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Accomplishments

Marination Properties of Broiler Breast Meat

The use of marination has increased dramatically in the past few years in the poultry industry. It is one of the methods used by the industry for tenderization of early harvested broiler breast fillets as well as a way to increase product yield and increase uniformity of product quality. These effects depend on various factors like deboning times, duration of time between deboning and marination, type of marinade, concentration of marinade, and method of marination. Marinating breast meat not only assists in tenderization process but also increases the yield of the final product. Studies were conducted to assess these factors on the tenderness, yield, product acceptability.

Experiment 1

The treatments consisted of 2h or 4h deboned breast fillet aged on ice for time periods of 0d, 1d, 3d and 6d which were tumble-marinated at respective time periods. Marination pickup was not different ($P < 0.05$) among any of the treatment groups, whereas drip loss and cook loss increased ($P < 0.05$) through day 6. On the other hand, thaw loss decreased with aging, compensating partially for the high drip loss. Shear values for marinated breast fillets belonging to 2h deboning - 0 day marination and 2h deboning - 1 day marination groups were significantly ($P < 0.05$) higher than rest of the treatments. But after three days of storage, the 2h deboned

fillets did not significantly differ ($P > 0.05$) from any of the treatment groups that were deboned 4h PM. It may be assumed that extended aging and marination led to a decrease in the shear values of early-deboned meat making it equally tender as post rigor-deboned meat.

Experiment 2

A total of 400 broiler carcasses were processed using an in-line system and deboned at various times: 0.25, 1.25, 2.0, 2.5, 3.0, 3.5, 4.0, 6.0 and 24.0 h post-mortem (PM). Breast fillets were marinated with 1% salt and 0.45% phosphate concentration. Consumer sensory evaluations for juiciness, tenderness, salt intensity, flavor intensity, and overall impression were obtained on all treatments using hedonic and just about right scales. Although there were slight differences in hedonic ratings for overall impression, texture and flavor of marinated breast fillets, all treatments could be categorized as “like slightly to like moderately.” Using a JAR scale, only a small percentage of consumers (<20%) considered any of the treatments as too tough. The scores for overall flavor or juiciness were not affected by the deboning times as the majority of the people considered them to be just about right. A majority of the consumers reported the potential for purchase of the product as “probably would buy” to “maybe/maybe not”.

Experiment 3

A total of 100 broiler carcasses were deboned at 4h postmortem and breast fillets were marinated with one of 4 concentrations of salt: 0.5%, 0.75%, 1%, and 1.25%. All marinated treatments had 0.45% phosphate concentration. A non-marinated control was also included. Sensory evaluations of left fillets for juiciness, tenderness, salt intensity, flavor intensity, and overall palatability were obtained on all treatments using hedonic and just about right scales. Instrumental tenderness analysis was conducted on right fillets using MORS methods. Using the hedonic scale, there was no significant difference in the marinated products (0.5% to 1.25% salt) for overall impression, flavor, and texture. However according to the JAR scale, as the percentage of salt in the formulation increased (0.5, 0.75, 1.0, 1.25%), the percentage of consumers who considered the product as not salty enough generally decreased. The products with the higher concentrations of salt (1.0 and 1.25%) resulted in high percentages of consumers who considered the product too salty. For juiciness and tenderness, a large percentage (>70%) of the consumers considered 0.5%, 0.75%, and 1.0% treatments to be just about right. Additionally, consumers rated samples with salt concentrations of 1% and above as being too strong for overall flavor. Using instrumental tenderness analysis, salt concentrations above 1.0 % were more tender than other treatments; however, all marinated treatments were significantly more tender than non-marinated controls. Using lower salt concentrations would allow companies to decrease ingredient costs as well reduce the potential for consumers considering products as too salty.

