Appendix A

Preliminary testing of the effectiveness of the Hydrodyne process on early de-boned broiler breasts.

I. Explosive level and distance determination

Objective:

To determine the effects of the Hydrodyne process on early de-boned breasts as compared to traditionally aged counterparts.

Materials and Methods:

The treatments consisted of aged breasts (AG); non-aged breasts (NA, boned immediately after initial chilling); and three Hydrodyne treatments applied to non-aged breasts. Poultry aging refers to a conditioning process which allows the breast muscle to set up into rigor prior to de-boning. The three hydrodyne treatments consisted of Hydrodyne treated breasts vacuum packaged in Cryovac^{TM} Primal Bone-guard bags positioned on the bottom of the Hydrodyne tank at 8 (20.3 cm) (HNA8) or 12 inches (30.5 cm) (HNA12) from the explosive. The last treatment included Hydrodyne treated breasts packaged in a heavy duty rubber bag, suspended in the water at 8 inches lateral to the explosive (HNAS). Broiler breasts were obtained from a commercial poultry processor 24 hours prior to Hydrodyne treatment. All Hydrodyne treatments utilized 200 g of explosive. Non-aged broiler breasts were divided into two lobes with one lobe receiving a Hydrodyne treatment and the other serving as a non-treated, non-aged reference. Strips (1.5 cm wide) of the cooked (77^{o}C) breast were analyzed for Warner-

Bratzler (WB) peak force (kg) and Lee-Kramer (LK) shear values (total energy, kg*mm) for all treatments.

Results and Discussion:

NA breasts had higher (P<0.001) WB peak force (5.41 kg) and LK total energy (72.3 kg*mm) than AG breasts (WB 1.47 kg; LK 35.9 kg*mm) (Table 1). HNA8 breasts (WB 2.92 kg) were 46% more tender (P<0.001) than NA counterparts (WB 5.41 kg). HNA8 breast were as tender (P<0.001) in WB peak force as the AG breasts. LK data followed a similar pattern (25% reduction, P<0.01, for HNA8 compared to NA). HNAS breasts exhibited (P<0.01) a 34% reduction in WB and a 14% reduction in LK shear force compared to the NA counterparts. This reduction in improvement in tenderness of the HNAS treatment demonstrated the importance of the location of the breasts in relationship to the explosive. HNAS breasts were less tender (P<0.001) than AG breast in WB and LK measurements. HNA12 did not reduce (P>0.05) WB or LK shear forces compared to the NA counterpars suggesting that this increased distance of explosive decreased the effectiveness of the Hydrodyne treatment.

Conclusions:

The Hydrodyne process generally resulted in an improvement in tenderness of non-aged breasts. However, distance to explosive and breast location affected tenderness improvement. This project is part of the ongoing research with the Hydrodyne process. This project will continue to include research with the Hydrodyne process by varying explosive level and location to determined more optimum conditions. Additionally, CIE color values, spectrophotometeric color, cooking loss, purge loss, sarcomere length, and sensory tenderness, texture and flavor of treated breasts will be evaluated.

Table 1—Warner Bratzler and Lee-Kramer shear values for Hydrodyne treated non-aged broiler breasts, companion non-aged (no treatment) breasts, and aged (control) breasts

	Warner-Bratzler		Lee-Kramer	
Treatment[d]	**Peak force (kg)**	**Total energy (kg*mm)**	**Peak force (kg/g)**	**Total energy (kg*mm)**
GROUP 1				
AG	1.47[b]	22.56[c]	2.20[b]	35.91[c]
(n=10)	(0.53)	(9.58)	(0.43)	(5.17)
NA	5.41[a]	98.34[a]	5.69[a]	72.50[a]
(n=9)	(0.59)	(10.59)	(0.48)	(5.72)
HNA8	2.92[b]	65.57[b]	3.59[b]	54.38[b]
(n=9, WB) (n=8, LK)	(0.59)	(10.59)	(0.52)	(6.18)
P value	0.0005	0.0003	0.0003	0.001
GROUP 2				
AG	1.47[c]	22.56[b]	2.20[c]	35.91[c]
(n=10)	(0.61)	(8.88)	(0.36)	(2.92)
NA	6.27[a]	110.10[a]	7.03[a]	86.29[a]
(n=8)	(0.75)	(10.87)	(0.44)	(3.57)
HNAS	4.11[b]	92.82[a]	5.40[b]	73.88[b]
(n=8)	(0.75)	(10.87)	(0.44)	(3.57)
P value	0.0008	0.0001	0.0001	0.0001
GROUP 3				
AG	1.47[a]	22.56[a]	2.20[a]	35.91[a]
(n=10)	(1.00)	(17.23)	(0.93)	(8.37)
NA	4.62[a]	88.98[a]	5.26[a]	69.01[a]
(n=4)	(2.00)	(34.45)	(1.85)	(16.73)
HNA12	4.62[a]	70.52[a]	5.40[a]	70.00[a]
(n=4)	(2.00)	(34.45)	(1.85)	(16.73)
P value	0.304	0.212	0.293	0.197

