Published February 1, 2019

2017 Reciprocal Meat Conference – Meat and Poultry Processing, Ingredient Technology and Packaging

Meat and Muscle Biology™

Improvement of Raw Meat Quality and Protein Functionality Using Hot-Boned, Quarter-Sectioned and Crust-Freeze-Air-Chilling (Hb-1/4cfac) and Cold-Batter Mincing Technology

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Keywords: cold-batter-mincing, crust-freezing-air-chilling, hot-boning, meat quality and protein functionality, quarter-sectioning
Meat and Muscle Biology 1(3):51 **doi:10.221751/rmc2017.047**

Objectives

Cold-batter mincing is an emerging technology that can be used to extract muscle protein without loss of protein functionality. The purpose of this study was to evaluate the combined effects of cold batter mincing and hot-boning, quarter sectioning and crust-freeze air chilling (1/4CFAC) on raw meat quality and protein functionality of turkey breast fillets (Pectoralis major). The fillets of 1/4CFAC were obtained after air chilling the fillets (hot-boned and quarter sectioned) in a freezing room at –12oC.

Materials and Methods

For each of 4 replications, 48 toms were processed traditionally at Michigan State University Meat Processing Center. After evisceration, the turkeys were subjected to: 1) water immersion chilling (WIC), chill boning (CB), and conventional mincing 2) WIC, CB, and cold-batter mincing after 1/4CFAC at –12oC (CB-1/4CFAC), and 3) hot-boning, quarter-sectioning, and cold-batter mincing after 1/4CFAC (HB-1/4CFAC). Statistical analysis was conducted using 3 factorial design (2 × 2 × 3). Data were pooled due to no interaction among factors. Muscle pH was measured after homogenizing 2.5 g meat in 25 mL of iodoacetate solution and R-value was measured using perchloric acid and phosphate buffer solution. Rheological properties was assessed by oscillatory measurements (storage modulus, G') using the ARES rheometer (TA instrument) with 25 mm diameter parallel plate.

Results

After chilling, the pH and R-value of turkey fillets in HB-1/4CFAC were higher and lower, respectively, than those of fillets in CB ($P < 0.05$). During cold-batter mixing in a bowl chopper at 4000 rpm, the batter temperature started at sub-zero (–1.5 to –2.1oC), reached 1.5 to 14oC at 6 to 12 min mincing, and ended with 26 to 31oC at 24 min, with high temperatures observed for 2% salt batter than 1% salt batter. During traditional mincing, the batter temperature started at 3 to 4oC, increased by ~10oC every 6 min, and ended with 32 to 35oC with higher temperature seen for 2% salt batter again. Dynamic rheological properties of meat batters indicated that the cold-batter mincing showed elevated G' than traditional mincing regardless of mixing time, indicating that gel-setting temperature was reduced in the cold-batter mincing over the conventional mincing potentially due to the less protein denaturation or protein structural change in a different way. After cooking, higher cooking yield and better protein functionality were observed in the cold-batter mincing especially at 6 min ($P < 0.05$).

Conclusion

These results indicated that the technology of HB-1/4CFAC produced superior raw meat quality and the combination of cold batter mincing and HB-1/4CFAC technologies improved protein gelation at 6 min where the batter temperature was not higher than 1.5oC.