Estimation of resilience parameters in pigs based on activity measured with computer vision

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Resilience could be referred to as the animal's ability to successfully adapt to a challenge. This is typically displayed by a quick return to initial metabolic or activity levels and behaviours. Pigs have distinct diurnal activity patterns. Deviations from these patterns could potentially be utilized to quantify resilience. However, human observations of activity are labor intensive and not feasible in practice. In this study, we show the use of a computer vision tracking algorithm to quantify resilience based on activity patterns following an LPS challenge. We expected this challenge to induce a mild sickness response and a dip in activity in LPS-treated pigs. The institutional Animal Care and Use Committee of approved the experiment. We used 121 pigs housed in barren or enriched housing systems. The enriched housing consisted of delayed weaning in a group farrowing system and extra space and environmental enrichment after weaning. The barren housing consisted of a conventional farrowing pen and a barren environment after weaning. Based on a previously developed computer vision algorithm, pigs were tracked for 24 hours per day for eight days around LPS injection. The location of each individual was used to calculate activity expressed in meter/hour. Statistical analyses were performed with the software R 4.1.0. Resilience parameters were analyzed using (generalized) linear mixed models with the function 'glmer' and 'lmer' from the R package 'lme4'. Parameters were log transformed to obtain normality if needed. Housing, sex and their interaction were included as fixed effects in each model and pen and batch as random effects. Concerning the response to LPS, first, the effect of the challenge treatment (LPS injected vs. control) on the probability to show a dip was analyzed. This study found that enriched housed pigs were more active pre-injection of LPS, especially during peak activity times, than barren housed pigs ($P < 0.001$). Four pigs per pen received an LPS injection in the ear vein with 2 µg of LPS/kg BW and two pigs a saline injection. As expected, LPS injected animals were more likely to show a dip in activity than controls ($P < 0.001$). Duration and area under the curve (AUC) of the dip were not significantly affected by housing, but the AUC:duration ratio was higher in enriched housed pigs compared to barren housed pigs (9.7 vs. 6.2). This effect might reflect a different strategy to cope with an LPS sickness challenge in enriched housing.