CHARACTERISTICS OF SURIMI-LIKE MATERIAL FROM BEEF, PORK AND BEEF BY-PRODUCTS

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INTRODUCTION

Surimi is a fish protein concentrate manufactured by fresh water leaching of mechanically deboned fish meat (Lanier, 1986). This process removes water soluble components, lipids and pigments to yield a functional, bland, light colored protein that has desirable binding and textural properties (Lee, 1986). Surimi has been utilized as an ingredient in manufacturing imitation crab, lobster, shrimp and other valuable seafoods.

We have evaluated beef and pork as a source of surimi-like material (Park et al., 1987). We developed a process to concentrate myofibrillar proteins and remove fat and pigments from beef or pork. The effect of pH, ionic strength and number of washing steps was further evaluated for pork based surimi-like material (Lee et al., 1987). Beef by-products have also been evaluated as a potential source of surimi-like material (Arnold et al., 1988).

Results of these studies indicate that surimi-like materials manufactured from beef, pork and by-products have excellent potential as ingredients for producing low fat meat products. We are optimistic about the use of these surimi-like materials because in the United States, consumer demand for low-fat, convenient meat products is growing. The objectives of this study were to evaluate the composition, functional properties and appearance of surimi-like material from beef, pork and beef by-products.

MATERIALS AND METHODS

Preparation of surimi-like material

Lean pork and beef were chopped with 5 volumes of water in a laboratory size silent cutter for 1.5 min and the resulting slurry was filtered through a metal screen with 2 mm mesh to remove connective tissue. The filtrate was centrifuged at 2000 x g for 15 min and the supernatant was discarded. The sediment was blended with 5 volumes of water and centrifuged and this procedure was repeated twice. By-products (hearts, weasand meat, head meat and tongues) were handled in the same manner with the exception of being chopped for 5 min. Samples were collected and held at 4C for subsequent analysis.

Preparation of heat induced gels

Mixtures of surimi-like material with protein concentrations from 10-22.5% were made by adding water, 3% NaCl, 4% sorbitol and .5% tripolyphosphate. Commercially available pollack surimi was also diluted with water, 3% NaCl and .5% tripolyphosphate (sorbitol was added previously as a cryoprotectant). Cooked gels were prepared by heating 15 ml of diluted surimi in capped, 50 ml test tubes. A copper-constantan thermocouple was inserted in parallel samples to monitor temperature during cooking. To prepare gels with constant cooking temperature, tubes were heated for 20 min in a circulating water bath at 60°C or 75°C. To prepare gels heated at a constant rate, a water bath was regulated to increase the temperature at a rate of .5°C/min (test tubes were submerged in the water bath at 35°C and were removed at 5°C intervals up to 80°C).

Gel strength measurement

Strength of gels was measured with a Model 1122 Instron Universal testing machine. Samples were cooled to room temperature prior to gel strength measurement. A 13 mm diameter plunger was utilized to compress the surimi samples. The Instron was fitted with a 500 kg compression load cell and instrument settings were: crosshead speed - 100 mm/min; chart speed - 500 mm/min; and load cell setting - 20 kg. Gel hardness was measured by determining the height of the compression force curve (expressed as g of force).

Chemical evaluations

Salt soluble protein was determined using the procedures of Johnson and Henrickson (1970). Moisture and fat contents were determined in triplicate by oven drying at 105C and repeated washes of chloroform:methanol (2:1)

