Title: The Development of Equations to Predict the Iodine Value of Various Swine Carcass Fat Depots – NPB# 13-077

Investigator: John Michael Gonzalez

Institution: Kansas State University

Date Submitted: 6/30/2014

Scientific Abstract:

Meta-Analysis: Meta-analyses used data from existing literature to generate equations to predict finishing pig back, belly, and jowl fat IV and an experiment was conducted to validate these equations. The final database included 24, 21, and 29 papers for back, belly, and jowl fat IV, respectively. For Exp. that changed dietary fatty acid composition, initial diets (**INT**) were defined as those fed before the change in diet composition and final diets (**FIN**) were those fed after. The predictor variables tested were divided into 5 groups: 1) diet fat composition (dietary % C16:1, C18:1, C18:2, C18:3, EFA, unsaturated fatty acids, and iodine value product) for both INT and FIN diets; 2) d feeding the INT and FIN diets; 3) ME or NE of the INT and FIN diet; 4) performance criteria (initial BW, final BW, ADG, ADFI, and G:F); 5) carcass criteria (HCW and backfat thickness). The PROC MIXED procedure of SAS (SAS Institute, Inc., Cary, NC) was used to develop regression equations. Evaluation of models with significant terms was then conducted based on the Bayesian Information Criterion (BIC). The optimum equations to predict back, belly, and jowl fat IV were: backfat IV =84.83+(6.87*INT EFA)-(3.90*FIN EFA)-(0.12*INT d)-(1.30*FIN d)-(0.11*INT EFA*FIN d)+(0.048*FIN EFA*INT d)+(0.12*FIN EFA*FIN d)-(0.0060*FIN NE, kcal/lb)+(0.0005*FIN NE*FIN d)-(0.26*backfat depth, in.); belly fat IV = 106.16+(6.21*INT EFA)-(1.50*FIN d)-(0.11*INT EFA*FIN d)-(0.012*INT NE, kcal/lb)+(0.00069*INT NE, kcal/lb*FIN d)-(0.18*HCW, lb)-(0.25*backfat depth, in.); and jowl fat IV =85.50+(1.08*INT EFA)+(0.87*FIN EFA)-(0.014*INT d)-(0.050*FIN d)+(0.038*INT EFA*INT d)+(0.054*FIN EFA*FIN d)-(0.0066*INT NE, kcal/lb)+(0.071*INT BW, lb)-(2.19*ADFI, lb)-(0.29*backfat depth, in.). Dietary treatments from the validation experiment are described below. The back, belly, and jowl fat IV equations tended to overestimate IV when actual IV were less than approximately 65 g/100g and underestimate belly fat IV when actual IV are greater than approximately 74 g/100g or when the fat blend was fed from d 0 to 84 or d 42 to 84. Overall, with the exceptions noted, the regression equations were an accurate tool for predicting carcass fat quality based on dietary and pig performance factors.

Validation Study: A total of 160 finishing pigs (PIC 327 × 1050; initially 100.5 lb.) were used in an 84-d experiment to evaluate the effects of dietary fat source and feeding duration on growth performance, carcass characteristics, lipogenic gene expression, and carcass fat quality in swine. Dietary treatments were a corn-soybean meal control diet with no added fat or a 3 × 3 factorial arrangement of treatments with main effects of fat source (4% tallow, 4% soybean oil, or a blend of 2% tallow and 2% soybean oil (**blend**)) and feeding duration (d 0 to 42, 42 to 84, or 0 to 84). On d 0, 41, and 81, one pig from each pen was selected for backfat, belly, and jowl biopsy collection. Added fat increased ($P < 0.05$) iodine value (**IV**) compared to control diets. Across all three depots a duration × fat source interaction ($P < 0.05$) showed increased poly unsaturated fatty acids (**PUFA**) and decreased mono unsaturated fatty acids (**MUFA**). For backfat there was a feeding period × fat source interaction ($P = 0.05$) for blend and soy bean oil where feeding soy bean oil in period 2 increased sterol regulatory element binding protein-1c expression. In belly samples, fatty acid synthase and acetyl-CoA carboxylase (**ACC**) were increased ($P < 0.05$) in control versus added fat diets. In jowl samples, added fat in period 1 increased ($P < 0.05$) ACC and peroxisome proliferator activated receptor gamma expression compared to period 2. Control diets resulted in decreased ($P < 0.05$) d 42 acyl-CoA oxidase expression compared to diets with added fat. In conclusion feeding soybean oil negatively impacts the fatty acid composition in terms of IV in finishing pigs. Lipogenic gene expression patterns were altered with duration and source of supplemental fat. These changes represent metabolic adjustments to the type and availability of fat in the die