EFFECT OF RICE BRAN OIL REPLACEMENT ON LIPID AND PROTEIN OXIDATION OF PORK PATTIES DURING FROZEN STORAGE

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I. INTRODUCTION

There has been an increased interest in ways to reduce fat content in meat products. This is because high intake of foods consisting high level of saturated fatty acid composition is associated with various cancers and coronary heart disease [1, 2]. Animal-originated fat has relatively large amount of saturated fatty acid composition than vegetable oils. Thus, vegetable oils, such as olive, linseed, canola, grape seed, and sunflower oils have been received attention in meat products as an animal fat replacer [3]. However, the impact of formulating meat products with rice bran oil has not been fully studied to date. Moreover, the considerably high amount of polyunsaturated fatty acids in vegetable oil increases the oxidative instability in meat products, thus causing poor sensory quality. Therefore, the present study aims to investigate the influence of rice bran oil on lipid and protein oxidation in pork patties during frozen storage.

II. MATERIALS AND METHODS

Lean pork and back-fat were purchased from a commercial slaughterhouse at 48 h postmortem, and rice bran oil was purchased from a local market. Connective tissue and excess fat were trimmed and ground in a grinder through a 5-mm plate. The basic recipes contained the following ingredients: lean pork (79%), back-fat (10%, CON) or rice bran oil (10%, RBO), ice (10%), salt (1%), and sodium nitrite (0.007%). Pork and other ingredients were mixed in a mixer for 5 min and formed into patties (100 g each) using sterile dishes (15 × 90 mm). Pork patties were stored at -20℃ for 8 weeks, and then evaluated for lipid oxidation, protein oxidation and fatty acid composition. The processing of pork patties was run in quintuplicate for each treatment. Lipid oxidation was measured primary oxidation (conjugated dine: CD) and secondary oxidation (malondialdehyde: TBARS) [4].Protein oxidation was analyzed by the method of Liu and Xiong [5]. Protein oxidation was determined by measuring thiol group and total carbonyl content. Statistical analysis for data was performed using the SAS package (SAS Inst. Inc., USA). Data were subjected to analysis of variance using general linear model.

III. RESULTS AND DISCUSSION

Table 1 shows the results of fat and protein oxidation of pork patties during the frozen storage period. CD was significantly lower in RBO than in CON throughout the 8 weeks of storage ($p<0.0001$). However, TBARS did not present significant difference between CON and RBO during frozen storage ($p>0.05$). Both CD and TBARS were increased during 8 weeks of frozen storage ($p<0.01$). Thiol groups were decreased in both CON and RBO during storage ($p<0.01$), however there was no significant difference between the two groups ($p>0.05$) throughout the frozen storage. Total carbonyl content of CON was higher in 0 and 4 weeks of storage ($p<0.05$) than that of RBO. Figure 1 shows the changes of fatty acids, such as saturated (SFA), unsaturated (UFA), monounsaturated (MUFA), and polyunsaturated (PUFA) fatty acid in pork patties during 8 weeks of frozen storage. According to replacement of pork back-fat with rice bran oil, PUFA was increased ($p<0.0001$), while SFA was decreased. However, MUFA was not changed ($p>0.05$). Storage effect on fatty acid composition was not showed in both CON and RBO patties ($p>0.05$). Vegetable oils could accelerate the lipid or protein oxidation in meat products due to relatively high content of PUFA than animal fat [3], however rice bran oil did not increase the oxidative instability in pork patties in the present study.

Table 1. Changes of lipid and protein oxidations in pork patties during 8 weeks of frozen storage

Oxidation traits		Treatments	Storage weeks 0		4		8		Storage effect
Lipid oxidation	CD (mmoles/g sample)	CON	0.83^{c}	0.00	0.92^{b}	0.00	1.02^{a}	0.03	***
		RBO	0.60^{c}	0.01	0.72^{b}	0.00	0.92^{a}	0.01	***
		Replacing effect		***		***		***	
	TBARS (mg MDA/kg sample)	CON	0.01^{b}	0.00	0.012^{b}	0.00	0.024^{a}	0.00	**
		RBO	0.008	0.00	0.011	0.00	0.023	0.01	
		Replacing effect							
Protein oxidation	Thiol group (mmoles/ mg protein)	CON	3.20^{a}	0.41	0.29^{b}	0.12	0.11^{b}	0.00	**
		RBO	3.33^{a}	0.62	0.12^{b}	0.00	0.30^{b}	0.17	**
		Replacing effect							
	Total carbonyls (mmoles/ mg protein)	CON	0.61^{b}	0.01	0.98^{a}	0.03	1.00^{a}	0.08	***
		RBO	0.53^{c}	0.02	0.78^{b}	0.06	0.97^{a}	0.07	***
		Replacing effect		**		*			

Significance level: *, $p<0.05$; **, $p<0.01$; ***, $p<0.0001$.
CON, back-fat 10%; RBO, rice bran oil 10%.

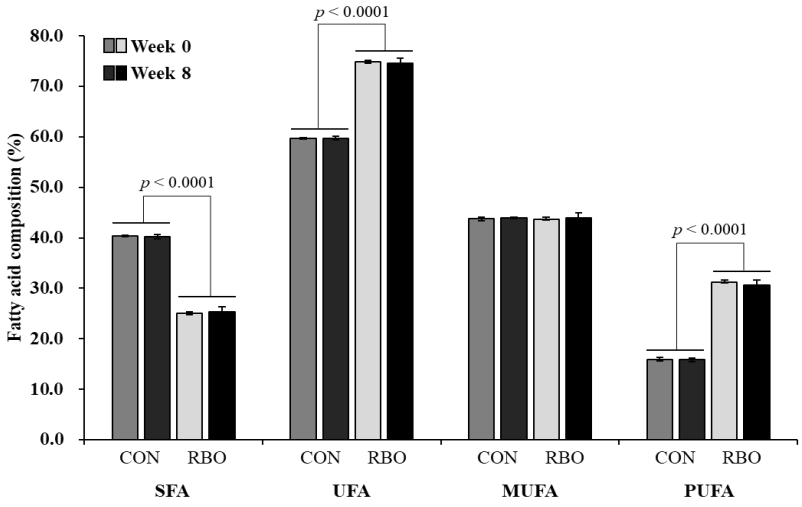

Figure 1. Changes of fatty acid compositions in pork patties during 8 weeks of frozen storage. CON, 10% back-fat; RBO, 10% rice bran oil; SFA, saturated fatty acid; UFA, unsaturated fatty acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid.

IV. CONCLUSION

Replacement of pork back-fat with rice bran oil did not affect acceleration of lipid and protein oxidation in pork patties. Therefore, rice bran oil could be used in pork patties to improve fatty acid composition without increase of the oxidative stability.

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