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STUDIES REGARDING THE EFFECT OF ROSEMARY EXTRACT ON SMOKED CHICKEN BREAST

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Abstract

The addition of antioxidants derived from different aromatic plant are used increasingly in order to preserve meat and meat product quality. Plant extracts can be used in brine or can be injected into muscle tissue and prevent lipidoxidation. Curing salts are used in food preservation to prevent or slow spoilage by bacteria or fungus. Generally they are used for pickling meats as part of the process to make sausage or cured meat. Curing salts are generally a mixture of table salt and sodium nitrite, which serves to inhibit the growth of bacteria and helps preserve the colour of cured meat.

In the present paper we try to replace the sodium nitrite to replace sodium nitrite with a rosemary extract, which is known to have a strong antioxidant activity.

Key words: smoked chicken breast, curing salts, rosemary extract, antioxidants, meat product freshness.

INTRODUCTION

Antioxidants are added to different meat products to prevent lipid oxidation, retard development of off-flavors, and improve colour stability. Production of safe and high quality meat and meat products along with recent consumer's demand for all-natural and clean-label is challenging. Plant-derived essential oils (EOs) have shown remarkable antimicrobial potency against spoilage and pathogenic microorganisms in meat and meat products (Jayasena and Jo C., 2013). Antioxidants are compounds that are capable of donating hydrogen radicals (Masuda et al., 2001; Saito et al., 2004) for pairing with other available free radicals to prevent the propagation reaction during the oxidation process.

Much interest has been developed during the last few years for naturally occurring antioxidants because of worldwide trend to avoid or minimize the use of synthetic food additives. The research for natural antioxidants has also increased in recent years; these antioxidants may be found in any plant part, such as grains, fruits, nuts, seeds, leaves, roots, and barks. The majority of natural antioxidants are phenolic compounds, and the most important are the tocopherols, flavonoids, and phenolic acids. All are generally common to all plant sources. They are added to an extensive variety of foods, in order to prevent or retard lipid oxidation (Kumar et al,

2015, Martinez et al., 2014), for their antimicrobial activity (Horsc et al, 2014, Zhang et al., 2009), to reduce nitrite residue and malonaldehyde (MDA) (Suryati et al., 2014). Application of herbs, spices and essential oils with antimicrobial effects comparable to synthetic additives is still remote for three major reasons: limited data about their effects in food, strong odor, and high cost (Tajkarimi et al., 2010).

In some meat products an increase in red colour may be desired. When selecting a natural antioxidant, sensory and quality impact on the product should be considered to achieve desired traits (Kare et al., 2013).

The aim of this study is to try to replace the sodium nitrite with a rosemary extract, which is known to have a strong antioxidant activity.

MATERIAL AND METHOD

The experiments were performed in 2015-2016, at the Laboratory of Meat and meat product analysis, of Faculty for Environmental Protection, University of Oradea.

For this study we used chicken breast, from market and rosemary extract.

Samples preparation

Rosemary extract preparation

The fresh rosemary leaves were chopped and extracted with 50% ethanol. After 24 hours is pressed, left to settle and was centrifuged at 5000 rpm for 10 minutes. The supernatant was evaporated by rotary evaporation, using a Heidolph rotavapor. The obtained rosemary extract was frozen.

From rosemary extract we determined the total phenolic and total flavonoid content.

Smoked chicken breast obtaining

We used immersion in brine like dressing method. The composition of brine was indicated in tabel 1.

Tabel 1.

Composition for 100 ml brine

Brine	Salt (g)	Sugar (g)	R.C.B.A * (g)	Rosemary extract ml
B1	10	0.625	2.25	-
B2 with 2% rosemary extract	10	0.625	-	2
B3 with 5% rosemary extract	10	0.625	-	5

*Mixture for salting R.C.B.A. salt, sodium nitrite (E 250), trisodium citrate (E331).

After 7 days of immersion, the chicken breast samples were smoked, vacuum packed and stored in the refrigerator at 0-4°C. The packaging was open after 14 days and analysed 3 and 30 days after package opening.

