Evaluation of Iodine Value Product and Dietary Linoleic Acid as a Predictor of Carcass Iodine Value under Commercial Conditions

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Summary and Implications

A 134 d experiment housed in a commercial research barn using 1,213 pigs randomly allotted to 1 of 6 dietary treatments [choice white grease (CWG) or corn oil (COIL) included at 2, 4, and 6%] found that: dietary linoleic acid is a superior predictor of carcass iodine value (IV) than iodine value product (IVP) and dietary linoleic acid must be limited to meet carcass IV standards. Using dietary linoleic acid to predict carcass iodine value will allow producers to meet carcass IV standards more accurately. It can be used as a tool to enable the use of various fat sources while maintaining packer standards for carcass IV. To achieve a maximum carcass of IV of 74, total linoleic acid in the diet should not exceed 3.8% and daily linoleic acid should not exceed 88 grams.

Introduction

The pig industry utilizes a variety of fat sources (FS) and fat levels (FL) in diets to increase energy content. Inclusion is largely decided by economic factors, including cost/unit of energy provided as well as impact on growth rate and feed efficiency. A secondary consideration is their impact on carcass fat composition and quality.

For nearly a century, it has been known that the nature of the lipid in the diet will be reflected in the composition of fat in the carcass. Thus, the lipid content of the diet could be used to predict the composition of carcass fat. Prediction of carcass IV (a measurement of the degree of unsaturation of a lipid sample) was first attempted over 50 years ago, by calculating the IVP; this value has become widely used to predict carcass IV but flaws in IVP have been identified; dietary linoleic acid concentration or intake may be more accurate. The objectives of this study were to investigate the impact of FS and FL on rate and efficiency of gain, digestibility of dietary fat, and pork fat composition, to test dietary predictors of carcass IV. It was hypothesized that dietary linoleic acid concentration or intake would be a superior predictor of carcass IV than IVP.

Materials and Methods

A total of 1,213 pigs (PIC 280 × PIC Camborough 42; PIC, Inc., Hendersonville, TN) housed in a commercial research barn (Swine Graphics Enterprises, Webster City, IA) with an initial BW of 70.5 ± 0.9 lbs. were allotted randomly to 1 of 6 dietary treatments on d 0. Treatments were arranged as a 2 × 3 factorial, with 2 FS: CWG (IV = 66.8) or COIL (IV = 123.2) and 3 FL: 2, 4, or 6%. Ten pens of ~20 pigs each were randomly assigned to each of the 6 treatments. Pigs were harvested in 1 of 3 marketing pulls, at which time belly fat samples were collected.

Results and Discussion

Daily rate of gain was not impacted by FS or FL (P = 0.325; Table 1). Increasing FL and dietary energy concentration increased feed efficiency (P < 0.001). No difference was evident for feed efficiency between FS (P = 0.107). Increasing FL of CWG resulted in greater daily intake of saturated fatty acids and monosaturated fatty acids than increasing FL of COIL (P < 0.001). Increasing levels of COIL resulted in greater daily intake of polyunsaturated fatty acids than increasing levels of CWG ($P \leq 0.012$). Feeding CWG tended to result in greater caloric efficiency adjusted for carcass yield than COIL (P = 0.074). The inclusion of COIL instead of CWG tended to increase true total tract digestion of acid hydrolyzed ether extract on d 39 (P = 0.066; Table 2), but not on d 104 (P = 0.402). Increasing COIL increased carcass IV at a greater magnitude than increasing CWG resulting in a FS × FL interaction. Dietary linoleic acid concentration had a stronger linear relationship than IVP (R^2 = 0.95 vs. R^2 = 0.85, Figure 1, 2). In conclusion, ADG and feed efficiency were similar between the two fat sources, but CWG tended to be slightly more efficient in producing carcass gain. Increasing FL improved feed efficiency, but not ADG or caloric efficiency. Limiting dietary linoleic acid intake is key to lowering carcass IV. Under these experimental conditions, to meet a carcass IV standard of 74 g/100 g the minimum dietary concentration of linoleic acid had to be less than 3.4% and daily linoleic acid intake had to be less than 88 g/d. Dietary linoleic acid is superior to IVP in predicting carcass IV, especially when high fat diets are used.

