LPS challenge on the blood of intrauterine growth restricted and normal pigs at weaning

Amdi, C., Williams, A.R., Lynegaard, J.C., and T. Thymann

Charlotte Amdi
Associate Professor, IVH, UCPH
ca@sund.ku.dk
EAAP 2019

UNIVERSITY OF COPENHAGEN

Intrauterine growth restricton (IUGR)

- Hyperprolific sows with large litters have resulted in more piglets being exposed to intrauterine growth restriction (IUGR)

- IUGR piglets can be easily recognised on their headshape as they have been subjected to brain sparing

- See poster in session 30
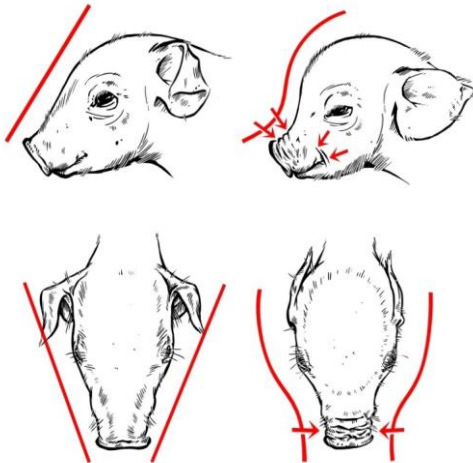
Hales et al., (2013)

(Picture by Helena Sato 2019)

Immune response

- Do they fall behind in the weaner section?
- Immune challenges are major obstacles to growth efficiency
- IUGR piglets may be more susceptible to disease?

Aim of study

To investigate the cytokine responses in PBMC (peripheral blood mononuclear cells) stimulated with LPS (lipopolysaccharide) of IUGR and normal piglets.

Bacterial LPS is an endotoxin, a potent inducer of the acute phase response and systemic inflammation.

In addition we measured the haematological and plasma biochemical profiles

(Penack et al 2010, Blood)
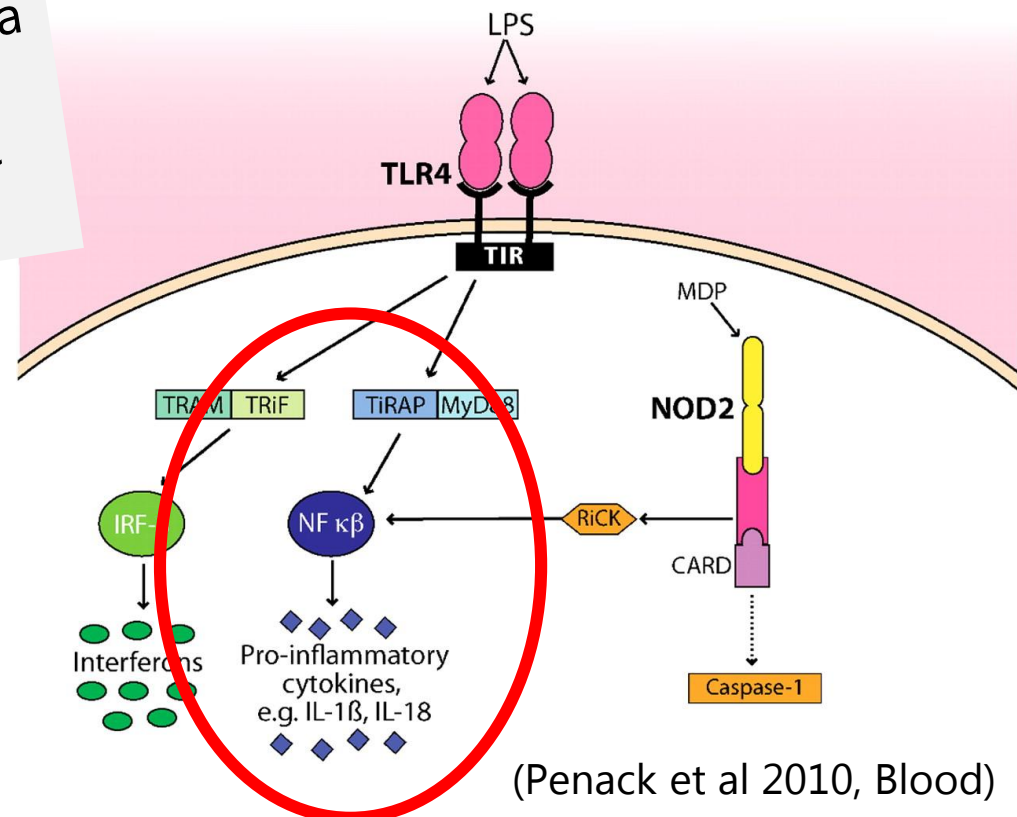
Why it is a good model!

