

0419 Changes to the muscle proteome during acute heat stress are dependent on predominant fiber type.

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The objective was to determine acute proteomic changes in muscle caused by heat stress. Crossbred gilts ($n = 16$) were exposed to either thermal neutral (TN, 20°C, 40% relative humidity) or heat stress (HS, 37°C, 40% relative humidity) conditions for 12 h with ad-libitum feed intake. The semitendinosus was collected, divided into red (RST) and white (WST) portions, and frozen in liquid N. Protein abundance changes due to treatment were determined ($P < 0.15$) in sarcoplasmic extracts of HS and TN animals via 2-dimensional difference in gel electrophoresis (2D-DIGE). Proteins were identified using electrospray ionization mass spectrometry. Compared with TN muscle, heat shock protein (Hsp) 70, mitochondrial Hsp70, Hsp27, Hsp20, and α -B crystallin were increased in abundance in muscle of HS pigs. However, 1 spot identified as α -B crystallin was decreased in abundance in the RST with HS. Several protein spots associated with glycolysis or the TCA cycle were changed in abundance with HS, indicating that muscle energetic metabolism is altered during HS. In the RST, these proteins included aldolase A (decreased, 1 spot), phosphoglycerate kinase 1 (increased, 2 spots), phosphoglycerate mutase 2 (decreased, 1 spot), malate dehydrogenase (increased, 2 spots), succinyl-CoA synthetase (increased, 1 spot), and creatine kinase (increased, 1 spot). In the WST, changes in the proteins aldolase A (increased, 1 spot), glyceraldehyde 3-phosphate dehydrogenase (increased, 1 spot), and creatine kinase (decreased, 1 spot) were identified. In both muscle types, β -enolase (increased, 1 spot), isocitrate dehydrogenase (increased, 1 spot), and malate dehydrogenase (increased, 2 spots) were changed in abundance with HS. Heat stress may also affect cell structure. In the WST, HS altered abundance of proteins involved in microtubule or microfilament structure, including α and β tubulin (decreased, 1 spot each) and cofilin 2 (increased, 1 spot). Finally, abundance of several peroxiredoxins was altered with HS, which may indicate that oxidation regulation is changed during acute HS. In HS pigs, peroxiredoxin 6 was increased in 1 spot in the RST, and peroxiredoxin 1 was decreased in 1 spot in the WST. Peroxiredoxin 2 was decreased in abundance in 2 spots in both muscle types due to HS. These results demonstrate that acute HS may have measurable impacts on muscle metabolism, structure, and antioxidant enzymes, which may contribute to the decreased performance generally observed in HS pigs. Additionally, muscle types may respond and adapt differently to acute HS.

Key Words: heat stress, pigs, fiber type

0420 Relationship of fat quality to meat quality traits of pork. E. D. Testroet*, C. Yoder, C. Bustos, S. M. Lei, D. C. Beitz, and T. J. Baas, *Iowa State University, Ames.*

The objectives of this research were to investigate the relationship of pork fat quality to meat quality, the effect of genetic differences on fat quality, how fat quality and adipocyte cellularity varies amongst anatomical sites, and finally how the 7 breeds performed when compared with one another. Our hypothesis was that measures of pork fat and meat quality vary with different breeds of pigs, and that a relationship exists between fat and pork quality measures. Barrows and gilts ($n = 352$) of 6 purebred lines and 1 commercial crossbred line were fed commercial swine diets with dried distillers grains with solubles (DDGS) inclusion at 30% of DM. Pigs began the experiment when the pen average pig weight was 31.8 kg and were harvested at a minimal weight of 111.1 kg. At harvest, carcass characteristics were measured, adipose tissue was collected from the back, belly, and jowl, and meat samples were taken from the longissimus muscle for evaluation of fat and meat quality characteristics. Iodine values varied amongst breed within anatomical site and between anatomical sites within each breed, and, therefore, the anatomical site of adipose tissue sampling may be of importance when evaluating iodine values of pork fat. Jowl fat iodine values are significant ($P < 0.0001$) predictors of back and belly fat iodine values ($R^2 = 0.2922$ and 0.3604 respectively). Backfat iodine values were not significantly correlated with ultimate pork chop muscle pH ($P = 0.0680$) but were significantly negatively correlated with visual color ($P = 0.0002$), visual marbling ($P < 0.0001$), and visual firmness ($P = 0.0346$), indicating that an increase in iodine value of pork fat is related to a decrease in pork quality as perceived by consumers. Finally, adipocyte cellularity was significantly affected by breed when compared within anatomical location across breeds ($P < 0.05$), but significant differences between breeds, within anatomical location, of mean cell size of adipocytes were only found for belly adipose tissues. Overall, these experimental results support our hypothesis that there is a significant relationship between pork fat and pork quality and that pork fat quality and meat quality vary by breed. Additionally, iodine values are a valuable measure of pork quality, and iodine values of jowl fat can be used to predict iodine values of back and belly fat, providing a powerful tool to meat packers for fat quality estimation.

