

Shipment associated effects on the somatotrophic axis in pigs - a pilot study



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Background

The acceptance of animal products is increasingly associated with standardized animal welfare, which relates to appropriate animal husbandry in conditions from birth, weaning, and fattening. In particular, shipment to the slaughterhouse is considered as a critical process exposing the animals to a number of, in part outmost, stressors. For the documentation of animal welfare, significant animal-based biomarkers are still missing. In the present study, the IGF-system has been assessed in a commercial pig transport in conjunction with established markers of stress response. Furthermore, the effect of repeated restraint as experimental model for repeated acute stress was investigated.



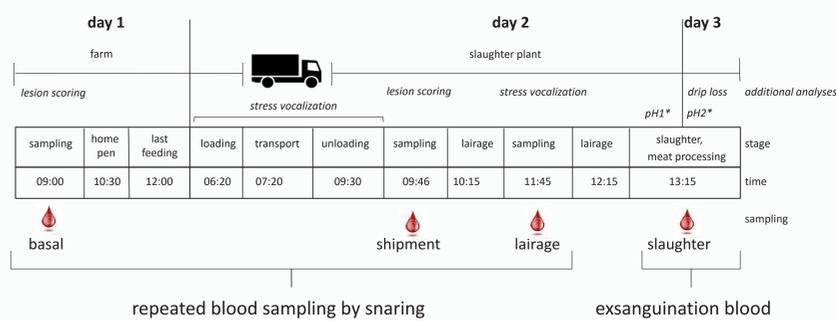
Methods

Animals: 65 market weight (115 ± 7.9 kg) crossbred gilts (Danish Landrace x Yorkshire sows x Piétrain boars, NN = stress resistant)

Analysis: IGF-1 and -2 were analysed using ELISA. IGF-binding proteins -3, -2 and -5 were analyzed using quantitative Western Ligand blotting (qWLB). As markers for IGF-binding capacity, IGF-1 bioavailability and somatotrophic growth, the total amount of IGFBPs, the ratio of IGF-1 to total IGFBPs and IGFBP-3 to -2 were calculated, respectively. Stress and inflammatory response were characterized by cortisol (ELISA), corticosterone (MS/MS), stress vocalization (STREMODO software) and Interleukine-2 (IL-2, ELISA).

Statistics: Data of blood parameters were evaluated by ANOVA using mixed procedure including repeated statement for effects of sampling time on treatment group. For evaluation of stress vocalization GLIMMIX procedure were employed, using a Poisson model. Results are presented as LSM ± SE. The Tukey-Kramer test was used for pairwise comparisons ($\alpha = 0.05$).

