Response of blood hormones and nutrients to stress in male pigs differing by their gonadal status

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(abstract number 16891)
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
Testicular hormones and response to acute stressors

Literature (data from rodents, primates and ruminants) suggests that:

✓ male sexual hormones inhibit the adrenal axis (e.g. data from van Lier et al 2003 & Turner et al 2006 in sheep)

✓ GnRH stimulates the adrenal activity (review from Skinner et al 2009)

Very few data in pigs
Material and methods

4 experimental groups of male pigs:

- no surgical castration, no vaccination against GnRH (Entire, n=9)
- no surgical castration, vaccination against GnRH at 82 and 117 days (ImmunoCastrated, n=8)
  - late suppression of sex hormones and GnRH
- neonatal surgical castration (SurgicallyCastrated, n=9)
  - early suppression of sex hormones
- neonatal castration + vaccination (SurgicallyImmunoCastrated, n = 8)
  - early suppression of sex hormones and late suppression of GnRH (role of GnRH per se)
Material and methods

At 131 d of age Jugular catheters by surgery

3 min Nose Lasso or i.v. ACTH (5 µg/kg) in pigs fasted for 6-10 h

No sympathetic component

Blood sampling: -30 to 95 post-Nose Lasso or -30 to 240 min post ACTH

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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

Focus on most representative parameters
Sensitivity of the adrenals to ACTH

ACTH test

Area 3 to 120 min

Plasma cortisol, ng/ml

Time from ACTH injection

SC + SIC > E + IC (0.06)
Response of the pituitary (ACTH release)

NL test

Time-related variations

Area 3 to 60 min

Plasma ACTH, pg/ml

Time from Nose Lasso application

SC + SIC < E + IC

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Response of the adrenals (cortisol release)

**NL test**

**Area 3 to 60 min**

**Ratio area cortisol/area ACTH**

**SC + SIC < E + IC**

**No significant effect**

Prunier et al, EAAP 2013 session 49
Metabolic response to the ACTH challenge

Plasma glucose

Basal & 30-60 min post ACTH
SC + SIC < E + IC, P < 0.002

Plasma lactate
Similar increase in all groups

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Metabolic response to the ACTH challenge

3-240 min post ACTH
SC + SIC > E + IC, P < 0.1

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Metabolic response to Nose lasso

**Glucose and lactate**

Similar increases in all groups

**Plasma NEFA**

Increase in FFA lower in vaccinated groups
Metabolic response to the ACTH challenge

**Plasma Amino Acids**

- Total AA ↓ after ACTH,
- Most AA (except Ala, Glu), ↑ 60 and/or 120 min,
- Some AA (Tyr) ↑ at 240 min
Metabolic response to the ACTH challenge

Regardless time, differences between groups for numerous AA BUT no difference in the ACTH-related variations

Prunier et al, EAAP 2013 session 49
Metabolic response to Nose Lasso

Plasma Amino Acids

Measures at -1 and + 60 min:

- Regardless times, differences between groups for numerous AA

- Variations with time for some AA: a decrease (most situations) an or increase (Hypro, Glu)

- No difference in the variations with time (due to Nose Lasso) between groups
Conclusion

Adrenal axis response to a challenge (ACTH or NL)
- Lower sensitivity of the hypothalamo-pituitary unit BUT higher sensitivity of the adrenals to ACTH in early castrated males (surgical castration).
- No clear effect of the vaccination

Metabolic response to ACTH
- More intense utilization of glucose in early castrated males
- More intense release of NEFA in early castrated males
- Similar utilization and release of amino acids
- No clear effect of the vaccination
Funding and participants

ANR-09-BLAN-0083 ANDROPIG

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