EFFECTS OF NITRITE LEVELS, COOKING TEMPERATURE AND STORAGE TIME ON THE PINK COLOR DEVELOPMENT IN TURKEY ROLLS

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ABSTRACT

In this study, the effects of nitrite levels (3ppm, 5ppm), end point cooking temperature (75°C,85°C) and storage (+4°C for 13 days) on pink color development in turkey rolls were evaluated. At 13 days of storage period on 0th, 4th, 8th and 13th days nitrosoheme pigment, total pigment, residual nitrite and color parameters were measured and sensory color evaluation were done on samples. During storage period, pink color development was observed in all samples, intensity of pinkness in control samples were lower than the samples containing 3 ppm and 5 ppm $NaNO_2$.

Key words: Sodium nitrite, cooking temperature, pink defect, turkey roll

Introduction

A pink color defect is a sporadic problem that affects cooked, uncured meat products (Serdaroğlu and Değirmencioğlu, 1998).) A pink color defect, variously characterized as pink spot or pink ring cause unacceptance of product (Ahn ve Maurer, 1990). Pigment concentration and pigment form of meat (Froning et al, 1968), presence of nitrite and nitrate (Nash et al.,1985), cytochrome c (Ahn and Maurer,1990), cooking methods (Helmke and Froning, 1971; Ghorpade and Cornforth, 1993), preslaughter stress (Babji et al., 1982) and additives (Schwarz et al., 1999; Slesinski et al., 2000) used in product formülation can cause a pink color in poultry meat.

The aim of this study was to investigate the effects of two different cooking temperatures (75°C, 85°C), nitrite added 3ppm and 5 ppm and 13 days of storage period on pink color development in turkey rolls.

Materials and Methods

Turkey rolls were prepared with turkey breast meat, 1.5 % salt, 0.5% STPP. 3 ppm and 5 ppm sodium nitrite and %10 distilled water. Mixture was divided into 3 groups. 3 ppm sodium nitrite (Carlo Erba Reagent) added to first group and 5 ppm sodium nitrite added to second group. Third group was evaluated as a control and no added nitritre. Sodium nitrite was desolved in distilled water to obtain homogen distribution in roll batter. The batter mix was stuffed into cellulosic salami casings (80 mm diameter) and cooked in an electric oven set at 220°C until an internal temperature of 75°C and 85°C was reached. Samples were stored at +4°C for 13 days. On 0th, 4th, 8th and 13th days nitrosoheme pigment (Hornsey, 1956), total pigment (Heaton et al., 2000), residual nitrite (AOAC, 1990) and color were measured and sensory evaluations were done on samples. And also chemical analysis (Moisture AOAC, 1990; protein, Anon, 1979; fat, Flynn and Bramblett, 1975, pH, Landvogt, 1991) in turkey breast meat were carried out.Data were analyzed by ANOVA using general linear model (GLM) procedure of SPSS V.8 (1997) with a significance level of $p=0.05$.

Results

Chemical analysis showed that raw turkey breast contained 75.4% moisture, 22.0 % protein, 2.1% fat and 1.2 % ash and pH was recorded 5.98. Nitrosoheme pigment levels of samples cooked at 75°C ranged from 8.62 ppm to 26.32 ppm and ranged 8.61 ppm and 17.99 ppm (Fig1). For each nitrite level higher nitrosoheme pigment were found in rolls cooked at 75°C. This results indicate that high cooking temperature as 85°C resulted effective myoglobin denaturation. Helmke and Froning (1971) found that increased reddening may become particularly important when endpoint temperatures were below 71°C and suggested that myoglobin may be only partially denatured upon cooking. Nitrosoheme pigment was significantly decreased in all trial groups at the end of the storage (13th day). Nitrite level was not found effective on nitrosoheme concentrations, our results showed that control samples cooked at 75°C and 85°C also had 8.62 ppm and 8.61 ppm nitrosoheme pigment respectively. This results indicate that there could be a nitrite or nitrate contamination from water supply, diet or exhaust gases to turkey meat. Addition of $NaNO_2$ caused an increment in total pigment concentration. At two different endpoint cooking temperatures, nitrite treated samples had higher total pigment levels (Fig.2). High total pigment levels in control samples probably due to presence of salt and phosphate in roll formulation. No residual nitrite was detected in any of the samples. L* values were not affected by storage period but addition of $NaNO_2$ and final cooking temperature affected L* values of turkey rolls (Table1). Lower L* values were recorded for control samples when compared nitrite treated samples. Increasing endpoint cooking temperature resulted lower a* values ($p<0.05$). This results indicate that effective cooking can minimise the pink discoloration on turkey meat. Different end point cooking temperature and addition of $NaNO_2$ did not result significant differences in b* values. During storage period, b* values of all samples significantly decreased ($p<0.05$). These results confirmed with sensory evaluation results. Panel members could not detect the effect of endpoint cooking temperature on pink colour development. (Figure 3).

Conclusion

3 ppm nitrite resulted pink defect in cooked turkey rolls. Increasing endpoint temperature, may be useful to minimize pink defect. Intensity of pink defect in control samples were lower than the nitrite-treated samples. Pink defect was also observed in control samples at the end of the storage period. More work is needed to determine the effects of diet, environmental and processing conditions.

