

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

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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 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)

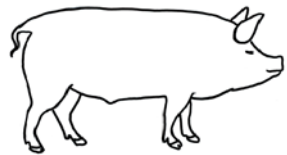
Very few data in pigs

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 μ g/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



Aims and measurements

Blood nutrients

- Glucose
 - Lactate
 - Non Esterified Fatty Acids
- } Automated colorimetric assays
- amino acids (not all samples)
- UPLC

Hormones

- ACTH (after NL), Cortisol
 - Catecholamines (after NL)
- } Immuno-assays

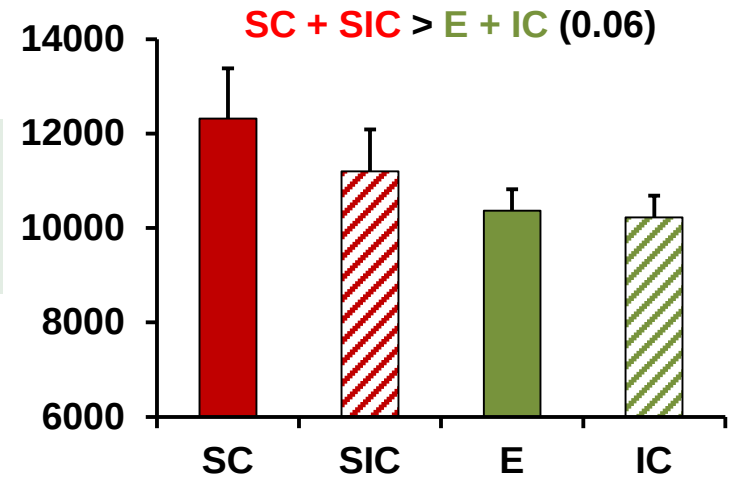
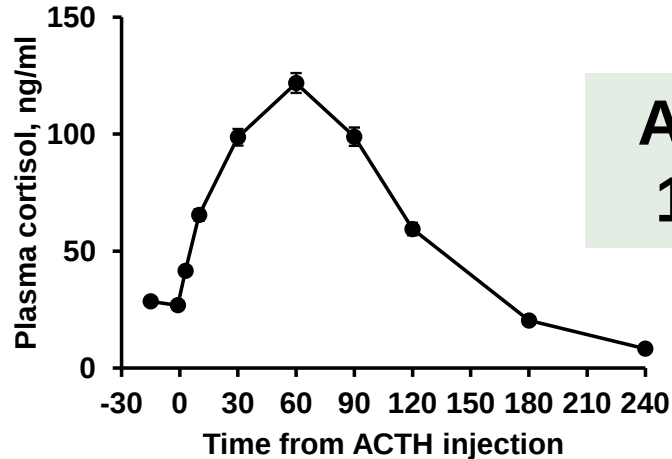
Data analysis by ANOVA using SAS

