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Ad libitum Feeding of Gilt Developer Diets Differing in Standard Ileal Digestive Lysine Concentrations Affected Growth and Feed Efficiency but did not Affect Age at Puberty in Replacement Gilts

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^{*} USDA is an equal opportunity provider and employer

Summary and Implications

The effect of ad libitum feeding diets with three lysine concentrations to developing gilts housed in groups from 100 to 220 days of age on growth, body composition, feed efficiency and age at puberty was evaluated. Gilts were randomly allotted to three corn-soybean diets formulated to provide three standardized ileal digestible (SID) lysine concentrations. Gilts received grower diets formulated to provide 0.68% (low), 0.79% (medium) or 0.90% (high) SID lysine from 100 days of age until approximately 90 kg BW. Then, gilts were fed finisher diets containing 0.52% (low), 0.60% (medium) or 0.68% (high) SID lysine until they were moved to the breeding barn at approximately 220 days of age. Data on BW, backfat thickness, loin area, feed and lysine intake and age at puberty was collected at different intervals during the study. Gilts fed the low lysine diet had lower average daily gain, body weight, backfat thickness and loin depth compared with gilts fed the high lysine diet. Overall, 34% of gilts displayed standing estrus before 220 days of age. The number of gilts that reached puberty was not different among dietary treatments; however, gilts fed the high and medium lysine diet reached puberty 10 days and 6 days before gilts fed the low lysine diet, respectively. Results from the present study suggest that growth rate can be successfully altered when feeding gilts ad libitum diets differing in SID lysine concentration without negatively affecting puberty attainment.

Introduction

Studies have suggested that gilt body composition could be manipulated by altering amino acid intake, energy intake and/or by restricting the daily amount of feeding offered per gilt. Although providing diets that contain excess amino

acid concentrations is common practice in the pig industry limit feeding gilts is impractical in the majority of USA commercial pig herds. The Animal Science Committee of the National Pork Board commissioned trials to develop ad libitum fed gilt development diets capable of altering growth rates and/or body composition. An initial trial was conducted with six diets fed ad libitum that contained two standard ileal digestible (SID) lysine and three ME concentrations that bracketed those currently used by commercial swine herds in the US. Three diets were to be used in a larger National Pork Board longevity study on gilt development and retention of sows in the breeding herd to third parity. Unfortunately, dietary treatments failed to alter gilt growth, body composition or estrous cyclicity. Thus, a second preliminary trial was developed with the objective to evaluate the effect of three diets differing in SID lysine concentration on growth, body composition and age at puberty. Successful development of diets that affect growth will then be used for a long term National Pork Board primary trial of dietary effects on gilt development, reproductive performance, and longevity.

Materials and Methods

Crossbred Large White × Landrace gilts (n = 641) housed in groups, were randomly allotted to three corn-soybean diets with similar ME levels but with three different SID lysine concentrations. Gilts received grower diets formulated to provide 0.68% (low), 0.79% (medium) or 0.90% (high) SID lysine from 100 days of age until approximately 90 kg BW. Then, gilts were fed finisher diets containing 0.52% (low), 0.60% (medium) or 0.68% (high) SID lysine until they were moved to the breeding barn at approximately 220 days of age. Gilts were weighed and backfat thickness, and loin depth were recorded at the beginning of the trial and then every 28 d until gilts reach 220 days of age. Feed intake was recorded as feed disappearance within the pen at 2 week intervals. Grams of lysine consumed were calculated based on diet formulations. Starting at 160 d of age, gilts were exposed daily to vasectomized boars and observed for behavioral estrus. On the day that standing estrus was observed, a flank to flank measure was taken for each gilt, and gilts were weighed and backfat thickness and loin depth were also measured. A blood sample was collected from each gilt at 210 and 220 days of age if she had not been observed in standing estrus and serum progesterone was measured by radioimmunoassay (RIA). Concentrations of ≥ 1 ng/mL were defined as indicative of luteal activity, which was used to distinguish between prepubertal gilts and behaviorally

anestrus (i.e. cycling but no estrus behavior) gilts. If gilts were not observed in standing estrus by 220 days of age, they were injected with PG-600 (5ml) to induce puberty. Gilts were observed for estrous behavior for an additional week after PG-600 injection, to determine their response to PG-600 treatment. Data were analyzed using mixed model equation methods (SAS v9.4 PROC MIXED; SAS Inst. Inc., Cary, NC).

Results and Discussion

Results suggest that body weight, backfat thickness and loin depth can be successfully altered when feeding gilts ad libitum diets differing in lysine concentration. Gilts fed the low lysine diet were 8 kg and 18 kg lighter compared with gilts fed the medium and high lysine diets by 212 days of age, respectively. Likewise, gilts fed the medium lysine diet were 10 kg lighter compared with gilts fed the high lysine diet. Gilts fed the low lysine diet had a lower ADG when compared to gilts fed the medium and high lysine diets; however, all gilts in this study had lifetime growth rates greater than 0.6 kg/day which has been suggested as the minimum daily growth rate for puberty attainment. There was no difference between gilts fed the low and medium lysine diets for backfat thickness and loin depth; however, in both dietary treatments, backfat thickness and loin depth was less when compared to gilts fed the high lysine diet.

Gilts fed the low lysine diet had a greater average daily feed intake and a lower average daily lysine intake when compared to gilts fed the high lysine diet but did not differ from gilts fed the medium lysine diet. Nonetheless, average daily lysine consumption was within the optimal range reported in other studies even for the lower SID lysine concentration provided. Furthermore, irrespective of dietary treatment, gilts consumed 20 g of lysine/kg BW gain which has been reported as the optimal amount of lysine needed per kg of BW gain.

Average age at puberty was 202 days of age with a range from 166 to 222 days of age. When all gilts that were on trial at 160 d of age were included in the data analysis, only 32% of gilts displayed standing estrus. When gilts removed from the trial before 220 days of age were excluded from the analysis, 34.1% of gilts displayed standing estrus. The number of gilts that reached puberty was not different among dietary treatments in either analysis. However, gilts fed the high and medium lysine diets reached puberty 10 and 6 days before (198 ± 1.73 and 202 ± 1.81 days for high and medium, respectively vs. 208.99 ± 1.94 days for low diets) gilts fed the low lysine diet, respectively.

Most of the gilts failing to achieve puberty by 220 days of age were still pre-pubertal as only 5% of gilts were determined to be behaviorally anestrus using progesterone concentrations as a determinant. Almost 88% of gilts treated with PG-600 showed standing estrus within one week. This suggests that PG-600 treatment of behaviorally anestrus gilts may provide some benefit in terms of

stimulating them to display estrus, although it is not clear whether these gilts would be likely to display estrus at the next cycle for successful mating.

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