Experiment 4

A total of 90 broilers were slaughtered at 6 wk of age. Carcasses were either water-chilled (2 stage pre-chill/chill system) (WC) or air-chilled (AC), and deboned at 3 hrs postmortem to allow sufficient chilling of the AC carcasses. Fillets were tumble marinated in a 15% solution (0.75% salt and 0.45% phosphate, final concentration) at 24 h postmortem for 30 min. During the chilling process, the WC birds had a significantly higher percentage water uptake in the RTC carcass (4.08%) than the AC birds (-2.12%). Although carcasses had weight changes due to chilling, drip loss of the boneless breasts was not affected by chilling method as indicated by no significant difference in drip loss of fillets. Additionally, the chilling treatments did not affect

marination properties; there were no significant differences between treatments in marination pickup, marination retention, or cook loss of fillets. The pH values measured at both 3 h and 24h postmortem were similar in both the treatments. Tenderness was not affected by chilling method as indicated by no significant difference between WC and AC in the MORS total energy of the marinated fillets.

Effect of Portioning on Broiler Breast Meat Tenderness

Boneless breast fillets are often portioned into smaller pieces in order to create highly uniform products for foodservice operations and to maximize usage of breast fillets. Larger birds (>7 lbs.) are often used in this deboning market. The purpose of this study was to evaluate the effect of age on tenderness of slittered (horizontally cut) breast meat and the effect of time of portioning on tenderness.

Two hundred forty broilers either 6 or 8 week of age (n=120 each) were slaughtered in an in-line system using a two stage chilling system, and carcasses were deboned at either 2 or 4 h postmortem. Boneless breast fillets were then horizontally cut (slittered) at either time of deboning or at 24 h postmortem to evaluate the effect of portioning time on tenderness. Whole and slittered fillets from 8 wk old birds were significantly heavier ($P<0.05$) than fillets (whole and slittered) from 6 wk old birds. The difference between the treatments of the slittered fillets was approximately 40 g. After cooking, the fillet height of the two treatments differed by less 3 mm (19 vs. 16.7 mm). Deboning at 2 h reduced tenderness compared to deboning at 4 h as indicated by the 2 h fillets having a significantly higher ($P<0.05$) MORS total energy than the 4 h fillets. Age impacted tenderness as well. The slittered fillets from the 8 wk broilers had significantly higher ($P<0.05$) MORS total energy (tougher) than the 6 wk broilers. The time of slittering did not further impact tenderness as indicated by no significant differences between total energy values of fillets slittered at time of deboning or at 24 h.

Impact Statements

Marination Properties of Broiler Breast Meat

Extended aging (>3 days) of breast meat after early deboning combined with marination (0.5% salt) could significantly improve meat tenderness similar to that of post-rigor deboned and marinated meat. Further, marination of pre-rigor deboned meat with higher concentrations of salt (1% salt) is effective in producing product similar to marinated post-rigor deboned meat without extended aging .

Differences exist among products marinated with varying concentrations of salt and may impact consumer acceptability of products. While meat marinated with higher concentrations of salt may give desirable levels of tenderness, it is possible to marinate with lower concentrations of salt while still improving meat characteristics and keeping ingredient costs low.

Marinating early deboned breast fillets with low levels of salt (0.5%) combined with extended aging may result in a product with acceptable levels of tenderness, flavor and other sensory attributes. Using these findings, processors can optimize their aging and marination procedures to produce a high quality poultry product with not only acceptable, but desirable sensory

characteristics.

While air chilling has a positive image with consumers and represents a niche market in the U.S., the process itself does not impact poultry meat tenderness or marination properties of broiler breast meat.

Effect of Portioning on Broiler Breast Meat Tenderness

The age of broilers and time of deboning impact tenderness of slittered/portioned breast meat more than the popular process of slittering (horizontally cutting). However, vertical portioning may impact tenderness more than horizontal portioning.

Publications

A. Journal Articles

Fanatico, A.A.*, P.B. Pillai, L.C. Cavitt, **C.M. Owens** and J.L. Emmert, 2005. Evaluation of slower-growing broiler genotypes grown with or without outdoor access: Growth performance and carcass yield. *Poultry Sci.* 84:1321-1327.

