



A Comparison of Water Chilling and Air Chilling on Poultry Shelf Life

T. L. Duarte^{1*}, A. Belk², J. N. Martin², K. Belk², J. Eisen^{3,4}, D. Coil³, J. L. Metcalf², and X. Yang¹

¹Animal Science, University of California Davis, Davis, CA, USA

²Animal Sciences, Colorado State University, Fort Collins, CO, USA

³Evolution and Ecology, University of California Davis, Davis, CA, USA

⁴Medical Microbiology and Immunology, University of California Davis, Davis, CA, USA

*Corresponding author. Email: tlduarte@ucdavis.edu (T. L. Duarte)

Keywords: air chilling, chicken breast, chilling method, shelf life, water-immersion
Meat and Muscle Biology 3(2):66

Objectives

In the U.S. water immersion chilling (WC) is commonly used to chill poultry, while the E.U. utilizes air chilling (AC). With demand for poultry continuing to rise, poultry products with longer shelf life and less food waste will be needed. Meanwhile, widespread efforts to reduce natural resource and energy expenditures, such as water, as a means of enhancing sustainability, exist across the meat industry, including the poultry industry. Therefore, the objective of this study was to compare the impact of WC and AC on the shelf life and meat quality of bone-in and boneless chicken breast.

Materials and Methods

A total of 256 eviscerated non-chilled chicken carcasses were obtained from a commercial processing facility in California and transported to the UC Davis meat laboratory within 2 h. Carcasses were randomly and evenly assigned to either water immersion chilling (WC) or air chilling (AC) and then were evenly assigned to be fabricated into bone-in (BI) or boneless (BL) breast. The breast samples were subsequently packaged onto polystyrene trays, overwrapped, and placed into cardboard boxes for dark storage at 4°C for either 7d (phase 1) or 14d (phase 2). Then breast samples were placed into a retail display case maintained at 4°C for 3d. Instrumental color measurement was performed every 12 h during retail display. Microbial analysis was conducted for samples collected on arrival, post chilling, post-fabrication, after dark storage at 4°C for 7d or 14d and after 3d retail display ($n = 10$ per sampling point per treatment). A panel of 8 untrained participants were asked to evaluate the color and their willingness to purchase (for example color: desirable, acceptable, unacceptable). Analysis of variance was conducted to evaluate the effect of chilling

method and storage time on all dependent variables using Proc Mixed in SAS (version 9.4).

Results

The WC chicken possessed lower psychrotrophic bacterial counts (1.05 log CFU/g) pre-fabrication than the AC chicken (2.12 log CFU/g), indicating that WC may remove a portion of the psychrotrophic bacteria. However, no difference in mesophilic bacterial counts was observed between the two treatments for pre-fabrication samples. The WC chicken and AC chicken, regardless of fabrication type, reached the end of shelf life (7 log CFU/g) at the 14d. The BL samples, regardless of chilling method, had lower total microbial counts throughout storage and display than the BI samples, since the removal of the skin physically removed the general microbial population as well. In terms of objective color, the a^* and b^* values were higher for AC breast, suggesting that AC breast was more red and yellow than WC breast through the display time. Chilling method did not have an impact on subjective color measurement. During phase 1, untrained panelist considered the color of BL chicken breasts more desirable than the BI breasts. During phase 2, regardless of chilling method or fabrication type, the desirability of color by untrained panelist decreased as display time increased.

Conclusion

The results indicate that chilling method had a minimal impact on the shelf life in terms of the microbial counts. Although AC chicken breast tend to be more yellow based on objective color measurement, consumers did not detect a distinct color difference of chicken treated with air chilling or water chilling.