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Characteristics of frankfurters from preblended pork

Abstract

Five pork carcasses were used to determine the effects of hot boning and various combinations of salt (0, 1.5, or 3.0%) and a phosphate mixture (0 or 0.5%) on functional, processing, and storage characteristics of preblended pork (preblends). Although hot-boned (HB) preblends had superior functional properties compared to conventionally boned (CB) preblends, HB and CB frankfurters had similar characteristics. More (P(.05) myosin and actin (proteins that cause lean and fat particles to bind together) were extracted from HB than CB preblends. Addition of salt (1.5 or 3.0%) or phosphate (0.5%) generally increased myosin and actin extraction in both HB and CB preblends. Salt levels can be reduced from 3.0 to 1.5% in frankfurters without any processing or storage difficulties, if phosphate is added. Some model system measurements could be used to predict relative processing yield of raw materials.; Swine Day, Manhattan, KS, November 19, 1987

Keywords

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CHARACTERISTICS OF FRANKFURTERS FROM PREBLENDED PORK

C.L. Kastner, Y.I. Choi, and D.H. Kropf

Summary

Five pork carcasses were used to determine the effects of hot boning and various combinations of salt (0, 1.5, or 3.0%) and a phosphate mixture (0 or 0.5%) on functional, processing, and storage characteristics of preblended pork (preblends). Although hot-boned (HB) preblends had superior functional properties compared to conventionally boned (CB) preblends, HB and CB frankfurters had similar characteristics. More ($P<.05$) myosin and actin (proteins that cause lean and fat particles to bind together) were extracted from HB than CB preblends. Addition of salt (1.5 or 3.0%) or phosphate (0.5%) generally increased myosin and actin extraction in both HB and CB preblends. Salt levels can be reduced from 3.0 to 1.5% in frankfurters without any processing or storage difficulties, if phosphate is added. Some model system measurements could be used to predict relative processing yield of raw materials.

Introduction

Processors are interested in reducing the amount of salt added to products such as frankfurters because of consumer demands for processed meat products that have little or no added salt. Salt plays an important role during processing because it solubilizes and facilitates extraction of meat proteins, which cause fat and lean particles to bind together. Particle binding is extremely important in frankfurters, which are made from finely chopped meat and fat. Hot-boned, prerigor muscle is an excellent source of extractable protein, which facilitates particle binding. Therefore, as the level of salt is reduced, techniques such as hot boning may be used to ensure proper binding and texture of frankfurters.

The objectives of this study were to evaluate 1) the effects of hot boning and selected levels of salt and phosphate on protein solubility, functionality, and storage characteristics of preblended pork used in frankfurters; 2) the relationship between functional characteristics and smokehouse yield of frankfurters; and 3) the relationships among textural characteristics of frankfurters determined by sensory and Instron tests.

Procedures

Five pigs were slaughtered at the Kansas State University Meat Laboratory. One side of each carcass was hot boned within 1 hr postmortem (HB). The other side was conventionally boned after chilling at 2-4 C until 24 hr postmortem (CB). The pH and temperature declines of carcasses were measured in the longissimus muscle at the 10th rib at 0, 1, 3, 5, and 24 hr postmortem. Shoulder, ham, and loin portions were excised (HB at 1 hr; CB at 24 hr) from each side and trimmed of exterior fat and connective tissue. Conventionally and hot-boned meat samples were coarsely ground (0.5 in plate) and divided into 6 subsamples (5.5 lb each), each of which was blended for 2 min with one of six different combinations of salt (3 levels of NaCl: 0, 1.5, or 3%) and a phosphate mixture (2 levels: 0 or 0.5% of a mixture of sodium acid pyrophosphate, pH 4.2; sodium tripolyphosphate, pH 9.8; and sodium hexametaphosphate, pH 7.0; mixing ratio of 1:5:4, respectively; mixture pH 7.2) using a Hobart bowl mixer. From each treatment, 0.5 lb of preblended meat (preblends) was collected for a model system study, and 5.0 lb of preblends were further mixed with prague powder (0.23%), placed in a vinyl bag, and stored in a 4 C cooler for a day before frankfurter production.

Model system studies were also conducted to measure water holding capacity (WHC), emulsifying capacity (EC), emulsion viscosity, and thermal emulsion stability (TES) of the emulsion created from preblended samples. For TES, the meat emulsion was weighed both before and after cooking for thermal cooking loss. After cooking, the amounts of released fat and gel were measured. The extractability of myofibrillar (myosin and actin) and sarcoplasmic proteins was also determined.

