

# ANTIOXIDANT AND ANTIMICROBIAL EFFECT OF DEHYDRATED AND FRESH GARLIC IN FRESH PORK PATTY DURING REFRIGERATED STORAGE

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## Introduction

Sensorial factors, such as appearance, taste and color may affect the food palatability. Especially, oxidative products produced by microbial spoilage or lipid oxidation deteriorate palatability because it may reduce quality and safety of meat and meat products. Thus, researches related to natural or synthetic antioxidants for inhibition of oxidative deterioration have been widely performed. Synthetic antioxidants can delay lipid oxidation, however they were limited as additive agents in food system because they may have many hazard factors in health. Therefore, antioxidants and antibiotics derived from natural sources are perceived to consumers and better and safer than synthetics. The objective of this study was to evaluate antioxidant and antimicrobial activity of dehydrated and fresh garlic in fresh pork patty.

## Materials and Methods

Fresh pork hams slaughtered one day ago were purchased from a wholesale market. Pork patties were manufactured with raw meat (785 g), back fat (200 g), salt (15 g), dehydrated garlic (5 or 10 g) and fresh garlic (13.9 or 27.8 g). Hunter L, a, b values were measured using Chroma Meter (CR-200, Minolta Co., Ramsey, NJ). Thiobarbituric acid reactive substance (TBARS) values were followed by method of Witte et al. (1970). Oxidative products (volatile compounds) were extracted by solid phase-microextraction (SPME) technique. Extracted oxidative products were quantitatively and qualitatively analyzed by GC and GC – MS. Total plate count (TPC), violet red bile (VRB) and Man Rogosa Sharpe (MRS) agar were used to determine total bacterial counts, *Enterobacteriaceae* and lactic acid bacteria, respectively. The experiment was replicated triplicates, and data were analyzed using one-way analysis of variance in SPSS 12.0 software. Means were separated by the Duncan's multiple range tests.

## Results and Discussion

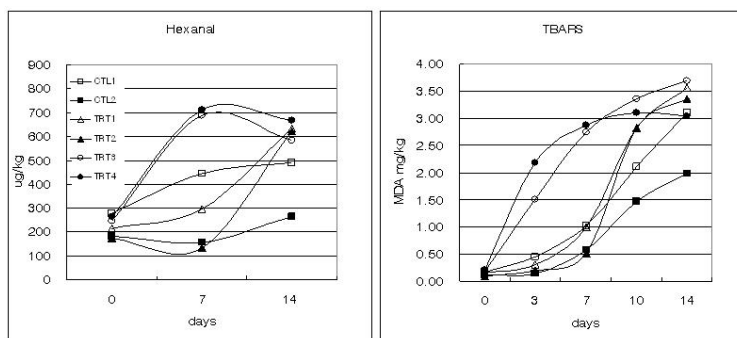
Hunter a values were decreased with increased with garlic content or increased storage time, regardless of type (Table 1). Differences in Hunter b values between control and garlic treatment became apparent, as the storage time increased. TBARS values were increased with increased storage time in all treatments, and patties containing garlic had higher TBARS values than controls. Also, the amount (ug/kg) of hexanal, which has widely used as an index to assess the degree of lipid oxidation, was also increased with garlic content (Figure 1). Ide et al. (1999) studied antioxidant effects of aged garlic extract and reported that allicin significantly increased low density lipoprotein (LDL) oxidation. Thus, these results may be partially due to the production of allicin induced from garlic during storage. In microbiological data (Figure 2), it took approximately 3 wks to reach the total plate counts (TPC) of  $10^7$  log cfu/g in CTLs, TRT1 and 2, and 4 wks in TRT3 and TRT4, respectively. Microbial counts of *Enterobacteriaceae* were continuously increased with storage time. The fresh garlic had better antimicrobial effect than others. However, lactic acid bacteria detected more in patties with fresh garlic than others.

**Table 1.** Changes of Hunter L, a, b and TBARS values of pork patties with dehydrated and fresh garlic during storage at 4°C

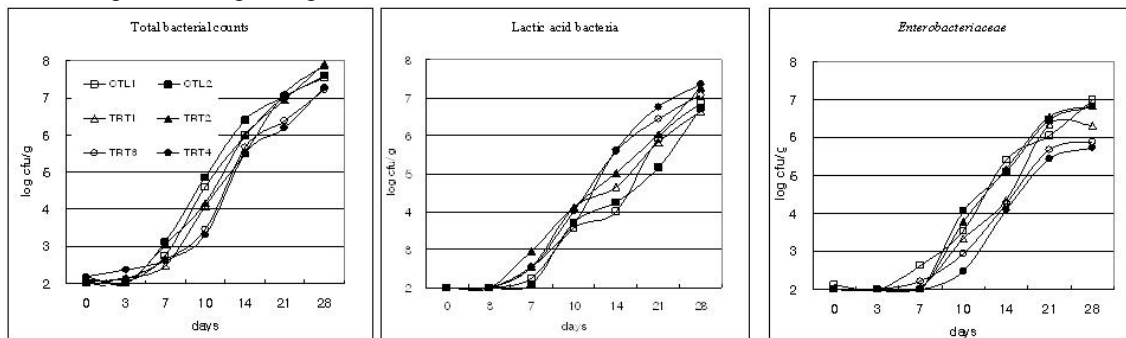
Treatments <sup>1</sup>	Storage time (days)					
	0	3	7	10	14	
L	CTL1	65.89 <sup>b</sup>	68.16 <sup>a</sup>	67.59 <sup>ab</sup>	68.12 <sup>a</sup>	69.58 <sup>a</sup>
	CTL2	64.33 <sup>b</sup>	67.64 <sup>a</sup>	67.87 <sup>a</sup>	68.69 <sup>a</sup>	69.22 <sup>a</sup>
	TRT1	65.49 <sup>c</sup>	65.93 <sup>bc</sup>	68.20 <sup>a</sup>	68.46 <sup>a</sup>	67.33 <sup>ab</sup>
	TRT2	66.14	67.09	67.21	67.24	69.20
	TRT3	65.14	67.87	69.64	69.60	70.47
	TRT4	65.81	69.77	71.48	69.80	69.30
	a	CTL1	13.78 <sup>aA</sup>	11.60 <sup>bA</sup>	10.60 <sup>bcA</sup>	9.59 <sup>cA</sup>
CTL2		13.27 <sup>aA</sup>	11.76 <sup>bA</sup>	10.79 <sup>bcA</sup>	9.66 <sup>cdA</sup>	8.49 <sup>dA</sup>
TRT1		11.23 <sup>aB</sup>	9.18 <sup>bB</sup>	8.04 <sup>cB</sup>	7.09 <sup>dB</sup>	6.04 <sup>eB</sup>

