

## Age-dependent changes in behavioural and neuroendocrine responses of neonatal pigs exposed to a psychosocial stressor

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### Introduction

Stressful early life events can have short- and long-term effects on neuroendocrine and behavioural mechanisms of adaptation with consequences for health and welfare in humans and animals. Psychosocial stress during postnatal life, such as weaning and social isolation in pigs, activates the HPA axis, resulting in increased glucocorticoid levels. These hormones play a major role in maintaining homeostasis thereby influencing many systems of the body including the brain.

Here, we investigated the effects of a single social isolation (4h) as a model of psychosocial stress in suckling piglets on behavioural alterations in open-field tests, stress hormone concentrations and modifications in the expression of genes regulating glucocorticoid response in stress-related brain regions.



### Material and Methods

#### Experimental design

- piglets from 25 litters (German Landrace) were used in two experiments and randomly allocated to an isolation treatment or to non-isolated controls
- on days 7, 21 and 35 of age naive piglets were socially isolated from mother and siblings for 4 h, each piglet was placed alone in a opaque plastic box under the same air conditioning terms as used in the farrowing pen

#### Analyses

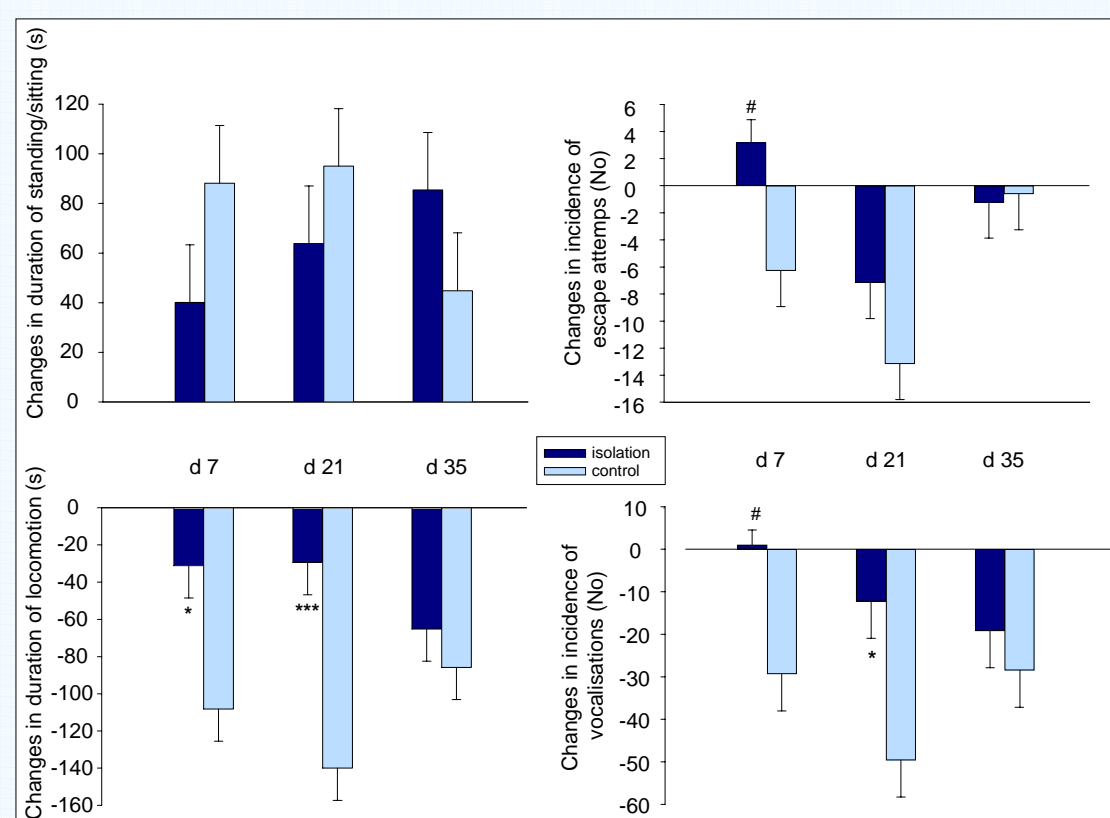
- ACTH, cortisol and CBG were analysed in plasma samples (n=8 per treatment group)
- mRNA was quantified in the brain by real-time RT-PCR (n=8 per treatment group)
- behaviour was scored in open-field tests before and after isolation (n=17 per treatment group)

#### Statistics

ANOVA using the GLM procedure of SAS; significant differences are indicated by asterisks: \*p<0.05, \*\*p<0.01, \*\*\*p<0.001; tendencies are indicated by hashes: #p<0.1

### Results

#### Behaviour in open-field tests



↪ Social isolation caused an elevated open-field reactivity (locomotion, jumping, vocalisation) compared to control piglets.