Key Words: iodine value, pork quality, adipocyte cellularity

0421 Effects of dietary level of dried citrus pulp on growth, feed efficiency, carcass merit, and lean quality of finishing pigs. C. M. Strong*, J. H. Brendemuhl, D. D. Johnson, and C. Carr, *University of Florida, Gainesville.*

As feed costs continue to be the largest expense for producers, fibrous feedstuffs such as dried citrus pulp (DCP), previously thought to be of marginal quality, are now being explored for use in swine diets because of their availability and low cost. Previous research has focused on DCP as an energy supplement in cattle diets in Florida, but there have been limited studies investigating the effects of differing dietary levels of DCP on the growth, efficiency, carcass merit, and lean quality of finishing pigs. Pigs ($n = 40$) were fed 1 of 4 diets for 49 d: a corn soybean meal control diet (CON; $n = 10$), or the same diet with DCP replacing 15% (15DCP; $n = 10$), 22.5% (22.5DCP; $n = 10$), or 30% (30DCP; $n = 10$) of the total diet DM. Overall, G:F over 49 d was greater in CON and 22.5DCP than 30DCP ($P < 0.02$). Pigs were slaughtered at the University of Florida Meat Laboratory abattoir. Initial pH was taken 60 min postexsanguination from the LM and the semimembranosus (SM). Carcasses were fabricated at 24 h postmortem, where initial meat quality measurements were made at the 10th and 11th rib interface of the LM and the gluteus medius of the ham face. Fat measurements taken at the blade region of the LM received higher L* values ($P < 0.04$) in CON animals compared with 22.5DCP and 30DCP. When evaluated objectively, bellies from CON pigs were firmer ($P < 0.0001$) than all other treatment groups, but both CON and 15DCP garnered higher subjective firmness scores than 22.5DCP and 30DCP ($P \leq 0.04$). Belly thickness at both the blade and flank ends decreased as DCP percentage increased, with CON exhibiting the thickest ($P < 0.03$) and 30DCP having the thinnest ($P \leq 0.02$) measurements. Longissimus muscle chops from 30DCP pigs received higher juiciness scores from panelists than 22.5DCP and CON ($P \leq 0.03$), while 15DCP chops only earned higher values than CON chops ($P = 0.03$). There was no effect of dietary DCP inclusion on muscle pH, lightness, redness, and yellowness values, chroma, or hue angle, drip or purge loss, live or hot carcass weight, dressing percentage, back fat, loin eye area, percentage lean, shear force, cook loss, retail evaluation, or retail lightness, redness, or yellowness values. Though sensory panelists reported increased palatability (juiciness) of chops from pigs receiving 30% DCP, increasing DCP percentage of the total diet DM appeared to be economically detrimental to overall production because of negative impacts on growth performance and pork belly quality.

Key Words: pork, citrus, byproduct

0422 Effects of zilpaterol hydrochloride and implants in beef heifers I: Feedlot performance, carcass characteristics, and intramyocellular lipid accumulation. M. A. Vaughn*, S. M. Ebarb, K. J. Phelps, D. D. Burnett, J. S. Drouillard, and J. M. Gonzalez, *Kansas State University, Manhattan.*

