EFFECTS OF REPLACING PORK BACK FAT WITH CORN OILS AND SEA MUSTARD FIBER ON QUALITY OF REDUCED-FAT PATTIES

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Abstract – The effects of reducing pork fat levels by partially replacing pork back fat with a mix of corn oil and sea mustard fiber were investigated based on quality characteristics of reduced-fat patties. The moisture and ash contents were higher in reduced-fat patties samples containing corn oil and sea mustard fiber than in the control. The results showed that reduced-fat patty samples with higher corn oil levels were no significantly moisture content, protein content, ash content, and sensory characteristics. Cooking loss, reduction in diameter, and reduction in thickness of the high-fat (25%) control samples were significantly higher than reduced-fat patties containing corn oil and sea mustard fiber. Thus, the results of this study show that incorporating corn oil and sea mustard fiber into the formulation successfully reduced pork back fat in patties, while improving quality.

Key Words – Reduced-fat, Dietary fiber, Corn oils, Sea mustard, Patties

I. INTRODUCTION

The traditional meat patties may contain up to 25% pork back fat. Pork back fat in meat products plays a major role in reducing cooking loss, improving water holding capacity and binding properties, and providing juiciness and hardness to the meat products [1]. Also, nutritional value of pork back fat is a source of energy and essential fatty acids, and as carriers of fat soluble vitamins [2]. However, diets with high pork back fat contents such as saturated fatty acids and cholesterol have been associated to the increased incidence of obesity, hypertension, coronary heart diseases, and cardiovascular diseases. Thus, manufacturers have reduced the fat content of meat products, typically by replacing vegetable oils for animal fat.

Corn is one of the four major annual oil seed crops produced in the world. Corn oil is an excellent source of essential fatty acids required by the human body, has a higher ratio of unsaturated to saturated fatty acids than animal fats [3]. However, the use of corn oils does not seem technologically suitable due to different physical properties.

Among the seaweed sources of dietary fiber, sea mustard contains many valuable substances such as dietary fiber, proteins, minerals, and vitamins required for human health [4]. The important component of dietary fiber in sea mustard has been known to prevent obesity, hypertension, coronary heart diseases, and cardiovascular diseases. Also, dietary fiber has been added to meat products to diminish problems caused by fat reduction since reduced-fat meat products.

The primary objective of this study was to investigate the effect of replacing pork back fat with corn oils emulsified by sea mustard fiber on the quality characteristics of reduced-fat patties.

II. MATERIALS AND METHODS

1. Preparation and processing of sea mustard fiber extract

Dietary fiber was extracted using the modified AOAC enzymatic-gravimetric method [5].

2. Patties preparation and processing

Fresh chicken breast meat, pork back fat, and corn oil were purchased from a local processor. Six different patties were produced (Table 1). The patties were processed using the methods previously described in Choi *et al*. [6].

Table 1. Patties formulations with varying corn oil and sea mustard levels (units: %)

Ingredients	Treatments					
	Con	T1	T2	T3	T4	T5
Chicken meat	65	65	65	65	65	65
Pork back fat	25	20	20	15	10	5
Corn oil	-	-	-	5	10	15
Ice	10	15	13	13	13	13
Sea mustard fiber	-	-	2	2	2	2
Total	100	100	100	100	100	100
Salt (NaCl)	1.5	1.5	1.5	1.5	1.5	1.5
Phosphate	0.15	0.15	0.15	0.15	0.15	0.15
Garlic powder	3.0	3.0	3.0	3.0	3.0	3.0
Onion powder	3.0	3.0	3.0	3.0	3.0	3.0
Ginger powder	0.7	0.7	0.7	0.7	0.7	0.7
Isolated soy protein	1.5	1.5	1.5	1.5	1.5	1.5
Sugar	0.8	0.8	0.8	0.8	0.8	0.8

3. Analysis of reduced-fat patties

To evaluate the physicochemical properties, the proximate composition [5], cooking loss, and reduction in diameter and thickness, and sensory evaluation were examined.

III. RESULTS AND DISCUSSION

The proximate composition of the reduced-fat patties formulated with various percentages of added corn oil and sea mustard fiber are given in Table 2. The moisture content of the reduced-fat patties containing corn oil and sea mustard fiber was higher than those of control ($P < 0.05$), but did not differ significantly between treatments with corn oil and sea mustard fiber ($P > 0.05$). The protein content of reduced-fat patty samples did not display any statistical difference compared to the control ($P > 0.05$). The fat content of control was 24.38% but reduced-fat patties were 15.89 to 18.35%. The ash content of the patties was higher in formulated with corn oil and sea mustard fiber than those control, because sea mustard fiber contains minerals and vitamins.

