Title: Comparison of red meat versus high carbohydrate diet as a means of preventing tissue-specific down-regulation of insulin receptors - NPB #13-177

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Scientific Abstract:

Objectives: The objective of this proposal was to accurately quantify insulin receptor concentration in muscle and adipose tissue through the use of quantitative polymerase chain reaction (qPCR) techniques.

Materials and Methods: Twenty-one gilts (Yorkshire × Duroc × Hampshire) born over a five-day period were provided ad libitum access to a low lysine diet (Lys = 0.45%) to promote hyperphagia and adiposity. Gilts were assigned to either a ground beef (GB; n = 5) or control (CON; n = 5) treatment upon reaching 3 cm subcutaneous backfat (10BF; 10/11th rib interface) and were fed for 84 d. The GB diet was 99.9% cooked ground beef (65:35 lean:fat) plus 0.1% calcium carbonate while CON comprised 70.55% ground corn, 15% vegetable oil, 8.5% DDGS and 4.25% soybean meal. Both rations met NRC requirements for gilts of this size and weight. Feed intake and orts were recorded daily. Body weights (BW) and blood samples were collected on d 0, 28, 56, and 84 for blood chemistry analysis. One gilt was removed from the GB treatment after d56 due to foot infection. Gilts were humanely euthanized on d 85 for tissue collections and body composition analysis. Samples of Longissimus thoracis muscle (LT; 10/11th rib interface), gracilis muscle (GR), 10BF, and liver tissues were snap frozen for IR qPCR analysis, and fixed in formalin for immunohistochemical evaluation of IR density.

Results: No differences were observed for mRNA expression of IR in the LT, GR, 10BF, and liver (P = 0.43, 0.2, 0.13, and 0.19, respectively). Image analyses of photomicrographs of tissues stained for IR did not differ between treatments for IR density in 10BF or pooled muscle, however GB GR IR density was significantly greater (P = 0.04) than CON GR, CON LT, and GB LT.

Conclusion: The higher density of insulin receptors in GR from ground beef-fed gilts could suggest the initiation of tissue-specific insulin resistance of that tissue. Further research is necessary to determine if consumption of a high calorie, high glycemic diet could lead to tissue-specific insulin resistance and to determine the specific metabolic role of the liver.