

Small intestinal utilization of branched chain amino acids (BCAA) in piglets

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The BCAA [isoleucine (ILE), leucine (LEU) and valine (VAL)] are essential amino acids and must be included in swine diets. Previously, we determined the total BCAA requirement of early weaned piglets to be 2.61 g/kg/d, which is 31% higher than the current NRC recommendations of 1.99 g/kg/d. We hypothesized that the increased requirement for BCAA could be due to utilization by the gut of the piglet.

Catabolism of the BCAA is initiated by a reversible transamination reaction catalyzed by branched chain amino transferase (BCAT) to form the ketoacids followed by irreversible oxidative decarboxylation. Enterocytes were isolated from piglet small intestine at 0, 3 and 7 d of age. Mitochondria were obtained from enterocytes, liver and muscle. A 96-well plate coupled enzymatic assay technique was used to determine BCAT activity. *In-vitro* oxidation was studied using 1-¹⁴C-labeled LEU, VAL, ILE and KIC (ketoacid of LEU) in liver enterocyte, and muscle mitochondria.

Enterocyte BCAT activity increased from 0.1 to 0.57 $\mu\text{M}/\text{min}/\text{mg}$ protein in 0 vs. 7 d piglets, respectively. Enterocytes and liver of 7d piglets showed 18 and 9%, respectively, of muscle mitochondrial BCAT activity. Oxidation of ¹⁴C-LEU and ¹⁴C-KIC were significantly higher than ¹⁴C-VAL and ¹⁴C-ILE in enterocytes; ¹⁴C-ILE having the least oxidation. Oxidation of ¹⁴C-KIC was highest in liver mitochondria, because the enzyme - branched chain keto-dehydrogenase which catalyzes irreversible decarboxylation of BCAA is higher in liver.

Implications:

Substantial catabolism of BCAA, particularly of LEU and VAL takes place in the enterocytes of the small intestine in pigs. LEU is probably providing a significant source of intracellular energy to the gut in these rapidly growing piglets. LEU is known to be very important in energy metabolism and regulation of protein synthesis in muscle; the same may be true for intestine. (Funded by Alberta Pork and AARI)