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The Effect of Infusion of Urea into the Jugular Vein on Feed Intake of Finishing Gilts

Hsin-Yi Chen
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Summary and Implications

Previous research suggested feed intake was reduced in growing-finishing pigs consuming corn-soybean meal diets high in crude protein. Because urea is the primary end product of the breakdown of excess dietary protein intake, the effect of intravenous infusion of urea solution on feed intake was evaluated. Daily infusions of 24 and 30 g of urea were used to mimic plasma urea concentration of pigs receiving a 25% crude protein (CP) diet. Blood samples were obtained and feed intakes were measured daily to determine plasma urea concentration and average daily feed intake (ADFI). Average daily feed intake was reduced 4% as daily infusion of urea was increased from zero to 30 grams. The data suggest that plasma urea concentration is involved in regulating feed intake in the finishing gilts consuming excess protein.

Introduction

In the 1996 Nebraska Swine Report, we described an experiment in which diets with five protein levels (13, 16, 19, 22 and 25% CP) were fed to finishing barrows and gilts. We found increasing dietary protein concentration from 16 to 25% reduced average daily feed intake (ADFI) in gilts. We also found plasma urea concentration increased with each incremental increase in dietary protein concentration up to the 22% CP treatment. Because of the apparent correlation between ADFI and the response of plasma urea concentration, we hypothesized plasma urea concentration may have a role in regulating feed intake. Therefore, three experiments were conducted to evaluate the relationship between ADFI and plasma urea concentration.

Procedures

Experiment 1. This experiment was a preliminary study conducted to investigate the effects of intravenous infusion of urea solution on plasma urea concentrations in finishing gilts. The objective was to determine the concentration of urea that would mimic the plasma urea concentration of pigs receiving a 25% CP diet. Six gilts (average body weight 117 lb) were used in a 5×5 + 1 Latin Square design. Catheters were placed into the vena cava of each pig via the external jugular veins (both left and right sides). Catheters were passed subcutaneously through a cannula to the back and exteriorized. Pigs were individually housed in stainless steel metabolism crates in a temperature-controlled room (72 to 74°F) and allowed five days to recover from the catheterization and to adapt to the metabolism crates.

Five gilts were fed a 16% CP corn-soybean meal diet and were infused with either saline or one of four concentrations of urea. The urea solution was infused at a constant rate of 6, 12, 18 and 24 grams of urea daily. Each of the five pigs received the five treatments. One treatment was administered on each of five periods (12 hour/period). Between periods, infusions were stopped for 36 hours to avoid carryover effects. The sixth pig received a 25% CP diet and was infused with saline

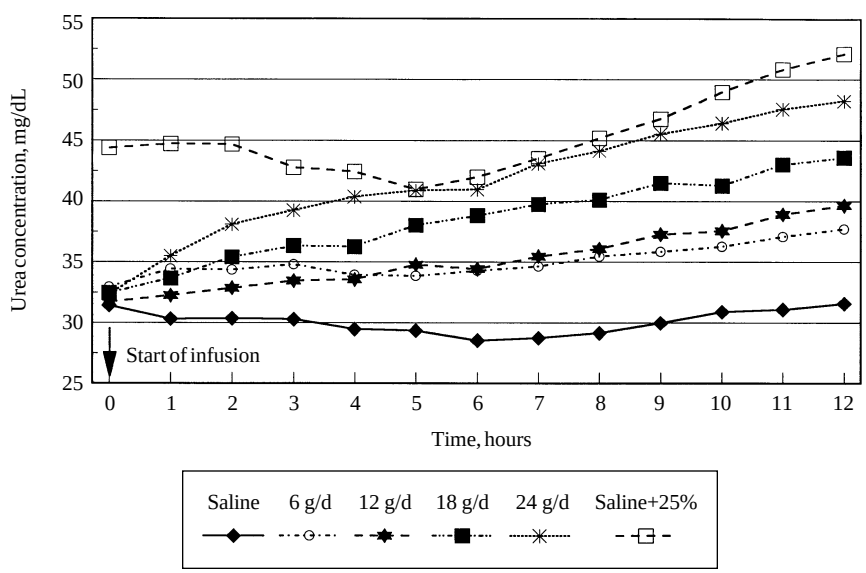

Figure 1. Effect of intravenous infusion of urea or saline on the pattern of plasma urea concentrations in gilts (Experiment 1).