To assess the effects of zilpaterol hydrochloride (ZH) supplementation and implants on feedlot performance, carcass characteristics, and intramyocellular lipid accumulation, 33 crossbred yearling heifers were blocked by initial BW (464 ± 2 kg) and randomly assigned to 3 treatments consisting of no implant or ZH (CON); Component TE-200 implant on d 1 of the study, no ZH (IMP); implant and 8.3 ppm of ZH for 21 d with a 3-d withdrawal period (ZIL). Animals were fed a finishing ration once daily, ad libitum, with bunks managed to leave a minimum amount of unconsumed feed. After a 75-d feeding period, cattle were harvested at a commercial abattoir. At 36 h postmortem, carcass characteristics were collected and boneless strip loins were transported to the Kansas State University Meats Laboratory. To assess intramyocellular lipid content, 13th-rib LM samples were cryopreserved, cut into 5- μ m sections, and exposed to BODIPY 493–503 staining. Final BW, DMI, ADG, and KPH were not affected by treatment ($P > 0.30$). The IMP and ZIL heifers had greater G:F compared with CON ($P = 0.04$). The ZIL heifers had greater ($P < 0.01$) HCW than CON heifers and IMP heifers tended to have greater ($P = 0.07$) HCW than CON heifers. The ZIL heifers had greater ($P = 0.03$) dressing percentage (DP) compared with CON heifers, and IMP heifers tended to have a greater ($P = 0.07$) DP than CON heifers. Heifers fed ZIL also had greater LM area ($P = 0.01$) compared with CON heifers, and IMP heifers tended to have greater ($P = 0.06$) LM area than CON heifers. Heifers from the CON treatment had greater ($P = 0.01$) amounts of backfat than ZIL heifers, and CON heifers tended to have more ($P = 0.09$) backfat than IMP heifers. The CON heifers had greater ($P = 0.04$) marbling than IMP heifers, but ZIL carcasses did not differ in marbling between the 2 other treatments ($P > 0.14$). For LM area, backfat, and marbling, ZIL and IMP carcasses did not differ from one another ($P > 0.37$). Additionally, IMP heifers contained a greater ($P = 0.04$) percentage of muscle fibers with intramyocellular lipid droplets than ZIL heifers. The CON heifers tended to have a greater ($P = 0.08$) percentage of muscle fibers that contained intramyocellular lipid droplets than ZIL heifers. These data suggest that implanting cattle and ZH supplementation increase efficiency of lean meat production while decreasing adipose tissue accumulation in all depots except KPH.

Key Words: implants, zilpaterol hydrochloride, intramyocellular lipids

0423 Effects of zilpaterol hydrochloride and implants in beef heifers II: Aging effects on Warner-Bratzler shear force, collagen solubility, and fiber cross-sectional area. S. M. Ebarb*, K. J. Phelps, M. A. Vaughn, J. A. Noel, C. B. Paulk, J. S. Drouillard, and J. M. Gonzalez, *Kansas State University, Manhattan.*

To evaluate the effects of zilpaterol hydrochloride (ZH), implants, and day of aging (DOA) on Warner-Bratzler shear force (WBSF), collagen solubility, and fiber cross-sectional area (CSA), 33 crossbred heifers were blocked by weight and randomly assigned to 1 of 3 treatments: no implant or ZH (CON); Component TE-200 implant on d 1 of the study (IMP); or implant and 8.3 ppm of ZH for 21 d with a 3-d withdrawal period (ZIL). After 75 d of feeding, animals were shipped to a commercial abattoir for harvest, chilled for 36 h, and boneless strip loins were transported to the Kansas State University Meats Laboratory. To assess CSA and myosin heavy chain isoform (MHC), 13th-rib LM samples were cryopreserved, sectioned into 5- μ m sections, and immunostained for MHC type I, IIA, and IIX. On d 3, 14, and 21 of aging, a 2.54-cm steak and a 0.64-cm steak were fabricated for WBSF and collagen solubility analyses, respectively. For WBSF, there was a treatment \times DOA interaction ($P < 0.01$). On d 3 of aging, CON steaks had decreased WBSF compared with IMP and ZIL steaks ($P < 0.01$). At d 14, CON and IMP steaks did not differ ($P = 0.21$) in WBSF, but ZIL steak WBSF values were greater than those of the other treatments ($P < 0.01$). After 21 d aging, there were no WBSF differences between treatments ($P > 0.13$). There was no treatment \times DOA interaction for percent soluble or total collagen ($P > 0.20$). Implants and ZIL increased the percentage of soluble collagen when compared with CON ($P < 0.05$), and solubility of collagen also increased between d 14 and 21 of aging ($P < 0.01$). Treatment or DOA did not affect total collagen content ($P > 0.51$). For type I muscle fibers, CSA was greatest for the IMP group ($P < 0.01$). Type IIA and IIX CSA were greater for ZIL compared with IMP and CON ($P < 0.01$). There were positive correlations between type IIX CSA and WBSF on d 3, 14, and 21 of aging ($R^2 = 0.64, 0.58, \text{ and } 0.37$, respectively; $P < 0.05$). Increased CSA for type I and type IIA were positively correlated with increased WBSF for d 3 and 14 (type I $R^2 = 0.51, 0.44, \text{ and } 0.26$; type IIA $R^2 = 0.51, 0.45, \text{ and } 0.27$, respectively; $P < 0.05$), but not for d 21 ($P > 0.14$). Implants and ZH increase the CSA of muscle fibers, which correlate positively with WBSF values.