Table 2. Effects of proximate composition of reduced-fat patties formulated with varying corn oil and sea mustard fiber levels

Treatments[A]	Proximate composition (%)			
	Moisture	Protein	Fat	Ash
Con	61.79^{b}	21.08	24.38^{a}	2.43^{b}
T1	58.99^{c}	21.83	18.35^{b}	2.78^{b}
T2	65.59^{a}	21.30	17.94^{b}	3.13^{a}
T3	66.79^{a}	22.01	16.56^{bc}	3.09^{a}
T4	66.48^{a}	21.61	15.46^{c}	3.27^{a}
T5	66.80^{a}	21.20	15.89^{c}	3.25^{a}

[a-c] Means within a column with different letters are significantly different ($P < 0.05$).
[A] For treatments denomination see Table 1.

The cooking loss and reductions on diameter and thickness of reduced-fat patties contained with various percentages of added corn oil and 2% sea mustard fiber are shown in Table 3. The reduced-fat patties with corn oil and 2% sea mustard fiber (T2, T3, T4, and T5) had less cooking loss compared to control containing pork back fat 25% ($P < 0.05$). The cooking loss was highest in the patty only added with 20% pork back fat without sea mustard fiber (T1) ($P < 0.05$).

Table 3. Effects of cooking loss and reductions in diameter and thickness of reduced-fat patties formulated with varying corn oil and sea mustard fiber levels

Treatments[A]	Cooking loss (%)	Reduction in diameter (%)	Reduction in thickness (%)
Con	26.88^{b}	13.80^{b}	18.93^{b}
T1	33.57^{a}	15.49^{a}	20.32^{a}
T2	18.28^{d}	9.42^{d}	11.52^{d}
T3	23.75^{c}	11.48^{c}	15.49^{c}
T4	21.71^{c}	10.89^{c}	15.55^{c}
T5	19.42^{cd}	9.33^{d}	14.05^{cd}

[a-d] Means within a column with different letters are significantly different ($P < 0.05$).
[A] For treatments denomination see Table 1.

The differences in the reduction in diameter and reduction in thickness of patties formulated corn oil at different concentrations and with 2% sea mustard fiber was significant (Table 3). The T1 treatment had the highest reduction in diameter and thickness ($P < 0.05$). The reduction in

diameter and thickness of reduced-fat patties formulated with corn oil and sea mustard fiber was lower for the patties than the control without sea mustard fiber ($P < 0.05$).

The sensory scores for reduced-fat patties at varying percentages of added corn oil and sea mustard fiber are presented in Table 4. Each patty sample was evaluated in term of color, flavor, tenderness, and overall acceptability. The control samples had the highest color, flavor, tenderness, and overall acceptability scores, while the reduced-fat treatments samples had lower scores ($P < 0.05$). Reduced-fat patties containing 10% pork back fat, 10% corn oil, and 2% sea mustard fiber generated overall acceptability scores similar to the control at high-fat patty.

Table 4. Effects of sensory characteristics of reduced-fat patties formulated with varying corn oil and sea mustard fiber levels

Treatments[A]	Sensory evaluation[B]			
	Color	Flavor	Tender-ness	Overall acceptance
Con	8.13[a]	8.24[a]	8.18[a]	8.11[a]
T1	7.78[b]	7.37[b]	7.44[b]	7.67[b]
T2	7.22[b]	7.44[b]	7.78[b]	7.45[b]
T3	7.45[ab]	7.35[b]	7.67[b]	7.61[b]
T4	7.89[ab]	7.67[b]	7.89[b]	7.93[ab]
T5	7.67[ab]	7.22[b]	7.92[b]	7.89[b]

[a,b] Means within a column with different letters are significantly different ($P < 0.05$).
[A] For treatments denomination see Table 1.
[B] Sensory scores, 1=extremely undesirable, 10=extremely desirable.

IV. CONCLUSION

In conclusion, the addition of 10% corn oil, 10% pork back fat, and 2% sea mustard fiber can contribute to the development of reduced-fat patties with desirable quality characteristics.

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