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

Prunier et al, Le Floc’h N, Leclercq C, Merlot, E

(abstract number 16800)
Biological response to an acute stressor

Mobilization of nutrients for various purposes:
- Fight/flight reaction (behavioural activity)
- Fever
- Synthesis of new peptides/proteins
- ....

Hormones from the adrenal axis:
ACTH, cortisol

Hormones from the sympathetic axis:
Adrenalin, noradrenalin
Various types of acute stressors

- **Immune challenges** (Merlot et al.)
- Psychological stressors (e.g. isolation...)
- Physical stressors: e.g. temperature, **pain due to a nose lasso (= snope rope)**....

- Model of a stressor: injection of ACTH
Material and methods

32 finishing
Aims and measurements

Blood nutrients

- Glucose
- Lactate
- Non Esterified Fatty Acids
- Amino Acids (not all samples)

Hormones

- ACTH (after NL), Cortisol
- Catecholamines (after NL)

Automated colorimetric assays

UPLC

Immuno-assays

Data analysis by ANOVA using SAS

Presentation of raw means in the following graphics
Response to the ACTH challenge

Prunier et al, EAAP 2013 session 32a
Response to the ACTH challenge

- **Hypro:** No significant variation
- **Total AA:** Significant decrease

**All AA except Hypro:**
- Significantly decrease at 1, 2, and/or 3 hours
- Some AA: Increase at 2 and/or 3 hours

**Significant decrease for 120 or 180 min**

- Thr
- Lys
- Trp
- Orn

**Significant decrease and increase**

- Glu x 10
- Ala

Prunier et al, EAAP 2013 session 32a
Response to the ACTH challenge

Firstly: high utilization of glucose and amino acids (glucose and most AA ""), mobilization of fat and glycogen reserves (NEFA, lactate ‘’) to meet the demand in energy

Secondly: plasma glucose is restored and even increased by mobilization of glycogen reserves and/or neoglucogenesis using glycerol, lactate and AA (?) as precursors
Endocrine response to Nose Lasso

Increase in ACTH followed by cortisol

Increase in noradrenalin

Prunier et al, EAAP 2013 session 32a
Metabolic response to Nose lasso

Increase in NEFA, lactate and glucose at +3, +10 min before cortisol, in parallel to noradrenalin
Metabolic response to the Nose Lasso

No significant variation

Significant decrease

No marked variations
Variations similar to those related to fasting (utilization of AA for neoglucogenesis)
Earlier transient effects?
Response to the Nose Lasso

Plasma glucose, lactate and NEFA are increased: intense mobilization of energy from body reserves, essentially fat and glycogen under catecholamines (firstly) and cortisol (secondly).

No clear mobilization of AA from proteins: lack of measurement at +30 min? stressor not sufficient?
General conclusion

- The adrenal axis stimulates the utilization of circulating nutrients (glucose and AA).
- The adrenal and sympathetic axes stimulate mobilization of fat and glycogen (protein?) reserves.
- The adrenal axis alone is not sufficient to maintain glucose level in the minutes following a stressor application.
- The sympathetic axis allows a very rapid response (in particular mobilization of glycogen and fat reserves) sufficient to maintain (even increase) plasma glucose.
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