Key Words: growth promotants, shear force, cross-sectional area

0424 Effect of zilpaterol hydrochloride on carcass composition, subprimal yield, and meat quality of Nellore heifers. N. R. B. Cônsolo*¹, R. S. Goulart², F. Rodriguez¹, M. O. Frassetto¹, R. A. P. Maciel¹, J. F. Penso¹, and L. F. P. Silva¹, ¹*University of São Paulo, São Paulo, Brazil,* ²*MSD Saúde Animal, Sao Paulo, Brazil.*

The aim of this research was to evaluate the effects of zilpaterol hydrochloride (ZH) on carcass composition, carcass subprimal yield and meat quality of Nellore heifers. Seventy-two animals were fed with ZH (Zilmax, Merck Animal Health, Summit, NJ) during 30 d, allowing for 3 d of product withdrawn before slaughter. The animals were blocked by BW and previous ADG and allocated into 2 groups: Control and Zilpaterol (8.3 mg ZH/kg of diet DM). After 24 h postmortem, left carcasses were processed and the ninth, 10th, and 11th rib sections (HH sample) were removed from the primal rib to determine carcass chemical composition. Four steak samples were collected from the longissimus muscle to determine cooking loss and Warner-Bratzler shear force (WBSF) after 0, 7, 14, and 21 d of aging. The right carcasses were processed into primal cuts, and weighed. Each primal cut was further processed into boneless subprimal cuts, minor cuts, lean trim, fat, and bone. Statistical analyses were conducted using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) considering the fixed effects of treatment and the random effect of block. Treatments had no effect on the protein, fat, or ash content of the carcass, as estimated by water content. Cooking loss was unaffected by ZH supplementation. There was a ZH \times Aging interaction for WBSF, with greater WBSF for ZH at 7 and 14 d of aging. Zilpaterol hydrochloride supplementation increased ($P < 0.05$) the weights of most of the meat cuts analyzed, especially the cuts from the hindquarter ($P < 0.01$), including top sirloin cap ($P = 0.01$), striploin ($P = 0.05$), tenderloin ($P < 0.01$), eye of rump ($P < 0.01$), knuckle ($P < 0.001$), inside round ($P < 0.001$), outside round ($P = 0.01$), and eye of round ($P < 0.05$). Additionally, ZH increased by 7.66% of the subprimal yield and by 1.94% of the debone yield of the heifers. In conclusion, ZH supplementation had no effect on chemical carcass composition, decreased meat tenderness after 7 and 14 d of aging, and increased meat cuts weights and carcass subprimal yield.

Key Words: β -agonist, shear force, subprimal yield

0425 Effects of duration of vitamin C supplementation on growth performance, carcass traits, and protein degradation of the longissimus thoracis of steers fed a 0.31 or 0.59% sulfur diet. D. Pogge*, S. M. Lonergan, and S. L. Hansen, *Iowa State University, Ames.*

