Whole body and hindlimb protein degradation is differentially altered by feeding in 10 and 28-d-old piglets

(Der Proteinabbau wird in Ganzkörper und Keule bei 10 und 28 Tage alten Ferkeln durch die Fütterung unterschiedlich beeinflusst)

The neonatal period is characterized by a high rate of muscle protein accretion, which is partly due to an elevated rate of skeletal muscle protein synthesis in response to feeding. However, little is known about the regulation of muscle protein accretion by protein breakdown in response to feeding during the neonatal period. To determine the feeding-induced response of protein breakdown at the whole body level and across the hindlimb in neonatal piglets, overnight-fasted 10- and 28-day-old piglets (n=6/age group) were infused for 7 h with \([1^{\text{13}}\text{C}]\)phenylalanine and \([\text{ring-D}_4]\)tyrosine during an initial 4 h fasting period, followed by a 3 h refeeding period. Refeeding was achieved by a continuous intra-duodenal infusion of an elemental diet. Plasma samples were obtained simultaneously from the carotid artery and the vena cava; blood flow of the caudal aorta was recorded using ultrasonic flow probes. Whole body phenylalanine kinetics showed that younger piglets have a higher protein turnover rate than older piglets. This was suggested by a higher whole body phenylalanine flux (tendency, P = 0.09), an increased utilization of phenylalanine for protein synthesis (P = 0.01), and a higher rate of phenylalanine appearing from whole body protein breakdown (tendency, P = 0.09) in 10-d-old piglets in comparison to 28-d-old piglets. Furthermore, 10-d-old piglets were more responsive to feeding for whole body protein synthesis (P = 0.03), and numerically more responsive to feeding for whole body protein breakdown (P = 0.12) than 28-d-old piglets. Hindlimb phenylalanine kinetics demonstrated that blood flow was markedly increased by feeding in 28-d-old piglets when compared to 10-d-old piglets (P < 0.01). This increase in hindlimb blood flow in response to feeding resulted in a greater response of muscle protein synthesis to feeding in older piglets (P = 0.04), without differential response to feeding between groups for hindlimb muscle protein degradation (P = 0.87). However, fractional protein synthesis rates in hindlimb skeletal muscle measured following feeding period, were greater in 10- than in 28-d-old piglets (P < 0.05). Results suggest that the high anabolic capacity of neonates is sustained by elevated protein turnover rates in response to feeding. The reduction in whole body proteolysis associated with feeding is due to a reduction in protein degradation in tissues other than the hindlimb in young animals.