

The importance of proline as a precursor for arginine in piglets

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Arginine (ARG) is necessary for protein, urea, polyamine, creatine and nitric oxide synthesis. ARG intake (~0.40 g/kg/d) from sow's milk is insufficient to meet the estimated daily metabolic arginine requirement (1.20 g/kg/d); therefore, endogenous ARG synthesis is important to maintain whole-body ARG status in suckling piglets. Sow's milk contains substantial amounts of proline, and we have previously shown that proline is an important ARG precursor in week-old piglets; however, the actual contribution of proline to whole-body ARG synthesis was not quantified. Our objective was to determine the contribution of proline to whole-body ARG synthesis, and the effect of dietary ARG intake on this contribution.

Intragastrically-fed week-old male piglets (n=10, ~1.7 kg) were allocated to receive either a deficient (-Arg; 0.20 g/kg/d) or generous (+Arg; 1.80 g/kg/d) arginine diet for 5 days (d 3 – d 7). On d 7, piglet received an infusion of [guanido-¹⁵N₂]ARG, [ureido-¹³C; 5,5-²H₂]citrulline, [U-¹³C₅]ornithine and [¹⁵N, U-¹³C₅]proline to measure the rates of conversion between ARG intermediates.

Piglets receiving the -Arg diet had a greater rate (μmol/kg/h) of total ARG synthesis (rate of citrulline to ARG conversion) than piglets receiving the +Arg diet (-Arg: 120; +Arg: 67; pooled SE: 15) (P < 0.05); however, regardless of ARG intake the proline to ARG conversion accounted for 60% of whole-body ARG synthesis (P > 0.05). Despite increased ARG synthesis; piglets receiving the -Arg diet displayed symptoms of ARG deficiency such as elevated plasma ammonia and urea concentrations, and low plasma ARG concentrations.

Implications: Proline is the major ARG precursor. There is a limit to the rate of conversion of proline to ARG. ARG is an indispensable dietary amino acid for piglets and proline can spare a portion of the ARG requirement. (Funded by Alberta Pork, NSERC and AARI).