THE EFFECT OF OAT AND SODIUM ISOASCORBATE ADDITION ON COLOUR AND LIPID OXIDATION OF COMMINUTED MEAT PRODUCTS

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Introduction

Oxidation processes in food systems deteriorate the sensory quality and nutritive value of a product; these processes frequently limits the shelf-life of meat products. Lipid and protein oxidation is responsible for the development of unpleasant tastes and odours, as well as changes in reological properties and formation of toxic compounds (Kanner, 1994). Moreover it deteriorates the colour of meat products. The studies concerning meat haem pigments initiate and catalyse the oxidation of muscle tissue. Free radical, produced during lipid oxidation, can oxidise haem pigments, causing discolouration of meat and meat products. Myoglobin catalyses lipid oxidation; iron ions (Fe^{2+}, Fe^{3+}) present in haem are better prooxidants than as free ions (Baron & Andersen, 2002). One method to reduce oxidation processes is the application of natural antioxidants. Oat grains are a basic source of essential components with a wide range of biological activity, e.g. polyphenols. Oat phenolics include simple phenolics, such as ferulic acid, caffeic acid, *p*-coumaric acid and vanillin, in free and bound forms, and flavonoids such as kaempferol and quercetin (Xing and White, 1997). The avenanthramides belong to a group of phenolic compounds which are unique to oat (Dimberg et al., 1993).
The aim of the study was to investigate the effects of oat preparation and sodium isoascorbate addition on the oxidative stability of comminuted meat products.

Materials and Methods

Experimental material consisted of finely comminuted meat products. Fundamental materials used for manufacturing the test products were: cured lean beef – 25%, cured pork meat – 25%, minced pork fat – 20%, ice water – 30% and oat grains preparation (2 and 5%) and sodium isoascorbate (0,05%). Oat grains (Polar) were purchased from a local grain manufacturer in Lublin. The grains were baked of 100°C. After that dried oat grains were milled to powder. All ingredients were chopped in the following order: meat, ice water, oat preparation and fat. Meat batters were heated in water (75°C) to an internal temperature of 70°C. After the completion of the thermal processing, the products were cooled in water to a temperature of 10°C, after which they were cold-stored at a temperature of 4°C. All samples were stored for up to 30 days at 4°C. Four options of the samples were obtained: PC – control meat products; PSA – meat products with addition of 0,05% sodium isoascorbate; PO1 - meat products with addition of 0,05% sodium isoascorbate and 2% oat preparation; PO2 - meat products with addition of 0,05% sodium isoascorbate and 5% oat preparation;
Hunter colour lightness (L*), redness (a*) and yellowness (b*) values were measured on freshly cut surfaces of each sample using X-Rite reflection spectro-colorimeter, using illuminant D65 and 10° observer angle (AMSA 2005). ΔE* (total color change) values were calculated ($\Delta E = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$) to determine the extent of color change. Acid number values (AV) were measured in accordance with PN- 84/A – 85803 and expressed in milligrams of KOH/ 1 g of fat in fat extracted from meat products according to Folch (Folch, Lees, & Stanley, 1957) with the use of chloroform:methanol solvent system (2:1). Lipid oxidation was assessed by the 2-thiobarbituric acid method. The rose-pink colour obtained through the reaction between malondialdehyde and 2-thiobarbituric acid was measured at 532 nm using a Nicole Evolution 300 spectrophotometer (Thermo Elektron Corporation). The TBA content was expressed as mg of malondialdehyde per kg of the samples.
To compare mean values of the investigated parameters, analysis of variance was applied and differences between groups were evaluated using Tukey test.

Results and Discussion

Colour and colour stability. There were no significant differences (P>0,05) between all experimental meat products during storage for lightness (L* value) and yellowness (b* value). L* and b* values of control sample (PC) tended to be slightly higher (but not significantly) when compared with the products with sodium isoascorbate (PSA) and oat (PO1, PO2) addition. Statistical analysis indicated that the addition of sodium isoascorbate and oat preparation did affect the redness (a* value). The control sample (PC) characterized significantly lower a* parameter values compared to the rest of meat products samples. During the chilling storage of meat products slight changes in a* parameters were noted. The total colour change (ΔE*) of control

meat products was significantly (P>0,05) higher compared to the products with sodium isoascorbate and oat addition (Table 1).

Table 1. Hunter colorimetry and colour stability of meat products stored at 4°C

Sample		Colour parameter			ΔE*
		L*	a*	b*	
PC	*1 day*	70,26[a]	4,58[a]	13,90[a]	-
	15 days	69,01[a]	5,98[a]	13,14[a]	2,03[a]
	30 days	70,40[a]	6,60[b]	11,21[a]	3,37[a]
PSA	*1 day*	69,16[a]	11,09[c]	11,43[a]	-
	15 days	68,78[a]	10,87[c]	11,82[a]	0,58[b]
	30 days	69,24[a]	10,92[c]	11,48[a]	0,20[d]
PO1	*1 day*	69,15[a]	10,74[c]	11,11[a]	-
	15 days	68,89[a]	11,23[c]	11,97[a]	1,02[c]
	30 days	69,14[a]	10,62[c]	11,84[a]	0,73[c]
PO2	*1 day*	68,89[a]	10,48[c]	12,23[a]	-
	15 days	68,51[a]	10,71[c]	12,32[a]	0,46[b]
	30 days	69,16[a]	10,45[c]	11,85[a]	0,47[b]

Averages marked with the same letters are not significantly different (P>0,05)

Lipid oxidation. The addition of sodium isoascorbate and oat preparation had an effect on TBARS values (Figure 1). After 15 and 30 days since the production, the rate of TBARS values was higher for control sample than for the samples with the sodium isoascorbate and oat preparation addition. Slight differences in TBARS values for PSA, PO1 and PO2 samples during 30 days of storage were noted. The acid number evaluation showed that the control characterized the highest acid number value after 30 days since the production.

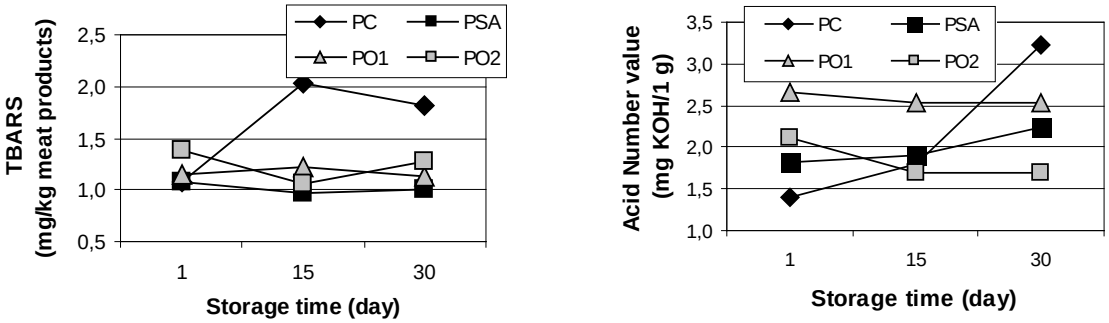

Figure 1. Lipid oxidation of meat products stored at 4°C

Conclusions

The addition of oat and sodium isoascorbate affected the changes of oxidation stability of comminuted meat products. The result indicated that oat preparation and sodium isoascorbate reduced lipid oxidation, and maintained redness (a* value). It is suggested that natural antioxidants which are present in oat grains prevented myoglobin formation and lipid oxidation.

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