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Use of Image Analysis to Identify Woody Breast Characteristics in 8 wk Old Commercial Broiler Carcasses

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Objectives

Woody breast (WB) myopathy causes a significant economic loss to poultry industry and the lack of an objective, reliable and rapid tool to identify this abnormal condition is a contributing factor. The aim of this study was to determine if there are conformation changes that can be used to identify broiler carcasses exhibiting WB characteristics using image analysis.

Materials and Methods

Images of 8-wk male broiler carcasses (n = 297) of high breast yielding commercial strain were captured prior to evisceration. Whole breast fillets were scored at 3 h postmortem for WB severity based on tactile assessment [0 or 0.5 as normal (n_1 = 93); 1 or 1.5 as mild (n_2 = 96) and 2, 2.5, or 3 as severe (n_3 = 108)] and the instrumental texture of these samples were measured using the compression analysis. Broiler carcass images were processed and analyzed using ImageJ software. Parameters for carcass conformation were M1: breast width in the cranial region; M2: a vertical line from the tip of keel to 1/fifth of breast length; M3: breast width at the end of M2; M4: angle formed at the tip of keel and extending to outer points of M3; M5: area of the triangle formed by M3 and lines generated by M4; M6: area of the breast above M3; M7: M6 minus M5. In addition, 3 ratios [M8 (M3/M1), M9 (M3/M2), and M10 (M7/M5)] were considered. Spearman correlation coefficients were estimated for WB severity scores, compression force and image measurements. A stratified random split was used to divide the data into 2 sets of 70 and 30% for training and validation, respectively. Generalized Regression platform (JMP Pro ver. 14.0, 2018) was performed to evaluate and select suitable prediction models with a binomial distribution for WB occurrence (WB score > 1.0) and lognormal distribution for compression force. Elastic Net was selected as the variable selection method with the validation column for authentication process.

Results

Spearman correlation between WB severity scores and compression force was highly significant (r = 0.86, P < 0.01). M4 (angle at keel), M9 (M3/M2) and M3 (caudal width) had the highest correlation to WB score (r = 0.81, 0.80 and 0.78, respectively; P < 0.01) and compression force (r = 0.76, 0.75 and 0.75, respectively; P < 0.01) followed by measurements M6, M5, M8, M7, M1, and M10, respectively (r = 0.42 to 0.72, P < 0.01), whereas M2, showing the lowest coefficient, was inversely correlated with WB score (r = –0.18, P < 0.01). The simplest and most adequate validated prediction models included M1, M2, and M3 (P < 0.05) measurements for WB occurrence (Gen. R^2 of 0.70 and 0.77, misclassification rates of 13% and 8%, and AUC of 0.94 and 0.96 for training and validation sets respectively). The same 3 predictors were similarly highly significant and selected as the best subset for predicting compression force [Gen. R^2 = 0.59 (training) and 0.61 (validation)].

Conclusion

These data support the possibility of the use of image analysis to predict WB condition in broiler carcasses. The potential integration of these image measurements into commercial in-line vision grading systems would allow processors to identify and sort broiler carcasses by WB category. However, additional research is required to validate relationships when broilers from other ages, strains and gender are included.