Frankfurters made from the preblends were evaluated for moisture, fat, protein, smokehouse yield, and weight loss during cooking. Juiciness, firmness cohesiveness, and chewiness were evaluated by a taste panel. The Instron Universal Testing Machine was also used to evaluate hardness, cohesiveness, springiness, and chewiness of the frankfurters.

Microbial counts and TBA (measure of fat rancidity) analyses on the frankfurters were determined after 0, 1, 2, 3, and 4 wk of display.

Results and Discussion

Generally, HB and addition of salt and phosphate increased ($P<.05$) the pH values, WHC, EC, and emulsion viscosity. These same results have been documented by other researchers.

For TES measurements (table 1), HB and addition of salt and phosphate generally decreased cooking loss, fat released, gel released, and total released. These observations are also consistent with other researchers' results.

Again, HB, salt, and phosphate all tended to increase ($P<.05$) myofibrillar protein (myosin and actin) solubility as expected. Addition of 1.5% salt was frequently equivalent to adding 3.0% salt.

Relative to the proximate composition of frankfurters (table 2), HB and CB treatments were similar ($P>.05$). Salt and phosphate proved to have a positive effect by increasing smokehouse yields and reducing cook test weight loss. This was true whether 1.5 or 3.0% salt was added. For smokehouse yield and cook test weight loss, HB was generally superior to CB; however, the differences between HB and CB were frequently nonsignificant ($P>.05$).

Smokehouse yield was correlated (P<.05) to model system measures of total fat and gel released, WHC, and EC. These relationships between smokehouse yield and model system measures indicate that the relative smokehouse yield of preblends used to make frankfurters can be predicted by using model system results.

Sensory evaluation results (table 3) show that HB means were equal or superior to CB means for frankfurter juiciness, cohesiveness, chewiness, and overall firmnes. As expected, salt and phosphate increased all of the sensory characteristics. Few differences existed between HB and CB for Instron measures of hardness, cohesiveness, springiness, and chewiness. The addition of salt (1.5 or 3.0%) and phosphate generally increased hardness, cohesiveness, springiness, and chewiness. When the results of sensory evaluation and the Instron test were compared, there were significant correlations (P< 0.05) between cohesiveness and overall firmness sensory scores and hardness and cohesiveness Instron values, respectively. Also, there was a significant correlation (P< 0.05) between sensory chewiness score and Instron chewiness value.

For both HB and CB frankfurters, addition of salt (1.5 or 3.0%) generally maintained acceptable mesophilic bacteria counts during a 28-day display period regardless of phosphate level. Phosphate had little influence on bacterial counts. The addition of salt increased TBA values during display, whereas phosphate reduced the values.

Meats graduate students, Steve Gall and Susanne Wright, discuss research data at a conference.

Table 1. Mean Values for Thermal Emulsion Stability (TES) of Preblended Pork by Boning Method and Salt (S) and Phosphate (P) Treatment

	TES							
	Cooking loss (%)^{ad}		Fat released (ml)^{bd}		Gel released (ml)^{bd}		Total released (ml)^{bcd}	
Treatment	HB	CB	HB	CB	HB	CB	HB	CB
S 0 ,P 0	30.9^{e}	35.1^{e}	2.1^{e}	3.6^{e}	12.4^{e}	13.6^{e}	14.5^{e}	17.2^{e}
S 1.5 ,P 0	5.2^{g}	9.6^{g}	0.0^{f}	0.0^{f}	1.8^{g}	4.0^{gh}	1.8^{g}	4.0^{gh}
S 3.0 ,P 0	3.3^{h}	5.4^{i}	0.0^{f}	0.0^{f}	0.8^{g}	2.1^{i}	0.8^{g}	2.1^{i}
S 0 ,P 0.5	26.1^{f}	30.2^{f}	1.3^{e}	3.1^{e}	11.0^{f}	11.9^{f}	12.3^{f}	14.8^{f}
S 1.5 ,P 0.5	5.2^{g}	10.3^{g}	0.0^{f}	0.0^{f}	1.8^{g}	4.5^{g}	1.8^{g}	4.5^{g}
S 3.0 ,P 0.5	3.1^{h}	7.4^{h}	0.0^{f}	0.0^{g}	0.8^{f}	3.0^{hi}	0.8^{g}	3.0^{hi}

[a] [(Weight of meat emulsion before cooking-wt after cooking)/(wt before cooking)] x 100.

