Prediction of Loin, Belly and Jowl IV Based on Diet Composition Verses Daily Fatty Acid Intake

A.S. Leaflet R3009

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Summary and Implications

Iodine value product (IVP) is commonly used to predict carcass fat iodine value (CIV). However, when higher fat diets are employed, IVP tends to emphasize the quantity of fat in the diet more than the composition of that fat. The objective of this experiment was to compare the effectiveness in predicting CIV by IVP versus individual fatty acid content in the diet or their daily intake. Forty-two gilts and 21 barrows (PIC 337 × C22/29) with an average initial weight of 77.8 ± 0.38 kg were allotted based on sex and weight across 7 treatments: a control diet with no added fat, and 6 diets containing either 3 or 6% of tallow, choice white grease, or corn oil. Pigs were individually housed to measure daily fatty acid intake. Adipose samples were collected from the jowl, loin, and belly at harvest (d 55). Of all the fatty acid intakes measured, only increased linoleic acid intake (LAI) generated a strong coefficient of determination in a positive correlation with CIV (CIV = 60.58 + (0.121× LAI/d (g)); R^2 = 0.611; P < 0.05; Root MSE = 3.24). Comparison of IVP of the experimental diets was approximately equal (CIV = 58.10 + (0.215 × IVP); R^2 = 0.93; P < 0.05; Root MSE = 1.45) to the treatment means of LAI (CIV = 58.57 + (0.139 × linoleic acid intake/d (g)); R^2 = 0.94; P < 0.05; Root MSE = 1.37) as a predictor of CIV. Under the conditions of this experiment, a CIV standard of 74 g/100 g can be met by limiting LAI to less than 111 g/d. Linoleic acid is clearly the fatty acid that most affects CIV.

Introduction

For over ninety years it has been demonstrated that increasing the concentration of unsaturated fatty acids in the diet results in more unsaturated fat in the pig carcass. Based on this phenomenon, it is logical that fat composition in the pig carcass can be predicted from the fat composition of the diet. This prediction has been attempted through the use of IVP, a value that is based on an equation that includes both the IV of the diet and the level of fat in the diet times a constant of 0.10. Although widely employed in the pig industry, the IVP equation has an inadequacy which becomes particularly apparent when higher fat diets are employed. Specifically, IVP places more emphasis on the inclusion level rather than the composition of the dietary fat. It is hypothesized that measuring the intake of fatty acids versus the composition of the diet, would be a more accurate predictor of CIV.

Materials and Methods

Forty-two gilts and 21 barrows (PIC 337 × C22/29) with an average initial weight of 77.8 ± 0.38 kg were allotted based on sex and weight across 7 treatments: a control diet with no added fat, and 6 diets containing either 3 or 6% of tallow (iodine value (IV) = 41.9), choice white grease (IV = 66.5) or corn oil (IV = 123.1). Pigs were individually housed to measure daily fatty acid intake. Adipose samples were collected from the jowl, loin, and belly at harvest (d 55). Iodine value was determined using gas chromatography on diet and carcass lipid samples and averaged across the three locations. Data were analyzed using PROC MIXED (SAS 9.3) with treatment and sex as fixed effects, and replicate as a random effect. PROC REG was utilized to compare the relationship between individual intakes of fatty acids and CIV, and to compare the analyzed diet IVP versus daily fatty acid intake on CIV.

Results and Discussion

Increased daily intake of palmitic acid (R^2 = -0.08; Root MSE = 4.98) and stearic acid (R^2 = -0.12; Root MSE = 5.07) were negatively correlated with CIV but with weak coefficients of determination (P < 0.05). Increased daily intake of oleic acid (R^2 = 0.08; Root MSE = 4.97) and linolenic acid (R^2 = 0.26; Root MSE = 4.45) were positively correlated with CIV but also had weak coefficients of determination (P < 0.05). However, increased linoleic acid intake (LAI) was positively correlated with CIV and generated a strong coefficient of determination (CIV = 60.58 + (0.121× LAI/d (g)); R^2 = 0.611; P < 0.05; Root MSE = 3.24). IVP of the experimental diets (Figure 1) was approximately equal (CIV = 58.10 + (0.215 × IVP); R^2 = 0.93; P < 0.05; Root MSE = 1.45) to the treatment means of LAI (Figure 2) (CIV = 58.57 + (0.139 × linoleic acid intake/d (g)); R^2 = 0.94; P < 0.05; Root MSE = 1.37) as a predictor of CIV. Of all the fatty acids present in the diet, only linoleic acid provided a strong coefficient on carcass IV. Therefore, limiting daily linoleic acid intake is a key to lowering carcass IV. Under the conditions of this experiment, a CIV standard of 74 g/100 g can be met by limiting LAI to less than 111 g/d. However, we found only a slight advantage to using daily linoleic acid intake as a predictor of carcass IV versus IVP. The advantage for using daily linoleic acid intake as a predictor versus IVP is most seen when high fat diets are employed.

