RESEARCHABSTRACT

ANIMAL SCIENCE — Nutritional Efficiency Consortium

Title: Regulation of Amino Acid Transport Efficiency by the Porcine Mammary Gland - revised
NPB #08-113

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Scientific Abstract

To test the hypothesis that reduction in dietary CP concentration coupled with crystalline amino acid (CAA) inclusion increases the efficiency of AA utilization for milk production, mammary AA arterio-venous concentration differences (A-V), AA transport efficiency (A-V/A × 100) and transcript abundance of AA transporters and milk proteins-encoding genes were determined in lactating sows fed 1 of 3 diets containing 9.5 (Deficient), 13.5 (Ideal), and 17.5 % (Standard) CP but a similar indispensable and dispensable AA profile. On d 7 and 17, arterial and mammary venous blood and mammary tissue were sampled post feeding. Transcript abundance of AA transporters *SLC7A9* ($b^{0,+}$AT), *SLC7A6* (y^+LAT2), *SLC6A14* ($ATB^{0,+}$), *SLC7A1* (CAT-1), and *SLC7A2* (CAT-2b), and milk protein *CSN2* (β-Casein) and *LALBA* (α-Lactalbumin) were determined using RT-qPCR. Piglet ADG increased curvilinearly with increasing % CP [Q (quadratic), $P < 0.01$]; it was lower ($P < 0.05$) for Deficient compared to Ideal and Standard diets, and did not differ between Ideal and Standard diets. On d 7, Lys and Arg A-V and transport efficiency increased curvilinearly (Q, $P < 0.05$) with increasing % CP; compared to Deficient and Standard diets, Arg A-V was higher ($P < 0.01$) and transport efficiency tended to be higher ($P = 0.09$) for the Ideal diet. On d 17, Lys A-V tended to increase linearly (L) (L, $P = 0.08$) with increasing % CP. Increasing CP linearly increased Ile and Val A-V on d 7 (L, $P = 0.05$ and $P = 0.08$, respectively) and Leu and Val on d 17 (L, $P = 0.07$ and $P = 0.04$, respectively). On d 7, plasma concentrations of BCAA:Lys, Leu:Lys and Ile:Lys decreased curvilinearly (Q, $P < 0.05$), with BCAA:Lys and Leu:Lys lower ($P < 0.01$) for Ideal compared to Standard diet. Plasma ratio of Val to Lys tended to decrease curvilinearly (Q, $P = 0.08$), and was lower ($P < 0.01$) for Ideal compared to Standard diet. Expression of genes encoding for AA transporter proteins $b^{0,+}$AT, y^+LAT2, $ATB^{0,+}$, CAT-1, CAT-2b, and for mammary synthesized proteins β-casein and α-lactalbumin, was unaffected by diet. In conclusion, decreasing the dietary CP from 19.4 (Standard diet) to 15.1 % (Ideal diet) with inclusion of CAA did not affect piglet ADG, but increased mammary transport efficiency and A-V of Lys and Arg. The increased in Lys and Arg transport efficiency was associated with a decrease in plasma concentration of BCAA to Lys ratio but unrelated to AA transporter and milk protein gene transcript abundance. These results indicate that CP reduction with CAA inclusion improves the efficiency of dietary AA utilization for litter growth, and that the mechanisms behind this response are independent of AA transporter or milk protein gene transcription.

These research results were submitted in fulfillment of the Nutritional Efficiency Consortium research projects.
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