[b] Amounts of released fat, gel, and total released after cooking per 100 g of meat emulsion.

[c] Total released = fat released + gel released.

[d] Means of HB and CB samples, underscored by common line, are not different (P>.05).

[efghi] Means in the same column with common superscripts are not different (P>.05).

Table 2. Mean Values for Smokehouse Yield, Cook Test, and Proximate Composition of Frankfurters Made from Preblended Pork by Boning Method and Salt (S) and Phosphate (P) Treatment

			Cook test		Proximate composition					
	Smokehouse yield (%)[ac]		Weight loss (%)[bc]		Moisture (%)[c]		Fat (%)[c]		Protein (%)[c]	
Treatment	HB	CB	HB	CB	HB	CB	HB	CB	HB	CB
S 0 ,P 0	66.9^{g}	65.5^{g}	15.6^{d}	16.2^{d}	47.5^{f}	47.7^{f}	32.9^{d}	32.3^{d}	17.0^{d}	16.7^{d}
S 1.5 ,P 0	81.6^{e}	79.3^{e}	1.3^{f}	4.2^{f}	55.4^{d}	55.9^{d}	28.8^{f}	28.6^{f}	13.2^{e}	13.0^{e}
S 3.0 ,P 0	82.2^{de}	81.3^{d}	1.1^{f}	3.7^{f}	55.3^{d}	55.4^{d}	27.4^{f}	28.0^{f}	12.7^{e}	12.7^{e}
S 0 ,P 0.5	69.2^{f}	68.1^{f}	14.2^{e}	14.6^{e}	51.1^{e}	50.8^{e}	30.9^{e}	30.3^{e}	16.2^{d}	15.9^{d}
S 1.5 ,P 0.5	81.7^{de}	79.1^{e}	1.2^{f}	2.5^{g}	55.7^{d}	55.7^{d}	28.8^{f}	28.1^{f}	12.8^{e}	12.4^{e}
S 3.0 ,P 0.5	83.0^{d}	80.4^{de}	1.0^{f}	1.5^{g}	55.4^{d}	55.5^{d}	28.1^{f}	28.2^{f}	12.7^{e}	12.2^{e}

[a][(Weight of frankfurter after cooking in smokehouse)/(wt before cooking)] X 100.

[b][(Weight of frankfurter before heating in boiling water - wt after heating)/(wt before heating)] X 100.

[c]Means of HB and CB samples, underscored by a common line, are not different (P>.05).

[defg]Means in the same column with common superscripts are not different (P>.05).

Table 3. Mean Values for Sensory Evaluation of Frankfurters Made from Preblended Pork by Boning Method and Salt (S) and Phosphate (P) Treatment

	Juiciness[ab]		Cohesiveness[ab]		Chewiness[ab]		Overall firmness[ab]	
Treatment	HB	CB	HB	CB	HB	CB	HB	CB
S 0 ,P 0	1.20[e]	1.12[e]	1.85[d]	1.93[e]	2.44[e]	2.45[e]	2.13[e]	2.14[f]
S 1.5 ,P 0	3.38[c]	3.18[c]	4.66[c]	3.21[d]	3.71[d]	3.31[d]	5.12[c]	4.14[d]
S 3.0 ,P 0	3.06[c]	3.03[c]	5.14[c]	4.28[c]	4.33[c]	3.97[c]	5.79[c]	4.99[c]
S 0 ,P 0.5	1.99[d]	2.00[d]	2.39[d]	2.41[e]	2.67[e]	2.70[e]	2.97[d]	3.19[e]
S 1.5 ,P 0.5	3.13[c]	3.14[c]	5.15[c]	4.75[c]	4.19[c]	4.20[c]	5.76[c]	5.44[c]
S 3.0 ,P 0.5	3.14[c]	3.12[c]	5.10[c]	4.71[c]	4.18[c]	4.03[c]	5.75[c]	5.37[c]

[a]Six-member panel: juiciness, 8 = very juicy, 1 = very dry; cohesiveness, 8 = very intense, 1 = not perceptible; chewiness, 8 = very tough, 1 = very soft; overall firmness, 8 = very firm, 1 = very mushy.

[b]Means of HB and CB samples, underscored by a common line, are not different (P>.05).

[cdef]Means in the same column bearing common superscript letters are not different (P>.05).