HYDRODYNAMIC SHOCK WAVE:
DECREASING BROILER BREAST AGING TIME

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(ABSTRACT)

The broiler industry faces the inability to effectively eliminate or significantly reduce the aging time required during the processing of broiler breast meat. Early boning results in breast meat that is unacceptable in tenderness. The breast meat must age on the carcass for 4 to 7 hours postmortem which increases labor, refrigeration, and storage costs. Additionally, during storage, considerable weight is lost from the breasts due to purge.

The Hydrodyne process is a unique technology that utilizes a small amount of explosive to create a shock wave in an enclosed specially designed tank filled with water. In a fraction of a millisecond, the shock wave passes through the water and objects that are a mechanical impedance match to the water. The meat's cellular components are instantaneously ruptured, thereby improving meat tenderness.

This research was designed to include two related objectives. The first objective was to determine the effects of different combinations of explosive level and distance of explosive to meat surface for tenderizing early de-boned broiler breasts using the Hydrodyne process, based on instrumental shear force measurements. The Hydrodyne process was imposed (24 hours post-mortem) on broiler breasts (*Pectoralis superficialis)* removed immediately after initial chilling (approximately 45 minutes post-mortem; early

de-boned, Hydrodyne treated; HYD) and were compared to early de-boned, non-Hydrodyne treated breasts (EB) and aged control breasts (CA). An explosive level and distance combination of 350 g at 20 cm (pressure front of 25,700 psi) produced a 28.3% improvement in tenderness (HYD; 4.3 kg shear force) over the EB (6.0 kg shear force) broiler breasts. Additionally, this treatment combination reduced the peak force required to shear the HYD samples (4.3 kg) to a statistically similar level as the CA broiler breasts (3.1 kg).

The second objective was to evaluate meat quality characteristics including tenderness, sensory, purge and cooking losses, breast thickness, and color characteristics of early de-boned broiler breasts treated with the most effective explosive amount and distance combination using the Hydrodyne process determined in objective 1. Based on the results from the first objective, four replications of EB broiler breasts were treated with the Hydrodyne process (350 g at 20 cm) 24 hours post-mortem over two subsequent weeks. Shear and sensory samples were analyzed on cooked 1.0-cm wide strips taken from the medial section of each breast. Cooking loss was determined on samples analyzed for sensory traits. pH was measured on raw CA and EB samples to determine a baseline. Additionally, the pH samples were used to determine purge loss and plumpness of each treatment. Color was determined on individual raw and cooked breasts.

Warner-Bratzler and Lee-Kramer shear values for CA (1.6 kg; 6.0 kg*mm/g, respectively) were different ($P<0.05$) from both HYD (3.8 kg; 11.0 kg*mm/g, respectively) and EB breasts (4.7 kg; 12.1 kg*mm/g, respectively). Furthermore, HYD were not different ($P>0.05$) than EB breasts. Part of this lack of tenderness improvement, unlike that found in objective 1, may be related to the initially more tender EB breasts used in this objective. CA breasts resulted in higher scores for the sensory characteristics of tenderness, moisture release initial and sustained, and flavor compared to HYD and EB. HYD breasts were lower than EB controls only in initial moisture release. The HYD and EB samples were not different ($P>0.05$) in tenderness, sustained moisture release, and flavor. pH values for CA (5.86) were higher ($P<0.05$) than EB (5.71) breasts. Purge loss was not affected by HYD or by boning treatment ($P>0.05$). Cooking loss was higher ($P<0.05$) for HYD (22.2%) compared to CA (20.6%). The raw HYD breasts were less red ($P<0.05$) than the CA breasts. Cooked color of HYD breasts was similar ($P>0.05$) to CA breasts for CIE a* and CIE b* and was darker (CIE L*) on the skin side.

EB breasts with significant tenderness problems can be tenderized by the Hydrodyne process based on instrumental shear results. However, higher levels of explosive may be required to optimize the tenderness improvement of EB breasts that vary significantly in initial tenderness. Incorporation of this technology, once optimized, on an industry production level would benefit poultry processors in reducing or eliminating broiler breast aging.

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