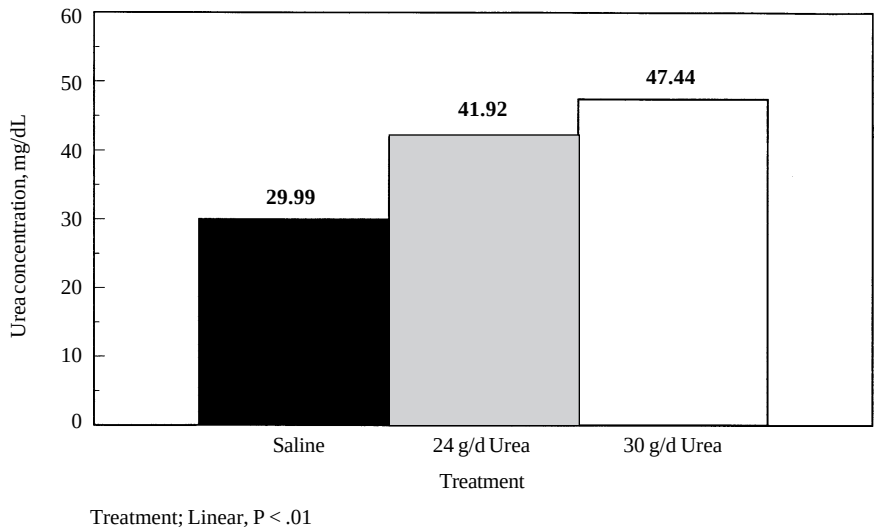

Figure 2. Effect of intravenous infusion of urea or saline on the pattern of plasma urea concentrations in gilts (Experiments 2 & 3).

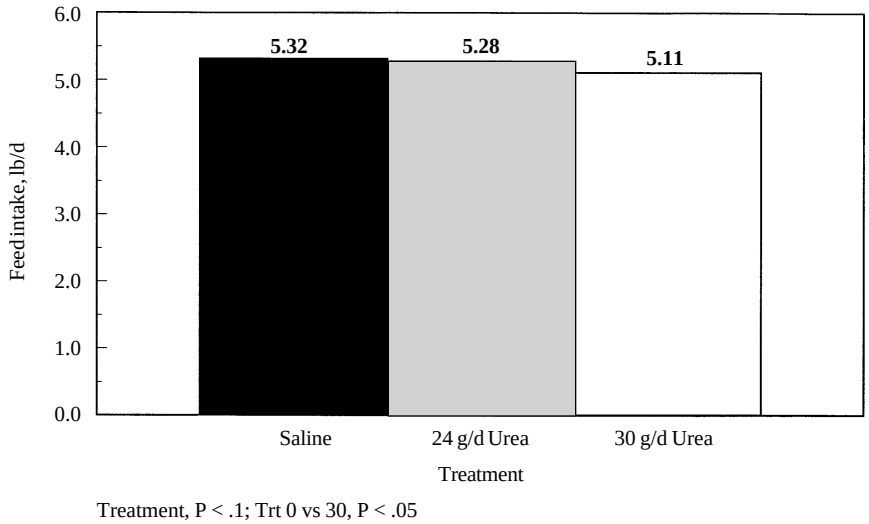

Figure 3. Effect of intravenous infusion of urea or saline on feed intake in gilts (Experiments 2 & 3).

throughout the experimental period. Venous blood samples were obtained at 1-hour intervals starting 1 hour before infusion. Plasma was separated and analyzed for urea concentration. Pigs and feeders were weighed before and after each infusion period to determine weight gain and ADFI.

Experiment 2. Three treatments were selected based on the results of Experiment 1 (0, 24 and 30 g/d of urea). Twelve gilts (average body weight 132 lb) were used in a crossover design. The catheterization procedures were similar to those used in Experiment 1. Pigs received a 16% CP diet and a different treatment in each of three infusion periods. Each infusion period lasted for two weeks. Infusions were stopped for two days between periods. Blood samples were obtained before infusion and daily after infusions started. Feeders were weighed daily to determine ADFI. Pigs were weighed before and after each infusion period.

Experiment 3. This experiment was very similar to Experiment 2 except only two treatments (0 and 30 g/d of urea infused) were used.

Results and Discussion

Experiment 1. The results of Experiment 1 are presented in Figure 1. Plasma urea concentration increased with increasing amount of urea infused. When pigs received a daily infusion of 24 grams of urea, plasma urea reached a concentration similar to the pig receiving the 25% CP diet and saline infusion. This concentration (approximately 50 mg/dL) was also similar to that of pigs fed a 25% CP diet in our previous research. However, we assumed a higher concentration of urea solution (30 g/d) may elevate plasma urea concentration even closer to that of pigs receiving the 25% CP and saline infusion. Therefore, daily infusions of zero (saline), 24 and 30 grams of urea were used in Experiment 2 and daily infusions of saline and 30 grams of urea in Experiment 3.

Experiments 2 and 3. Data from both experiments were combined for statistical analysis. The data for plasma urea concentration are shown in Figure 2. Plasma urea concentration increased linearly ($P < .01$) with increasing concentration of urea solution. The data for ADFI are presented in Figure 3. There was a trend ($P < .1$) for urea infusion to decrease ADFI. Average daily feed intake was reduced 4% ($P < .05$) as daily infusion of urea increased from zero to 30 grams. Although the reduction in feed intake was less than we observed previously in gilts fed 25 vs 16% CP, these data do suggest that plasma urea concentration may have a role in regulating feed intake in gilts consuming excessive protein. However, further research is required to elucidate the mechanism(s) whereby plasma urea affects feed intake in finishing pigs.

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