EVALUATION OF THE ANTIOXIDANT ACTION OF NATURAL INGREDIENTS IN RAW- DRIED MEAT PRODUCTS

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Abstract – The lipids can be subjected to auto-oxidation, photo-oxidation, thermal oxidation, respectively, in different conditions, to enzymatic oxidation. To prevent lipid oxidation and to ensure the optimal the conservation with natural antioxidants were used rosemary, oregano, pine seeds, pomegranate juice, fresh blueberries, grape seed extract. The objective of this study was to research the antioxidant capacity of condiment herbs and different vegetable products used to obtaining raw-dried meat products without chemical additives. Natural antioxidants which have been studied and used in raw-dried sausages include flavonoids (anthocyanidins, quercetin, catechins), vitamins (C, B5, A, E), minerals (selenium, potassium, iron), tannins, ellagitannins, and phenolic acids and essential oils such as cineol, camphene, borneol, bornyl acetate. For the analysis of the antioxidant activity was determined the peroxide value, Kreiss reaction, acidity and pH. The results obtained during 30 days of storage of raw-dried sausages showed that the highest antioxidant effect have had the grape seed extract and blueberries. Unsatisfactory results were obtained at raw-dried sausages with added pomegranate juice and pine seeds. The raw-dried meat products have positive sensory qualities, characteristics which are well defined.

Key Words – conservation sausages without chemical additives, natural antioxidants, peroxide value

I. INTRODUCTION

Lipid oxidation is a significant cause of the food quality deterioration, being a challenge for the food scientists and manufacturers from the food industry. Lipids are susceptible to oxidation, especially in the processes catalyzed by light, heat, enzymes, metals, metal-proteins, and micro-organisms, which lead to the development of off-flavors and to the loss of essential amino acids, fat-soluble vitamins and other bioactive compounds.[1,2,3]

The lipids can be subjected to auto-oxidation, photo-oxidation, thermal oxidation, respectively, in different conditions, to enzymatic oxidation. Autooxidation - the most frequent process that lead to oxidative damage - is defined as the spontaneous reaction of the atmospheric oxygen with the unsaturated fatty acids from lipids during three stages: initiation, propagation and end. The hydro-peroxides are identified as primary products of auto-oxidation, which by decomposition leads to aldehydes, ketones, alcohols, hydrocarbons, organic acids and volatile epoxy compounds, known as products of secondary oxidation. These compounds, together with the free radicals, represent the support for the evaluation of the oxidative stage of the food lipids. [4-7] Lipid oxidation reduces meat quality by a number of ways, including off-flavour formation, drip loss, colour changes etc.

During lipid oxidation poly-unsaturated fatty acids are degraded to volatile short-chain oxidation products, which lead to off-odour and off-flavour formation. [8] In order to diminish the lipid oxidation in raw-dried meat products there are used artificial antioxidants. [9,10] Because a number of these chemical substances are related to an increased risk of cancer, it tries to focus the research towards the development of a new class of additives based on plant extracts. [11-14] These ones can be used as substitutes for nitrates and nitrites in raw-dried meat products, having antioxidant, preservative and flavoring role. The consumers can benefit both by the nutrients from meat and the biologically active compounds from spicy and antioxidant supplements, with can reduced the risk of developing chronic diseases.

Throughout history spices were known to possess antibacterial and antioxidant properties.[15] Garlic and clove are effective against some common strains of *E.coli*. [16] The total antioxidant capacity of fruit and vegetable extracts reflects concentrations of ascorbic acid (vitamin C), alpha-tocopherol (vitamin E), beta-carotene (vitamin A

precursor), diferits flavonoids, and other phenolic compounds. [17-21]
Use of the natural antioxidants pose a real challenge to manufacturers who, in the face of scientific evidence on the health problems caused by artificial additives, can no longer however much increase the quantities they use in production without considering the potential consequences.

II. MATERIALS AND METHODS

Materials

To obtain the raw dried sausages were used pork, fat back, salt, pepper, sugar and natural hog membranes. As an added with natural antiseptic and antioxidant role were used oregano, rosemary, pomegranate, blueberry, pine seeds and grape seed extract. Oregano and rosemary were used as dry powder, in proportion of 1%, the same for the pine buds. Fresh blueberries were crushed to a size of 4 mm and used 5%. Grape seed extract was purchased from drugstore and used in proportion of 1%. Raw materials and additives were dosed and properly shredded using appliances, then obtained composition, which was introduced in processed pig intestines. The meat products are smoked at temperatures ranging between 9-12 deg.C, and the control factors for drying are temperature (15-16 deg. C), relative humidity (75-80%), air speed (0.1-0.2%). Maturation sausages was performed at 12 degrees C for 21 days. Were performed following notation:

- Blank sample without antioxidant additives mentioned (M);
- Sample with added grape seed extract in a 1% (MES);
- Sample with added fresh blueberries in a 5% (MA);
- Sample with added fresh pomegranate juice in a 5% (MSR);
- Sample with added chopped pine nuts in a 1% (MP);
- Sample with added rosemary in a 1% (MR);
- Sample with added oregano in a 1% (MO).

