EFFECTS OF MODIFIED FOOD STARCH ON THE FUNCTIONAL PROPERTIES OF BONELESS CURED PORK PRODUCED FROM PSE AND RFN PORK

M.W. Schilling[1], N.G. Marriott[1], and J.C. Acton[2]

[1]Department of Food Science and Technology, Virginia Polytechnic Institute & State University, Blacksburg, VA 24061-0418
[2]Department of Food Science & Human Nutrition, Clemson University, Clemson, SC, 29634-0371

Background

Pale, Soft, and Exudative (PSE) pork is a quality classification characterized as being very light colored, soft, and watery. Such meat is classified as low quality pork that is undesirable to consumers due to its poor appearance, texture, and palatability (Pearson and Gillett, 1996). This problem causes several million dollars per year in losses to the pork industry, which include excessive shrinkage, costs of sorting carcasses, customer claims, and the salvage of discounted pork in sausage manufacture. Processed meat products produced from PSE pork demonstrate poor cohesiveness, textural firmness, and cured color formation (Pearson and Gillett, 1996). The ability to produce a restructured, chunked and formed ham through the utilization of PSE pork would add utility to this lower value foodstuff since it could be used in a higher quality product than the sausage items currently being manufactured from this lower value raw material.

Objective

The first objective was to perform a preliminary study to determine the effects that porcine raw material quality and Modified Food Starch (MFS) have on the protein functionality of a restructured boneless ham roll. The second objective was to use these data to speculate on future research possibilities for improvement of protein functionality through combining PSE and Red, Firm, and Non-exudative (RFN) pork and the addition of non-meat adjuncts such as MFS.

Methods

Porcine *semimembranosus* and *adductor* muscles were selected from a large volume pork processing facility. Twelve muscles were selected as RFN, and 12 were obtained to be PSE. CIE L* and pH values were obtained for the samples prior to processing. Porcine *semimembranosus* and *adductor* muscles were cut into 2.5 cm by 2.5 cm cubes and 1.36 kg of these muscles were incorporated in the formulation of each treatment. Treatments consisted of PSE, RFN, 50 % PSE+50 % RFN (50/50), PSE+ 3 % MFS (Pure-Gel B990, Grain Processing Corporation, Muscatine, Iowa), RFN+3% MFS, and 50% PSE +50 % RFN+3% MFS (50/50+3% MFS). Ten percent of the meat was reduced in particle size (<0.25 cm) to increase bind. The brine solution was formulated consisting of added water [15 %(rep 1), 25 %(rep 2)] Meat Weight Basis (MWB)), sodium chloride (2 % MWB)), sodium tripolyphosphate (0.5 % MWB), dextrose (1 % MWB), sodium nitrite (156 ppm), and sodium erythorbate (0.042 % MWB). Added water was increased from 15 % to 25 % for the second replication due to the difficulty of dissolving non-meat adjuncts. Ice was added to reduce the brine temperature to 4-6^0 C. Each treatment was placed in a vacuum tumbler, and the brine for each treatment was poured onto the meat samples. The samples and brine were tumbled under vacuum (3-3.5 kPa) for 1.5 hr at 4° C. Each ham treatment was stuffed manually in cellulose casings, and clipped to seal the casing. The samples were set in a meat lug for approximately 16 hr (4^0 C). The next day, the product was processed in a smokehouse (Model TR-2, Vortron, Beloit, Wis.) to an internal temperature of 69^0 C.

Cooking Loss

Cooking Loss was calculated as (raw weight-cooked weight/raw weight)x100 and was reported as a percentage.

Texture Profile Analysis

Texture Profile Analysis was performed using an Instron Universal Testing machine according to Bourne (1978). Four cores (19 mm diameter) were taken from each 12.7 mm slice and 2 slices were tested per treatment.

Instrumental Color Determination

Two randomly selected ham slices from each treatment were used to evaluate cooked color. Three measurements were taken for each slice, and CIE L*a*b* values were determined using a Chroma Meter. The Chroma Meter was calibrated using a standard Minolta calibration plate (white plate, No. 20933026; CIE L* 97.91, a* -0.70, b* +2.44) each time prior to testing.

Expressible Moisture

The Instron Universal Testing machine was used to determine expressible moisture for two randomly selected ham slices from each treatment according to Motzer et al. (1998). Four cores (19 mm diameter) were taken from each 12.7 mm slice.

Bind

Bind strength was evaluated using a procedure detailed by Field et al. (1984) incorporating the Instron Universal Testing machine. Three 12.7 mm slices were randomly selected from each treatment.

