IMPACT OF DELAYED CARCASS PROCESSING ON BROILER BREAST MEAT QUALITY

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I. INTRODUCTION

In the modern U.S. broiler chicken industry, at the time of harvest birds are usually manually captured on the farm, loaded into crates, and transported to a commercial processing facility for slaughter. Most of the broiler slaughter facilities in the U.S. utilize electrical stunning. At these plants, birds are unloaded from the crates and hung on moving shackles prior to stunning. The handling, transport, and transfer activities are known to be stressful to birds [1, 2]. Additionally, stresses associated with handling and transport can have a negative impact on meat quality [3, 4, 5]. On-farm slaughter and the transport of carcasses rather than live broilers is being investigated as a potential method to reduce animal welfare concerns related with the transport and handling of live birds. Slaughtering broilers on-farm would likely cause a time delay between the stunning-bleeding steps of slaughtering (conducted on-farm and during transport) and the subsequent defeathering and evisceration steps of carcass processing. The effects that delayed carcass processing would have on processing efficiency, carcass quality, and meat quality are unknown. The objective of this study was to determine the effects of delayed broiler carcass processing on breast meat quality.

II. MATERIALS AND METHODS

At a commercial broiler processing plant, broilers (~2.9 kg liveweight) were live hung, electrically stunned, and bled out according to standard industry procedures. Carcasses (10 per treatment) were removed from the processing line after bleeding and held on shackles for 0, 2, 4, or 6 h before being placed back on the processing line prior to carcass scalding and picking. After defeathering, carcasses were removed from the processing line for carcass evaluation and breast fillets were deboned. Fillets were chilled on ice and held overnight at 4 °C prior to meat quality measurements. Right breast fillets from each carcass were utilized for pH and color (L*a*b*) measurements prior to cooking and Blunt Meullenet-Owens Razor shear force measurements (BMORS). From the left fillets from each carcass, a 30 g sample was taken from the mid-caudal portion of the fillet for drip loss measurement (days 1, 4, and 7) and the cranial portion of the fillet was frozen/thawed and used for marination (salt-phosphate marinade, 20 min vacuum tumbled) prior to cooking and BMORS assessment. The entire experiment was replicated 3 times on separate trial days. Data were analyzed as a one-way ANOVA using SAS (v 9.3, SAS Institute Inc.) with carcass treatment (0, 2, 4, 6 h) as a fixed factor and trial day as a random factor. Means were separated using Tukey HSD with differences considered significant at $P < 0.05$.

III. RESULTS AND DISCUSSION

Visual assessment of raw fillets indicated that delayed carcass processing resulted in a greater proportion of fillets with reddish discoloration on the skin-side surface on the cranial end. This observation was supported by increased a* values in raw fillets. After cooking, no differences in meat color were observed on the skin-side of fillets. No treatment differences in meat pH were observed. With regards to water-holding capacity, delayed processing had minimal effects. Drip loss after 4 and 7 days was similar between treatments. Thaw loss was not influenced by delayed processing. Cook loss in fresh samples was similar between 0, 2, and 4 h treatments but was greater in 6 h samples. In fresh samples, cooked shear measurements indicated that delayed processing can result in more tender meat. This is likely due to the muscle remaining on the bone during rigor mortis development with delayed carcass processing. Marination uptake was greater in 6 h samples compared to controls. In marinated samples, differences in meat color and cook loss were not observed. In marinated samples, shear measurements were similar between controls (0 h) and delayed processing samples.

Table 1. Effect of delayed carcass processing (0, 2, 4, 6 h) on breast meat quality (n = 30).

Trait	0 h	2 h	4 h	6 h	SE	P-value
pH	5.75	5.76	5.79	5.72	0.04	0.072
L* (skin-side, raw fillet)	61.9	61.9	62.8	63.5	0.77	0.182
a* (skin-side, raw fillet)	0.48^{b}	0.77^{ab}	1.00^{ab}	1.27^{a}	0.64	0.020
b* (skin-side, raw fillet)	11.4	11.6	12.3	12.0	1.02	0.203
L* (skin-side, cooked fillet)	82.4	82.3	81.4	82.6	1.04	0.171
a* (skin-side, cooked fillet)	1.67	1.50	1.80	1.61	0.25	0.245
b* (skin-side, cooked fillet)	16.0	15.4	15.9	15.7	0.31	0.207
Drip Loss %, day 1	2.18^{ab}	1.74^{b}	2.73^{a}	2.37^{ab}	0.54	0.031
Drip Loss %, day 4	5.15	4.95	5.15	5.22	1.19	0.941
Drip Loss %, day 7	6.93	6.41	7.02	6.83	1.77	0.701
Cook Loss %	19.5^{b}	19.9^{b}	19.9^{b}	21.8^{a}	1.08	0.010
BMORS, peak force (N)	18.8^{a}	17.6^{ab}	16.0^{ab}	15.5^{b}	6.36	0.017
BMORS, shear energy (N*mm)	110.1^{a}	102.1^{ab}	93.5^{b}	91.3^{b}	27.1	0.014
Thaw Loss %	9.33	9.16	9.66	9.48	0.81	0.834
Marination Uptake %	10.9^{b}	12.7^{b}	14.6^{b}	19.8^{a}	1.71	<0.0001
Cook Loss %, marinated	15.4	15.1	14.9	15.0	1.06	0.855
BMORS, peak force (N), marinated	7.16^{ab}	7.11^{ab}	8.18^{a}	6.61^{b}	0.65	0.046
BMORS, shear energy (N*mm), marinated	46.9^{ab}	46.5^{ab}	52.7^{a}	42.9^{b}	4.38	0.034

[ab] Means in the same row with different superscripts differ ($P < 0.05$).

IV. CONCLUSION

Data demonstrated that delays in the processing of broiler carcasses had minimal impact on breast meat water-holding capacity and improved cooked meat tenderness. Although delayed processing can potentially increase discoloration in raw breast fillets, it was not observed to be a problem in cooked or marinated meat. Overall, data from this study suggest that potential delays in carcass processing inherent with on-farm slaughter would likely not be detrimental to meat quality.

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