Angus steers ($n = 42$) were allotted equally to 7 pens with individual feed intake monitoring technology by BW (304 ± 13 kg), and fed 1 of 7 diets: 4, high-S (0.59% S) diets, supple-

mented with 10 g vitamin C (VC)·steer⁻¹·d⁻¹ for 0 d (HSCON), 56 d (HSVC56), 90 d (HSVC90), or 127 d (HSVC127), and 3 low-S diets (LS, 0.31% S) supplemented with 10 g VC·steer⁻¹·d⁻¹ for 56 d (LSVC56), 90 d (LSVC90), or 127 d (LSVC127). Jugular blood (d 0, 56, 90, 127) and liver (d 121 or 122) were collected from all steers. Steers ($n = 40$) were harvested on d 128, and carcass data and rib-sections were collected. Steer was the experimental unit and data were analyzed using Proc Mixed. Final BW ($P < 0.01$), ADG ($P < 0.01$), and DMI ($P = 0.09$) were greater in LS steers than HS steers, but G:F was not affected ($P = 0.41$) by treatment. Total ($P = 0.06$) and reduced ($P = 0.03$) plasma glutathione (GSH) concentrations were greater, and the ratio of oxidized-to-reduced liver GSH was lesser ($P < 0.01$), in VC-fed HS steers compared with HS CON. Ribeye area and marbling score were not affected by diet ($P \geq 0.33$), but LS steers had greater ($P = 0.05$) back-fat than HS steers. a^* and b^* values were greater ($P \leq 0.05$) in LS steaks than HS steaks over 7 d. Steaks from HS steers had greater total ($P = 0.02$), soluble ($P = 0.06$), and insoluble ($P = 0.06$) collagen (d 2) than steaks from LS steers. Steaks (d 2) from steers fed the HS diet had a greater ($P < 0.01$) and lesser ($P = 0.04$) percentage of the 80 kDa and 76 kDa subunit of calpain-1, respectively, than the LS steers. Adding VC to the HS or LS diets linearly decreased the 80 kDa subunit ($P = 0.03$) and 76 kDa subunit ($P = 0.04$) of calpain-1, respectively. Troponin-T (TT) degradation 2 d postmortem tended to be greater ($P = 0.08$) in LS steers than HS steers, while TT 7 d postmortem did not differ ($P \geq 0.55$) by treatment. In conclusion, improved GSH indices in the VC-supplemented HS steers may be supporting increased activation of calpain-1 compared with steers fed HS alone. It appears that high-S diets may negatively affect the rate, but not extent of longissimus thoracis protein degradation.

Key Words: beef cattle, sulfur, vitamin C

0426 Interaction of various inclusion levels of dietary vitamin D₂ enriched yeast cell wall with zilpaterol hydrochloride on dry matter intake and postmortem tenderness in feedlot steers.

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The objectives of this study were to examine the impact of various inclusion rates of vitamin D₂ enriched yeast cell wall (YCW) on performance and carcass characteristics of cattle finished with zilpaterol hydrochloride (ZH). Crossbred steers ($n = 192$; BW = 546 ± 11 kg) were blocked by BW in a randomized block design and randomly assigned to pen (6 pens/block; 4 cattle/pen). Pens within block were assigned to 1 of 6 treatments (8 pens/treatment): (1) negative control (-CON; no ZH, no YCW), (2) positive control (+CON; ZH, no YCW), (3)

vitamin D₂ YCW containing 100,000 IU vitamin D₂/gram (2.5 g · animal⁻¹ · d⁻¹), (4) vitamin D₂ YCW (5.0 g · animal⁻¹ · d⁻¹), (5) vitamin D₂ YCW (10.0 g · animal⁻¹ · d⁻¹), (6) YCW C-wall product (2.5 g · animal⁻¹ · d⁻¹). Steers were supplemented with respective treatments for the 51 d duration of the trial, of which ZH was supplemented d 28 to 47. Daily DMI was recorded and BW was collected at d 0, 28, and 51. Carcass data was collected on harvest and 10 choice strip loins were randomly collected from each treatment for further analysis. Strips were cut into steaks and assigned to 1 of 4 aging periods (7, 14, 21, 28 d). Tenderness was estimated using Warner-Bratzler shear force (WBSF). Data were analyzed using a randomized block design with the fixed effect of treatment and the random effect of block. Warner-Bratzler shear force values were analyzed using the same model, including aging period as an additional factor. Dry matter intake showed a significant quadratic relationship ($P = 0.01$) for increasing levels of D₂ YCW for the entire feeding period, with the greatest intake in the 10.0-g treatment (10.30, 10.27, and 10.66 kg/d, respectively). All ZH fed treatments had numerically greater WBSF values than negative control, but values among ZH treatments were insignificant across all aging periods. There was a tendency for lower WBSF values in the 10.0 g D₂ YCW treatment when compared with positive control ($P = 0.10, 0.06, 0.10$, and 0.09), and WBSF values of steaks from the 10.0 g YCW treatment ranged from 0.44 kg (d 21) to 0.69 kg (d 7) lower than positive control for all aging periods. Results indicate that yeast cell wall supplementation could increase performance of finishing steers during ZH supplementation, while vitamin D₂ supplementation may have positive effects on tenderness.