- Gives a good overview of the inflammatory state of the animal (general immune response)
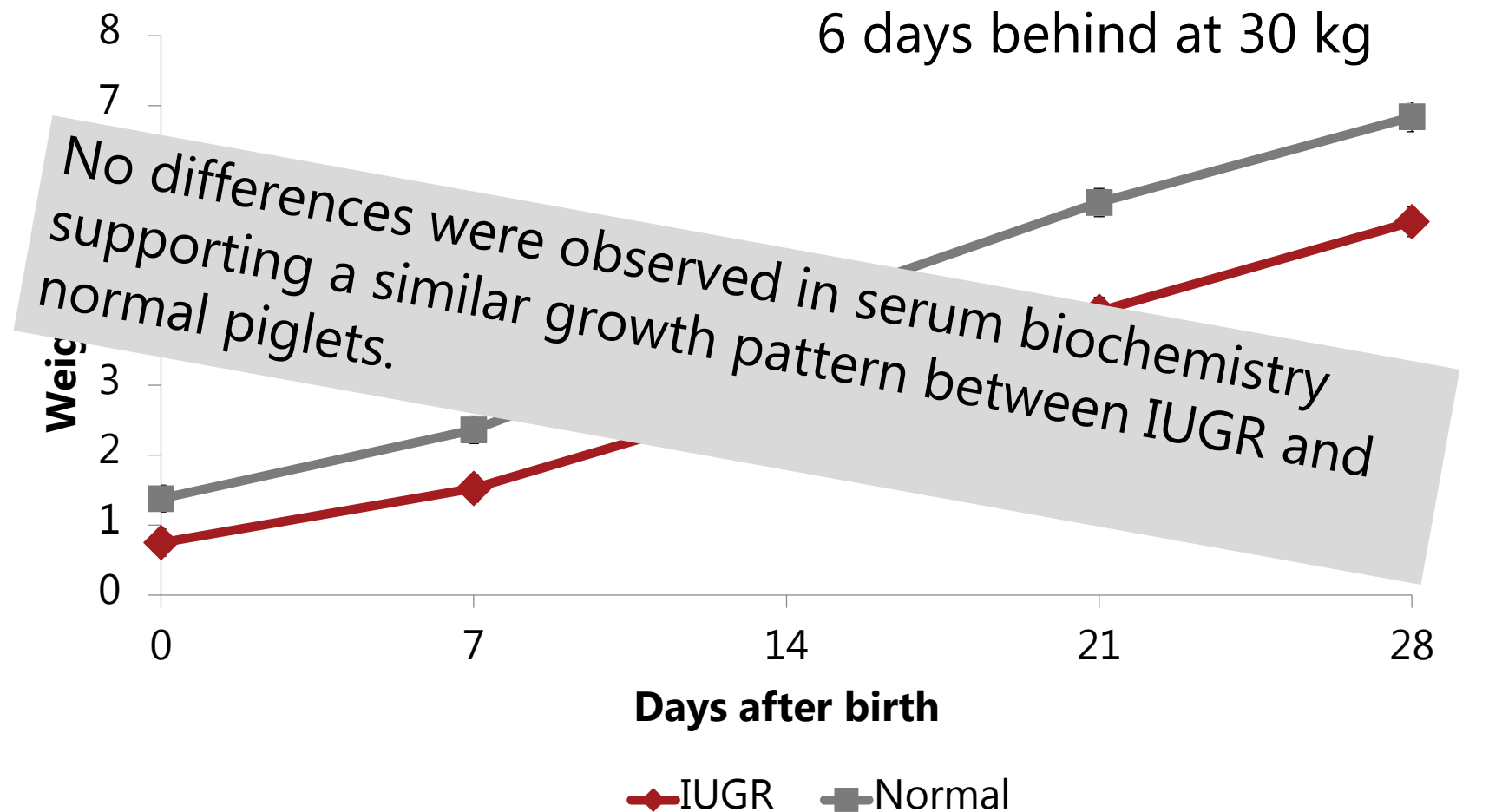- Non-invasive as it is uses the pigs blood rather than the pig
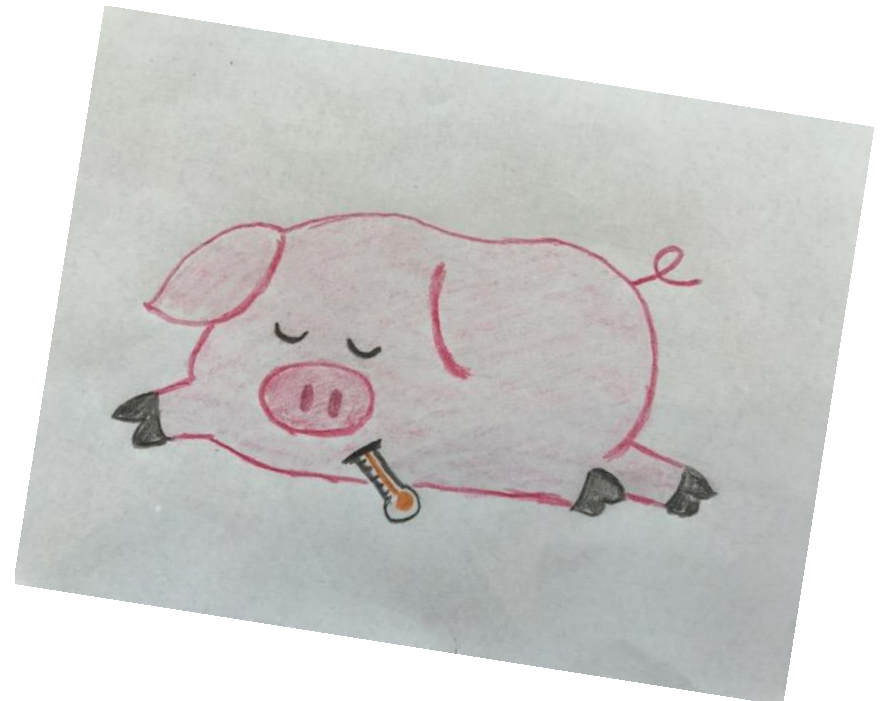
Material and Methods (subset of pigs)