Methods

The analysis methods have evolved lipid oxidation state by determining the peroxide value, Kreiss reaction acidity. It was also determined humidity finished products and weight loss during ripening and drying of sausages.
The peroxide value (PV) is used for determining the peroxide oxygen (especially hydroperoxides). It is expressed in milliequivalents of active oxygen per 1 kg of fat, according with AOCS Standard Method. Solvent, and later potassium iodide are added to the fat that has to be examined. In the presence of peroxide oxygen, iodide will be discharged in the sample. It is this amount of iodide that represents the peroxide content, allowing its exact determination.
Kreiss reaction identify aldehydes results in advanced stages of fat oxidation. Kreiss reaction occurs in acidic medium between epihidrinic aldehyde and phluoroglucine. Resulting color intensity is directly proportional to the amount of epihidrinic aldehyde, and therefore the oxidation process.
Determining acidity is the basic criterion for assessing the installation and intensity of hydrolysis and consist in the neutralization of free fatty acids with sodium hydroxide 0.1 N, in the presence of phenolphthalein as indicator. Acidity was expressed in oleic acid grams to 100 g of fat. The pH values were measured with a HACH pHmeter.

III. RESULTS AND DISCUSSION

In purpose of assessing antioxidant capacity of used ingredients were performed following chemical analysis: the peroxide value, the acidity, Kreiss reaction, the moisture and pH.

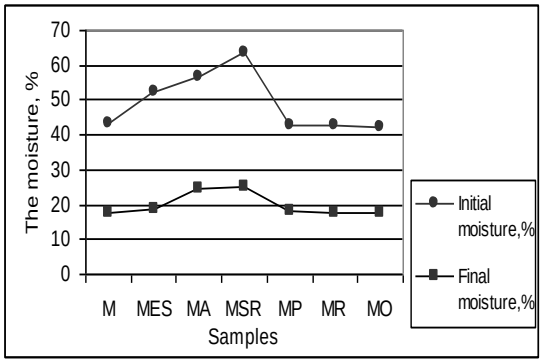

Figure 1. The moisture values in the analyzed samples

Water, by its presence in food, determining quality and affect stability in time of the sausages. The finished products are analyzed before and after the

step of curing-drying in terms of moisture content and have obtained the values shown in figure 1.
The initial moisture was determined before the maturation of sausages. Highest moisture content was recorded in the case of additions of blueberries 56, 55% and pomegranate juice 63.53% for measurements performed immediately after obtaining. The final moisture was determined after 21 days of maturing sausages. The raw-dried sausages with powder supplements had the lowest moisture (17, 78% for MR sample and 17, 61% for MO sample) so highest stability. The average weight decrease of the sausages during maturation is 59.08%. The peroxide value was determined after 21 days of aging and had the values specified in figure 2.

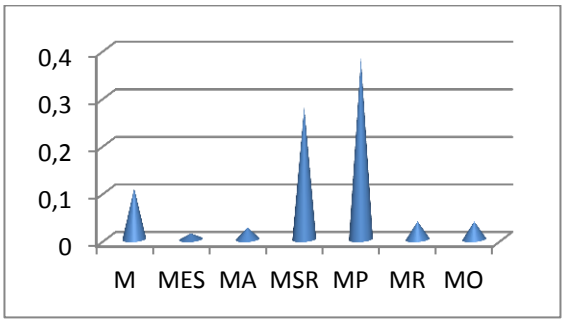

Figure 2. The peroxide values in the samples

Was observed that the peroxide index of the sample MP (sausages with added pine seeds) was the highest 0,3815, and the lowest value found in the sample with grape seed extract being 0,0126.
In the other samples was a decrease of the peroxide value compared to control sample with 88,33% for the sample with grape seed extract, 76,57% for the sample with blueberries, 64,81% for the sausages with oregano and rosemary. According to Savu, 2013, the altered fats have the peroxide value more than 0,1%, relatively fresh fat 0,1-0,06% and the fresh fat less than 0.06%. [22]
The samples obtained with the addition of antioxidants have had Kreiss reaction negative and the blank sample was positive. The acidity is an important property in food quality assessment because it contributes directly to the formation of taste (sour taste is given by the presence of acids in the product) and for raw-dried sausages acidity was an indicator of their freshness.

The abnormal growth of it to over maximum permissible values is an indication of the beginning of alteration and degradation even sausages. The control sample showed the highest value of the acidity 2,115% (fig. 3).

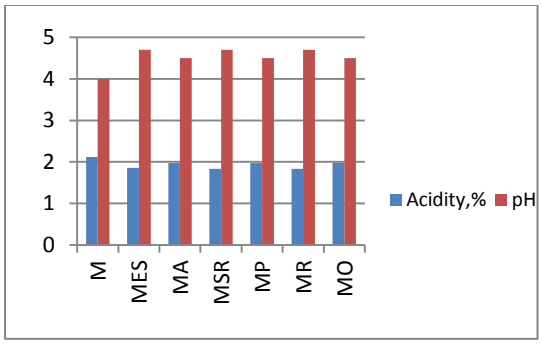

Figure 3. The acidity value of sample after maturation-dried stage

The lipid hydrolysis had a lower intensity in the case of sausages with vegetable additions and rosemary determined lowest hydrolytic degradation of lipids (1,833 oleic acid/100g).