Key Words: vitamin D, yeast, zilpaterol hydrochloride

0427 Zinc methionine alters muscle and adipose gene expression and protein concentration of calf-fed Holstein steers fed zilpaterol hydrochloride.

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Zinc has been shown to have allosteric binding sites on β 2-adrenergic receptors (β -AR), enhancing agonist affinity, and inhibiting antagonist binding. Therefore, our objective was to determine the effect of supplementing a Zn methionine complex (ZINPRO, Zinpro Corp., Eden Prairie, MN) during the last 115 d of feed, when zilpaterol hydrochloride (ZH) is fed for the final 20 d, with a 3-d withdrawal before slaughter on muscle and adipose tissue gene expression and protein concentration of calf-fed Holstein steers. Steers ($n = 211$; initial BW = 468.5 ± 0.5 kg) were blocked by weight and randomly assigned to pens and treatment: (1) Control; ZnSO₄ added to provide 90 ppm Zn, and (2) ZINPRO; 720 mg Zn · animal⁻¹ · d⁻¹ provided by ZINPRO at the time of terminal implant. Steers were harvested at a commercial abattoir, and 20 steers

per treatment were randomly selected for *semimembranosus* muscle and adipose tissue biochemical analysis. Messenger RNA and protein was isolated from the muscle and adipose tissue for quantitative reverse transcription PCR (RT-qPCR), western blotting, and myosin analysis. Using RT-qPCR analysis, genes of interest included AMPK α , β 1AR, β 2AR, β 3AR, MHC-I, MHC-IIA, MHC-IIX, GPR43, GPR41, Glut4, SCD, CEBP β , and PPAR γ . No differences ($P > 0.05$) were detected in muscle tissue mRNA abundance between treatments for AMPK α , MHC-IIA, β 2AR, β 3AR, GPR43, GPR41, Glut4, and CEBP β . ZINPRO-fed cattle had an increased quantity of MHC-I mRNA ($P < 0.05$) in muscle tissue. Control cattle had an increased quantity of MHC-IIX, β 1AR, PPAR γ and SCD mRNA ($P < 0.05$) in muscle tissue. In adipose tissue, Control cattle had an increased quantity of Glut4 mRNA ($P < 0.05$). There were no differences ($P > 0.05$) between treatments for AMPK α , β 2AR, GPR43, GPR41, SCD, CEBP β , and PPAR γ mRNA in adipose tissue. Protein quantification for muscle and adipose tissue was performed via western blotting procedures to assess the abundance of the β 1AR, β 2AR and β 3AR; however, no differences ($P > 0.05$) were detected between treatments. Muscle protein was also run on acrylamide gels to separate MHC-I and II; ZINPRO fed cattle had a greater concentration of MHC-II protein ($P > 0.05$). These results indicate that ZINPRO and ZH in combination increases MHC-I, decreases MHC-IIX gene expression, and increases myosin protein concentration in skeletal muscle.

Key Words: myosin heavy chain, zilpaterol hydrochloride, zinc methionine

0428 Muscle fiber and color characteristics of different locations within beef *Longissimus lumborum*

steaks. K. J. Phelps*, M. A. Vaughn, S. M. Ebarb, D. D. Burnett, J. S. Drouillard, and J. M. Gonzalez, Kansas State University, Manhattan.