- Selected at birth: Normal and IUGR from each litter
- At day 24 – 20 IUGR and 20 normal were blood sampled within an hour after arrival

Five blood samples were taken:

- 1: 1.8 ml citrat stabilized tube for thromboelastografy (TEG) and fibrinogen analysis (immediate processing).
- 2 + 3: heparinized tubes for the LPS challenge on blood, and phenotyping of peripheral leukocytes by flow cytometry.
- 4: 4.0 ml tube (EDTA) for hematology (CBC/Diff/Retic)
- 5: 4.0 ml tube for serum, for later analysis of IGF-1 and biochemistry.

Results – Lynegaard et al., 2019, Animal

6 days behind at 30 kg

No differences were observed in serum biochemistry supporting a similar growth pattern between IUGR and normal piglets.

Days after birth

◆ IUGR   ■ Normal

(Lynegaard et al., 2019, Animal)

The characteristics and blood profile of IUGR and normal piglets at weaning

	Classification			P-values
	Normal	**IUGR**		
n	20	20		
Birth weight, kg	1.51	0.77		0.001
Body weight at weaning, kg	6.84	4.53		0.001
n	18	18		
Total erythrocytes, bill/L	6.1	5.4		0.003
Neutrophils, pct	55.4	62.5		0.016
Lymphocytes, pct	39.9	32.7		0.008
Reticulocytes, pct (estim)	3.9	5.0		0.115

Amdi et al., submitted

UNIVERSITY OF COPENHAGEN

Cytokine concentrations in cells with a LPS challenge

		Classification		P-values
		Normal	IUGR	P-values
N		19	20	
IL-6 (pg/mL)				
LPS		1508.2	929.7	0.148
IL-8 (ng/mL)				
LPS		213.7	211.4	0.961
TNFa (pg/mL)				
LPS		1479.0	1101.2	0.491
IL-1β (ng/mL)				
LPS		17.3	9.9	0.021

Amdi et al., submitted

Lymphocytes concentrations

	Classification			P-values
	Normal	IUGR		
n	18	16		
CD3+				
CD4+	49.4	43.5		**0.063**
CD8+	39.7	40.9		0.744
CD8low	21.8	22.5		0.601*
CD8High	17.9	18.4		0.883
CD4+CD8+	17.2	17.2		0.923*

(Pictures by Helena Sato 2019)

Conclusion

- A minor modulation of the immune function of IUGR pigs, most likely due to a drop in CD4+ t-cells

- Lower levels of IL-1β and numerically lower levels of IL-6 and TNFa in IUGR pigs suggesting that IUGR pigs are hypo responsive

- Higher levels of reticulocytes and lower levels of erythrocytes suggest altered bone marrow hematopoiesis in IUGR pigs

(Picture by Helena Sato 2019)

Take home message

- The immune response of IUGR piglets is slightly suppressed

- Which may have implications for resistance to pathogenic challenges in the post-weaning period in IUGR piglets

For more IUGR from UCPH see poster 30.18

in session 30 plus invited talk session 60