

Regulation of lysine degradation during the postnatal stages of growth and development in the pig

Desmond B.S. Pink, Rajavel Elango, Walter T. Dixon and
Ronald O. Ball

Swine Research and Technology Centre, 4-10 Agriculture/Forestry Centre, University of Alberta,
Edmonton AB T6G 2P5; *Email*: ron.ball@ualberta.ca

The activity of lysine α -ketoglutarate reductase (LKR), the main enzyme in the lysine degradative pathway, strongly influences the rate of dietary lysine breakdown; yet the factors which control the activity of this enzyme are poorly understood in the pig. Lysine is the first or second limiting amino acid in grain diets fed to growing pigs and must be supplemented to optimize growth and protein deposition. Hence understanding the factors which control the rate of dietary lysine degradation are important. We determined the tissue distribution of LKR activity in pigs from birth to 120kg, and investigated compounds that may decrease lysine degradation in these tissues.

LKR activity was measured in mitochondria (cellular location of enzyme) from intestinal cells (enterocytes), liver, kidney, and muscle tissues. Liver, the primary tissue of lysine degradation, had similar LKR activity (~2 nmol/min/mg) at all weights. Muscle activity was highest during the 1st week of growth (50% Liver), decreased to marginal activity, then increased again to 50% liver activity. Kidney LKR activity was high at birth (25%>Liver) and then declined to ~50% liver activity. Enterocyte activity was ~50% liver activity at all weights. Metabolically related compounds such as amino adipate, keto adipate and homocitrulline showed varied levels of significant LKR inhibition at different stages of pig growth.

Implications:

Tissues other than the liver have significant LKR activity in the pig. We have also shown that lysine degradation in the liver could be decreased at different stages of growth. Inefficient utilization of dietary lysine may be decreased at various stages of pig growth using metabolically related compounds to lysine, reducing the amount of lysine supplementation required.

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