Results and Discussion

The most pronounced trends among treatments were observed in cooking loss (Fig. 1) and expressible moisture (Fig. 2). Differences in values were found in other determinations, but no trends were evident. MFS contributed to a trend in decreased cooking loss and less expressible moisture. RFN treatments had lower cooking loss values than PSE for both 15 % and 25 % added water treatments, but 50/50 combination treatments were similar to RFN treatments for cooking loss. Expressible moisture values were similar for all 25 % added water treatments, but the addition of MFS revealed a trend toward decreased expressible moisture for PSE and 50/50 treatments with 15 % added water. This study suggests a potential for protein functionality improvements through the use of non-meat adjuncts such as MFS. Furthermore, this study reveals a possibility of improving the functionality of PSE pork through combining it with RFN meat. These data reflect both similarities and differences to research reported by Motzer et al. (1998). Their results indicated differences between PSE, RFN, and 50/50 treatments for all of the instrumental tests. RFN treatments were superior to 50/50 samples and 50/50 combinations were more acceptable than PSE treatments. MFS decreased lightness and expressible moisture and improved cohesiveness and cooking yield. Results reported by Motzer et al. (1998) differed from our study since they incorporated the use of a different MFS, with more replications, and their product was thermally processed in a steam-jacketed kettle.

Conclusions

Further research is needed to evaluate the effects of combining PSE and RFN pork and use of non-meat adjuncts in the production of boneless cured pork utilizing PSE pork. Research should focus on which non-meat adjuncts can improve protein functionality, how much RFN must be added to PSE pork to make the product functional, and the optimal combinations of adjuncts such as modified food starch, carrageenans, sodium caseinate, and soy proteins for protein functionality enhancement.

References

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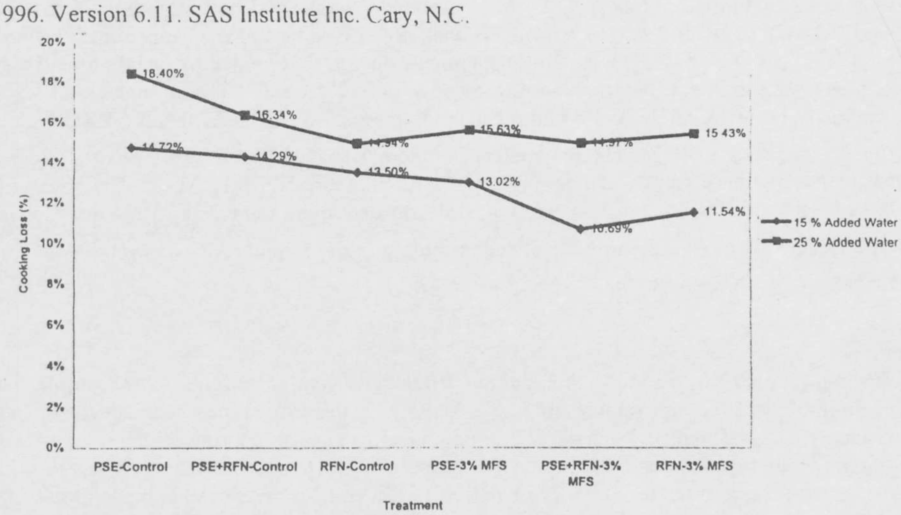

Fig. 1- Cooking loss percentage of boneless cured pork formulated with RFN pork, PSE pork, and a 50/50 combination of RFN and PSE. The brine solutions were formulated with 15 % or 25 % added water and either no binder or 3 % Modified Food Starch (MFS).

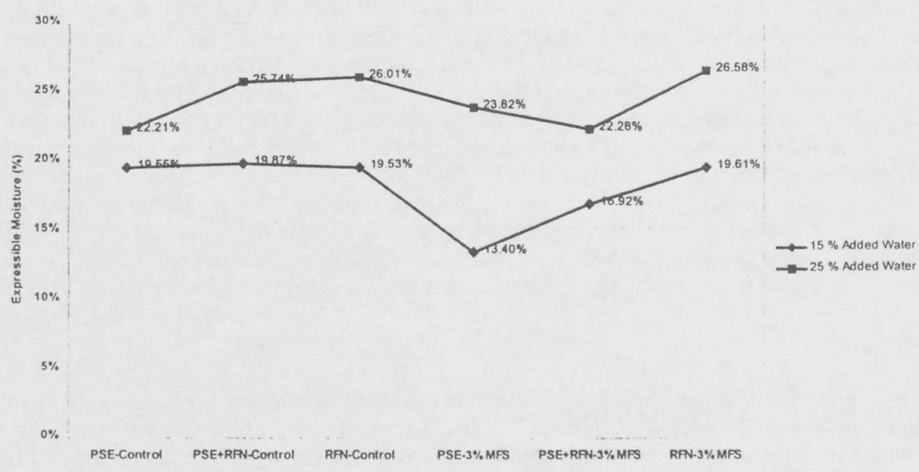

Fig. 2 - Expressible moisture percentage of boneless cured pork formulated with RFN pork, PSE pork, and a 50/50 combination of RFN and PSE. The brine solution was formulated with 15 % or 25 % added water and no binder or 3 % MFS.