Irrespective of Differences in Weaning Weight, Feed Efficiency is Not Different among Pigs with Varying Average Daily Gain

A.S. Leaflet R2652

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Summary and Implications

A total of 120 weanling barrows were selected to represent the 10% lightest, median, and heaviest pigs at weaning (n=30 per weaning weight category). Eight pigs per weaning weight (WW) category were harvested as an initial slaughter group. The remaining 96 barrows were utilized in a 27-d growth and metabolism study, and harvested on d 33 or 34 post-weaning. At the completion of the experiment, pigs in each WW category were divided into the slowest, median, or fastest 33% average daily gain (ADG) category, yielding a nested design. Although average daily feed intake (ADFI) increased with increasing WW and ADG categories, feed efficiency (G:F) was not different. While tissue accretion rates varied due to WW and ADG category, the composition of gain was not affected. In conclusion, both WW and ADG affect the physiological development of pigs.

Introduction

Fallback pigs are those that fail to achieve performance in the barn equal to that of their contemporaries. Pigs can be born as fallbacks, in that they have a lighter birth weight and thus diminished capacity for postnatal growth due to intrauterine growth retardation. However, pigs with a normal or heavy birth weight can become fallback pigs due to poor nutrition, environmental conditions, or disease management. Thus, the fallback pig category includes, but is not limited to, pigs defined as runts, tail-enders, fall-behinds, and those with failure to thrive. In fact, there are many causes for this underachievement, many of which remain undetermined or undefined. Whatever the cause, these pigs compromise barn throughput, result in weight penalties at market, and may disrupt overall herd health if they harbor pathogens that constantly challenge healthy pigs sharing the same airspace.

While the problems associated with fallback pigs are largely understood in the field, there is little understanding as to the root cause of pig fallback. This limits the development of solutions and possible management strategies. The current industry standard to manage nursery fallback pigs is to create a fallback pen and feed additional quantities of phase 1 and phase 2 starter diets. At least one large production system has found success in segregating fallback pigs to separate barns in order to improve overall throughput, but this generally relies on comingling the poorest pigs. Despite the proposed solutions, fallback pigs pose a serious problem for the industry. Understanding these pigs will allow for their proper management and may prevent them from serving as a drag on net income and increased labor due to treatment and special management that they may require. This particular experiment's objective was to evaluate the effects of pig WW category on post-weaning growth, body composition, and tissue deposition rates in order to determine if physiological differences exist between fallback pigs and their normal cohorts.

Materials and Methods

This study was conducted at the Iowa State University Swine Nutrition Farm under the approval of the university Institutional Animal Care and Use Committee (#9-09-6807-S). Through four replicates, a total of 960 weanling pigs (PIC C22/C29 × 337; ages 18-21 d) were individually tagged and weighed for this experiment. From this general population, 120 barrows, representing the 10% lightest, median, and heaviest pigs at weaning were selected for the experiment (n = 30 per WW category; BW = 4.6, 6.2, and 8.1 kg, respectively). Eight pigs per WW category (24 total pigs) were harvested on d 5 post-weaning as an initial slaughter group. The remaining 96 barrows were housed in individual crates and fed *ad libitum* quantities of a commercial nursery phase feeding program during a 27-d growth and metabolism study. Free access to water was provided at all times using individual cup waterers. Pigs were harvested on d 33 or 34 post-weaning.

Whole carcasses from all 120 pigs were ground, homogenized, and analyzed for percentage DM, lipid, protein, and ash. Within each treatment, the difference between the growth/metabolism carcass composition and initial slaughter group carcass composition was determined and utilized to calculate tissue deposition rates.

At the completion of the study, pigs in each WW category were divided into the slowest, median, or fastest 33% ADG category, yielding a nested design with 9 treatments plus an initial slaughter group. Data were analyzed using the GLIMMIX procedure of SAS (SAS Inst. Inc., Cary, NC). The model consisted of the fixed effects of WW category and WW category nested within ADG category and the random effects of replicate and crate. Least squared means were calculated, and treatments were compared using the SLICE and SLICEDIFF procedures.

Tukey-Kramer corrections were used to adjust for multiple comparisons among treatments.

Results & Discussion

Growth and carcass composition are reported in Table 1. Both ADG and ADFI were affected (*P* < 0.0001) by differences in treatments, but G:F was not different (*P* = 0.30). Interestingly, the lowest ADG and ADFI from the lightest and median WW categories were not statistically different, suggesting that these pigs underperformed, regardless of initial WW. The root cause of this underperformance appears to be correlated with feed intake, as there were no differences in feed efficiency. This is in contrast to our hypothesis that pigs from lighter WW or slower ADG are less efficient at converting feed to gain.

While differences in ADG were detected, the composition of gain was not statistically different among treatments. Neither the carcass composition of protein nor lipid differed (*P* = 0.12 and 0.19, respectively), so it was surprising to find the rates of protein and lipid accretion were significantly maximized (*P* = 0.0002) by both WW and ADG. While differences in tissue deposition rates were expected due to the variation in ADG, rates still varied when expressed per kg of metabolic body weight. It is common to transform data so that it is expressed per unit of body weight in order to compare pigs of unequal weights on a more equal basis. Because differences still existed after this transformation, it can be assumed that the variation in tissue accretion rates is due to physiological differences beyond simple body weight differences.

The results from this trial carry significant ramifications. This research can be applied to additional knowledge gained by analyses of nutrient and energy utilization, immune status, and gut function to develop a deeper understanding pig variation in WW and ADG. Such knowledge will lead to the development of more individualized and cost-effective managerial strategies for weanling pigs in the future.

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Table 1. Effects of WW and ADG on growth and carcass composition of weanling pigs.

	ADG, g/d	ADFI, g/d	G:F	% Protein	% Lipid	Protein Deposition[1], g/d/kg$^{0.60}$	Lipid Deposition[1], g/d/kg$^{0.60}$
Lightest 10% WW							
Slowest ADG	378	421	0.92	15.3	10.9	8.9	4.9
Median ADG	503	601	0.84	15.8	11.1	12.0	7.2
Fastest ADG	569	673	0.85	14.7	10.9	11.5	7.5
Median 10% WW							
Slowest ADG	378	455	0.82	15.2	10.7	9.7	5.4
Median ADG	579	699	0.83	15.8	11.9	12.4	8.4
Fastest ADG	672	845	0.79	15.8	12.1	13.7	9.6
Heaviest 10% WW							
Slowest ADG	543	655	0.85	15.2	11.8	10.6	6.7
Median ADG	637	758	0.85	15.2	12.4	12.9	9.5
Fastest ADG	719	872	0.82	15.9	12.6	14.8	10.5
Pooled SEM	22.9	37.5	0.039	0.42	0.45	0.90	0.82

[1]Expressed per kg of metabolic body weight according to Noblet et al., 1999: metabolic body weight = (body weight)$^{0.60}$.