Acknowledgements

We gratefully acknowledge the Iowa Pork Producers Association for funding this experiment, along with, Feed Energy and DSM Nutritional Products for their donations and JBS for their cooperation and expertise.

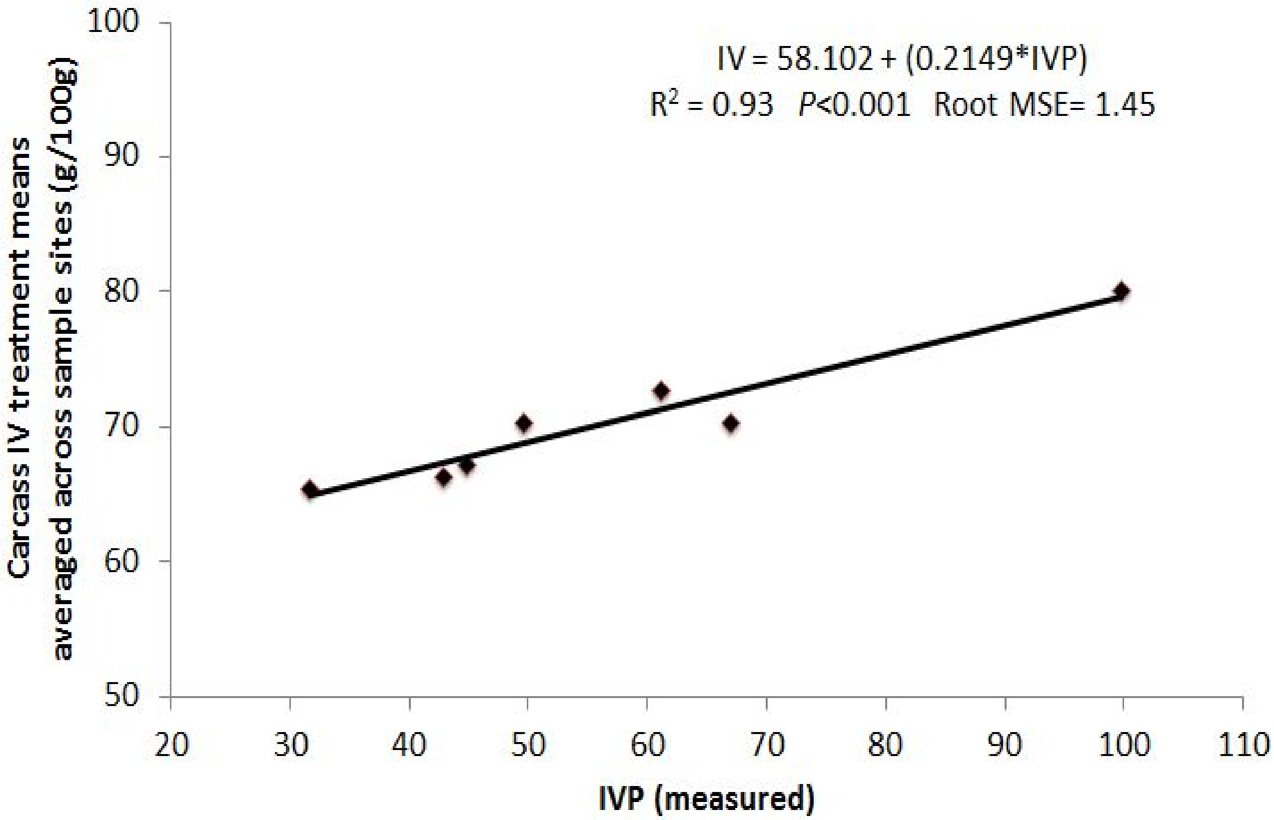

Figure 1. Carcass iodine value (IV) averaged across three sample sites affected by iodine value product (IVP)[1]