Presentation of raw means in the following graphics

Focus on most representative parameters

Sensitivity of the adrenals to ACTH

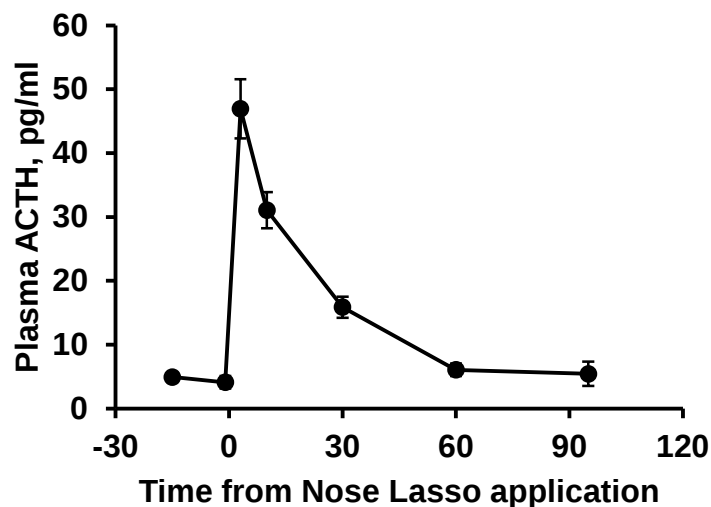
ACTH test



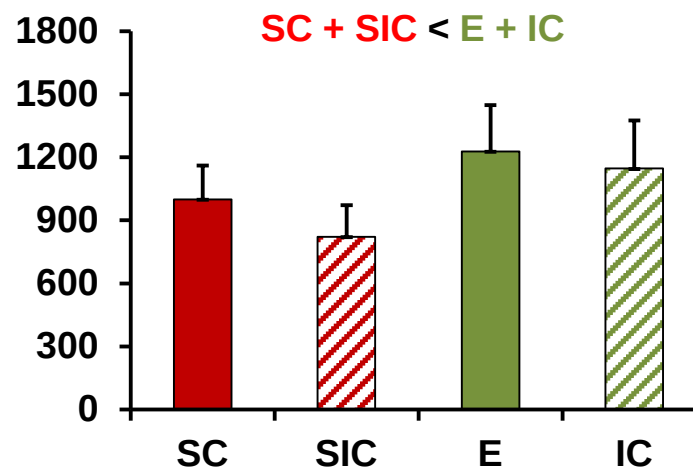
Response of the pituitary (ACTH release)

NL test

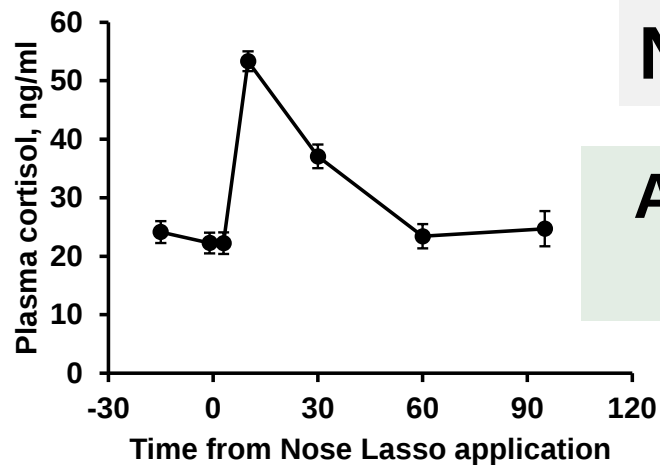
Time-related variations



Area 3 to 60 min

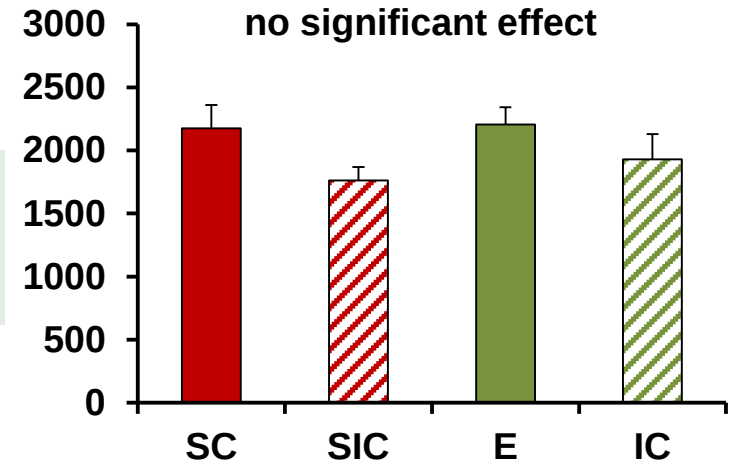


Response of the adrenals (cortisol release)

