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The Effects of Ascorbic Acid, Rosemary Extract and α-tocopherol/Ascorbic Acid on some Quality Characteristics of Chicken Patties Stored at 4°C for 7 Days

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Abstract: The effects of using ascorbic acid (AA), rosemary extract (RE) and α-tocopherol/ ascorbic acid mixture (T/AA) on some quality characteristics of cooked chicken patties were evaluated. On 0th , 2nd , 5th and 7th days of storage at 4°C, TBA, non-heme iron content and colour parameters were measured and flavour evaluation was performed. RE treatment showed lower lipid oxidation than other treatments. Non-heme iron content indicated no differences during storage periods and among formulations. No significant differences were recorded for L*, b* and CH values in chicken patties. In all treatments a* values decreased during the storage except samples treated with AA. On 7th day RE treatment had the highest flavour scores.

Key words: Ascorbic acid, rosemary,α-tocopherol, chicken patty

Introduction

Development of rancidity in ground precooked muscle foods, is a serious problem in food industry. The susceptibility of precooked meat products to lipid oxidation depends on a number of factors. Differences between various types of meat could be explained by differences in the concentrations of polyunsaturated fatty acids, iron and α-tocopherol contents (Mielche and Bertelsen, 1994). Effective control methods against lipid oxidation include processing by minimizing the loss of natural tocopherols and using antioxidant additives (Frankel,1996). However consumers have expressed an interest in reduced use of chemical additives with many segments of the food industry responding by use of natural ingredients. Using of natural antioxidants offers the potential advantages of a reduction and replacement of synthetic antioxidants, lowered assumed toxicity due to their natural origin as components of foods, enhanced masking of off-flavours arising from oxidation and greater consumer acceptability as natural ingredients in foods (Boyd *et al.*, 1993). Vitamin E and C are the most common used natural antioxidants (Kim *et al.*, 1997). Rosemary, sage, fenugreek, mulberry, citrus juice concentrates, cherry, oilseed products, maillard reaction products and carnosine have antioxidant properties (Serdaroğlu and Yildiz-Turp, 1997).

Extracts of rosemary are considered as effective alternative to chemical antioxidants. Rosemary extracts contain many compounds with antioxidant properties such as rosmaridiphenol, rosmariquinone, rosmanol and carnosol which probably function as free radical scavengers similar to BHA and BHT (Ho *et al.*, 1995).

α-tocopherol behaves as a chain breaking anioxidant (Frankel, 1996). Localization of α-tocopherol in the membranes allows it to function very efficiently compared to other antioxidants (Lauridsen *et al.*, 1997). The synergist effects of ascorbate and tocopherol has been evaluated by several researchers (Mitsumoto *et al.*, 1991 and Yin *et al.*, 1993). The primary objective of our study was to evaluate the effects of ascorbic acid, rosemary extract, α-tocopherol /ascorbic acid on lipid oxidation in chicken patties during cold storage.

Materials and Methods

Deboned chicken thighs, breasts, trimmings and skin were obtained from a local meat processing plant. After all visible fat was removed, the white and dark meat and cooked (95°C ± 2 for 10 min) were ground through 1 cm. plate. The patties were formulated with 40% breast meat, 30% thigh meat, 15% skin and 14% trimmings. Mixture was divided into 4 equal batches. Three different additives were used (i) 300 ppm. rosemary extract (Dragoco 9/037174), (ii) 500 ppm. L (+) ascorbic acid (Merck 5.00074.0100), (iii) 200 ppm. (+)-α-tocopherol (Sigma, Type V from vegetable oil T-3634)/ 500 ppm. L (+) ascorbic acid (Merck 5.00074.0100). Additives were mixed with 1% NaCl before used to obtain homogenous distribution in batter. 1% NaCl salt was added in order to obtain a control batch.

Table 1: Antioxidants added to ground chicken mix

Batch No	Additive
1	1%NaCl (contol)
2	Rosemary extract 300 ppm + 1% NaCl
3	L (+) Ascorbic acid 500 ppm + 1%NaCl
4	(+)-α-tocopherol 200 ppm + L(+) ascorbic acid 500 ppm + 1%NaCl