	TRT2	8.78 <sup>aC</sup>	6.49 <sup>bC</sup>	6.28 <sup>bcC</sup>	5.47 <sup>cdC</sup>	4.88 <sup>dB</sup>
	TRT3	8.68 <sup>aC</sup>	6.98 <sup>bC</sup>	5.68 <sup>bcC</sup>	4.63 <sup>cdC</sup>	4.28 <sup>cC</sup>
	TRT4	6.49 <sup>aD</sup>	5.19 <sup>abD</sup>	4.23 <sup>bd</sup>	3.70 <sup>bd</sup>	3.73 <sup>bc</sup>
<hr/>						
b	CTL1	12.40 <sup>BC</sup>	12.61	12.80 <sup>BC</sup>	13.06 <sup>BC</sup>	12.94 <sup>BC</sup>
	CTL2	12.06 <sup>C</sup>	12.17	11.94 <sup>C</sup>	12.96 <sup>C</sup>	12.64 <sup>C</sup>
	TRT1	12.77 <sup>ABC</sup>	13.14	13.22 <sup>BC</sup>	14.22 <sup>AB</sup>	14.34 <sup>AB</sup>
	TRT2	13.31 <sup>bAB</sup>	13.40 <sup>b</sup>	14.62 <sup>aA</sup>	15.01 <sup>aA</sup>	15.29 <sup>aA</sup>
	TRT3	13.24 <sup>bAB</sup>	13.32 <sup>b</sup>	13.62 <sup>bAB</sup>	14.18 <sup>abAB</sup>	15.03 <sup>aA</sup>
	TRT4	13.71 <sup>A</sup>	13.67	13.76 <sup>AB</sup>	14.88 <sup>A</sup>	15.30 <sup>A</sup>
<hr/>						
TBARS (MDA mg/kg)	CTL1	0.17 <sup>d</sup>	0.45 <sup>cdC</sup>	1.02 <sup>cB</sup>	2.11 <sup>bBC</sup>	3.11 <sup>aA</sup>
	CTL2	0.11 <sup>c</sup>	0.14 <sup>cC</sup>	0.57 <sup>cB</sup>	1.47 <sup>bC</sup>	1.98 <sup>aB</sup>
	TRT1	0.16 <sup>c</sup>	0.31 <sup>bcC</sup>	1.00 <sup>bB</sup>	2.82 <sup>aAB</sup>	3.56 <sup>aA</sup>
	TRT2	0.09 <sup>b</sup>	0.19 <sup>bC</sup>	0.51 <sup>bB</sup>	2.83 <sup>aAB</sup>	3.36 <sup>aA</sup>
	TRT3	0.18 <sup>d</sup>	1.50 <sup>cB</sup>	2.75 <sup>bA</sup>	3.36 <sup>abA</sup>	3.69 <sup>aA</sup>
	TRT4	0.20 <sup>c</sup>	2.18 <sup>bA</sup>	2.88 <sup>aA</sup>	3.11 <sup>aA</sup>	3.04 <sup>aA</sup>

<sup>a-e</sup>Means with a same superscript within a same row are not different ( $P > 0.05$ ). <sup>A-D</sup>Means with a same superscript within a same column are not different ( $P > 0.05$ ). Treatments<sup>1</sup>: CTL1 = control; CTL2 = with BHT; TRT1 = with dehydrated garlic 5 g; TRT2 = with dehydrated garlic 10 g; TRT3 = with fresh garlic 13.9 g; TRT4 = with fresh garlic 27.8 g



**Figure 1.** Change of hexanal and TBARS values in pork patties with dehydrated and fresh garlic during storage time at 4 °C. (CTL1- TRT4 = same as Table 1)



**Figure 2.** Change of microbiological of pork patties with dehydrated and fresh garlic during storage time at 4 °C. (CTL1- TRT4 = same as Table 1)

## Conclusions

Patties containing fresh garlic had higher TBA values and hexanal level, as compared to the CTLs and dehydrated garlic. However, fresh garlic inhibited the growth of *Enterobacteriaceae*, resulting in showing antimicrobial effect and possible extension of the shelf-life. Further research will be performed to understand how the fresh garlic increased the TBA values and hexanal levels in patties during storage.

## References

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