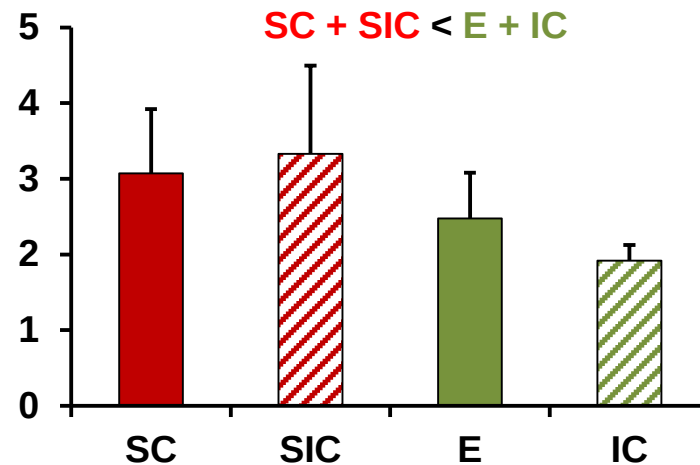


NL test

Area 3 to 60 min

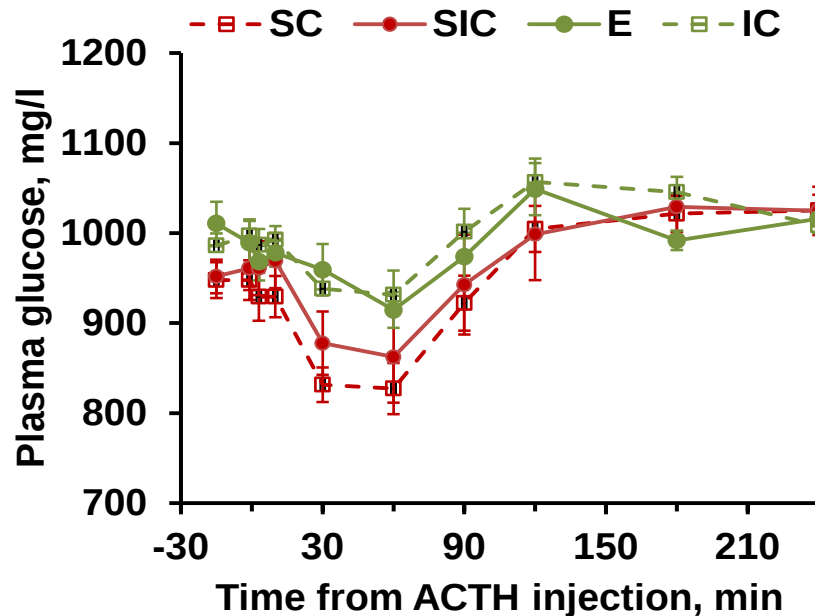


**Ratio area
cortisol/area
ACTH**



Metabolic response to the ACTH challenge

Plasma glucose



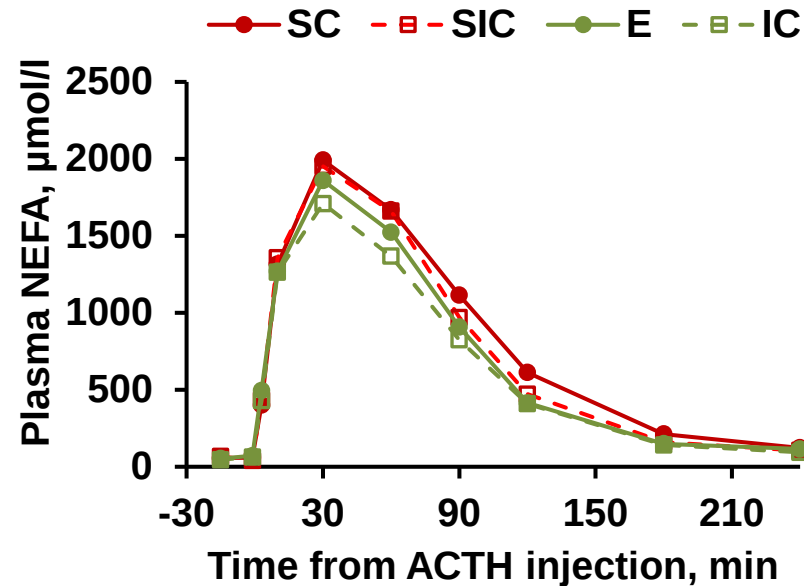
Basal & 30-60 min post ACTH
SC + SIC < E + IC, $P < 0.002$

