O-06-01

Oxidative stress as an underlying cause of the impaired meat quality in chicken breasts affected by the White Striping myopathy (#649)

Leila Carvalho[2], Marta Madruga[2], Mario Estevez[1]

[1] University of Extremadura, Food Technology, Caceres, Spain; [2] Federal University of Paraiba, Food Engineering, Joao Pessoa, Brazil

Introduction

Meeting the increasing global demand for chicken meat has been made by selecting broilers for fast growth and high carcass yields. As a result of this, emerging abnormalities in chicken breasts have appeared including the white-striping (WS) myopathy. WS is characterized by the occurrence of white striations along the direction of the muscle fibers. Unlike the typical marbling fat in certain pork and beef muscles, these striations do not respond to a physiological accretion of lipids that may improve meat quality. Conversely, it is regarded as a reflection of a myodegeneration process that involves interstitial inflammation, edema, and necrosis. Besides the impaired appearance, some quality traits have been found to be impaired in WS breast muscles including water-holding capacity (WHC). The incidence is very high as more than 90% of commercial samples in the US are affected by this condition. The identification of the underlyng causes is essential to find means to avoid the ocurrence of the myopathy and alleviate the meat quality problems. The objective of this work was to investigate the role of oxidative stress on the onset of WS myopathy and the associated loss of protein functionality.

Methods

Commercial samples of chicken breasts were obtained from local slaughterhouses and classified in 3 groups depending on the ocurrence and severity of WS condition: Normal (N), moderate WS (MWS) and severe WS (SWS) (n=15 for each group).

Muscles were analyzed for their chemical composition (AOAC methods), the oxidative damage to lipids (TBARS) and proteins (carbonyls by HPLC and cross-links by fluorescence spectroscopy), endogenous antioxidant enzymes (catalase, superoxide dismutase and glutathion peroxidase; by spectrophotometric methods), instrumental color, instrumental texture and water-holding capacity by a centrifugation method.

SPSS was used to compared between means by using ANOVA and Tukey tests as post-hoc analyses.

Results

The ocurrence and degree of severity of WS had an influence on all measurements applied to the samples. WS samples had more lipids and less water than N samples. Color (more palid) and texture (harder) parameters were also impaired by the WS condition. While no significant differences were found between samples for the concentration of MDA, proteins from WS samples were severely oxidized as compared with N breast samples. Concomitantly, WS muscles had lower concentrations of endogenous antioxidant enzymes (particularly catalase). While the collapse of the endogenous antioxidant defenses would explain the more intense oxidative damage in WS muscles, the intense protein oxidation may be responsible for the loss of WHC as positive and significant correlations were found between protein carbonyls and WHC ($r = 0.76$; $p<0.05$).

Conclusion

Though the origin of the myopathy seems to be indefinite, the present results indicate that oxidative stress may be playing a major role in the impaired quality traits and particularly on the WHC. While some antioxidant strategies may be applied to avoid this condition and its negative effects on meat quality, it seems obvious that the decisions taken at the farm in terms of genetic selection, feeding strategies and animal handling have gone too far at promoting animal production parameters and overlooking meat quality issues. A "slowlier" animal production system for broilers may be recommended.

Notes

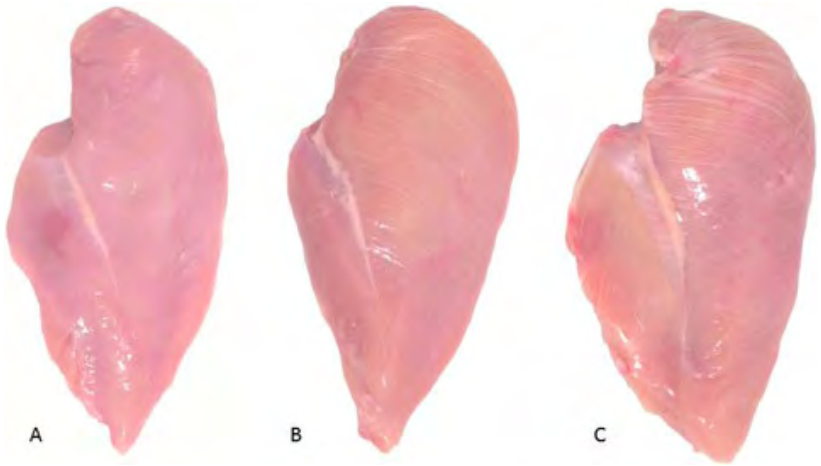

Figure 1
Normal chicken breast sample (A) and chicken breasts affected by moderate (M) and severe (S) White Striping myopathy.

Notes