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Fanatico, A.A.*, P.B. Pillai, L.C. Cavitt, J.L. Emmert, J.F. Meullenet, and **C.M. Owens**, 2006. Evaluation of slower-growing broiler genotypes grown with or without outdoor access: Sensory attributes. *Poultry Sci.* 85:337-343.

Mehaffey, J.M.*, S.P. Pradhan, J.F. Meullenet, J.L. Emmert, S.R. McKee and **C.M. Owens**, 2006. Meat quality evaluation of minimally aged broiler breast fillets from five commercial genetic strains. *Poultry Sci.* 85:902-908.

Owens, C.M., L.C. Cavitt, G.W. Youm, and J-F.C. Meullenet, 2005. Using a novel razor blade shearing method to measure poultry meat tenderness. *Zootecnica International. World's Poultry Journal.* Number 1:56-59.

Xiong, R., Cavitt, L. C., Meullenet, J.-F., and Owens, C.M. 2006. Comparison of Allo-Kramer, Warner-Bratzler and Razor Blade shears for predicting sensory tenderness of broiler breast meat cooked in bags immersed in water. *J. Texture Studies* 37: 179-199.

B. Abstracts:

Brewer, V. P. Pillai, A. Saha. J. Meullenet, C. Owens, and J. Emmert. 2006. Phase-feeding in broilers: Impact on breast fillet dimensions, cook loss, and tenderness. *Poultry Sci.* 85 (Suppl. 1):161 (Abstr.)

Fanatico, A., P. Pillai, J. Emmert, J. Meullenet, and C. Owens. 2006. Impact of alternative

broiler genotype and production system on sensory attributes. Poultry Sci. 85 (Suppl. 1):198 (Abstr.)

Owens, C.M., A. Saha, A. V. S. Perumalla, and J. F. Meullenet. 2006. Impact of age and time of portioning on tenderness of slittered broiler breast fillets. Poultry Sci. 85 (Suppl. 1):58 (Abstr.)

Perumalla, A.V., A.Saha, Y. Lee, J.F.Meullenet, and C.M.Owens. 2006. Marination properties of air chilled and water chilled broiler breast fillets. Poultry Sci. 85 (Suppl. 1):59 (Abstr.)

Saha, A., A. Perumalla, J. Meullenet, and C. Owens. 2006. Deboning time, extending aging, and marination: Impact on poultry breast meat quality. Poultry Sci. 85 (Suppl. 1):163 (Abstr.)

Saha, A., A. V. Perumalla, Y. Lee, J. F. Meullenet, and C.M. Owens. 2006. Optimizing meat tenderness, juiciness and flavor of marinated broiler breast fillets using varying levels of salt. Poultry Sci. 85 (Suppl. 1):59 (Abstr.)

Saha, A., A. V. S. Perumalla, J. F. Meullenet, and C.M. Owens. 2006. Tenderness, juiciness and flavor of pre- and post-Rigor marinated broiler breast fillets evaluated by consumer sensory panel. Poultry Sci. 85(Suppl. 1):115 (Abstr.)

C. Books and Book Chapters:

Alvarado, C.Z., and **C.M. Owens**, 2005. Poultry: Chemistry and Biochemistry. *In: Handbook of Food Science, Technology and Engineering. Volume I -Food Science: Properties and Products.* Ed. Y. H. Hui. CRC Press, Taylor and Francis Group, Boca Raton, FL.

D. Symposia Presentations:

Owens, C.M., Muscle to meat conversion: Impact on quality and yield. U.S. Poultry & Egg Association Poultry Processors Workshop. Atlanta, GA. May 17-18, 2006

E. Proceedings:

None

F. Popular Trade Articles:

Fanatico AC., Emmert JL., Owens CM., Meullenet JF. 2006. Impact of Genotype and Production System on Performance, Meat Quality and Sensory Attributes of Meat Chickens. Feedinfo News Service Scientific Reviews. July 2006. Available from URL:

<http://www.feedinfo.com>.

Owens, C.M., 2006. Further Processing: Big Time. Page 39, Poultry Magazine. February/March issue.