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The Ampk V199i Mutation and Meat Quality in Berkshire Pigs

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Objectives

Berkshire pigs produce meat that is darker and redder in color and contains a greater abundance of intramuscular fat compared to some commercial crossbred pigs. This phenotypic superiority may be attributed to a mutation that occurs in the AMP-activated protein kinase (AMPK). This mutation arises from a valine to isoleucine substitution in the γ3 subunit which is thought to dysregulate the function of AMPK. Because the Berkshire breed carries this mutation with high frequency, the objective of this experiment was to characterize the effects of the AMPK γ3V199I mutation on carcass traits, meat quality, and postmortem metabolism in Berkshire pigs.

Materials and Methods

Homozygous mutant Berkshires (BERK-II, n = 9 consisting of 5 gilts and 4 barrows), heterozygous Berkshires (BERK-VI, n = 10, consisting of 5 gilts and 5 barrows), homozygous wild-type Berkshires (BERK-VV, n = 5, consisting of 2 gilts and 3 barrows) and commercial crossbred pigs (CROSS-VV, n = 7, consisting of 3 gilts and 4 barrows) were harvested under commercial processing conditions at the Ohio State University Meat Science Laboratory. *Longissimus thoracis et lumborum* muscle samples were collected from the right side of the carcasses at 0, 0.5, 1, 2, 4, and 24 h postmortem and frozen in liquid nitrogen. At 24 h postmortem, the left side of the carcasses were ribbed between the 10th and 11th rib where meat quality characteristics were evaluated [backfat thickness, loineye area, percent fat-free lean, and CIELAB color ($L*$, $a*$, and $b*$)]. The carcass data were analyzed with 2 separate mixed models in JMP. First, the 3 AMPK genotypes were analyzed among Berkshire pigs. The model included the main effects of

AMPK genotype, sex, and their 2-way interaction. The second model compared the BERK-VV animals to the CROSS-VV to evaluate breed differences of the same AMPK genotype. This model included the main effects of breed, sex, and their 2-way interaction. In both models, differences between LS means were evaluated using a student's t test and considered significant at $P \leq 0.05$.

Results

In the first evaluation, there was no difference in live weight between Berkshire AMPK genotypes for sex ($P = 0.29$) or genotype ($P = 0.79$) groups. Barrows exhibited increased backfat thickness and decreased fat-free lean (%) ($P = 0.03$) compared to gilts. However, no carcass or meat quality differences were detected between AMPK genotypes. In the second analysis, there was no difference in live weight between the BERK-VV and CROSS-VV groups for sex ($P = 0.81$) or genotype ($P = 0.63$). However, the BERK-VV pigs exhibited increased backfat ($P = 0.009$), decreased lightness ($L*$; $P = 0.034$), and increased redness ($a*$; $P = 0.018$) compared to the CROSS-VV pigs.

Conclusion

The data suggest that the AMPK γ3V199I mutation does not affect carcass traits or meat quality within the Berkshire breed. However, previous data from our lab indicated differences in postmortem glycolysis and pH decline between the BERK-II and BERK-VI populations. These data also suggest that the BERK-VV animals produce pork with superior color compared to the CROSS-VV animals. Future analysis of pH decline and biochemical metabolites will occur to assess the rate and extent of postmortem glycolysis.