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UPGRADING SPENT LAYER MEAT BY MECHANICAL DEBONING AND FURTHER PROCESSING

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Summary

Underutilized spent layer chickens were mechanically deboned and the meat used to prepare a chicken frankfurter.
The above franks were found tough as compared to commercial brands on the market by the majority of a 59 member taste panel. However they were not found unacceptable.
Collagen content of spent layer franks was no higher than for commercial brand franks. It is concluded the toughness could have been due to the nature of the myofibrillar proteins which could be modified by enzymatic treatment of the raw material to produce varying degrees of softness or tenderness.

Introduction:
The object of the research was upgrading tough spent layer meat into an acceptable product through the use of advanced mechanical deboning.

Materials and Methods:
Dressed spent layers were quartered, shank bones were removed and the quarters deboned in a Model AV-1271 Beeehive meat bone separator with a 0.5 mm screen, without pregrinding. The mechanically deboned poultry meat (MDPM) was immediately frozen. the frozen MDPM was tempered to -6° C. and used to prepare chicken frankfurters henceforth referred to as franks. Following chopping with spices, carbohydrates and seasonings in a 100 lb. capacity commercial chopper, cure was chopped in, then ascorbic acid and at 14° C. the batter was stuffed into cellulose casings. The stuffed batter was linked into frankfurters and these were cooked to an internal temperature of 68° C. with smoke added into the chamber. After cooking the franks were cooled and frozen in their casings pending their chemical and physical testing and organoleptic analysis.
Together with these Lab produced franks two commercial brands of franks found in supermarkets throughout the United States were also tested chemically, physically and organoleptically for comparison.
pH and proximate composition were determined on the raw MDPM as well as on the cooked franks.
Zinc, sodium, calcium, residual nitrite, collagen content, microbial analyses, shear tests and organoleptic tests were determined on the cooked chicken franks and the two commercial brands in the U.S.

Results:
Table 1 shows the proximate composition of the raw MDPM before processing; Table 2, the pH's of the 3 types of franks. pH's ranged between 6.4 & 6.5. In Table 3 Lab franks had somewhat lower water and ash content than the two commercial brands and 16.4% fat - similar to one of the commercial brands but lower than a second brand which had 23.9 % fat.
Table 4 shows collagen content of Lab franks was 4.29 mg per gram frank, similar to one of the commercial brands but lower than the second which had a collagen content of 4.45

Table 1 Proximate composition of MDPM

Moisture percent	62.5 ± 0.35 *
Fat percent	20.0 ± 0.36
Ash percent	1.1 ± 0.03

* ± Standard error of the mean (S.E.M.)

Table 2 pH of Lab franks and Commercial Brands I and II chicken franks

Lab Franks	6.52 ± 0.009
Brand I	6.52 ± 0.01
Brand II	6.40 ± 0.01

Table 3 Moisture, Fat and Ash of the Lab and Commercial Brands I & II Chicken franks

	Lab	Brand I	Brand II
Moisture	54.5 ± 0.84	56.1 ± 1.1	57.6 ± 0.63
Fat	16.4 ± 0.49	29.9 ± 0.5	16.9 ± 0.32
Ash	2.5 ± 0.15	3.7 ± 0.2	3.6 ± 0.24

Table 4 Collagen content of the Lab franks & Commercial Brands I and II Chicken franks (milligram collagen per gram sample)

Lab franks	4.29 ± 0.012
Brand I	9.84 ± 0.008
Brand II	4.45 ± 0.012

mg./g of frank. In table 5 the calcium content multiplied by the factor for chicken gave a bone content of 0.59%. The franks contained 16.2% zinc and 2.24% sodium. In Table 6, Warner Bratzler and Kramer Shear values showed the Lab franks had greater resistance to shear than either of the two commercial brands. In Table 7, results of the 59 member taste panel showed a significant difference in preference between all three franks tested with the greatest preference scores for the two commercial brands.

Discussion: The raw MDPM had a fat content of 20% while the collagen content was only 4.29 mg./g. These two parameters are apparently interrelated. The bone crusher on the beehive deboner broke up the bones as the intact chicken parts entered the deboner. The flesh then approached the separating screen and upon entering the screen, pressure built up at the distal end of the screen.The meat, plus the fat from the relatively intact skin was extruded through the small holes in the screen leaving the major portion of the skin behind to be expelled with the bones. The low skin content in the MDPM was then translated into a low collagen content in the MDPM. Spices and carbohydrates which were added in the processing of the franks resulted in a relatively low fat content of 16% despite the higher fat content in the raw MDPM. The bone content of 0.59% was also low by U.S.D.A. standards. The zinc content of the franks is equal to the average value for mixed light and dark chicken meat. The Lab franks had a nitrite content of 62 ppm ppm. However generally the cellulose casings are removed after processing frank and this allows the nitrite added in processing to dissipate

Table 5 Zinc, Calcium and Nitrite content of Lab franks (± S.E.M.)

Calcium percent	0.133 ± 0.009
Zinc ppm	16.20 ± 0.03
Sodium percent	2.24 ± 0.09
Nitrite ppm	62.0 ± 1.73

Table 6 Shear Values of the Lab franks and Brand I and II Commercial chicken franks

	Warner Bratzler units	Kramer lbs. force per gram sample
Lab franks	4.20 ± 0.11	0.153 ± 0.002
Brand I	0.43 ± 0.09	0.042 ± 0.009
Brand II	1.90 ± 0.06	0.069 ± 0.002

Table 7 Sensory Evaluation Scores for the Lab franks and Brands I and II Commercial Chicken franks by the 59 member panel.

	Mean	Verbal equivalent
Lab franks	4.02a*	"neither like nor dislike"to"like slightly"
Brand I	2.65b	"like moderately"
Brand II	3.42ab	"Like slightly"to "like moderately"

*Within a column figures with different letters are significantly different at the P<0.05 level.

with storage. In this case the casings were left on for experimental reasons. Warner Bratzler and Kramer shear values had shown the Lab franks resisted shear to a much larger extent than the two commercial brands tested. Panel scores showed that the Lab franks were less acceptable than the two commercial brands but the Lab franks were not rejected. The general trend in acceptability was in the direction of a softer frank. However a certain number of panelists preferred a strong bite and a chewy frank. Forty three percent of the panelists who made comments on their score sheets said the Lab franks were "hot dog tender" to their palate.

Conclusions: 1) Lab prepared franks from spent layer MDPM were found acceptable although they scored lower on acceptability than two commercial brands used for comparison. 2). Shear values and analysis of the scores for acceptability and comments on texture indicated panslists preferred a softer chicken frank than the one prepared in the lab. 3).The collagen content of the Lab franks did not indicate that the toughness or chewiness was due to collagen content. Therefore the nature of the myofibrillar proteins could have been responsible for the toughness. Meat can be tenderized by treatment with proteolytic enzymes (Lawrie, 1974).The meat could therefore be treated with selective enzymes for myofibrillar tenderization purposes. This offers a possibility of tailor making the frank texture for a variety of consumers. This is a relatively easier task to perform than if the meat had been soft to begin with. Thus a problematic raw material could be upgraded into a good quality and nutritious product.

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