



Proteome Basis of Pale, Soft, and Exudative Broiler Breast (Pectoralis Major) Meat

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Keywords: broiler, color, pale soft exudative, pH, whole muscle proteome
Meat and Muscle Biology 1(2):83

doi:10.221751/rmc2016.080

Objectives

Pale, Soft, and Exudative (PSE) broiler breast meat has poor protein functionality, which leads to quality problems and economic loss in the poultry industry. Proteomics has been applied to characterize the biochemical mechanisms governing tenderness, color, and water holding capacity in meat. However, the proteome basis of PSE has not yet been characterized for broiler breast meat. Therefore, this study was conducted to determine the differences in meat quality (cooking loss and shear force), descriptive sensory characteristics, consumer acceptance, and whole muscle proteome between normal and PSE broiler breast meat.

Materials and Methods

Male Hubbard × Cobb 500 birds ($n = 1050$) were raised in commercial houses. Short-term stressed broilers ($n = 900$) were hand caught, released to a lighted poultry house at 38°C for 2 h whereas control broilers ($n = 150$) were hand caught, placed in live haul crates at 21°C for 2 h, and then slaughtered. Broilers were electrically stunned by placing their heads in a saturated saline batch, similar to industry standards. Whole carcasses were stored in metal containers in ice water for 4 h postmortem to mimic the commercial chilling process, and then hand deboned. Broiler breast (*Pectoralis major*) meat was collected and characterized by pH₂₄ and L^*_{24} as normal (pH₂₄ 5.8 to 6.2, L^*_{24} 45 to 55) or PSE (pH₂₄ 5.4 to 5.7, L^*_{24} 55 to 65) samples.

For proteomic analysis, the whole muscle proteome with separated using 2 dimensional electrophoresis and proteins were identified using an LTQ-Orbitrap mass spectrometer. Trained panelists with more than 100 h experience in muscle food sensory evaluation were trained for 20 h for

descriptive analysis of broiler breast samples. In addition, consumer acceptability testing of normal and PSE broiler breast samples was conducted (panelists = 55 to 60 per replication; replications = 2) using a 9 point hedonic scale.

Results

Normal broiler breast meat had lower shear force values than PSE meat ($P < 0.05$). Based on sensory descriptive analysis, normal cooked chicken breast meat was more tender and juicier than PSE breast meat ($P < 0.05$). Consumer sensory analysis results indicated that 81% of consumer panelists liked normal breast meat whereas 62% of the panelists liked PSE breast meat. Whole muscle proteome profiling identified fifteen differentially abundant proteins in normal and PSE broiler breast samples. Actin α , myosin heavy chain, phosphoglycerate kinase, creatine kinase M type, β -enolase, carbonic anhydrase 2, proteasome subunit α , pyruvate kinase, and malate dehydrogenase were over-abundant ($P < 0.05$) in PSE broiler breast whereas phosphoglycerate mutase-1, α -enolase, ATP-dependent 6-phosphofructokinase, and fructose 1, 6-bisphosphatase were over-abundant ($P < 0.05$) in normal meat.

Conclusion

Results indicate that the over-abundance of proteins involved in glycolytic, muscle contraction, proteolytic, ATP regeneration, energy metabolism and CO₂ hydration in PSE-like breast meat may be related to the meat quality differences between normal and PSE-like breast meat. Based on the protein markers identified in the present study, future studies should focus on identifying the genes responsible for differences in protein abundance and their relationship to poultry meat quality.