Response of blood nutients to an LPS inflammatory challenge in pigs

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Response of blood hormones and nutrients to an ACTH challenge and to a physical stressor in pigs

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The mobilization of body reserves is particularly important for an animal to face a stressor. However, precise data regarding the blood availability in metabolic substrates in response to a stressor are still missing in pigs. The present study aimed at describing the endocrine and metabolic response to a physical stressor (nose lasso applied during 3 min: NL) and to an i.v. injection of ACTH (5 µg/kg live weight) in 34 finishing male pigs. Concentrations of ACTH (only after NL), cortisol, glucose, lactate, free fatty acid (FFA) and amino acids (AA) were measured in blood samples collected serially through a jugular catheter before and after NL (3 to 95 min) or ACTH (3 to 240 min) applied 6 to 10 h after the last meal. Data were analyzed by ANOVA using SAS. After NL, ACTH increased from 3 to 60 min, cortisol from 10 to 30 min, glucose and lactate from 3 to 10 min and FFA from 3 to 30 min ($P<0.05$). AA were measured at -1 and 60 min. Several essential (Ile, Thr, Val) and non-essential AA (Asn, His, Orn, Pro, Ser, Tyr) decreased at 60 min whereas Glu increased ($P<0.05$). After the ACTH injection, cortisol increased from 3 to 120 min, FFA from 3 to 240 min, lactate from 10 to 240 min, glucose from 120 to 180 min whereas glucose decreased from 30 to 60 min ($P<0.05$). AA were measured at -1, 60, 120 and 240 min. Several essential (Ile, Leu, Lys, Met, Phe, Thr, Trp, Val) and non-essential ones (Ala, Arg, Asn, Cit, Glu, His, Orn, Pro, Ser, Tyr, Val) decreased at 60 min ($P<0.05$). Some of them were back to the pre-injection level at 120 min (e.g. Tyr) or 240 min (e.g. Gly). A few AA (Ala, Glu, Tyr) were even higher at 120 min than before ACTH ($P<0.05$). Present data suggest that a physical stressor induced a fast energetic demand supplied by the mobilization of all sources of body reserves (fat, glycogen, proteins) supported, at least in part, by the ACTH and cortisol release.

Response of blood nutrients to an LPS inflammatory challenge in pigs

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Understanding the nutrient metabolism during inflammation is a first step to develop feeding strategies that help sick animals to overcome or recover from an excessive inflammatory response. This study aimed at describing the response of blood nutrients to an LPS injection (O55:B5, 15 µg/kg) in 32 finishing male pigs. LPS was administered i.v., 6 h after the daily meal. Concentrations of cytokines, catecholamines, cortisol, plasma glucose, lactate, free fatty acids, urea and amino acids (AA) were measured in blood samples collected through a jugular catheter from -30 to +420 min and 24 h post LPS. Data were analyzed by ANOVA using SAS. The inflammatory response was revealed by the increase in TNF-alpha (at 60 and 90 min), IL-1 and -6 (from 180 to 300 min), adrenaline (at 60 and 240 min), noradrenaline (at 240 and 420 min), and cortisol (from 30 to 420 min) levels. Glycaemia continuously decreased from 120 to 420 min. Lactate concentrations were sharply increased between 30 and 420 min. Fatty acid and urea concentrations increased from 90 and 360 min respectively. After 24 h, glucose was back to basal levels but lactate and fatty acids were still elevated and urea was at its maximal level. Most of essential (His, Leu, Lys, Met, Phe, Thr, Trp) and non-essential AA (Arg, Asp, Gln, Gly, Orn, Pro, Ser, Tyr) had lower plasma levels at time points 60 or 180 min and were nearly back or even exceeded basal levels at 420 min. Plasma levels remained lower than the initial levels until 420 min for the two essential AA Val (-24%) and Ile (-27%) as well as Cit (-15%). Ala, Glu and Tau steadily increased from 60 min with maximal values at 420 min. Thus, an acute systemic inflammation generates a high and fast energetic demand, leading to anaerobic glucose utilization and release of fatty acids and AA from fat and protein for gluconeogenesis. The degradation of AA carbon skeleton for energy supply released amino groups that were probably used for the synthesis of Ala and Glu during the first hours and of urea at later stages.