[abc] Means within a treatment group and column with unlike superscript letters are different at the listed P values.

[d] AG = aged (control) breasts; NA = non-aged, no treatment breasts; HNA8 = Hydrodyne treated non-aged breasts, 8” from explosive (200g); HNAS = Hydrodyne treated non-aged breasts 8” suspended laterally from explosive (200g); HNA12 = Hydrodyne treated non-aged breasts 12” from explosive (200g).

II. Sensory Testing

Objective:

To determine if a sensory tenderness improvement could be noted by an untrained panel due to Hydrodyne treatment.

Materials and Methods:

Samples were collected and distributed as outlined in section 3.3.1. Early de-boned broiler breasts were treated with the hydrodyne process in two treatment groups: 150 g of explosive at 30.5 cm and 200 g of explosive at 20.3 cm. The breasts were cooked on a portable electric grill for about 20 minutes and an internal temperature of 74^{o}C. The breasts were trimmed of outer edges and cut into 1.5-cm strips. An informal/untrained sensory test was performed.

Results and Discussion:

The early de-boned, non-treated samples were described as rubbery and chewy. Companion treated samples for both levels of explosive were considered improved. The tenderness of the 200 g of explosive at 20.3 cm was described as easier to chew when compared to the other treatment group. The aged control samples were definitely the most tender and juicy of the samples tested. Early de-boned breasts were less tender and more chewy than the aged control samples. The Hydrodyne treated samples were perceived as more tender than their counterparts, but there was not a distinct sensory response based on treatment level.

Conclusion:

An untrained, informal panel can determine a distinct difference in tenderness between early de-boned and aged controls. Hydrodyne treatment improved the sensory response of tenderness of early de-boned broiler breasts.

III. Bag Testing

Objective:

To determine if a single or double seal on a bag and double bagging aided in maintaining bag integrity during Hydrodyne treatment of broiler breasts.

Materials and Methods:

Samples were collected and distributed as outlined in section 3.3.1. Early de-boned broiler breasts were treated with the hydrodyne process in two treatment groups: 200 g of explosive at 30.5 cm and 200 g of explosive at 20.3 cm. The breasts were packaged in one of four bags including, a bag with double seals on four sides, double seals on 3 sides, single seals on four sides, or double bagged with a rubber outer bag. The breasts were randomly distributed in each bag type and treated with the Hydrodyne process.

Results and Discussion:

All bags failed at the 200 g of explosive at 20.3 cm level of treatment. The rubber bags failed in the double bag treatment, however all breasts were intact and recovered. In the bags with double or single seals at this same level, 40 to 50% of the breasts were lost during the treatment as the seams completely failed. The unrecoverable breasts were pulverized during the treatment. The bags treated at the 200 g of explosive at 30.5 cm of treatment remained intact. These results are consistent with previous studies in that level of explosive to meat surface affects tenderization ability.

Conclusion:

There was not an advantage to single or double sealing of bags for Hydrodyne treatment. However, double bagging and further distances of explosive ensured recovery of broiler breasts after treatment.

Appendix B
Experienced Panel Score Card

Evaluation of Chicken Breast Meat
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INSTRUCTIONS:

- Evaluate the chicken sample for flavor, tenderness, moisture release –initial, and moisture release—sustained by placing a vertical mark on the following line scales.
- Sip water between samples.

Sample number____________

Tenderness

____

Not Very

Moisture release—Initial

____

None Extreme

Moisture release—Sustained

____

Not Very

Chicken Flavor

____

Slight Strong

Panelist #_______