#### Stress hormones

	day 7		day 21		day 35		
	isolation	control	isolation	control	isolation	control	SE
ACTH (pg/ml)	215.4	145.6	180.2	120.5	132.2	98.9	28.5
Cortisol (nmol/l)	106.7*	48.0*	132.9**	42.8**	64.5	25.9	14.3
CBG (ng/l)	698	871	1228	1643	1525	1505	238
FCI	19.6*	5.3*	14.2	4.0	5.9	2.2	3.0

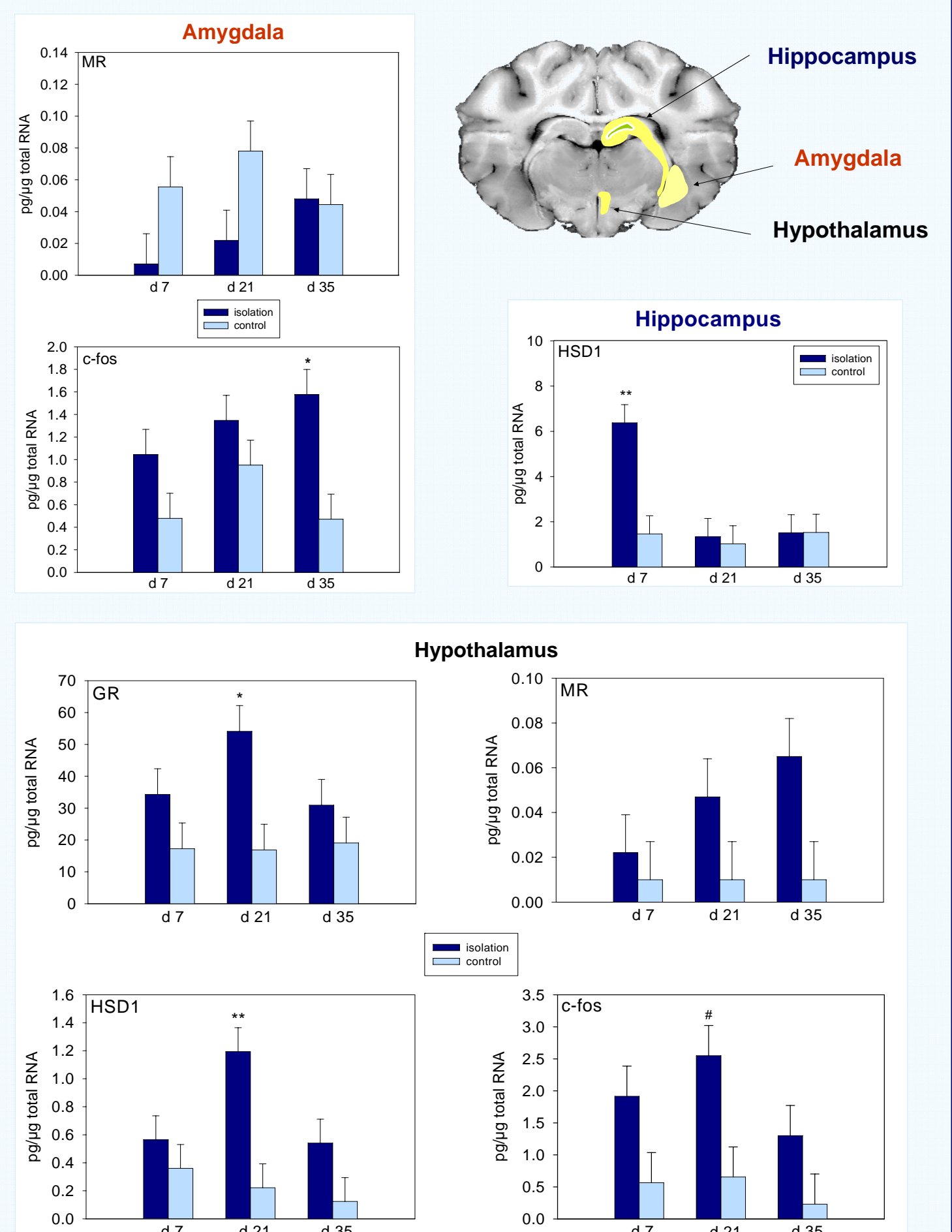
Data are expressed as LS-means ± SE (n=8 per group and day of age).

↪ ACTH and cortisol levels, and FCI were increased by social isolation.

### Conclusions

- Psychosocial stress modeled by a single social isolation in piglets causes enhanced behavioural arousal and increased neuronal activation as well as activation of the HPA axis and the limbic system.
- The behavioural and hormonal patterns in the context of mRNA alterations in glucocorticoid-regulating genes show that younger piglets are more vulnerable to isolation stress.
- The results suggest that psychosocial stress effects should be considered for the assessment of livestock handling practices (e.g. weaning of piglets) with respect to health and welfare.

#### Expression of genes in stress-related brain areas



↪ Isolation increased mRNA expression of GR, MR and HSD1 in the hypothalamus and the HSD1 mRNA in the hippocampus, but decreased the MR mRNA in the amygdala.

↪ C-fos mRNA expression as a marker of neuronal activation was enhanced in the hypothalamus and the amygdala indicating the psychological component of the stressor.