

## QUALITY CHARACTERISTICS OF GROUND BEEF PATTIES EXTENDED WITH WHEAT GERM PROTEINS.

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### BACKGROUND

Wheat germ contains high quality proteins, carbohydrates, minerals, and vitamins. It is also a source of fiber (5%). Addition of wheat germ protein flour (WGPF) to frankfurters formulation improved batter stability, and increased water holding capacity (WHC). Frankfurters containing WGPF resulted in the highest yield compared to control (Gnanasambandam, 1993). Advantages of WGPF and the need of low-cost and nutritive products, require investigation on the use of WGPF in meat products. However, no information has been found related to the utilization of WGPF as an additive in beef patties.

### OBJECTIVES

To investigate the functionality of WGPF in coarse ground meats and to develop a process to incorporate WGPF in beef patties at 2.0, 3.5, and 5.0% extension levels, and to investigate the effects of this additive on pH, WHC, water activity ( $a_w$ ), yield, cooking losses, shrinkage, proximate composition, sensory and textural properties, and color of beef patties.

### MATERIALS AND METHODS

Ground beef (20% fat content) was obtained from beef knuckles and plates. WGPF was added to the meat as a slurry (1:3 WGPF: water ratio) to obtain extension levels of hydrated WGPF 8, 14, and 20%. pH, WHC (centrifuge method), and  $a_w$  were measured in raw patties. Patties were broiled or grilled to an internal endpoint temperature of  $69 \pm 1^\circ\text{C}$ . Weight, diameter and thickness of each patty were measured before and after cooking to calculate yield, cooking losses and dimensional changes. Protein, fat and moisture percent were determined for both raw and cooked patties. Amino acids analysis was performed in grilled patties. Sensory attributes (aroma, flavor, juiciness, firmness) were evaluated by a trained sensory panel. L, a, and b color values were measured by HunterLab D54 spectrophotometer and shear force by TA-XT2 texture analyzer.

### RESULTS AND DISCUSSION

The pH of raw beef patties increased with the addition of WGPF slurry. However, WHC significantly decreased as the extension level increased. Perhaps, proteins were not capable of binding more water than added to the formulations. There were no differences in water activity among the treatments. For both broiled and grilled beef patties the higher yields and lower cooking losses were obtained in the 20% extension treatment. The highest yields were observed in broiled patties. The less change in diameter was obtained in patties extended at 20% in both cooking methods. Nevertheless, broiled patties exhibited higher thickness than grilled patties with the addition of WGPF (Table 1). Thompson et al. (1982) reported that patties extended with plant protein concentrate had the highest yields and smallest decrease in diameter when compared to all-beef patties.

Protein content of raw and broiled WGPF-added patties was significantly lower compared to all-beef patties. Grilled patties extended at 20% level were significantly lower in protein content compared to other treatments (Table 2). Amino acid composition of proteins in beef patties was not affected by the addition of WGPF. However, methionine content decreased as the level of extension increased. Fat content decreased with the addition of WGPF at all three extension levels. The lowest percent of fat was obtained with the 20% extension treatment in both raw and cooked patties. Water content slightly increased with the addition of WGPF. Raw and broiled WGPF-added patties resulted in a higher moisture content compared to all-beef patties. No difference was found in grilled patties (Table 2).

Sensory characteristics were affected by the addition of WGPF. Meaty aroma and flavor decreased and wheat-like aroma and flavor increased as the level of extension increased. Grilled patties extended at 14 and 20% levels resulted in a less intense wheat-like aroma and flavor compared to their counterpart broiled patties (Table 3). Juiciness increased and firmness decreased with the addition of WGPF. Juicier and softer patties were obtained with the 20% extension treatments in both cooking methods. Berry et al. (1985) reported juicier patties formulated with iron and zinc fortified soy flour when compared to all-beef patties. Correlation coefficients of  $r = 0.83$  (broiled patties) and  $r = 0.97$  (grilled patties) were found between firmness and shear force measured by sensory panel and instrument, respectively (Table 4). Grilled patties were slightly softer than broiled patties.

In raw patties, lightness had no change, and redness and yellowness increased slightly with increasing the percent of WGPF in the patties' formulation. Broiled WGPF-extended patties were slightly darker and grilled WGPF-extended patties were slightly lighter than control patties. In both broiled and grilled patties, redness decreased with the addition of WGPF and yellowness was not affected.

### CONCLUSIONS

Addition of hydrated WGPF increased yield and decreased cooking losses of beef patties. Extended patties were capable of entrapping water when they were cooked, resulting in a more tender and juicier product. Protein and fat content of both raw and cooked beef patties decreased with addition of WGPF. Amino acid composition was not affected, except methionine content. Moisture content increased and other nutrients as macro- and micro-elements were added to the patties by extension with WGPF. Wheat-like aroma and flavor increased with the addition of WGPF. A dilution or masking effect of meat pigments was observed due to the extension with WGPF. WGPF showed a potential to be used as an extender in ground beef products.

### REFERENCES

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TABLE 1. YIELD COOKING LOSSES, AND DIMENSIONAL CHANGES OF BROILED AND GRILLED BEEF PATTIES EXTENDED WITH WHEAT GERM PROTEIN FLOUR (WGPF).

