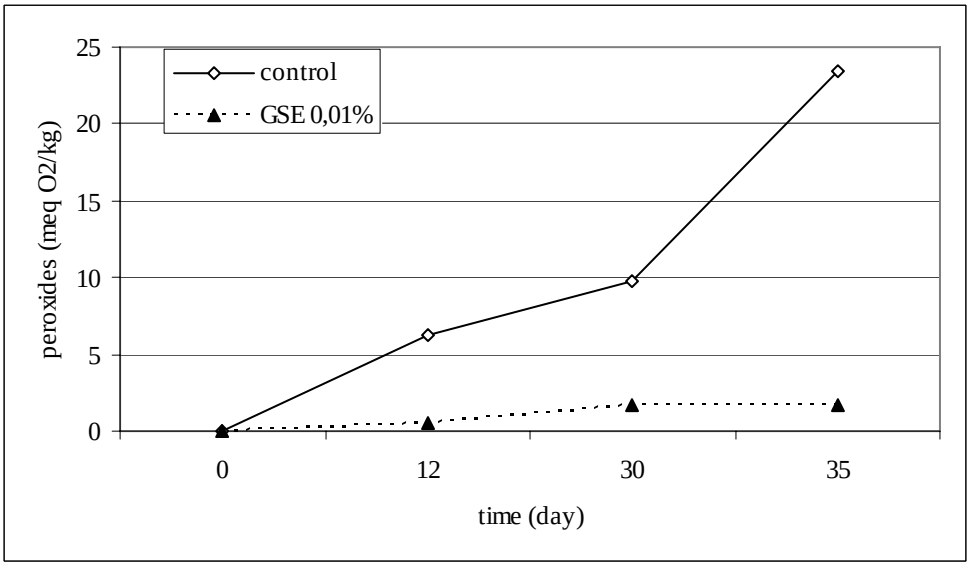

Figure 2. Evolution of the peroxide value in control sample and in lard sample containing 0.01 % of grape seed extract (GSE).

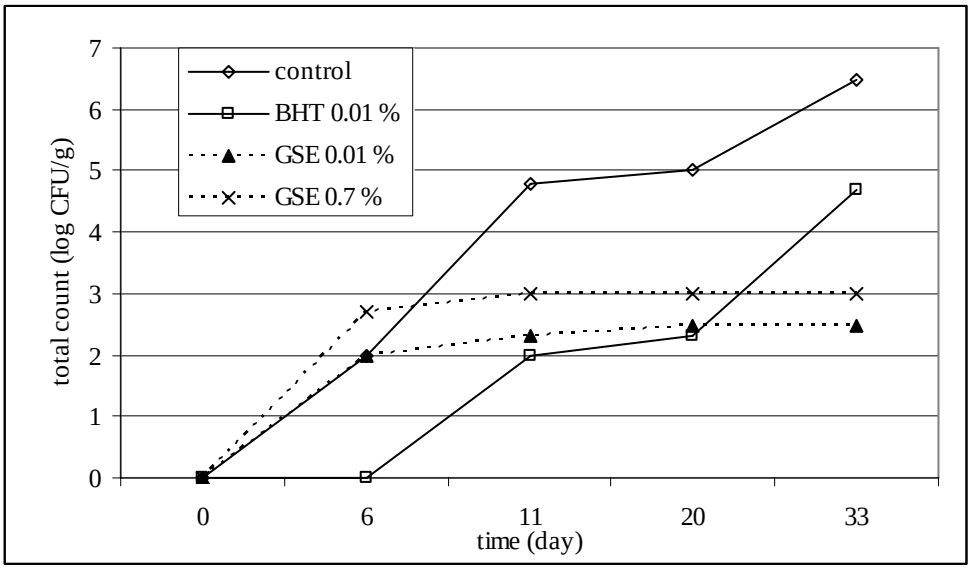

Figure 3.Total count of bacteria in the lard samples.

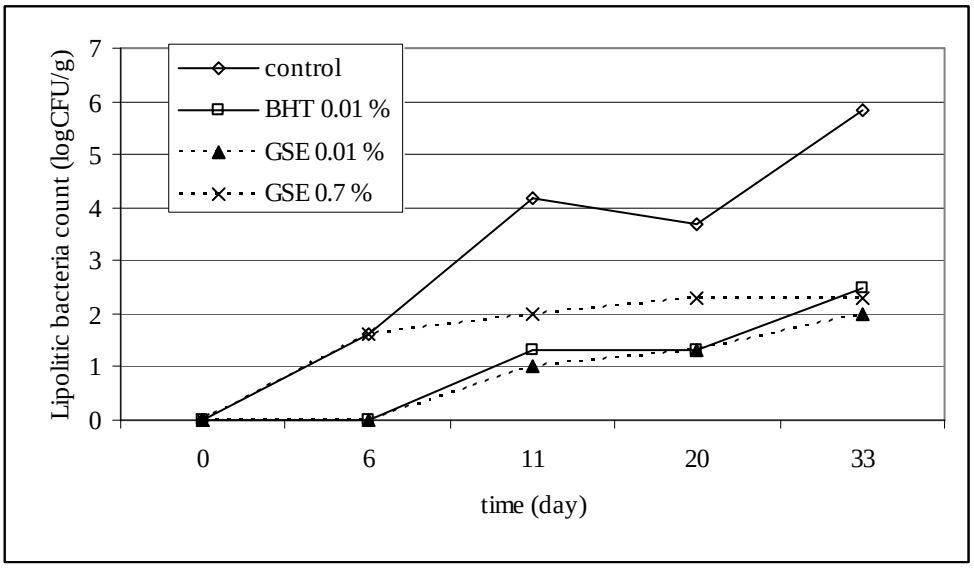

Figure 4. Lipolytic bacteria count in lard samples.