Table 2:Colour parameters results of patties stored at 4°C for 7 days

Treatment	Hunter Values	Day 0	Day 2	Day 5	Day 7
AA	L*	72.0	73.6	71.1	70.6
	a*	2.1	2.1	2.7	3.2
	b*	13.9	13.7	13.6	14.2
	CH	14.0	13.8	13.9	14.6
	H	81.5	81.1	78.7	77.1
RE	L*	72.2	71.6	68.9	70.3
	a*	1.9	1.9	2.2	1.9
	b*	14.1	13.0	14.0	13.2
	CH	14.3	13.1	14.2	13.4
	H	82.1	81.7	80.9	81.8
α-T/AA	L*	68.9	72.8	71.4	72.2
	a*	1.7	2.2	2.9	2.9
	b*	12.9	13.9	14.0	14.4
	CH	12.9	14.1	14.4	14.7
	H	82.6	80.9	78.2	78.4
C	L*	68.5	74.0	70.1	72.6
	a*	1.9	2.2	2.3	2.8
	b*	13.8	14.0	13.9	13.4
	CH	13.9	14.2	14.1	13.7
	H	81.8	81.1	80.7	78.3

5 kg batches of appropriate amounts of each formulation was mixed by hand and processed into chicken patties by using metal shaper. Moisture (AOAC 1990), fat (Flynn and Bramblet, 1975), protein (Anon,1979) and ash analysis (AOAC 1990) were done on raw patty mixtures to evaluate the proximate composition. Patties were cooked in an electric oven to internal temperature of 75°C and stored at 4°C for 7 days in polypropylene boxes with lids. On 0th , 2nd , 5th and 7th days of storage samples were removed and heated in grill for10 min. at each side with medium heat, before the analyses. TBA was determined by the distillation method according to Tarladgis *et al.* (1960). Non-heme iron content of samples was measured according to Schricker *et al.* (1982). CIE color parameters (L*, a*, b*,CH,H) of cooked patties were measured by Datacolor 3881 Texflash Spectrophotometer. Patties were divided horizontally and internal colour parameters were recorded.

Sensory evaluation for oxidize flavor was carried out by 8 trained panelists. Patties were heated in the grill for 10 min. at each side with medium heat before serving to the panel. For evaluation of oxidize flavor, scoring test was applied (Kramer and Twigg, 1970). All samples were evaluated using a 5 point scale with 1 = very strong oxidized flavour and 5 = no detectable oxidized flavour. All analyses were performed in duplicate with the entire experiment replicated twice. Data was evaluated by ANOVA, Duncan Test with TARIST computer programme (Açikgöz, 1993).

Results and Discussion

Moisture contents of patties were ranged from 67.9 to 68.9%, fat contents ranged from 13.4 to 14.6%, protein contents ranged from 18.1 to 18.9% and ash contens ranged from 1.4 to 1.7%. Changes in TBA values were given in Fig. 1. TBA values increased in all treatments during the storage period. On 0th and 2nd day, no significant differences were found between TBA values of treatments however on day 5th , TBA values were higher in C treatment and AA treatment than RE and α-TA/A treatments. Antioxidative effect of rosemary has been demonstrated by other researchers (Cavoski *et al.*, 1991; Liu *et al.*, 1992 and Ho *et al.*, 1995). α-TA/AA mixture retarded lipid oxidation during storage. This effect was expected due to the synergist effect of ascorbic acid with α - tocopherol. Several researchers reported strong antioxidative effect of ascorbic acid and tocopherol mixtures. (Mitsumoto *et al.*, 1991 and Yin *et al.*, 1993).

After 7 days of storage, patties with AA had TBA values similar with C samples. AA was completely ineffective in preventing oxidation and showed a prooxidation effect. Similar to our results Benedict *et al.* (1975) and, Bruun-Jensen *et al.* (1996) reported the prooxidative effect of ascorbic acid in ground meat. RE was the most effective additive on inhibition of lipid oxidation.

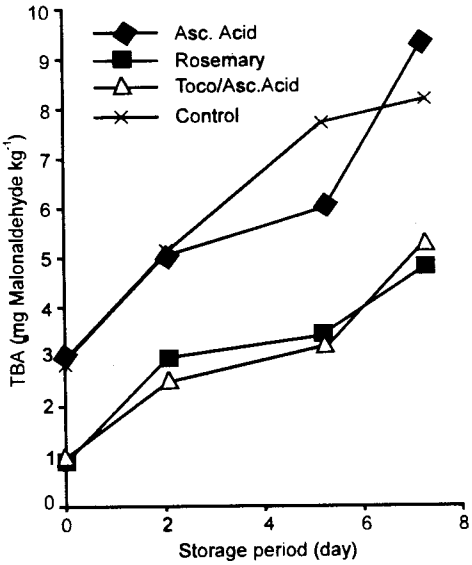

Fig. 1: TBA values of samples stored at 4°C for 7 days(mg ma kg^{-1})

