Dietary Protein and Fermentable Fiber Affect Nitrogen Excretion

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Summary

Nitrogen excretion is of concern because of its potential impact on the environment inside and outside the barn. The effects of reducing dietary protein content and inclusion of dietary fermentable fibre sources on reducing urinary nitrogen excretion were additive, together resulting in a 55% reduction. Urinary nitrogen excretion could be predicted from plasma urea (PU) concentration.

Introduction

The intensification of pig production has raised environmental concerns. Urinary nitrogen is emitted easily as ammonia while fecal nitrogen is less volatile because it is bound within proteins. Reduction of dietary protein is a direct way to reduce nitrogen excretion and ammonia emission. Nitrogen excretion can be shifted from urea in urine to bacterial protein in feces with dietary fermentable carbohydrates. Effects of two levels of protein and three fermentable fibre sources on nitrogen excretion patterns were investigated.

Experimental Procedures

Diets (wheat, barley, soybean meal; soybean hulls or sugar beet pulp as fibre source) supplemented with synthetic amino acids were formulated to 3300 kcal DE/kg and 2.40 g Dlys/Mcal. Feces, urine and blood samples were collected. Pigs had free access to feed.

Results and Discussion

For low compared to high protein diets, urinary and total nitrogen were reduced 27% and 16%, respectively, while nitrogen retention was reduced 7% (Figure 1). Urinary nitrogen was reduced 9% – units for soybean hulls – and 10% for sugar beet pulp diets. Fecal nitrogen (as % of nitrogen intake) was increased 5% – units for soybean hulls – and 9% for sugar beet pulp diets, compared to control. Dietary fermentable fibre did not affect nitrogen retention. Urinary and total nitrogen excretion was not affected by a protein and fibre interaction, indicating a cumulative effect. Both soybean hulls and sugar beet pulp are good sources of fermentable fibre for pigs. Comparison of urinary nitrogen excretion to PU by regression analysis indicated that PU could predict urinary N excretion (Figure 2).

Implications

Lower total nitrogen excretion may reduce land base needed to apply manure in a sustainable manner. Lower urinary nitrogen excretion will reduce ammonia emission inside and outside the barn. Models to predict urinary nitrogen excretion may be useful to access nitrogen status on farms. Further studies are required to validate these models under various conditions.

Acknowledgements

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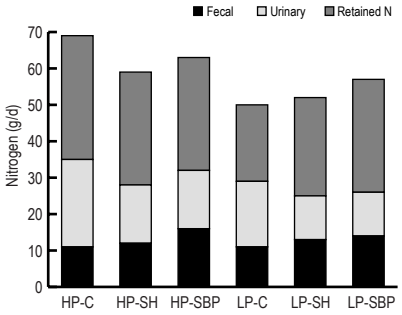

Figure 1 **Effects of dietary protein level (HP = high protein; LP = low protein) and fermentable fiber source (C = Control, SH = soybean hulls; SBP = sugar beet pulp) on nitrogen retention and excretion patterns in grower pigs with free access to feed.**

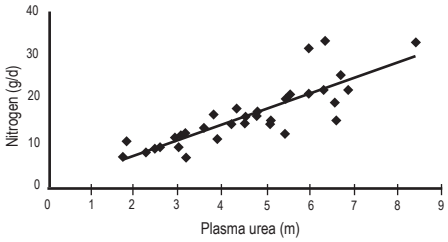

Figure 2 **Relationship of plasma urea to urinary N excretion at 0800 in grower pigs with free access to feed (R^2 = 0.71).**

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