COMPARISON TO BHT/BHA AND ASTAXANTHIN ON OXIDATION STABILITY OF COOKED PORK SAUSAGE DURING COLD STORAGE

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I. INTRODUCTION

The problems, associated with oxidation of meat products, have obtained much interest as they have related to loss of safety and nutritional value, flavor deterioration, and biological damage from oxide [1]. Accordingly, synthetic preservatives are commonly used in the meat processing industry. In recent research, it is one of the main goal to utilize natural antioxidants for substitution of synthetic sources, such as BHT and BHA because of negative opinions about the synthetic antioxidants by some human health professionals and consumers [2]. Astaxanthin is one of the obtained carotenoid from by-product of crustacean, algae, yeast and etc. Astaxanthin has higher antioxidant capacity than other carotenoids, such as lycopene, α-carotene, β-carotene and etc [3]. Additionally, the antioxidant capacity of astaxanthin was 10 to100 times more than other xanthin group and α-tocopherol [4]. However, information about the antioxidant activity of meat products using astaxanthin is very scarce. Therefore, the objective of this study was to evaluate the effect of astaxanthin on oxidation stability compare with synthetic antioxidants.

II. MATERIALS AND METHODS

The sausages were prepared with three different treatments. Each treatment was manufactured with three replicates. All treatments included to same amount of raw meat (67.7%), fat (20%), iced water (10%), salt (1.5%), phosphate (0.3%) and sugar (0.5%). The three different treatments consisted of non-added antioxidant (control), 0.02% BHT/BHA (1:1 mixed) and 0.102 mg astaxanthin. Then, sausages were cooked at 90°C for 1 h to an internal temperature of 75.5°C (CHS-76, Alto-Shaam Inc., FL, USA). After cooking, sausages were allowed to cool at 4°C for 2 h, and then packaged by using oxygen-permeable bags (polyethylene, Thai Griptech Co. Ltd., Bangkok, Thailand), and stored at 4°C for 4 weeks. The data were analyzed using the PROC ANOVA procedure with Duncan's multiple range test (p<0.05).

III. RESULTS AND DISCUSSION

On week 1, the pork sausage with control exhibited significantly higher hardness value than other treatments (p>0.05). Similarly, on week 4, the control sausage showed the highest hardness value, as compared with other treatments (p<0.05). Also, hardness in control and astaxanthin treated sausage were increased with the increasing of storage period except for BHT/BHA (p<0.05). Natural antioxidants could reduce the hardness of sausage by increasing emulsion stability [5]. On week 1, thiol content was significantly lower in control and astaxanthin added sausage (p<0.05). Again, thiol content of sausage with added astaxanthin was significantly higher than other treatments after week 4 (p>0.05). Furthermore, thiol content of all treatments had decreased with the increasing of storage period (p<0.05). The TBARS was significantly different in all treatments and storage periods (p<0.05). The TBARS value of control sausage in all storage periods was the highest among all treatments (p<0.05). However, with the increasing of storage period, TBARS of all treatments had increased (p<0.05). Interestingly, astaxanthin treated sausage exposed the lowest TBARS value during all storage periods. The natural antioxidants could lead to reduce the denaturation of disulfide cross-linking, and to protect the lipid oxidation in muscle membranes [6].

Table 1. Result of changes in thiol content, TBARS and hardness values with added BHT/BHA and astaxanthin in cooked pork sausage during cold storage.

Treatments	Storage periods (weeks)		
	1	4	SEM

Hardness (N)	Control	144.00^{Aa}	158.50^{Ab}	4.73
	Astaxanthin	129.07^{Bb}	137.67^{Ba}	5.90
	BHT/BHA	116.18^{B}	118.68^{C}	8.25
	SEM	8.03	4.55	
Thiol content (nmol/mg protein)	Control	61.77^{Aa}	32.53^{Bb}	1.64
	Astaxanthin	63.64^{Aa}	40.02^{Ab}	0.35
	BHT/BHA	73.85^{Ba}	35.02^{Bb}	1.58
	SEM	0.24	1.14	
TBARS (mg MDA/kg sample)	Control	0.47^{Ab}	1.15^{Aa}	0.22
	Astaxanthin	0.10^{Bb}	0.84^{Ba}	0.29
	BHT/BHA	0.06^{B}	0.78^{B}	0.01
	SEM	0.02	0.33	

$^{A-D}$Means with different superscript capital letters in a column within each treatments differ significantly (p<0.05).

$^{a-d}$Means with different superscript small letters in a row within at storage time differ significantly(p<0.05).

IV. CONCLUSION

This study shows that cooked pork sausage with added astaxanthin has exhibited the decreasing of lipid/protein oxidation, compared with control. Also, astaxanthin showed almost the same level of oxidation inhibition as BHA. Therefore, our findings can be stated that astaxanthin can substitute the synthetic additives, and it can also be used as natural antioxidant in processed meat products.

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