

Graduate Student Research Poster Competition

Ph.D. DIVISION

Diverse birth and rearing housing systems: effects on pig growth, meat quality and muscle fiber types

J. G. Gentry, J. R. Blanton, Jr., J. J. McGlone, M. F. Miller. E-mail: jessica.gentry@ttu.edu. Texas Tech University, Lubbock

The objective of this experiment was to examine the effects of diverse birth and rearing environments on pig growth, meat quality and muscle fiber types. Barrows (n=48, 6 pigs/pen) were randomly selected from a group of indoor-born and outdoor-born pigs at weaning and placed into an indoor or outdoor growing/finishing environment. The outdoor environment consisted of 4 pens (212 m²/pig) on alfalfa pasture. The 4 indoor pens (1.2 m²/pig) had concrete slatted flooring. Pigs were slaughtered at an average weight of 114 kg at a commercial facility. Fiber type samples were taken from the *longissimus* (LD) and *semimembranosus* (SM) muscles at 4 hr post-mortem and stored at -80° C until analysis. Samples (12-1m thick) were stained histochemically with ATPase after acid pre-incubation (pH= 4.3) to detect I, IIA and IIB fiber types. Boneless loins were collected following 24 hr chilling and aged for 14 d. Chops (2.54 cm thick) were cut for sensory and shear force analysis. Data were analyzed using the GLM procedures of SAS (1995) with pen as the experimental unit. Outdoor-born pigs grew faster than indoor-born pigs (ADG, kg/d: .81 vs .72 ± .03, P < .05). Outdoor reared pigs had more backfat, higher NPPC color scores and lower CIE L• values than the indoor reared pigs (P < .05). Sensory panel scores for pork flavor intensity were 6.07 and 6.48 ± .10 for the indoor and outdoor-born groups, respectively (P < .05). Shear force values were lower for the group finished outdoors (2.0 vs 2.2 kg ± .06, P < .05). LD and SM from the outdoor reared group had a lower percentage of type IIB fibers (LD: 66.6% vs 73.2% ± 2.0, SM: 53.6% vs 65.1% ± 3.1; P < .05). Type I fibers in the SM represented 13.8% and 24.6% ± 3.1 for the indoor and outdoor reared pigs, respectively (P < .05). Outdoor rearing of pigs may improve pig growth, pork color and tenderness. Further studies should be conducted to link pork quality measures with muscle fiber types and environmental housing systems.

Key Words: Pigs, Housing systems, Pork quality

Comparison of breed and diet on factors associated with tenderness in two muscles

P. S. Kuber, J. R. Busboom, S. K. Duckett, D. J. Marks, P. S. Mir, Z. Mir, R. G. McCormick, C. T. Gaskins, J. D. Cronrath, and M. V. Dodson. E-mail: pskuber@wsu.edu. Washington State University, Pullman, WA, University of Idaho, Moscow, ID, Agriculture and Agri-food Canada, Lethbridge, AB, University of Wyoming, Laramie, WY

The objective of this study was to evaluate attributes associated with tenderness in divergent breeds, Wagyu (**W n=12**), Limousin (**L n=12**) and F1-cross cattle (**WxL n=12**), fed two dietary treatments (either 0 or 6% sunflower oil). Data were analyzed using GLM procedures with breed and diet as main effects in a 2 x 3 factorial arrangement of treatments. Cattle were fed a barley-based diet for an average period of 259 d. Twenty-four hours post mortem (**PM**), steaks from the *longissimus* (**LD**) and *semitendinosus* (**ST**) were sliced, vacuum packed, aged (1, 3, 7, 14, 28 and 56 d PM) at 2° C and frozen (-40° C) until analyzed. Breed differences in Warner-Bratzler shear force (**WBS**) existed (P < 0.05) across aging times in LD. A WBS breed x day interaction existed in ST (P < 0.05) and tended to exist in LD (P = .11). On d 14, W LD (P < 0.05) required 0.77 kg less force to shear than L. Comparatively, W were more desirable in d 14 LD sensory panel sustained tenderness (P < 0.05) than L. In the ST, WxL (P < 0.1) required 0.60 kg less force to shear than L, but no difference (P > 0.1) in ST panel initial or sustained tenderness was evident. Wagyu LD and ST samples were slower (P < 0.05) in pH decline, and more rapid (P < 0.05) in temperature decline than L or WxL. Breed and diet did not affect (P > 0.1) free calcium (**FC**) over time (0, 1, 3, 7 and 14 d PM), 0 h calpastatin activity (**CA**), d 1 % collagen (**OH-Pro**), or d 1 collagen cross-linking (**HP**) in LD; or d 1 OH-Pro and d 1 HP in ST. Western blot analysis for measuring the presence of the Troponin-T (**Tn-T**) 30kda fragment demonstrated more proteolysis in LD at d 3 in L than W or WxL. Breed differences in mechanical and sensory measures of tenderness existed (d 14 - LD and ST), but were not explained by FC, CA, OH-Pro, HP and Tn-T.