IV. CONCLUSION

Dried raw sausages have positive sensory qualities, characteristics which are well defined. The high quality is given by safe raw and auxiliary materials, and the absence of the chemical additives.
Natural ingredients has made it possible that after 21 days the sausages have a good fresh condition, in particular the use of grape seed extract and fresh blueberries, which laboratory tests have shown to be in very fresh.
Antioxidant and antiseptic effect of natural additives was observed in all samples analyzed, compared with the control, which had the lowest peroxide value and Kreiss reaction was positive. Pine nuts and pomegranate juice were not strong enough to prevent lipid oxidation, because, even if Kreiss reaction was negative, peroxide index and acidity were higher and sensory properties were deteriorated.

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REFERENCES

1. Ladikos, D. & Lougovois, V. (1990). Lipid Oxidation in Muscle Foods: A Review. Food Chemistry 35: 295-314.
2. De Owen R., F. (1996). Food Chemistry, 6th edition, Marcel Dekker Ink., New York, p.252-312.
3. Velasco, J., Dobarganes, C. and Marquez Ruiz, G. (2010). Oxidative rancidity in foods and food quality. Woodhead Publishing Limitid, Cambridge, p. 3-28.
4. Dominguez, R., Gomez, M., Fonseca, S. and Lorenzo, J.M. (2014). Effect of different cooking methods on lipid oxidation and formation of volatile compounds in foal meat. Meat Science 97: 223–230.
5. Park, S. Y., Undeland, I., Sannaveerappa, T. and Richards, M. (2013). Novel interactions of caffeic acid with different hemoglobins: Effects on discoloration and lipid oxidation in different washed muscles. Meat science 95: 110-117.
6. Nieto, G., Díaz, P., Bañón, S. and Garrido, M. D. (2010). Dietary administration of ewe diets with a distillate from rosemary leaves (*Rosmarinus officinalis* L.): Influence on lamb meat quality. Meat science 84: 23-29.
7. Wasowicz, E., Gramza, A. , Hêœ, M., Jeleñ, H. H., Korczak, J., Ma³ecka, M., Mildner-Szkudlarz, S., Rudziñska, M., Samotyja, U. and Zawirska-Wojtasiak, R. (2004). Oxidation of lipids in food. Polish journal of food and nutrition sciences, 13/54: 87–100.
8. Kemin Europa N.V. (2009). The interaction between meat quality, lipid oxidation and antioxidants in animal diets Kemin Industries, Inc., www.Kemin.com.
9. Manea, I. and Avram, D. (2008). Additives and auxiliaries food, Publishing Printech, Bucharest.
10. Manea, I. (2013). Technologies for processing and preserving of meat", Publishing EUROPLUS, Galaţi.
11. Shah , M.A., Bosco, S. J., Mir, S. M. (2014). Plant extracts as natural antioxidants in meat and meat products. Meat science 98: 21-33.
12. Paun, G., Zrira, S., Boutakiout, A., Ungureanu, O., Simion, D., Chelaru, C. and Radu, G. (2013). Chemical composition, antioxidant and antibacterial activity of essential oils from Morrocan aromatic herbs. Revue Roumain de Chimie 58: 891-897.
13. Karre, L., Lopez, K., Getty, K. (2013). Natural antioxidants in meat and poultry products. Meat science 94: 220-227.
14. Neagu, E., Paun, G., Alecu, A. and Radu, G. (2013). Chitosan-polyvinilpyrrolidone/ ellagic acid based membranes with controlled antioxidant properties. Revue Roumain de Chimie, 58:791-797.
15. Mitić, S., Stojanović, B., Pavlović, A., Mitić, M. and Stojković, M. (2013). The phenol content, antioxidant activity and metal composition of the Serbian vineyard peach. Revue Roumain de Chimie, 58: 533-541.
16. http://www.meatsandsausages.com/sausage-types/fermented-sausage.
17. Velasco, V., Williams, P. (2011). Improving meat quality through natural antioxidants. **C**hilean Journal of Agricultural Research 71: 313–322.
18. Zheng, G., Xu, L., Wua, P., Xie, H., Jiang, Y., Chen, F. and Wei, X. (2009). Polyphenols from longan seeds and their radical-scavenging activity, Food Chemistry, 116:433-436.
19. Tabart, J., Kevers, C., Pincemail, J., Defraigne, J.-D. and Dommes, J. (2009) Comparative antioxidant capacities of phenolic compounds measured by various methods. Food Chemistry 113:1226-1233.
20. Kahkonen, M.P., Hopia, A.I., Heinonen, M. (2001). Berry phenolics and their antioxidant activity. Journal of Agricultural and Food Chemistry 49:4076-4082.
21. Scalzo, J., Politi, A., Pellegrini, N., Mezzetti, B., Battino, M. (2005). Nutrition, 21:207-213.
22. Savu, C., Petcu, C. (2002). Hygiene and control of animal products, Publishing Semne, Bucharest.