

Optimal Dietary Energy and Protein for Gilt Development: Growth and Body Composition, Feed Intake and Carcass Composition Traits

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Summary and Implications

Body weight, body composition, feed intake (FI) and carcass traits of 1221 crossbred Large White × Landrace gilts housed in groups from 100 d of age until slaughter (approximately 260 d of age) and randomly allotted to six corn-soybean diets formulated to provided two standardized ileal digestible lysine levels [100% (high, HL) and 85% (low, LL)] and three metabolizable energy levels [ME, 90% (low, LME), 100% (medium, MME), 110% (high, HME)] were evaluated. There were no differences between lysine or ME levels for growth and body composition, except for back fat, which was slightly greater for gilts fed a HME diet (~ 2 mm). Gilts fed HME diets had a lower FI but a greater ME intake compared with gilts fed LME. Additionally, gilts fed the HME diet had consumed less feed and less grams of lysine per each kg of body weight gain. However, there was no difference in the ME required per kg of body weight gain among diets. Carcasses from gilts fed the HME diet were 3.3 kg and 2.5 kg heavier than those from gilts fed the LME or MME diets, respectively. Despite significant differences in the lysine:ME ratio in the diets no changes in growth or body composition traits occurred, likely due to compensatory changes in FI in response to dietary ME content. Carcass weight differences at slaughter were likely related to organ size and organ weight, which could have been affected by FI. Further research is necessary to identify the optimal lysine-to-energy ratio to manipulate growth and body composition in replacement gilts fed *ad libitum*.

Introduction

Gilt development diets are often formulated to contain excess amino acid levels plus other nutrients to encourage maximal protein deposition; however, the key for success in gilt development may be to slow down protein deposition

and build fat reserves. Fat reserves could be manipulated by altering amino acid intake. Inadequate availability of amino acids in the diet restricts lean tissue growth and redirects dietary energy into fat deposition. Conversely, energy intake can also affect the ratio between fat and protein deposition in pigs. There are few studies comparing gilt development diet compositions fed *ad libitum* involving large numbers of observations or in a commercial setting. Thus, the objective of this study was to manipulate the lean to fat ratio of developing gilts by *ad libitum* feeding diets differing in lysine and metabolizable energy. A secondary objective was to evaluate lysine and caloric efficiency between dietary treatments fed to developing gilts from 100 to 260 d of age

Materials and Methods

Crossbred Large White × Landrace gilts (n = 1221) housed in groups from 100 d of age until slaughter (approximately 260 d of age) and randomly allotted to six corn-soybean diets formulated to two standardized ileal digestible lysine levels [100% (high, HL) and 85% (low, LL)] and three metabolizable energy levels [ME, 90% (low, LME), 100% (medium, MME), 110% (high, HME)] were used in this study. The 100% ME, 100% lysine control diet was based on an average from an informal survey conducted by the National Pork Board to provide a consensus dietary lysine and ME content for gilt development diets commonly utilized by the U.S. swine industry. Gilts were provided with *ad libitum* access to a grower diet from 100 d of age until they reached approximately 90 kg body weight. Then, gilts were provided *ad libitum* access to a finisher until they were slaughtered. Gilts were weighed and backfat thickness and loin area were recorded at the beginning of the trial and then every 28 days. Feed intake was recorded as feed disappearance within the pen at 2 wk intervals. Biweekly and daily lysine (g) and ME (Mcal) consumed were calculated based on diet formulations. Finally, warm carcass weight and fat thickness were recorded at slaughter. Pen was considered the experimental unit (12 pens per diet; 72 pens on trial). Data were analyzed using mixed model equation methods (SAS v9.4 PROC MIXED; SAS Inst. Inc., Cary, NC).

Results and Discussion

Differences in dietary lysine and ME did not alter gilt growth and/or body composition in the present study (P > 0.05) except for backfat thickness, which was slightly greater for gilts fed the HME diets. Because the backfat differences between the treatment groups is so small (~2 mm), the difference is likely to be biologically irrelevant.

Furthermore, the lack of differences among dietary treatments for the different growth and body composition traits in the present study can be explained by changes in gilt feed intake in response to the various diets.

Results indicate that gilts adjust their feed intake according to dietary ME content. Gilts fed the LME diet had 7.26 kg and 14.9 kg greater feed consumption and 0.06 kg and 0.12 kg greater lysine consumed than gilts fed the MME and the HME diet, respectively ($P < 0.05$). Decrease in energy content in the diet is associated with a compensatory increase in feed intake and with a slightly lower energy intake level when compared to pigs fed a higher energy diet. This may be explained by gastrointestinal capacity limitation before energy demand is met

There was a difference in lysine utilization among treatments as gilts fed a low lysine diet consumed 5 g of lysine less per kg of BW gain compared with gilts fed a high lysine diet ($P < 0.01$). This is almost certainly related to feed intake per kg of BW gain, as the gilts consumed the same amount of feed per kg of BW gain but the amount of lysine present in the feed was different. Additionally, gilts fed the low ME diet consumed 0.34 kg and 0.72 kg more feed per kg of body weight gain than gilts on the medium ME and high ME diet, respectively ($P < 0.05$). Furthermore, gilts fed the low ME diet consumed 2.7 g and 5.7 g more lysine per kg of body weight gain than gilts fed the medium ME and high ME diet, respectively ($P < 0.05$). Further research is necessary to examine amino acid needs and amino acid efficiency in developing gilts with the potential to reach heavy body weights as studies are limited regarding this topic.

Warm carcass weight, and fat thickness were similar regardless of dietary lysine treatment ($P > 0.05$). However, carcasses from gilts fed the HME diet were 3.3 kg and 2.5 kg heavier than those from gilts fed the LME or MME diets, respectively. Although organ weights were not recorded for this study, it is possible that the greater carcass weights are related to organ size and organ weight. Alterations in digestive organs could be advantageous for gilts during subsequent lactations, when it is difficult for some animals to eat enough to meet lactation demands. Whether diets alter digestive organ weights, and whether this could provide an advantage, warrants further study.

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