Key Words: Wagyu, Limousin, Beef Tenderness

***In-vitro* oxidation of bovine oxymyoglobin as affected by 4-hydroxy-nonenal**

A.L. Phillips, S. Lee, L.K. Silbart, and C. Faustman. E-mail: cfaustma@canr.uconn.edu. University of Connecticut, Storrs, CT

Discoloration from the desirable cherry red to brown color in fresh meat is a result of oxidation of ferrous oxymyoglobin (OxyMb) to ferric metmyoglobin (MetMb). Lipid oxidation, among other factors, influences the rate of fresh meat discoloration. 4-Hydroxy-nonenal (HNE), a known product of ω -6 fatty acid oxidation, is very reactive toward protein and has been shown to accelerate equine cardiac OxyMb oxidation. Our objective was to determine the influence of HNE upon bovine skeletal OxyMb *in-vitro* under a variety of temperature (4, 25 and 37° C) and pH (5.6 and 7.4) conditions and to identify the adduction of HNE to OxyMb using Western Blots. Bovine skeletal muscle myoglobin (Mb) was purified from beef via ammonium sulfate fractionation and gel filtration chromatography. OxyMb was prepared by hydrosulfite-mediated reduction and adjusted to physiologic or post-mortem pH via phosphate (pH 7.4) or citrate (pH 5.6) buffer dialysis, respectively. OxyMb (0.15 mM) was incubated with 1 mM HNE (OxyMb:HNE) at 4, 25 and 37° C; controls were aldehyde-free. Following incubation, samples were passed over a desalting column to remove unreacted HNE, scanned spectrophotometrically from 650 to 450 nm, and the percentage of MetMb calculated. Western Blot analysis was completed using control and OxyMb:HNE reacted at pH 7.4, 37° C for 2 hr. Identification of Mb bound HNE was visualized using a monoclonal antibody specific for HNE bound to histidine residues. Overall, MetMb formation increased with increasing temperatures and was greater at pH 5.6 than pH 7.4 ($P = 0.05$). At 37° C, a prooxidant effect of HNE was seen at pH 7.4 but not at pH 5.6 when compared to control ($P = 0.05$). At both 25 and 4° C, a prooxidant effect of HNE was seen at pH 7.4 and 5.6 relative to CON ($P = 0.05$). Western Blots revealed that OxyMb:HNE incubated at pH 7.4, 37° C yielded OxyMb:HNE adducts at histidine residues whereas control samples showed no reaction. This research suggests that HNE accelerates *in-vitro* bovine skeletal muscle OxyMb oxidation and appears to do so, in part, via covalent modification at histidine residues.

Key Words: 4-hydroxy-nonenal, Oxymyoglobin, Metmyoglobin

Goat kids meat quality: artificial rearing and weight at slaughter effects

A. Arguello, A. Marichal, J. F. Capote, and J. L. Lopez. E-mail: arguello@vet.ulpgc.es. Animal Production Unit, Las Palmas de Gran Canaria University, Arucas, Spain., ICIA, La Laguna, Spain

The objective of our study was to examine the effects of the rearing system and weight at slaughter on meat quality in young Canary Caprine Group kids. Forty twin, male kids were allotted to one of four groups based on feeding regimens: kids nursed by their dams (ND, n: 10), or kids fed a commercial milk replacer (23.7 percent CP and 22.8 percent fat) and controlled intake (CR, n: 10), and live weight at slaughter: 6 kg (WS6, n: 10), or 10 kg (WS10, n: 10). Immediately after slaughter, pH was measured on the Longissimus dorsi (LD). The carcasses were chilled at 4 °C for 24 h, and pH, Warner-Brazler shear force (WBSF), color (Lightness, L, Chroma, C, Hue, H), water holding capacity (WHC), chemical composition (moisture, protein, fat, ash, collagen and its solubility), muscle fiber types proportions and their areas, were determined in the LD muscle. No interactions were observed in any parameter between rearing method and weight at slaughter. No statistical effect was found in pH values, although the ND kids showed a higher pH values when the weight at slaughter increased, the evolution in CR kids were opposite. Compared with the WS10 kids, the LD muscle from WS6 kids had higher L ($P < .05$), but no differences were found in Chroma or Hue. Rearing method and weight at slaughter did not affect WBSF, but a relation between WBSF and solubility collagen may be observed. The meat from ND animals were more exudative than CR kids ($P < .001$), while no statistical effect was observed by weight at slaughter. The chemical composition changed lightly, reducing moisture percentage ($P < .001$) and increasing protein proportion ($P < .001$) in WS10, probably due to hypertrophy growth muscle fiber areas were higher. No effects were described in muscle fiber type population. The WS10 muscle fiber area was higher than WS6 ($P < .05$), but in opposite the rearing system did not show statistical effects. Thus, the results show that using milk replacers in goat kids and increasing the weight at slaughter did not affect negatively to meat quality.

Key Words: Kid meat quality, Rearing system, Weight at slaughter