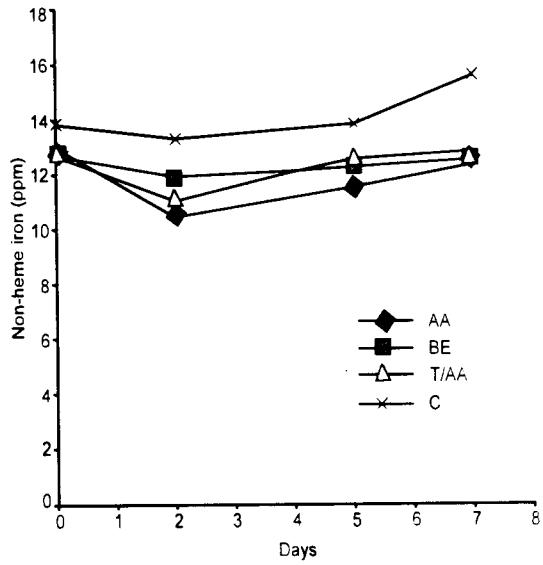

Fig. 2: Non-heme iron content of samples stored at 4°C for 7 days

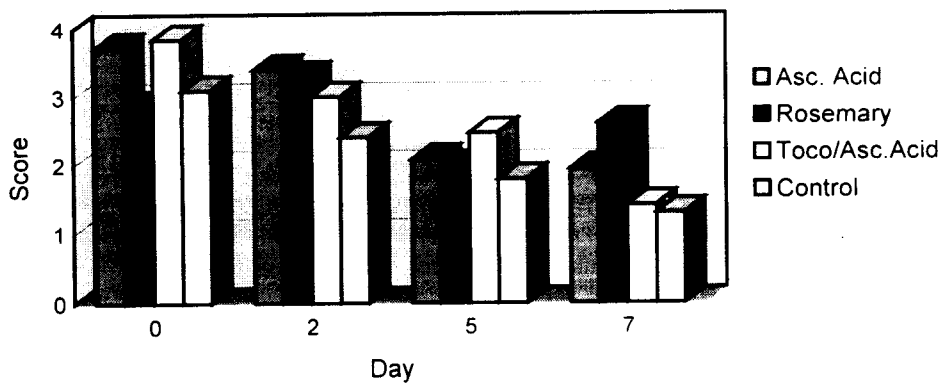

Fig. 3: Flavour scores of patties stored at 4 for 7 days

Changes in non-heme iron content of samples are shown in Fig. 2. Significant role of non-heme iron in accelerating lipid oxidation has been demonstrated by several researchers (Sato and Hegarty,1971 and Igene *et al.*, 1979). Non-heme iron content increased in all treatments, but no differences were recorded between the treatments. Cooking causes the releasing the iron from myoglobin and thereby indirectly accelerates development of oxidation (Igene *et al.*, 1979).

Colour parameters were in Table2.No significant differences were recorded for L*, b* and CH values of samples. a* values of all samples except AA treatment decreased during the storage period. On 7th day, the highest a* value and the lowest H value was found in AA treated samples. Ascorbic acid caused decrement myoglobin oxidation and increased the colour stability of chicken patties. The effect of ascorbic acid on colour stability of beef (Mitsumoto *et al.*, 1991 and Kim *et al.*, 1997) and minced beef (Demos *et al.*, 1996) was recorded. In contrast to our findings, Benedict *et al.* (1975) reported that 0.005 % ascorbic acid increased metmyoglobin formation in beef. H values were found higher in RE treated samples on 7th day. The green colour of rosemary extract probably could have changed the colour of chicken patties. Flavour scores of patties stored at 4°C for 7 days were given in Fig. 3. On 0th day, the lowest score was recorded in RE treated samples. Specific flavour of rosemary probably caused decrement in flavour scores. Butler and Larick (1993) reported similar findings in their research on rosemary

oleoresin in beef gels. On 0th , 2nd and 5th , days of storage there were no significant differences in flavour scores of samples, however off-flavour sourced by lipid oxidation could be easily detected by the panel in AA treated samples on the last day. The highest flavour score was found in RE samples at the end of the storage period, due to the strong antioxidative effect of rosemary extract. Huisman *et al.* (1994) also reported depressive effect of rosemary on warmed-over flavour in precooked pork meatballs during storage.

Conclusion

Results indicated that using α-tocopherol /ascorbic acid mixture and rosemary extract in chicken patties during storage at 4°C for 7 days, slowed down the lipid oxidation effectively. Ascorbic acid was found completely ineffective in preventing lipid oxidation and showed a prooxidative effect. Ascorbic acid increased the colour stability of patties, but rosemary extract had negative effect on patty colour. Rosemary extract could be used in precooked chicken patties as an antioxidant.

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