Interaction of Net Energy Concentration and Feeding Level in Weaned Pigs

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Summary

Weanling barrows were fed diets of 3 energy concentrations at 3 different feed restrictions to determine the effect of energy intake on piglet growth and body composition. Growth was not affected by dietary energy concentration but was improved with increased feed intake. Increased energy intake, whether from a higher energy concentration in the diet, or increased feed intake, resulted in an increased deposition of lipid. The NE system provided no advantage over the DE system in prediction of weanling pigs growth or body composition. Once again, increased dietary energy concentration failed to improve weanling pig performance

Introduction

Energy intake, perhaps due to restrictions in gut capacity, restricts growth in the weaned pig. Increasing dietary energy concentration, therefore, should increase energy intake and growth. However, in recent studies, increasing dietary energy concentration failed to improve weanling pig growth performance, primarily because feed intake declined and daily energy intake remained unchanged.

There have been no studies in weaned pigs comparing the impact of changing energy intake through control of daily feed intake to changes in dietary energy concentration. The objective of this study was to define the interaction between daily energy intake and dietary energy concentration on body weight gain and on tissue (protein, lipid ash and water) accretion rates and ratios.

"Bodyweight gain and carcass lipid and protein deposition are highly correlated with energy intake."

Experimental Procedure

A total of 81 barrows (9.5 ± 0.1 kg; 31.5 ± 0.3 days of age) were allotted to one of 9 treatments arranged as a 3 x 3 factorial (3 diets x 3 feed intake levels). Diets were formulated to contain either 2.21, 2.32 or 2.42 Mcal NE/kg. Digestible lysine to energy ratios were maintained constant. Three feed levels were employed corresponding to 100%, 80% and 70% of ad libitum intake. Freshly voided faeces were collected from each pig to determine actual DE content. Net energy was calculated from digestible nutrient content according to CVB (1998). Pigs were sacrificed when they reached 25 kg. The gastrointestinal tract was removed, weighed

and analyzed separately. Carcass and organs were ground and analyzed for protein, lipid, water and ash content. The calculation of nutrient deposition was determined by comparing the composition of these pigs to a cohort slaughtered at experiment initiation.

Results and Discussion

Average daily gain and feed intake were unaffected by NE content of the diet but improved with increasing feeding level ($P < 0.0001$). Feed efficiency improved with feed intake restriction, but only at the highest NE concentration (interaction, $P < 0.03$). The efficiency of utilization of energy, for BW gain or lipid deposition, increased with NE content of the diet and feeding level ($P < 0.0001$). Conversely the efficiency of energy use for protein deposition decreased with increased energy content of the diet and feeding level ($P < 0.0001$). Except for protein deposition, which was unaffected by dietary NE content, the deposition of protein and lipid followed a similar pattern as the efficiency of energy utilization. Moreover, the carcass lipid:protein ratio increased with increased NE content of the diet and feeding level ($P < 0.0001$). A dramatic increase in the lipid:protein ratio of the carcass was seen at the highest dietary NE content and 100 % feeding level (interaction, $P < 0.002$). Energy intake was correlated positively with average daily gain, and carcass and protein lipid deposition, regardless of whether energy intake was calculated using the DE or NE system (Table 2).

Table 1. Effect of dietary energy concentration and intake on performance, energy utilization and carcass composition of weanling pigs (9.5kg initial to 25kg final BW)

	NE, Mcal/kg			Feeding Level, % of ad lib			P values			
Item	**2.15**	**2.26**	**2.37**	**70**	**80**	**100**	**SEM**	**NE**	**Feeding Level**	**NE x FL**
Number of Pigs	27	27	27	27	27	27				
Performance										
Days on test	27.1	28.4	27.3	31.0	29.0	22.8	0.6	0.03	0.0001	0.75
ADG, g/d	577	561	579	491	534	692	8.0	0.23	0.0001	0.34
ADFI, g/d	789	771	784	661	740	943	9.0	0.35	0.0001	0.15
Gain:Feed	0.73	0.73	0.74	0.74	0.72	0.73	0.01	0.53	0.28	0.03[a]
Energy Utilization										
Mcal intake, Mcal/d	2.07	2.12	2.26	1.86	2.04	2.54	0.03	0.0001	0.0001	0.47
Mcal NE/kg gain	2.43	2.59	2.75	2.44	2.60	2.73	0.04	0.0001	0.0001	0.14
g Protein/Mcal NE intake	68.0	63.9	59.4	68.0	63.9	59.3	1.0	0.0001	0.0001	0.24
g Lipid/Mcal NE intake	25.0	27.7	32.2	27.2	26.0	31.7	14.3	0.001	0.008	0.004[b]
Carcass Deposition										
Protein, g/d	77	75	77	67	72	89	2.0	0.17	0.0001	0.11
Lipid, g/d	33	37	51	30	34	57	3.0	0.0001	0.0001	0.0001[b]
Lipid:protein Ratio	0.42	0.49	0.64	0.45	0.47	0.63	0.02	0.0001	0.0001	0.002[b]

[a] Feed efficiency increased with increasing restriction, but only at the highest NE concentration.
[b] Efficiency of lipid deposition (g lipid/Mcal NE intake), lipid deposition (g/d) and the lipid:protein ratio increased at the highest NE concentration with 100 % ad libitum intake.

Table 2. Correlation between energy intake and performance

Variable	r coefficient	P value
DE intake, and		
ADG	0.92	0.0001
Gain:Feed	-0.14	0.23
Carcass protein deposition	0.93	0.0001
Carcass lipid deposition	0.80	0.0001
Carcass lipid:protein ratio	0.60	0.0001
NE intake, and		
ADG	0.90	0.0001
Gain:Feed	-0.12	0.28
Carcass protein deposition	0.91	0.0001
Carcass lipid deposition	0.85	0.0001
Carcass lipid:protein ratio	0.67	0.0001

Implications

Maximal energy intake in weaned pigs resulted in increased lipid deposition, not the desired increase in lean (protein) deposition, regardless of whether the energy intake was provided by increasing energy concentration of the diet or through increased feed intake. Bodyweight gain and carcass lipid and protein deposition are highly correlated with energy intake: however, the NE system was not shown to be superior to the DE system in this regard.

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