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Exploring New Dimensions of Poultry Meat Quality Using Advanced Technologies

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Objectives

In the poultry industry, breast meat is the most valuable portion of a value-added carcass. Recent advances in poultry science have allowed for rapid increases in breast yield. However, several defects in poultry breast meat quality have arisen in modern broilers, resulting in loss of product quality and therefore decreasing the value of affected filets. Further complicating the issue, instrumental methods used to examine meat quality and detect these conditions are often destructive or inaccurate. Woody Breast (WB) was selected as a model defect for this research due to its pervasiveness, negative impact on meat quality, and lack of accurate organoleptic detection technique. In the modern poultry industry, these filets are frequently detected at the plant level using manual palpation, but this is highly unreliable and results in erroneous sorting of both affected and unaffected filets. Additionally, this method is difficult to apply in live birds or whole carcasses, limiting its application. The objective of this research was to examine potential new methodologies of determining meat quality in poultry breast meat, including bioelectric impedance analysis (BIA), shear wave elasticity imaging (SWEI), ultrasonography (US), and magnetic resonance imaging (MRI). Each of these methods have been applied in various capacities to soft tissue analysis in either traditional or veterinary medicine.

Materials and Methods

To evaluate and compare these methods, fresh jumbo boneless skinless butterfly breast filets were collected, separated into right and left breasts, and categorized by manual palpation into WB severity categories: normal, mild, moderate, and severe. Three filets to represent each severity category were selected for a total of 12 filets. BIA analysis was performed using a handheld device approximately 5 to 6 h postmortem. Left side filets were then vacuum packaged, followed by MRI scanning at approximately 8 to 10 h postmortem and US/SWEI imaging at approximately 24 h postmortem. Right side filets were frozen at approximately 5 to 6 h postmortem, stored at –80°C, then thawed, ground, and analyzed for proximate composition using a Foodscan Lab Meat Analyzer. This allows for verification of WB severity and is made possible due to the compositional nature of WB, which has been shown to have significantly higher moisture and lower protein content compared with normal filets. Data were analyzed using SAS ANOVA (SAS Inst. Inc, Cary, NC) with Tukey's HSD.

Results

Significant differences ($P < 0.05$) were found between severely wooden and normal categories using MRI generated data, with average T1 relaxation times of 846 m/s in normal filets and 933 m/s in severely woody filets. Conversely, BIA values were not significantly different between filet groups, though this finding was inconsistent with previous, larger studies. SWEI also did not generate statistically significant differences in this study, however, examination of filet architecture using US and SWEI generated images suggest that further investigation of this technique, increased sample size, and improvement of methodology may yield valuable results.

Conclusion

In conclusion, the lack of appropriate instrumental quality detection methods and the rise of meat quality defects in the poultry industry presents an opportunity to explore advanced technologies. However, these methods may require further investigation before they can be used as standalone techniques.