Treatment <sup>1</sup> (% extension)	Yield (%)		Cooking losses (%)		Decrease in diameter (%)		Increase in thickness (%)	
	Broiled	Grilled	Broiled	Grilled	Broiled	Grilled	Broiled	Grilled
0	75.40 <sup>a</sup>	73.30 <sup>a</sup>	24.60 <sup>a</sup>	26.70 <sup>a</sup>	13.48 <sup>a</sup>	15.31 <sup>a</sup>	10.60 <sup>a</sup>	10.68 <sup>a</sup>
8	79.24 <sup>b</sup>	75.50 <sup>a</sup>	20.59 <sup>b</sup>	26.50 <sup>a</sup>	12.88 <sup>a,b</sup>	14.61 <sup>b</sup>	2.80 <sup>b</sup>	6.14 <sup>a,b</sup>
14	80.30 <sup>b,c</sup>	76.59 <sup>b</sup>	19.70 <sup>b,c</sup>	23.42 <sup>b</sup>	12.05 <sup>b,c</sup>	12.65 <sup>b</sup>	6.60 <sup>a,b</sup>	5.39 <sup>a,b</sup>
20	81.68 <sup>c</sup>	79.53 <sup>c</sup>	18.32 <sup>c</sup>	20.47 <sup>c</sup>	11.31 <sup>c</sup>	10.26 <sup>c</sup>	9.84 <sup>a</sup>	1.59 <sup>b</sup>

<sup>a,b,c</sup>Means in the same column with different superscripts are significantly different ( $P < 0.05$ )

<sup>1</sup>Percent of extension = slurry of WGPF and distilled water in ratio 1:3 added to formulation.

Table 2. PROXIMATE COMPOSITION OF RAW, BROILED, AND GRILLED PATTIES EXTENDED WITH WHEAT GERM PROTEIN FLOUR (WGPF).

Treatments <sup>1</sup> (% of extensions)	Protein (%)			Fat (%)			Water (%)		
	Raw	Broiled	Grilled	Raw	Broiled	Grilled	Raw	Broiled	Grilled
0	17.34 <sup>a</sup>	21.82 <sup>a</sup>	21.39 <sup>a</sup>	21.04 <sup>a</sup>	21.61 <sup>a</sup>	21.24 <sup>a</sup>	49.61 <sup>a,c</sup>	40.30 <sup>a</sup>	43.47 <sup>a</sup>
8	15.77 <sup>b</sup>	19.71 <sup>b</sup>	20.90 <sup>a,b</sup>	20.29 <sup>a</sup>	20.61 <sup>b</sup>	20.19 <sup>b</sup>	47.64 <sup>a</sup>	43.42 <sup>b</sup>	42.45 <sup>a</sup>
14	15.41 <sup>b</sup>	19.03 <sup>b</sup>	20.03 <sup>b</sup>	18.89 <sup>b</sup>	18.98 <sup>c</sup>	18.71 <sup>c</sup>	51.86 <sup>b</sup>	44.90 <sup>b</sup>	44.31 <sup>a</sup>
20	14.86 <sup>b</sup>	18.67 <sup>b</sup>	18.43 <sup>c</sup>	17.48 <sup>c</sup>	17.84 <sup>d</sup>	17.76 <sup>d</sup>	50.71 <sup>b,c</sup>	45.57 <sup>b</sup>	45.27 <sup>a</sup>

<sup>a,b,c,d</sup>Means in the same column with different superscripts are significantly different ( $P < 0.05$ )

<sup>1</sup>Percent of extension = slurry of WGPF and distilled water in ratio 1:3 added to formulation.

TABLE 3. SENSORY CHARACTERISTICS OF BROILED AND GRILLED PATTIES EXTENDED WITH WHEAT GERM PROTEIN FLOUR (WGPF).

Treatment <sup>1</sup> (% extension)	Meaty aroma <sup>2</sup>		Meaty flavor <sup>2</sup>		Wheat-like aroma <sup>2</sup>		Wheat-like flavor <sup>2</sup>	
	Broiled	Grilled	Broiled	Grilled	Broiled	Grilled	Broiled	Grilled
0	9.68	9.39	10.28	10.33	4.93	4.37	2.47	3.08
8	8.63	10.03	10.20	8.75	5.82	4.69	4.35	5.09
14	9.30	8.65	6.84	8.40	5.69	4.71	6.84	5.02
20	7.83	9.08	4.92	7.40	7.40	5.21	9.20	6.57

<sup>1</sup>Percent of extension = slurry of WGPF and distilled water in ratio 1:3 added to formulation.

<sup>2</sup>Evaluated in a 15 cm semi-structured line scale with anchors at extremes: "none" (0) and "very" (15).

TABLE 4. TEXTURAL PROPERTIES OF BROILED AND GRILLED PATTIES EXTENDED WITH WHEAT GERM PROTEIN FLOUR (WGPF).

Treatments <sup>1</sup> (% extension)	Firmness <sup>2</sup>		Juiciness <sup>2</sup>		Shear force (kg)	
	Broiled	Grilled	Broiled	Grilled	Broiled	Grilled
0	8.89 <sup>a</sup>	9.54 <sup>a</sup>	7.01 <sup>a</sup>	6.69 <sup>a</sup>	3.28 <sup>a</sup>	3.47 <sup>a</sup>
8	7.83 <sup>a</sup>	8.00 <sup>a</sup>	8.35 <sup>a</sup>	7.09 <sup>a</sup>	2.79 <sup>b</sup>	3.03 <sup>b</sup>
14	7.01 <sup>a</sup>	6.67 <sup>a</sup>	9.12 <sup>a</sup>	8.79 <sup>a</sup>	2.45 <sup>c</sup>	2.36 <sup>c</sup>
20	4.59 <sup>a</sup>	4.28 <sup>a</sup>	10.39 <sup>a</sup>	10.88 <sup>a</sup>	2.43 <sup>c</sup>	2.00 <sup>d</sup>

<sup>a,b,c,d</sup>Means in the same column with different superscripts are significantly different ( $P < 0.05$ )

<sup>1</sup>Percent of extension = slurry of WGPF and distilled water in ratio 1:3 added to formulation.

<sup>2</sup>Evaluated in a 15 cm semi-structured line scale with anchors at extremes: "none" (0) and "very" (15).