Total Phenolic content

The total phenolic (TP) content was determined by using the Folin-Ciocâlteu (1927) colorimetric method developed by Singleton and Rossi (1965). A diluted extract (0.5 ml) or phenolic standard was mixed with 2.5 ml Folin- Ciocâlteau reagent and after 5 minutes 2.0 mL sodium carbonate (7.5%). The absorption was read after 2 h at 20°C, at 750 nm. For the preparation of calibration curve 0.5 ml aliquot of 0.2, 0.4, 0.8 and 1.2 μM/ml aqueous gallic acid solution were used as the standard and expressed as mg of gallic acid equivalent (GAE) (Gergen, 2004).

Total Flavonoid compounds content

The total Flavonoid compounds content (FC) was measured with $AlCl_3$ colorimetric assay (Atanassova et al, 2011). The absorbance was measured at 510nm. As standard we used quercitine.

Organoleptic exam **-** It was analyzed shape, appearance on surface and section, consistency, color, taste and smell (STAS 11061-88).

Chemical reaction (pH) - was measured with potentiometric determination with HATCH SensyION 378 multiparameter meter (STAS 9065-8, 1974).

Determination Of Easily Hydrolysable Nitrogen in Meat Products **-** was done by direct titration with sodium hydroxid. Easily hydrolysable nitrogen released with magnesium oxide (as ammonia) is trained by distillation with water vapor and captured in a sulfuric acid solution in which is dosed by titration with sodium hydroxid from red to yellow colour (STAS 9065-7, 1974).

Sodium chloride content – Mohr titration. Mohr method (titration of Cl^- and Na^+ ions in the aqueous extract with a solution of $AgNO_3$ 0.1 N in the presence of potassium chromate used as an indicator) (STAS 9065-5, 1973).

Nitrite content – Griess method - by UV-VIS spectrophotometer, (STAS 9065-9, 1974).

RESULTS AND DISSCUSIONS

Results obtained after performing analyses for rosemary extract were content in table 2.

Table 2.

Calculated values for TP and FC in rosemary extract

Sample	Total phenolic content mean value	Total flavonoid content mean value
Rosemary extract	96.4 mg GAE/100 ml extract	79.2 mg Quercitin/100 ml extract

Total Phenolic and flavonoid content - Results of the determination of TP and FC are shown in Tabel 2. Santos et al, 2012, found 46 mg GAE/100 ml rosemary extract, lower than our results, but the extraction time was shorter.

The results are difficult to compare with other researchers due to the different type of extraction and to the different ways to express the amount of antioxidant content.

Organoleptic examination The results of the Organoleptic examination was carried out in poultry meat samples after the start of the experiment, on the product obtained after smoking and at the end of the experiment, were inserted in Table 3.

Tabel 3.

Senzorial characteristics of chicken meat and meat product

Parameters	**First day of experiments** ***(meat)***	**First day after package opening** ***(meat product)***	**30 days after package opening** ***(meat product)***
Appearence	Normally, characteristic for species and anatomic region	Normally, characteristic for smoked products	The surface covered by crystals of tyrosine, phenomenon less observed in samples immersed in brine with 5% rosemary extract- this indicates products at the borderline of validity
Color	Rose	Red - brown	Dark brown, with white tyrosine crystals
Consistency	Compact, dens and with elasticity, characteristic for the specie.	Compact, dens and with elasticity, characteristic for the species. At the samples wich contained rosemary extract feels rosemary aroma.	Compact, hard, due to dehydration. Rosemary aroma feels less intens than imediattley after package opening
Smell and taste	Pleasant, characteristic for the specie	pleasantly smoky	pleasantly smoky

Physical-chemical determination

The results for physical-chemical parameters were inserted in tabels 4 and 5 and figure 1a and b.

Tabel 4.

Mean value of physical-chemical parameters, for meat freshness and aditives before smoking.

Parameters	**First day**	**3 days after immersion**			**7 days after immersion**		
		B1	**B2**	**B3**	**B1**	**B2**	**B3**
pH	5.64	5.70	5.92	5.86	5.80	5.98	5.89
Easily Hydrolysable Nitrogen mg NH_3%	16.1	17.8	18.2	18.0	17.8	19.3	18.6

NaCl%	-	5.4	5.3	5.4	5.6	5.5	5.6
Nitrite mg%	-	5.9	0	0	5.9	0	0

- *In the first day of experiments* the registered pH value was 5.64, and the mean value for Easily Hydrolysable Nitrogen was 16,1 mg%. These results characterize a fresh meat.
- *3 days after the immersion at 0-4°C*, the maximum value reached for pH was 5.92 and for Easily Hydrolysable Nitrogen increased up to 18.2 mg%. The results obtained in this step characterize a fresh meat.
-*7 days after immersion* in brine, pH value increased at 5.98; Easily Hydrolysable Nitrogen value was 19.3mg%. These results characterize a fresh meat.

