RESEARCH ABSTRACT

ANIMAL SCIENCE — Nutritional Efficiency Consortium

Title: Evaluating the contribution of ion pumps and protein turnover towards feed efficiency in finisher pigs selected for low and high residual feed intake **– NPB #10-009** **Revised**

Investigator: Nicholas Gabler

Institution: Iowa State University

Date Submitted: January 26th 2012

Scientific Abstract Residual feed intake (RFI) is defined as the difference in the observed and expected feed intake, while accounting for growth and backfat. However, little is known about why pigs selected for reduced RFI (low RFI) are more efficient at converting feed into body weight gain compared to the high RFI pig. To this end, a line of Yorkshire pigs divergently selected for reduced RFI over seven generation was used. The objective of this proposal was to determine the extent to which energy sensing, insulin signaling and muscle protein turnover (synthesis and degradation) contributes to the improved feed efficiency in finisher pigs. We hypothesized that pigs selected for low RFI have lower feed intake and are more efficient at nutrient utilization and lean tissue accretion because they have reduced protein degradation and turnover compared to high RFI pigs. To test this, 12 low RFI and 12 high RFI line gilts were paired by age and weight (68.4±3.49kg) and randomly assigned to individual pens for six weeks. After this period, pigs were euthanized and muscle and liver samples collected and analyzed for enzyme activities and protein expression of energy metabolism, insulin signaling, and protein synthesis and degradation markers. As expected, ADFI was significantly lower in the low RFI compared to the high RFI pigs (2.0 vs 2.4 kg/d, $P<0.0001$). However, as expected the ADG remained the same between the two lines. Additionally, compared to the high RFI line, G:F was significantly higher in the low RFI pigs (0.29 vs 0.35, $P<0.001$, respectively). Muscles from gilts animals selected for low RFI had less 20S proteasome, μ- and m-calpain activities and greater calpastatin activity compared to that of high RFI, less FE pigs ($P<0.05$). Furthermore, 20S proteasome activity was lower in low RFI muscle compared to the high RFI muscle ($P=0.026$). Significant moderate positive correlations were observed between RFI and muscle 20S proteasome activity, but not with liver activity. No differences in muscle insulin signaling intermediates and translation initiation signaling proteins (mTOR pathway) were found ($P>0.05$). However, tissue specific differences in AMPK activities were observed. In conclusion, selection for reduced RFI decreases feed intake with no significant difference in growth performance. Altogether, these data indicate lower skeletal muscle protein degradation. Therefore, protein turnover (particularly degradation) may be an important aspect to FE in swine.

These research results were submitted in fulfillment of the Nutritional Efficiency Consortium research projects.
Contributing organizations for 2010 include: AgriSolutions, Inc., DPI Global, Iowa Pork Producers Association, Illinois Corn Marketing Board, Illinois Pork Producers Association, Kansas Pork Association, Missouri Pork Producers Association, Mississippi Pork Producers Association, National Pork Board, Nebraska Corn Board and the Utah Pork Producers Association.

This report is published directly as submitted by the projects principal investigator. This report has not been peer reviewed.