NITRIC OXIDE PRODUCTION IN POST-RIGOR SEMIMEMBRANOSUS PORK MUSCLE

K. M. Modrow*, W. Osburn, and Osburn, Wesley N. 2019.

Amino acid alternative curing system. Patent Attorney Docket No. TAMU-19489 December 2019, issued 2019.,

[1]*Animal Science, Texas A&M University, College Station, TX, USA*,

*kmmodrow2017@gmail.com

I. OBJECTIVES

This study was conducted to validate that L-arginine activated nitric oxide synthase (NOS) system in living skeletal muscle can produce nitric oxide (NO) and residual nitrite in pre-rigor porcine muscle, and to investigate whether post-rigor *semimembranosus* pork produces NO.

II. MATERIALS AND METHODS

Pre-rigor pork *semimembranosus* muscle samples (60–75 g) were collected from 4 pre-rigor pork carcasses at 3 separate times over a 3-d period ($N = 12$). Post-rigor samples were collected from the same carcasses after 18 h of refrigerated storage to ensure rigor completion ($N = 12$). Subsamples (~5 g) were placed in separate test tubes and treated with one of 5 concentrations of 2 mL L-arginine solution (2, 4, 8, 16, and 32 mM) with the control water (0 mM). Additionally, a solution containing 72 mg NaCl, 576 ppm sodium erythorbate, and 8 mL of water was added to each sample ($n = 288$). Muscle pH was determined before and after treatment. Samples were either heated (water bath cooking samples to 62°C within 60 min) or left raw (uncooked). All treated samples were analyzed for residual nitrite by supernatant and pellet sampling by modified ultraviolet/visible spectrophotometric method. Cooked sample supernatant and pellets were analyzed for nitrosylation (determination of nitrosylhemochromagen) after a 1-wk storage period (−30°C; freezer, then thawed in 0°C cooler).

III. RESULTS

For residual nitrite, all L-arginine treated raw pre-rigor supernatants were higher ($P < 0.05$; range 11.9–44.6 ppm) than the control (0.26 ppm). For all raw post-rigor supernatants, L-arginine treatments had higher residual nitrite levels ($P < 0.05$; range 9.5–23.5 ppm) compared to the control (2.06 ppm). The pre-rigor cooked 4 mM supernatants had the highest level of residual nitrite (61.9 ppm; $P < 0.05$), while 2 mM (61.1 ppm) and 16 mM (53.7) had higher levels compared to other treatments and the control. Cooked pre-rigor pellets were not different for residual nitrite with the highest level at 32 mM (40.1 ppm). In cooked post-rigor pellets, 4 mM (23.7 ppm), 8 mM (22.1 ppm), 16 mM (22.2 ppm), and 32 mM (32.9 ppm) were different from the control (11.02 ppm; $P < 0.05$). All pre-rigor cooked supernatants and pellets were greater than the control for nitrosylhemochromagen (NO-heme), total heme pigment, and nitrosylation. The same results were observed for post-rigor cooked supernatants and pellets. Nitrosylation for post-rigor pellets were different for all concentrations to the control. Nitrosylation for pre-rigor pellets were highest at 32 mM (86.1%) and different than the control (37.1%). Nitrosylation for post-rigor supernatants were highest at 32 mM (104.3%). The NO-heme content was greatest at 32 mM concentration (27.3 ppm), while 4 mM (19.7 ppm), 8 mM (18.3 ppm), and 16 mM (18.4 ppm) concentrations were greater than the control (9.16 ppm). The observed bimodal effect is similar to findings from previous research regarding NO production in endogenous skeletal

muscle. As NO converts to nitrite by increasing 0.5 to 5 mM concentrations, addition of L-arginine in pre-rigor meat (4 mM) and at higher concentrations (32 mM) resulted in more efficient NO generation. This likely occurred by reducing interference in NOS competition to regenerate L-arginine as a substrate for NO, residual nitrite, and NO-hemachromagen formation.

IV. CONCLUSION

Based upon the results of this study, there is evidence that the NOS system is activated by addition of L-arginine to produce NO and residual nitrite in post-rigor meat. These results suggest that an L-arginine alternative meat curing system may be viable.

Keywords: L-arginine, nitric oxide synthase, nitrite, post-rigor meat