Plasma lactate

Similar increase in all groups

Metabolic response to the ACTH challenge

Plasma NEFA



3-240 min post ACTH

SC + SIC > **E + IC**, $P < 0.1$

Metabolic response to Nose lasso

Glucose and lactate

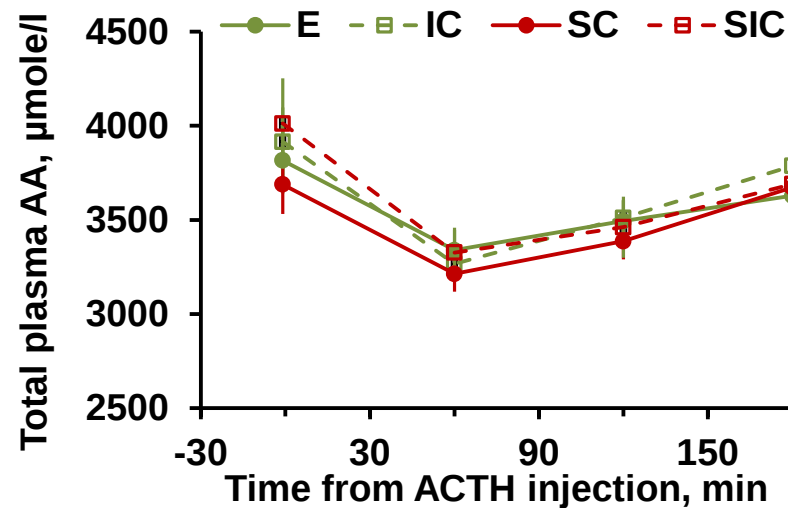
Similar increases in all groups

Plasma NEFA

Increase in FFA lower in vaccinated groups

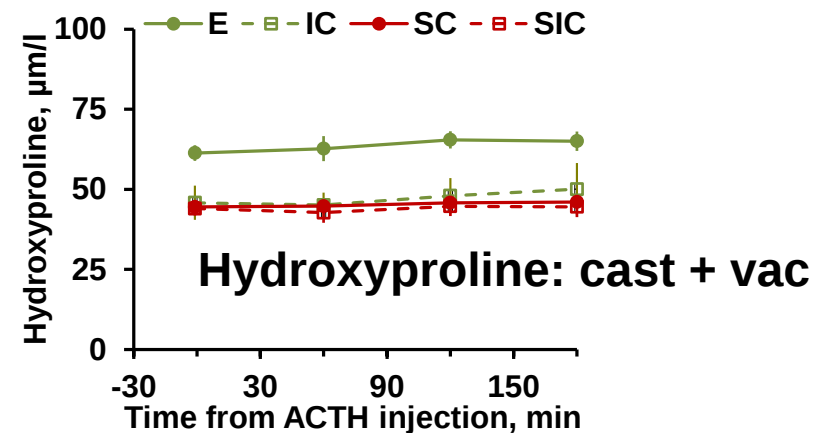
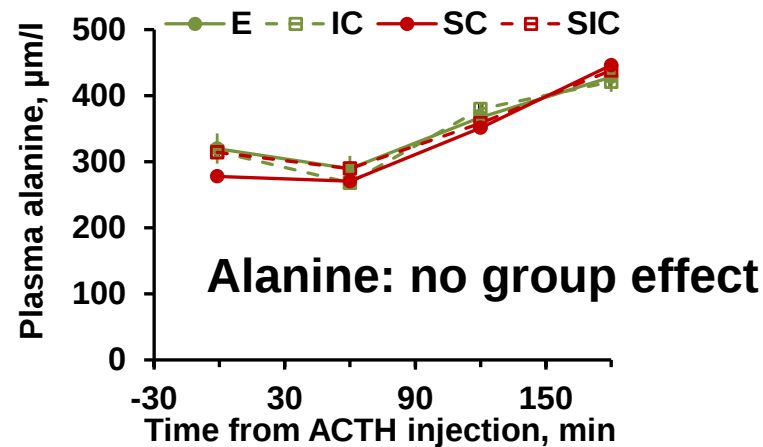
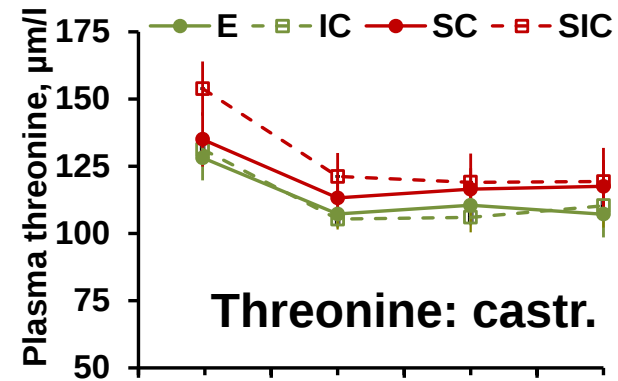
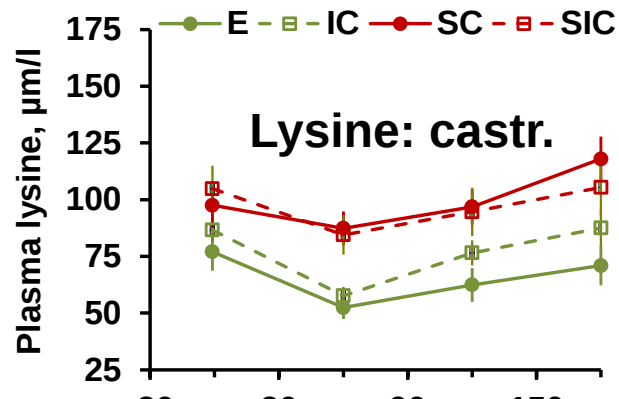
Metabolic response to the ACTH challenge

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

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
- ☐ 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



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