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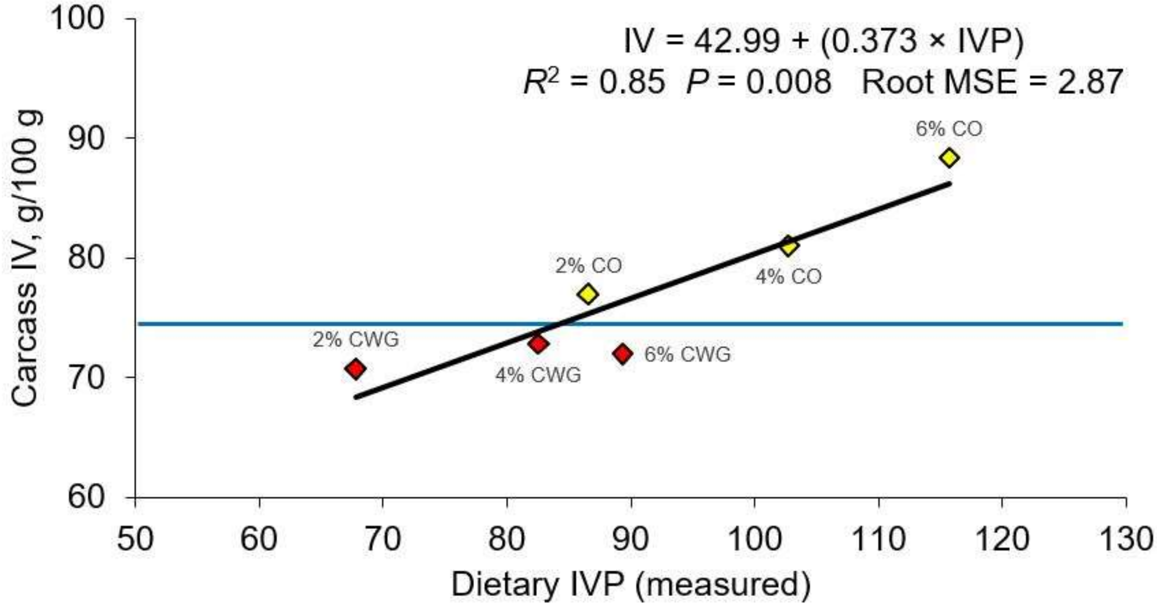
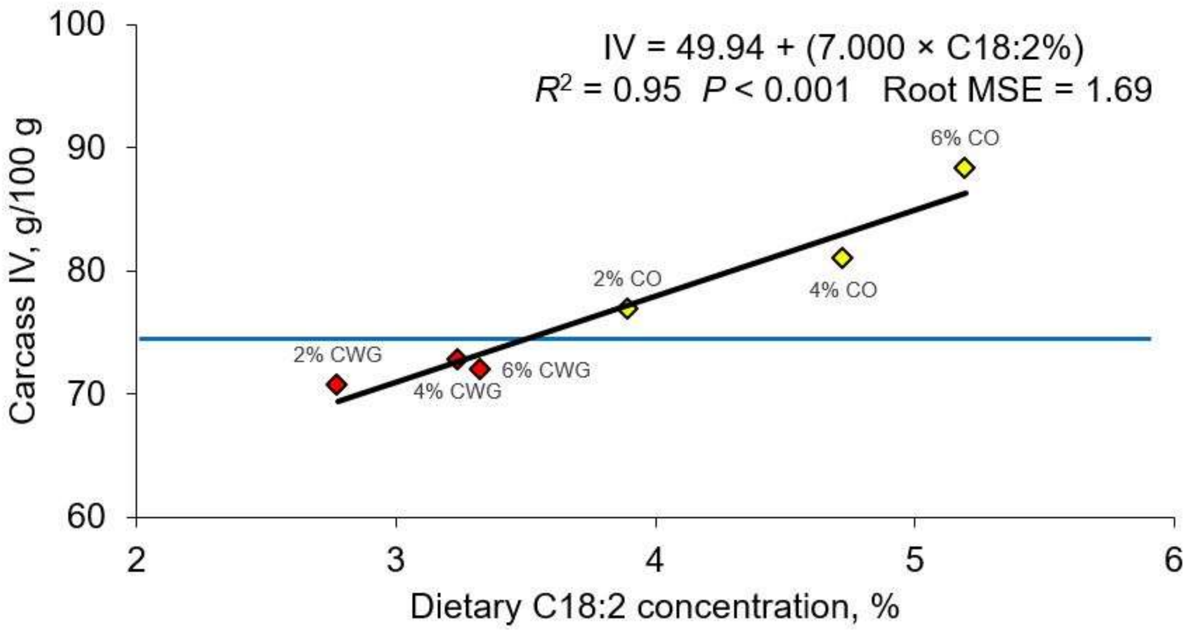
Figure 1. Prediction of carcass iodine value (IV) by iodine value product (IVP)[1]



