Quantifying cortisol in hair as a chronic stress biomarker in group-housed and stall-housed sows during gestation

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Background: There is consumer pressure in the US to ban the use of gestation stalls to improve sow welfare. Welfare concerns with group housed sows related to injuries and stress from fighting has limited widespread adoption of group sow housing. Cortisol is a biomarker for stress, but its concentrations fluctuate diurnally and in response to stressors over time in blood and saliva and may not adequately reflect stress over a period of time or account for individual stress response to handling during sample collection. Blood cortisol deposits in growing hairs, so frequent, repeated periods of stress leads to higher cortisol in the hair that grew during the stressful experience. Hair cortisol may therefore be a better indicator of chronic stress during gestation.

Materials and Methods: Sows (n=66, parity 0-6) were housed at the SDSU sow facility and assigned to one of two housing systems. Thirty-four sows in two breed groups were assigned to stall housing (STL) and housed in gestation stalls from breeding until d111 ± 1.1 of gestation. Thirty-two sows in two breed groups were assigned to pen housing (PEN) and moved to group pens approximately 24 h after breeding. All sows were to farrowing crates at approximately d111 of gestation. Hair was shaved from the right hip within 5d of breeding (defined as d0). At d37, d74, and d111 of gestation the same area was shaved and hair regrowth collected; samples from d37 and d111 were analyzed for cortisol. In the statistical model, main effects of housing system, day of gestation (time), and their interactions were teste with parity as random effect. Sows were later assigned a parity group [0-1 (n=23), 2-3 (n=17), and 4-6 (n=26)] to assess the impact of parity.

Results: Across parity, STL sows had greater ($P < 0.05$) overall hair cortisol than PEN sows (49.8 vs 20.3 ± 3.8 pg/mg hair). Hair cortisol concentration tended to be lower ($P = 0.073$) at d37 than d111 (30.0 vs 40.5 ± 4.3 pg/mg) and no time by treatment interaction was observed. There was a treatment by parity interaction ($P < 0.001$) where parity 0-1 STL group had higher cortisol (75.6 pg/mg) than parity 0-1 PEN group (24.2 pg/mg) and no effect of housing on parity 2-3 and 4-6 groups.

Implications: Gilts may find stall housing more stressful, and may benefit more from a group housing system than older females that have spent multiple parities in stalls. Given that cortisol rises in late gestation, using cortisol as a physiological marker in late gestation may be less reflective of welfare and more an indicator of pregnancy progression.

Acknowledgements: Financial support for this project was provided by USDA National Institute of Food and Agriculture (Hatch project: SD00H666-18).

For Swine Innovation Porc Poster Session at the virtual 2020 Porc Show
November 25, December 3 & 9, 2020