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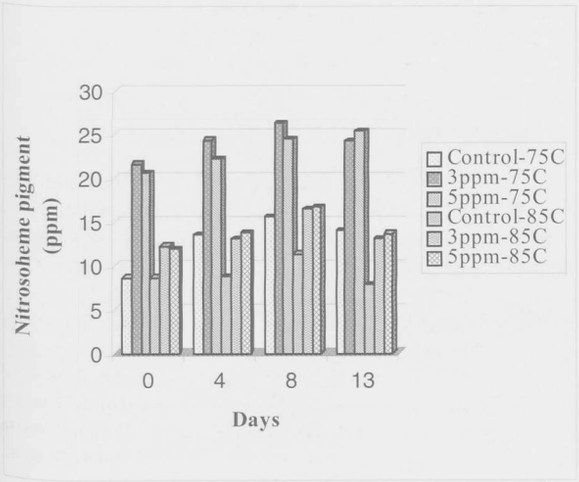

Figure 1. Effects of endpoint cooking temperature and nitrite levels on nitrosoheme pigment

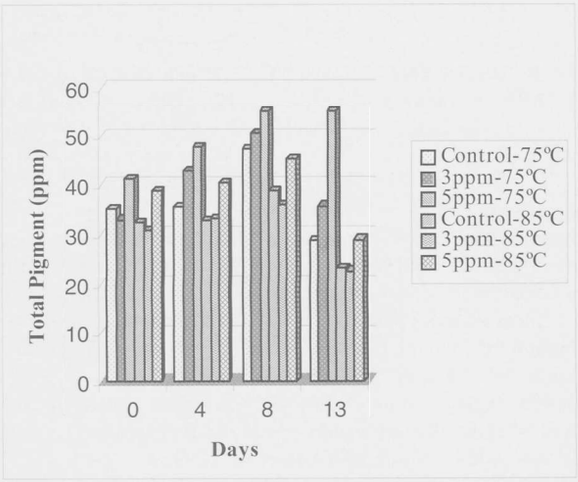

Figure 2. Effects of endpoint cooking temperature and nitrite level on total pigment.

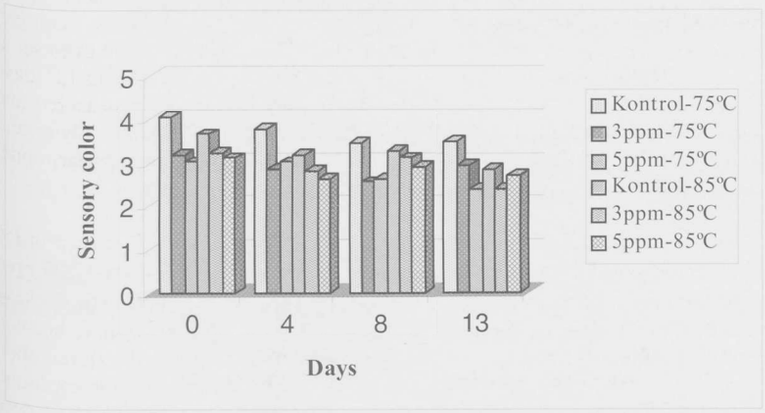

Figure 3. Sensory color scores of turkey rolls

Table 1. Effects of nitrite level and endpoint cooking temperature on L*, a* and b* values

	Treatment groups		Storage period (day)			
			0	4	8	13
L*	75°C	Control	73.45[a]	70.99[a]	68.04[a]	67.98[a]
		3 ppm	77.08[a]	74.94[a]	74.27[a]	74.37[a]
		5 ppm	76.17[a]	74.65[a]	74.24[a]	72.64[a]
	85°C	Control	76.35[a]	74.97[b]	74.58[b]	74.62[b]
		3 ppm	76.59[a]	76.21[b]	75.50[b]	74.87[b]
		5 ppm	77.22[a]	75.83[b]	76.74[b]	75.22[b]
a*	75°C	Control	7.97[b]	9.30[b]	9.65[a]	9.10[b]
		3 ppm	8.35[b]	9.44[b]	9.87[a]	9.03[b]
		5 ppm	8.95[b]	10.03[b]	10.81[a]	10.26[b]
	85°C	Control	8.00[b]	9.11[b]	9.12[a]	8.44[b]
		3 ppm	7.23[b]	7.94[b]	8.73[a]	8.46[b]
		5 ppm	7.67[b]	7.87[b]	8.38[a]	8.04[b]
b*	75°C	Control	12.30[a]	10.22[b]	10.12[b]	11.08[b]
		3 ppm	11.21[a]	10.12[b]	9.04[b]	10.64[b]
		5 ppm	11.63[a]	10.11[b]	9.35[b]	10.05[b]
	85°C	Control	12.02[a]	10.17[b]	9.49[b]	10.59[a]
		3 ppm	11.92[a]	11.19[b]	10.80[b]	11.08[a]
		5 ppm	12.38[a]	11.17[b]	10.90[b]	12.17[a]

[ab]Means in the same row within each samples, with different letters differ significantly ($P<0.05$).