The objective of this study was to demonstrate the effect that muscle fiber composition differences within anatomical location of beef strip loin steaks elicit on color characteristics over a 7-d simulated retail display. Beef strip loins ($n = 120$) were collected from a commercial abattoir and before aging, steaks were removed from the 13th rib for immunohistochemical analysis of muscle fiber cross-sectional area (CSA) and myosin-heavy chain (MHC) isoform distribution. Sampling locations included medial (MED), mid-lateral (M/L), and lateral (LAT) within each steak. After 14-d of aging, steaks were fabricated, and L*, a*, surface metmyoglobin, and metmyoglobin reducing ability (MRA) were analyzed during a 7-d simulated retail display. There was a day \times location interaction for all color characteristics ($P < 0.01$). Initially, LAT was darker and redder than both MED and M/L ($P < 0.04$), and M/L was redder ($P < 0.01$) than MED. On d 7, MED tended to have reduced ($P < 0.05$) L* value than the M/L and LAT area. The MED area was more ($P < 0.05$) red than LAT, while M/L did not differ in redness compared with

the other areas ($P > 0.10$). On d 0, all 3 treatments differed in surface metmyoglobin percentage, with the MED possessing greater a percentage than the other locations ($P < 0.01$). At the end of display, all 3 treatments differed, with the LAT possessing 0.83 and 1.75% more metmyoglobin than M/L and MED, respectively ($P = 0.01$). All locations had similar MRA on d 0 ($P > 0.10$), but treatments differed in MRA on d 7 ($P < 0.05$). The MED possessed 3.01 and 6.19% greater MRA than LAT and M/L, respectively ($P < 0.05$). Percentage of type IIA fibers was not different between the 3 locations ($P > 0.10$). The MED area tended to possess fewer Type I fibers ($P = 0.10$) than the M/L, and MED possessed less ($P < 0.01$) Type I fibers than LAT. Type I fiber number in LAT and M/L did not differ ($P = 0.25$). The MED area had more ($P = 0.02$) Type IIX fibers than the M/L and LAT ($P < 0.02$), but the M/L and LAT did not differ ($P = 0.94$). The M/L area had larger Type I and IIX fibers than MED and LAT ($P < 0.01$), and MED tended to have larger ($P = 0.08$) Type I fibers than LAT. Also, LAT had smaller ($P < 0.01$) IIA fibers than M/L and MED, but size of IIA fibers in M/L and MED were similar ($P > 0.10$). Based on fiber distribution, expected biochemistry of these locations does not accurately explain color characteristics during simulated retail display.

Key Words: fiber type, color characteristics, sampling location

0429 In utero manipulation of muscle development in beef cattle fetuses.

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Fetal programming has been suggested as new tool in the current meat industry to produce animals with a potential to produce high quality beef. Such hypothesis is based on the fact that the main cells that compose the skeletal muscle tissue (myocytes, adipocytes, and fibroblasts) are all derived from a common pool of mesenchymal stem cells and their commitment to one of those lineages can be altered, among other factors, by maternal nutrition during the gestational period. Besides myogenesis and adipogenesis, fibrogenesis is very active during the fetal stage, during which generates connective tissue. The presence of connective tissue, primarily in the form of collagen fibrils, contributes to the background toughness of meat. Therefore, we investigated the effect of maternal nutrition on molecular mechanisms governing the early commitment of mesenchymal stem cells to either myogenic or adipogenic-fibrogenic lineages in beef cattle fetuses. Twenty-three Nellore pregnant cows were randomly assigned into 2 feeding level groups where 12 cows were fed at 1.0 times the maintenance requirement (Control, C) and 11 cows were fed at 1.5

times the maintenance requirement (Obese, OB) to evaluate effects of maternal obesity on fetal skeletal muscle development. The mRNA expression of β -catenin ($P = 0.0844$), MyoD ($P = 0.5623$), myogenin ($P = 0.7048$), and the number of muscle cells ($P = 0.9032$) was not affected by maternal obesity. Conversely, mRNA expression of adipogenic markers Zfp423 ($P < 0.0001$), C/EBP α ($P = 0.0004$), and PPAR γ ($P < 0.0001$)

was enhanced by maternal obesity. Indeed, mRNA expression of fibrogenic markers TGF β ($P < 0.0001$), collagen III ($P < 0.0001$), and collagen content ($P = 0.0032$) was enhanced in OB fetuses. These data show that maternal obesity enhances fibrogenesis and likely adipogenesis without compromise myogenesis in fetal skeletal muscle of cattle.

Key Words: development, muscle, Nellore