[1]Developed via 10 pens (7.53 ft^2/pig) and 200 pigs/treatment; start BW 70.5 lbs. to end BW 309 lbs.

Figure 2. Prediction of carcass iodine value (IV) by linoleic acid (C18:2) concentration in the diet[1]



[1]Developed via 10 pens (7.53 ft^2/pig) and 200 pigs/treatment; start BW 70.5 lbs. to end BW 309 lbs.

Table 1. Impact of dietary fat source and level on growth performance[1]

	Treatment								
	Corn oil			Choice white grease				P-value[2]	
Item	2%	4%	6%	2%	4%	6%	SEM	FS	FL
ME intake, Mcal/d	8.71	8.91	8.77	8.65	8.63	8.74	0.14	0.426	0.890
ADG, lbs.	1.99	2.01	2.03	1.99	1.99	2.04	0.02	0.907	0.266
ADFI, lbs.	5.73	5.67	5.45	5.69	5.50	5.43	0.09	0.325	0.028
Feed to gain ratio	2.88	2.82	2.68	2.86	2.76	2.66	0.01	0.107	<0.001
C.V. (d 0), %	19.7	19.3	19.8	19.0	20.0	20.4	1.1	0.857	0.832
C.V. (d 105), %	8.9	8.8	8.5	8.1	9.3	9.1	0.5	0.799	0.589
Average market BW, lbs.	308	310	310	308	308	310	1	0.749	0.513
Pig days/number of head sold	119	119	119	120	119	116	2	0.407	0.417

[1]10 pens (7.53 ft^2/pig) and 200 pigs per treatment; Starting BW 70.5 ± 0.9 lbs.
[2]No significant interaction between fat source and fat level was evident (*P* > 0.30).

Table 2. Impact of dietary fat source and level on apparent (ATTD) and true total tract (TTTD) digestibility of dry matter (DM), gross energy (GE), and acid hydrolyzed ether extract (AEE) on d 39[1]

	Treatment									
	CO			CWG				*P*-value		
Item	2%	4%	6%	2%	4%	6%	SEM	FS	FL	FS × FL
ATTD[2]										
DM, %	77.4	82.0	83.7	78.3	82.0	80.5	0.6	0.048	<0.001	<0.001
GE, %	78.6	82.7	84.2	78.8	82.5	81.1	0.3	0.006	<0.001	<0.001
AEE, %	66.2	74.9	79.2	65.2	75.4	75.7	0.9	0.017	<0.001	0.012
TTTD[3]										
AEE, %	95.0	94.1	93.4	91.6	92.8	92.9	0.8	0.062	0.954	0.395

[1]10 pens (7.53 ft^2/pig) and 200 pigs/treatment; start BW 70.5 lbs. to end BW 309 lbs.
[2]Titanium dioxide was included at 0.40%; Apparent total track digestibility (ATTD; %) of either AEE, DM, or GE was calculated according to Oresanya et al. (2007).
[3]True total tract digestibility (TTTD; %) of AEE was calculated by correcting ATTD of AEE for endogenous fat losses at 20 g of AEE/kg of DM intake (Acosta et al., 2015).