

## ANIMAL SCIENCE

**Title:** Projecting changes in pig growth, pork quality, eating experience, and muscle physiology due to increasing live and carcass weights, **NPB #17-090**

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revised

### Scientific Abstract:

The primary objective of this study was to determine the space allowance needed to evaluate the carcass quality of pigs with increased live weights that might be expected in the next 50 years. To achieve this primary objective we had five specific goals: 1) compare k-value space allowances, 2) compare temperature decline of hams and loins, 3) compare fresh loin quality (muscle pH, color, marbling, firmness, and predicted tenderness) of loins, 4) determine how increased carcass size affects eating experience and purchasing preferences of consumers, and 5) compare muscle physiology, hypertrophy, and fiber types. A total of 976 pigs (PIC 327 × L42, initially  $48.6 \pm 3.4$  lb body weight [BW]) were used in a 160-d growth study. Pens were blocked by location within the barn and allotted to 1 of 6 treatments with 8 pens per treatment. The first four treatments reduced space allowance per pig via initial pen stocking density and had only one final marketing event. The fifth and sixth treatments consisted of different pig removal strategies. Average daily gain (ADG), average daily feed intake (ADFI), and final BW decreased (linear,  $P < 0.001$ ) during the overall experimental period (d 0 to 160) as space allowance decreased. When comparing treatments with multiple marketing events to those with similar initial stocking density (23 pigs per pen), there was no evidence for differences ( $P > 0.05$ ) for overall ADG or ADFI; however, overall feed efficiency was improved ( $P < 0.05$ ) for pigs initially stocked at  $7.1$  ft<sup>2</sup>/pig and marketed four times compared to both treatments that initially allowed  $7.7$  ft<sup>2</sup>/pig, regardless of marketing structure. Additionally, overall F/G was improved for pigs that began at  $7.7$  ft<sup>2</sup>/pig and had 3 marketing events compared to the treatment that also began at  $7.7$  ft<sup>2</sup>/pig but had only a single marketing event. Once the marketing events began on d 93, ADG and F/G were improved ( $P < 0.05$ ) for the remaining pigs in the pen for the rest of the trial (d 93 to 160) for both multiple marketing treatments, compared to the  $7.7$  ft<sup>2</sup>/pig allowance where all pigs were marketed together at the end of the trial. Pigs were slaughtered in a federally inspected facility under the supervision of the USDA Food Safety and Inspection Service. Pigs were slaughtered on 2 separate days using CO<sub>2</sub> immobilization and terminated via exsanguination. Data were collected on a total of 666 carcasses at the production facility. Early quality measurements were collected on the ham ( $n = 203$ ) and loin ( $n = 613$ ). Aged quality measurements were collected on chops at 14 d. Coefficients of determination ( $R^2$ ) were calculated to determine the predictability of HCW on quality characteristics, sensory traits, and fiber type characteristics. Hot carcass weight explained the greatest proportion of variability in ham weight ( $R^2 = 0.7261$ ,  $P < 0.0001$ ). As HCW increased, back fat ( $R^2 = 0.2097$ ,  $P < 0.0001$ ), loin depth ( $R^2 = 0.1278$ ,  $P < 0.0001$ ), loin weight ( $R^2 = 0.1803$ ,  $P < 0.0001$ ), and chop weight ( $R^2 = 0.2170$ ,  $P < 0.0001$ ) also increased. There was a decrease in calculated iodine value ( $R^2 =$

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0144,  $P = 0.0035$ ) and estimated lean ( $R^2 = 0.2352$ ,  $P < 0.0001$ ). Additionally, at 14 d there was a decrease in pH value ( $R^2 = 0.0201$ ,  $P = 0.0187$ ). As carcasses got heavier, there was an increase in tenderness due to a decrease in slice shear force for both 160 °F ( $R^2 = 0.0810$ ,  $P < 0.0001$ ) and 145 °F ( $R^2 = 0.0241$ ,  $P = 0.01$ ) and an increase in trained tenderness scores ( $R^2 = 0.0352$ ,  $P = 0.0017$ ). Furthermore, there was a decrease in cook loss for both 160 °F ( $R^2 = 0.0464$ ,  $P < 0.0003$ ) and 145 °F ( $R^2 = 0.0222$ ,  $P = 0.0190$ ) as carcass weight increased. For loins targeted for consumer palatability ratings, pork loins ( $n = 200$ ) were collected from 4 different hot carcass weight groups: light weight group (less than 246.5 lb; LT), medium-light weight group (246.5 to 262.5 lb; MLT), medium-heavy weight group (262.5 to 276.5 lb; MHVY), and a heavy weight group (276.5 lb and greater; HVY). Instrumental color, visual color and marbling, and pH were collected for each loin prior to fabrication. Loins from all weight groups differed ( $P < 0.05$ ) in weight (LT < MLT < MHVY < HVY). No carcass weight effects ( $P > 0.05$ ) were found for loin instrumental color, visual color, visual marbling, purge loss, and pH. Carcass weight did not affect ( $P > 0.05$ ) juiciness, flavor, or overall like ratings, but did affect ( $P < 0.05$ ) tenderness ratings. Chops from the HVY group were rated as more ( $P < 0.05$ ) tender compared to chops from the LT weight group. Weight group did not contribute ( $P > 0.05$ ) to the percentage of chops rated acceptable for flavor and overall like. The greatest ( $P < 0.05$ ) percentage of samples were rated acceptable for juiciness for chops from the HVY weight group, and the lowest ( $P < 0.05$ ) percentage of acceptable ratings for tenderness for chops were from the LT weight group. Consumers perceived the lowest ( $P < 0.05$ ) percentage of chops from the HVY group as unsatisfactory quality in comparison to chops from the 2 lightest weight groups. These results indicate top loin chops from heavier weight carcasses have improved tenderness compared to chops from lighter carcasses.

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