Salt content ranged between 5.3 and 5.6 %. Nitrite content was under 7 mg% for sample type B1. In case of brine containing rosemary extract without nitrite the nitrite content was 0 (Tabel 4).

Tabel 5.

Mean value of physical-chemical parameters, for meat freshness and aditives after smoking.

Parameters	**First day**	**3 days after package opening**			**30 days after package opening**		
		B1	**B2**	**B3**	**B1**	**B2**	**B3**
pH	5.8	5.9	6.0	5.9	6.1	6.2	6.1
Easily Hydrolysable Nitrogen mg NH_3%	16.1	24.4	23.8	24.7	33.1	34.2	33.8
NaCl%	5.1	5.2	5.1	5.1	5.3	5.1	5.2
Nitrite mg%	-	1.2	0	0	1.5	0	0

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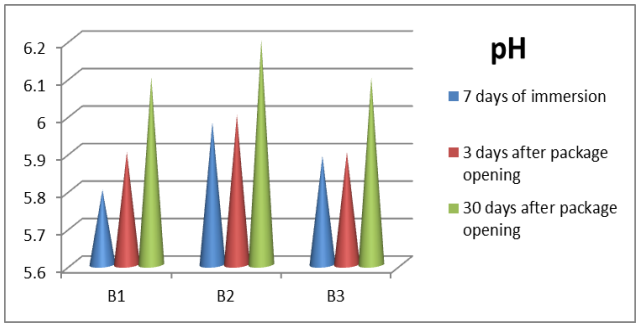
The chicken breast samples were smoked, vacuum packed and stored in the refrigerator at 0-4°C. The packaging was open after 14 days and the samples were analysed. The analysis were repeated at 3 and 30 days after package opening.

a.



b.

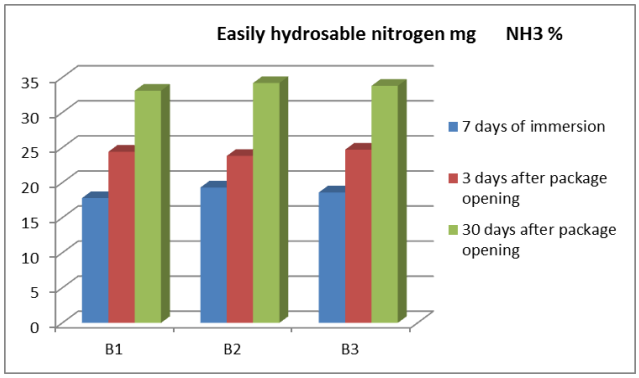


Fig. 1a-b. Graphical representation of dynamics of freshness parameters of analyzed samples

pH of the samples immediately and 3 days after the package opening, was between 5.8 and 6.0, values that indicate fresh products, a fact proven by the amount of free ammonia ranged between 16.1 and 24.7 mg NH_3 % in case of samples immersed in brine with 5% rosemary extract. The values for additive content were close to the evidence before the smoking process.
30 days after the package opening and preservation of the samples at 0-4°C, pH increased slightly to 6.1 for samples type B1and B3, and maximum 6.2 for samples type B2.

The values for Easily Hydrolysable Nitrogen were under 35 mg NH_3%, maximum admitted value for a fresh meat product (Tabel 5).

Best results were obtaine for brine with 5% rosemary extract.

CONCLUSIONS

Analyzing the obtained results, can draw the following conclusions:
- All the analyzed samples were classified as fresh products, pH and free ammonia were kept in normal range, characteristic for fresh products.
- Content of additives is within the permissible limits.
- Rosemary extract has a high content of polyphenolic compounds with antioxidant capacity and can be used in the manufacture of smoked chicken breast. The best results were obtained with brine containing 5% rosemary extract. It can successfully replace sodium nitrite, to increase the shelf life of products and to preserve the colour, but for greater safety it is necessary to perform microbiological examination.
- In the future we plan to test other plant extracts and meat from other species to try to replace all or even part of nitrites and nitrates used in meat production.

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