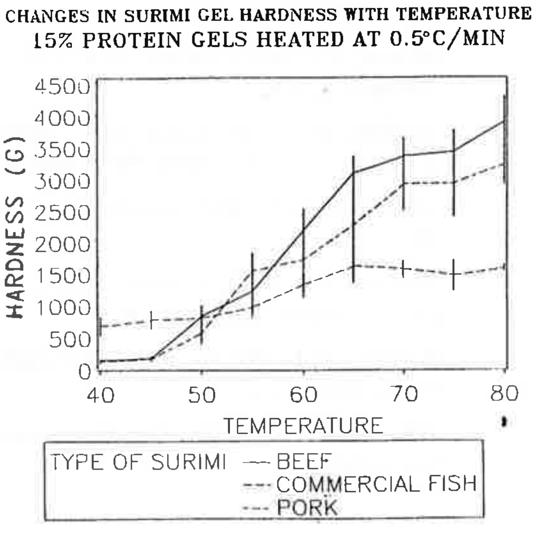

Figure 1

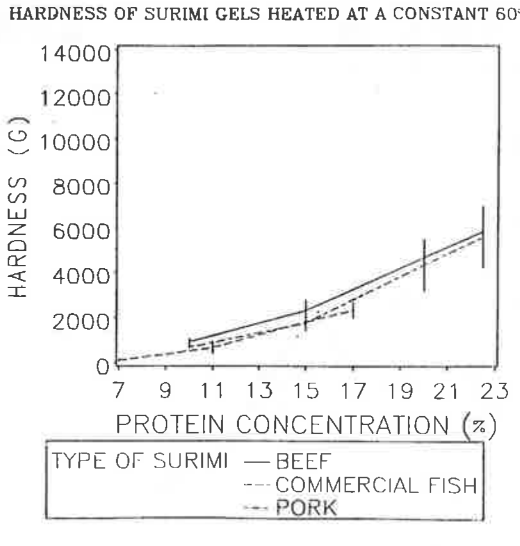

Figure 2

TABLE 1. COMPOSITION OF SURIMI-LIKE MATERIAL

	Protein (%)	Water (%)	Fat (%)	Salt soluble protein[a] (%)
Beef	20.6	72.2	7.3	
Beef surimi	22.5	76.8	>.1	7.8
Pork	21.3	73.2	5.2	
Pork surimi	22.5	78.1	>.1	7.9
Commercial fish surimi	17.0	75.0	.2	3.6
Beef by-products				
Heart	16.8	76.6	3.4	
Heart surimi	13.8	85.6	.7	
Tongue	14.6	65.8	18.1	
Tongue surimi	-	76.7	4.4	
Cheek meat	15.1	75.6	7.8	
Cheek-meat surimi	17.9	84.7	.7	
Weasand meat	15.1	77.8	5.7	
Weasand-meat surimi	16.0	80.4	2.2	

TABLE 2. HUNTER COLOR VALUES[a] OF COOKED SURIMI[b]

	L	a	b
Beef surimi	49.1	-1.9	3.9
Pork surimi	52.7	-2.3	5.4
Commercial fish surimi	56.6	-3.2	-1.8
Beef by-products			
Heart surimi	38.8	3.7	7.9
Tongue surimi	34.4	1.6	2.6
Cheek-meat surimi	33.5	6.0	1.7
Weasand-meat surimi	23.8	7.2	4.2

[a]Lab scale: L, white = 100 and black = 0; a, red = (+) and green = (-); b, yellow = (+) and blue = (-).
[b]Protein content adjusted to 10%.

TABLE 3. TEXTURAL PROPERTIES[a] OF COOKED BEEF BY-PRODUCT SURIMI

	Hardness	Cohesiveness
Heart surimi	667.5	.63
Tongue surimi	191.3	.99
Cheek-meat surimi	720.0	.82

[a]Procedures described by Bourne (1978).

described by Riss et al. (1983). Color was evaluated with a Hunter colorimeter using an L, a and b scale.

RESULTS

Processing yields of surimi-like material (wet weight basis) were approximately 45% for beef, 45% for pork, 38% for beef heart, 18% for beef tongue, 10% for beef cheek meat and 7.5% for beef weasand meat. Differences in the yields are partly the result of the different connective tissue contents of the starting materials. Yield data indicated that hearts were the most viable by-product for manufacture of surimi-like material.

Protein concentration of the surimi-like material was higher than the original meat source used for processing (Table 1).

Similarly, water content was higher for surimi-like material for all products evaluated and dramatic decreases in fat content were observed in all comparisons. Fat content was reduced between 60% (weasand meat) and 99% (beef) by the processing procedure. Salt soluble protein content was much higher for beef and pork surimi-like material than commercial fish surimi. Surimi-like material from beef and pork had a higher protein content and similar fat concentrations when compared to commercial fish surimi. However, all by-products had higher fat contents than commercial fish surimi.

After cooking, red meat surimi was somewhat darker than commercial fish surimi and by-product surimi was considerably darker. Hunter colorimeter L scores were correspondingly lower for pork or beef surimi and much lower for by-product surimi. Similarly, a and b color values were higher in red meat or by-product surimi. Pigment concentration of hearts may explain the color difference observed in heart surimi.

Textural characteristics of beef and pork surimi are presented in Figures 1 and 2. Gel harness of beef and pork surimi-like material (15% protein) was lower up to 50C and was much higher than fish surimi at 80C. The hardness of fish surimi approximately doubled over the 40°C range while beef and pork increased over 10 fold (Fig. 1). Gel hardness appears to be directly related to protein concentration for all three species (Fig. 2). Harness and cohesiveness of by-product surimi were similar to commercial fish surimi when protein concentration was taken into consideration.

SUMMARY

Results of this study indicate that surimi-like material from beef, pork and by-products has textural properties similar to or better than commercial fish surimi. Beef and pork are similar in composition to and have more salt soluble protein than commercial fish surimi. Beef hearts appear to be the best by-product to be utilized as a raw material for manufacture of surimi-like material.

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