[1]IVP = (IV of the dietary lipids) × (% dietary lipid) × 0.10 (Madsen et. al. 1992)

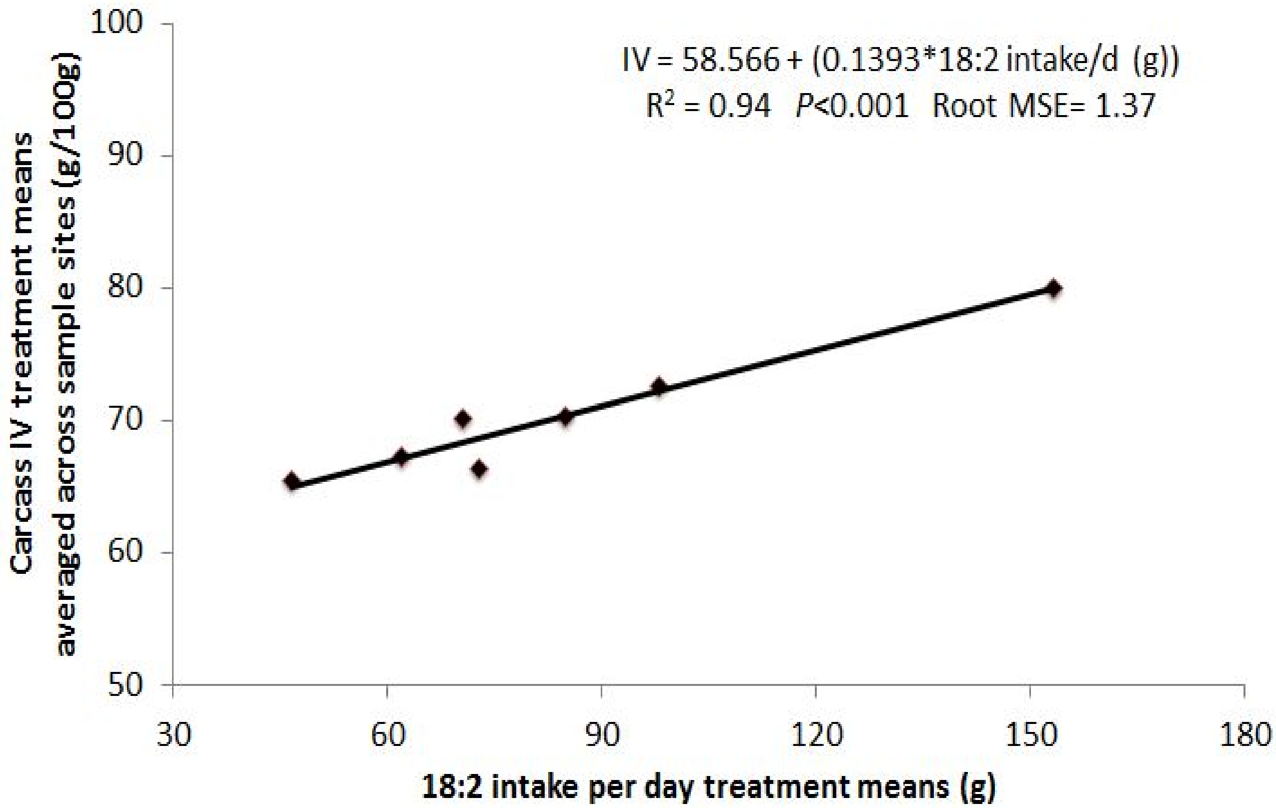

Figure 2. Carcass iodine value (IV) averaged across three sample sites affected by treatment means of linoleic acid (18:2) intake[1]

[1]Fatty acid intake (g/d) = ADFI (g/d) × dietary fatty acid (%) × ether extract (%)