

# MARINATION AND MEAT QUALITY OF INTACT AND PORTIONED BROILER BREAST FILLETS WITH THE WOODY BREAST CONDITION

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**Abstract – This study investigated the effects of woody breast (WB) on marination performance and meat quality of intact and horizontally portioned broiler breast fillets. Marinade uptake and retention were lower in WB meat compared to normal meat (no WB). Dorsal portions had greater marinade uptake and retention than ventral portions. For intact fillets and ventral portions, cook loss was greater in WB meat. For marinated dorsal portions, cook loss was similar between normal and WB meat. Ventral portions from WB meat exhibited greater cooked shear force. Shear force was similar between normal and WB dorsal portions. Results demonstrated that the negative influence of WB on marination and meat texture were most severe in the ventral portion of the *Pectoralis major*.**

**Key Words – meat quality, muscle myopathy, *Pectoralis major***

## I. INTRODUCTION

The woody breast (WB) myopathy negatively impacts meat quality in broiler breast meat. Raw breast fillets with WB exhibit abnormal muscle rigidity, hardened areas, and a distinct ridge-like bulge in the caudal end [1]. Histological and compositional data indicate that WB causes myodegeneration, lipidosis, and fibrosis within the *Pectoralis major* [1,2]. The WB condition influences cooked meat texture, increases cook loss, and decreases marinade absorption [3]. Due to their size and asymmetrical shape, breast fillets from large broilers are often portioned for use in retail and foodservice. Because the distinct tactile and histological characteristics of the WB myopathy are more evident on the ventral surface and cranial end of the fillet, it is hypothesized that the influence of WB on the technological and texture quality is not uniform throughout the *Pectoralis major*. The objective of this study was to determine the effects of WB on the marination, cooking, and meat texture characteristics of intact and horizontally portioned broiler breast fillets.

## II. MATERIALS AND METHODS

On 3 separate trial days, butterfly breast fillets (*Pectoralis major*) were collected from the deboning line of a broiler processing plant. Fillet weight, pH, and color (CIE L\*a\*b\*) were measured at 6 h postmortem. Fillets were assessed WB and white striping scores (1=normal, 2=moderate, 3=severe) based on published criteria [4]. Normal (no WB) and severe WB butterfly fillets were assigned control (non-marinated) and marinated treatments. At 24 h postmortem, raw compression force was measured on the ventral surface of each fillet. One side of each butterfly was then horizontally portioned into ventral (skin-side) and dorsal (bone-side) portions and the other side left intact. All samples were individually weighed and tagged for identification. Marinated samples were vacuum tumbled (4°C, 559 mm Hg, 16 rpm) with marinade at a 20% (wt/wt) marinade to meat ratio. Marinade was formulated to target a final concentration of 0.75% salt and 0.45% STPP. After 20 min of vacuum tumbling or 4°C storage (controls), samples were reweighed and stored overnight at 4°C. Samples were then weighed, packaged, and cooked to 75°C. Cooked samples were then reweighed and sub-samples were removed from the cranial ends of the portioned fillets and from equivalent anatomical locations within the intact fillets for Warner-Bratzler shear force measurements. Data were analyzed as either a 2-way ANOVA (marinade uptake and retention) or a 3-way ANOVA (cook loss and shear force).

## III. RESULTS AND DISCUSSION

Initial measurements indicated that WB fillets exhibited greater average weights (523 g vs. 479 g), white striping scores (2.3 vs. 1.4), pH (6.11 vs. 5.91), drip loss (1.31% vs. 0.93%), and raw compression force (3.15 kg vs. 0.98 kg) than normal fillets, similar to previous data [3]. For both intact breast fillets and fillet portions, WB meat exhibited lower marinade uptake and retention. The dorsal fillet portions had greater marinade uptake and retention than the ventral portions. Compared to the ventral fillet portions, the increased marinade uptake and retention of the dorsal

portions may have been due to their having increased areas of exposed muscle fibers due to deboning and fillet portioning. The outer membrane on the ventral portion of the fillet may also have served as a barrier to marinade absorption. In both control and marinated samples, WB meat had greater cook loss than normal meat for both intact fillets and the ventral fillet portions. For the marinated dorsal fillet portions, however, cook loss was similar between normal and WB meat. Both marination and the WB condition influenced cooked meat texture. In non-marinated controls, cooked shear force values in the ventral portions of the breast fillets were greater in WB meat compared to normal breast meat. Marination similarly decreased the shear force of normal and WB ventral portions. Whether or not the ventral portions were marinated as part of the intact fillets or as portioned samples did not seem to make a difference in the marination effect on shear force. Despite an improvement in shear force with marination, however, the ventral portions of WB fillets were still tougher than normal samples. The WB effects on cooked texture were different between the dorsal and ventral portions of the fillets. Contrary to what was observed in the ventral portions, cooked shear force values in the dorsal portions of the fillets were statistically similar (but numerically lower) in WB meat compared to normal meat. This observation is consistent with sensory data suggesting that WB effects on texture attributes were different between the ventral and dorsal portions of the fillets [5].