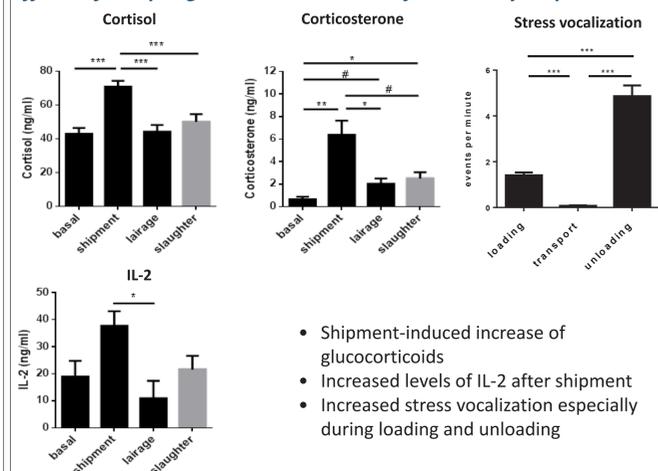
Experimental design



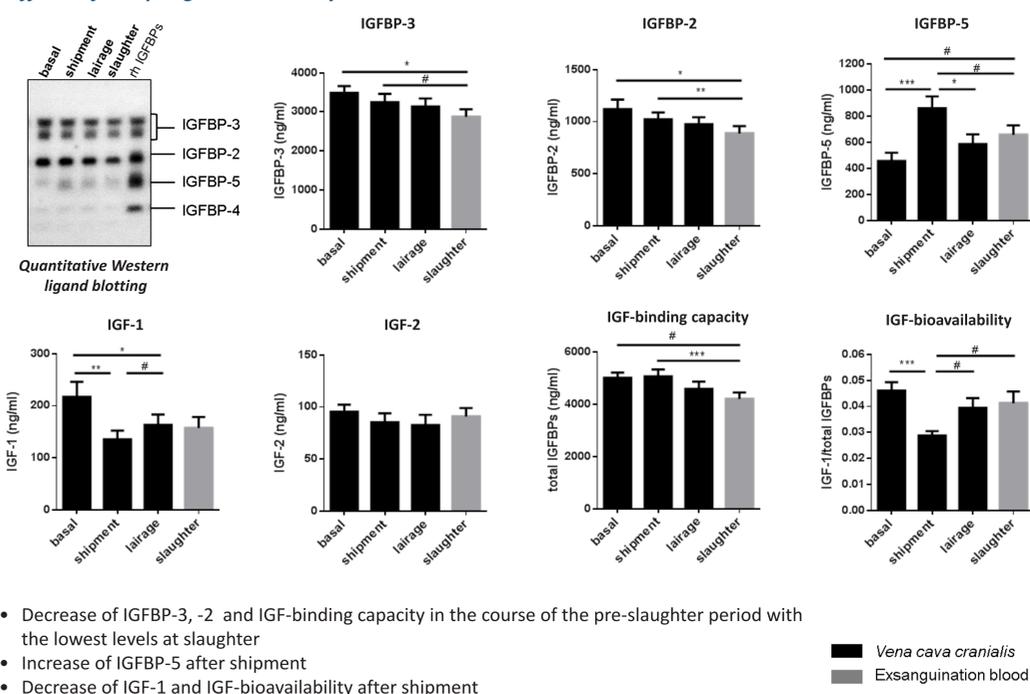
Treatment group: repeated *vena cava* blood sampling in the pre-slaughter period before exsanguination
Control group: no *vena cava* blood sampling before exsanguination

Results

Effects of sampling time on stress and inflammatory response



Effects of sampling time on IGF-system



Effects of repeated blood sampling in the pre-slaughter period on parameters of IGF-system in exsanguination blood



Short-term restraint stress induces an acute stress response characterized by an increase of cortisol, catecholamines, lactate and glucose

Parameters	Treatment group	n	Control group	n	p-value
IGFBP-3 (ng/ml)	2855.21 ± 165.38	31	2362.57 ± 152.13	34	0.0323
IGFBP-2 (ng/ml)	904.46 ± 57.96	31	998.26 ± 53.31	34	0.2384
IGFBP-5 (ng/ml)	653.20 ± 86.31	31	489.71 ± 80.41	34	0.1723
IGF-1 (ng/ml)	157.44 ± 17.31	13	108.07 ± 15.74	14	0.0476
IGF-2 (ng/ml)	82.82 ± 8.63	13	82.60 ± 7.66	14	0.9845
Total IGFBPs (ng/ml)	4098.24 ± 232.44	31	3725.65 ± 289.55	34	0.2180
IGF-1/total IGFBPs	0.04 ± 0.004	13	0.03 ± 0.004	14	0.0616
IGF-1/IGFBP-3	0.06 ± 0.01	13	0.05 ± 0.01	14	0.1301
IGF-1/IGFBP-2	0.19 ± 0.02	13	0.13 ± 0.02	14	0.0519
IGF-1/IGFBP-5	0.21 ± 0.05	13	0.16 ± 0.03	14	0.3608
IGFBP-3/IGFBP-2	3.44 ± 0.29	31	2.60 ± 0.27	34	0.0392

• Increase of IGFBP-3, IGF-1 and IGFBP-3/IGFBP-2 ratio in exsanguination blood after repeated acute stress in the pre-slaughter period

Summary and Conclusion

- Plasma concentrations of IGFBP-3 and IGFBP-2 were reduced over time
- IGFBP-5 concentrations were highly dynamic between selected segments of the transportation chain and similar to alterations of IL-2 and glucocorticoids
- Plasma IGF-1 concentrations are flexible during animal shipment and may increase or decrease during transportation, while IGF-2 was not regulated acutely
- Repeated short-term stress in the pre-slaughter period increases IGF-1, IGFBP-3 and the IGFBP-3/-2 ratio in exsanguination blood
- **The signature of the IGF-system contains a complex set of information for specific segments in the transport process from farm to slaughter**
- **Evidence that compounds from the IGF-system are regulated by a number of stressors**
- **Monitoring compounds from the IGF-system in pigs may generate novel biomarker information and improve current standards of animal husbandry.**



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