EFFECT OF POSTMORTEM AGING AND GROWTH PROMOTANT USE ON *M. GLUTEUS MEDIUS* COLLAGEN CHARACTERISTICS AND MEAT QUALITY IN CROSSBRED ANGUS STEERS

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I. OBJECTIVES

The beef industry aims to enhance production efficiency without compromising beef tenderness. Tenderness is influenced by myofibrillar proteins and surrounding connective tissues, mainly composed of collagen. The influence of collagen has been considered immutable and deemed responsible for the "background toughness" of beef. Our objective was to determine whether its contribution to beef toughness is indeed immutable through investigation of the effects of residual feed intake (RFI), steroids, ractopamine hydrochloride (RH), and postmortem aging on collagen solubility and meat quality of the *m. gluteus medius* (GM).

II. MATERIALS AND METHODS

Forty-seven crossbred Angus steers from low (efficient, $n = 26$) (-0.33 ± 0.08 kg/d) and control (inefficient, $n = 21$) (0.63 ± 0.09 kg/d) RFI breeding lines were randomly assigned to one of 3 treatments in a $2 \times 2 \times 2$ factorial design within RFI status: control (no implant, no RH) ($n = 12$); implant and RH ($n = 11$); RH only ($n = 12$) and implant only ($n = 12$). Steers' actual RFI performance was confirmed during finishing using GrowSafe™ technology. Implanted steers received a first implant (200 mg progesterone, 20 mg estradiol benzoate, and 29 mg tylosin tartrate) at 332.21 ± 2.54 d of age and 383.19 ± 2.88 kg live weight, and a terminal implant (120 mg trenbolone acetate and 24 mg estradiol) at about 100 d before slaughter. RH was fed 28 d before slaughter at 200 mg head^{-1} day^{-1}. GM muscles were excised 48 h postmortem from the right carcass side. Muscles were cut in half and halves randomly assigned to 3 and 12 d of aging at $4°C \pm 2°C$ balanced within treatment for position within muscle. Warner-Bratzler shear force (WBSF), muscle proximate content, and collagen heat solubility were measured. Data were analyzed using RStudio as a split plot blocked by slaughter group with experimental units of animal in the main plot and muscle half in the split plot. RFI, steroids, RH, aging, and their interactions were fixed variables. Models were considered significant at $P < 0.05$. Pearson correlations were performed between meat quality and collagen solubility measurements with significance at $P < 0.05$.

III. RESULTS

Steaks from implanted muscles had a higher mean peak shear force (37.70 ± 1.30 N) than nonimplanted steers (33.38 ± 1.29 N) ($P = 0.0217$). WBSF was correlated with protein content ($P = 0.0131$) ($r = 0.38$), suggesting that muscles undergoing active protein deposition were tougher. Total collagen increased from day 3 to 12 due to biological variation in the steaks (Table 1), and at day 12 was positively correlated with WBSF ($P = 0.0278$) ($r = 0.34$), indicating that collagen contributed to GM toughness more so after aging. There was an interaction between steroid, RH, and aging on collagen solubility, where steaks from cattle

with no growth promotion had the highest increase in solubility percentage with postmortem aging ($P = 0.0049$) (Figure 1). RFI status did not affect collagen characteristics ($P > 0.05$).

Table 1.
Effect of ageing on collagen characteristics and WBSF

	Day		
Measurement (n = 46)	**Day 03[1]**	**Day 12[2]**	**Pr>F[3]**
Soluble collagen (mg collagen/g raw meat)	0.60±0.17[a]	1.09±0.17[b]	0.0208
Total collagen (mg coliagen/g raw meat)	2.53 ±0.31[a]	3.49 ± 0.31[b]	0.0067
Warner-Bratzler Shear Force (N)	39.32 ±131[b]	31.76 ±1.31[a]	0.0001

- a, b Least square means within a row lacking a common letter differ at P < 0.05. [1]Muscles aged for 3 days. [2]Muscles aged for 12 days. [3] Probability of the F test, with significance at P < 0.05.

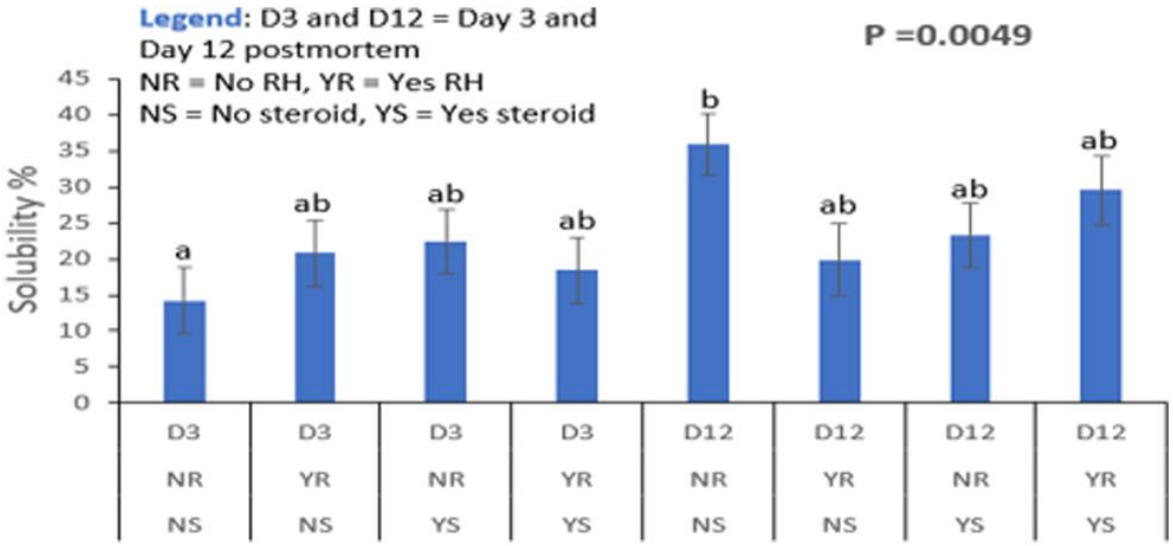

Figure 1.
Interaction effect between ageing, RH and steroid on collagen solubility

IV. CONCLUSION

This study confirmed that steroid use in beef steers increased cooked GM toughness, but that this increase can be resolved with postmortem aging. This study also showed that the effect of collagen on beef toughness is not immutable as collagen solubility can increase with postmortem aging, and that the contribution of collagen to WBSF can become more prominent after aging.

Keywords: beef tenderness, collagen, ractopamine, residual feed intake, steroids