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Dietary approaches to altering the composition of body weight gain in growing gilts

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Introduction

Increased attention is being directed at gilt development programs that focus more on reproductive development and less on growth. While this has been a common practice in the poultry industry, the definition of specific feeding and management programs for replacement females and boars is only gradually evolving in the pork industry. This paper considers the impact of daily energy intake on the composition of gain in the young, growing gilt.

Body composition is considered an important variable in the onset of puberty in the gilt. Furthermore, the lifetime productivity of the sow is related to her body composition at first and subsequent matings. Therefore, feeding to achieve a given body composition at puberty should be considered as an important focal point of any gilt development program.

The study

A total of 75 gilts were randomly assigned to one of five dietary treatments: ad libitum access to feed, or restriction of feed intake to 93, 86, 79, or 72% of the ad libitum intake. A three-phase feeding regime was employed. From 25 to 50 kg the diet contained 3.50 Mcal DE/kg and 1.00% apparent digestible lysine, resulting in a lysine:DE ratio of 2.85 g/Mcal. From 50 to 80 kg the diet contained 3.45 Mcal DE/kg and 0.85% apparent digestible lysine, resulting in a lysine:DE ratio of 2.5 g/Mcal. From 80 to 120 kg the diet contained 3.30 Mcal DE/kg and 0.65% apparent digestible lysine, resulting in a lysine:DE ratio of 2.0 g/Mcal. In all cases, lysine was formulated to exceed the expected requirement of the pigs for protein deposition by 10% or more. Other amino acids were formulated to maintain the ideal ratio of indispensable amino acids relative to lysine. Fifteen pigs within each treatment began the experiment at 25 kg. Three pigs within treatment were sacrificed at 50 kg, another three within treatment at 75 kg, four within treatment at 100 kg, and five within treatment were sacrificed at 120 kg. In addition, eight pigs were sacrificed at 25 kg to determine baseline body composition. All carcasses were homogenized following removal of gut contents to facilitate determination of total body fat, protein, ash, and water.

Overall gilt performance is presented in **Table 1**. The ad libitum fed gilts grew extremely well, with an overall average daily gain of 980 g/d. For every percentage decrease in feed intake, there was a corresponding mean decrease in growth rate of 11.5 g/d. This underscores the importance of maximizing feed intake for commercial pigs destined to market, in order to maximize growth rate and barn turnover. However, it also illustrates the degree of growth restriction that can be achieved by reducing feed intake in gilts destined for the breeding herd.

With respect to feed conversion, the ad libitum fed animals also performed extremely well, averaging 2.43:1 from 25 to 120 kg. Interestingly, feed conversion only tended to be reduced by restricted feed intake (P = 0.066). While our first inclination was to question this result, in the context of conventional thinking on the subject, and based on past research by others, we ultimately realized that conducting this study to a constant weight endpoint explained the result. The pigs on the most heavily restricted dietary regime required an additional 56 days to reach 120 kg, as compared to the ad libitum treatment.

Table 1: Impact of decreasing energy intake on gilt performance from 25 to 120 kg.

	% of Ad Libitum					
	100	**93**	**86**	**79**	**72**	**SEM**
Daily gain, kg[1]	0.98	0.90	0.82	0.76	0.62	0.02
Daily feed, kg[1]	2.55	2.35	2.17	1.99	1.81	0.02
Gain:feed	0.41	0.41	0.40	0.41	0.37	0.01
P2 Backfat, mm[2]	16.7	13.6	10.8	12.3	12.3	0.4
Loin depth, mm	62.3	58.7	54.6	59.6	59.2	0.8

[1]Impact of treatment significant, P < 0.001
[2]Impact of treatment significant, P < 0.025

This greatly extended feeding period (+59%) meant that the pig's maintenance requirement was also magnified; when we modeled energy utilization in the ad libitum and restricted-fed pigs, the almost constant feed conversion was readily explained.

The restriction of energy reduced the backfat thickness as expected, but loin thickness was unaffected by dietary treatment. However, the amount of protein in the carcass increased proportionately more than the reduction in lipid, indicating that reducing energy intake may be an acceptable way to increase body protein mass while lipid content is reduced to a lesser extent. This is a topic that clearly requires additional investigation. (For those readers wondering how protein mass could increase proportionately more than lipid, the answer lies in the quantity of water associated with the protein.)

It is also interesting to note that, across treatments, the ash:crude protein ratio remained constant, suggesting that restricted energy intake did not compromise—or benefit—skeletal development. Therefore, reducing growth rate in order to "strengthen" the skeleton may be misguided logic. This particular subject is discussed in more depth by Dr. Crenshaw.

There were other interesting and unexpected findings as well. For example, the size of the stomach, expressed as a proportion of total body weight, increased with restriction of intake, rather than decreased. It is plausible that this ratio is more a function of age than daily feed intake—a disappointment to human dieters, I am sure! As expected, the intestinal weight did decline as a portion of total body weight with increasing restriction in feed intake.

Conclusion

It is clearly possible to impact, in a substantive manner, the composition of growth in the developing gilt. By extension, it is therefore reasonable to assume that feeding programs designed to achieve pre-planned growth targets are also possible. What is clearly missing is the targets, expressed in terms of gilt body composition, that optimizes lifetime reproductive productivity in the sow. Furthermore, while these data demonstrate the response to energy intake achieved with defined daily feed intakes, additional research is required to achieve similar outcomes using diet modification under ad libitum conditions, or using managed feed delivery systems.