Table 1. Marination performance, cook loss, and cooked meat shear force of normal and WB meat (lmeans  $\pm$  SE).

Trait	Treatment	Intact fillet		Ventral fillet portion		Dorsal fillet portion	
		Normal	WB	Normal	WB	Normal	WB
Marinade Uptake %	Marinated	9.0 $\pm$ 0.6 <sup>c</sup>	6.2 $\pm$ 0.6 <sup>e</sup>	7.7 $\pm$ 0.8 <sup>d</sup>	4.2 $\pm$ 0.8 <sup>f</sup>	18.7 $\pm$ 1.6 <sup>a</sup>	11.7 $\pm$ 1.5 <sup>b</sup>
Marinade Retention %	Marinated	74.8 $\pm$ 4.4 <sup>ab</sup>	61.4 $\pm$ 4.3 <sup>c</sup>	73.8 $\pm$ 5.5 <sup>b</sup>	43.1 $\pm$ 5.4 <sup>d</sup>	80.1 $\pm$ 1.8 <sup>a</sup>	72.9 $\pm$ 1.7 <sup>b</sup>
Cook Loss %	Control	22.1 $\pm$ 1.3 <sup>b</sup>	31.9 $\pm$ 1.6 <sup>a</sup>	20.3 $\pm$ 1.3 <sup>bc</sup>	29.2 $\pm$ 1.5 <sup>a</sup>	22.7 $\pm$ 1.1 <sup>b</sup>	30.1 $\pm$ 1.2 <sup>a</sup>
	Marinated	15.3 $\pm$ 1.0 <sup>e</sup>	21.1 $\pm$ 0.9 <sup>b</sup>	16.7 $\pm$ 1.0 <sup>de</sup>	21.2 $\pm$ 1.0 <sup>b</sup>	16.3 $\pm$ 0.9 <sup>de</sup>	17.8 $\pm$ 0.8 <sup>cd</sup>
Shear Force (kg) ventral portion	Control	3.75 $\pm$ 0.44 <sup>bc</sup>	6.26 $\pm$ 0.52 <sup>a</sup>	3.53 $\pm$ 0.54 <sup>bc</sup>	6.60 $\pm$ 0.64 <sup>a</sup>	---	---
	Marinated	3.27 $\pm$ 0.33 <sup>c</sup>	4.35 $\pm$ 0.31 <sup>b</sup>	3.05 $\pm$ 0.41 <sup>c</sup>	4.41 $\pm$ 0.38 <sup>b</sup>	---	---
Shear Force (kg) dorsal portion	Control	4.16 $\pm$ 0.35 <sup>a</sup>	3.11 $\pm$ 0.41 <sup>abc</sup>	---	---	3.90 $\pm$ 0.40 <sup>a</sup>	3.32 $\pm$ 0.47 <sup>ab</sup>
	Marinated	3.26 $\pm$ 0.26 <sup>ab</sup>	2.79 $\pm$ 0.24 <sup>b</sup>	---	---	2.65 $\pm$ 0.30 <sup>bc</sup>	2.16 $\pm$ 0.28 <sup>c</sup>

<sup>a-f</sup> Means within a trait with no common letter differ significantly ( $p < 0.05$ ).

#### IV. CONCLUSION

The negative influences of the WB myopathy on marination performance, cook loss, and meat texture were not uniform throughout the *Pectoralis major*. Problems with product yield and cooked meat toughness were most severe in the ventral portions of the breast fillets. Marination improved cook loss and shear force in the ventral portions of WB fillets, but differences in quality due to the myopathy were still apparent following moisture enhancement. In the dorsal fillet portions, the WB condition did not impact cook loss in marinated meat or significantly alter cooked meat shear force. Thus, processors may be able to utilize breast fillet portioning and portion specific marination strategies to better manage the processing and meat quality problems associated with the WB myopathy in broiler breast fillets.

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