

Validation of non-invasive sensor technologies to measure use of enrichment material in weaned piglets

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Measuring animal behaviour is important in the assessment of animal welfare. In this study, novel non-invasive sensor technologies were validated for measuring use of enrichment material (EM) in pens with weaned fattening piglets. The experiment was carried out in four pens (2.61 m²) with six weaned piglets per pen (until a bodyweight of ± 25 kg) at a semi-commercial farm. Pens were provided with EM (a ball and piece of wood connected to a chain). Four different sensor technologies were tested: passive infrared detectors (PID's), tri-axial accelerometers (TAA, not yet analysed), neural network model algorithm (NNMA) and radio frequency identification system (RFID, data not shown). Per pen, a PID was placed above the EM which measured movement around the chain ($\varnothing 20$ cm) in Volts every second. A TAA was attached to the EM (top of the chain) and measured acceleration based on x-, y- and z-axis every second. A video camera was placed above each pen to record video images that were used to feed the NNMA and for validation of the sensor technologies. A RFID antenna was placed above the EM in two pens. Use of EM was manually scored per second per pig (pooled per pen afterwards) for 30 minutes of video footage per pen per week (for week one, three and five after weaning) which resulted in 21612 observation points in total, of which 4032 points were active use of EM (shake, carry, nose, bite, chew, root or >1 type). Manually scored use of EM (gold standard) was compared with data from PID's and the NNMA. F1 score and Matthews Correlation Coefficient (MCC) were calculated to measure performance of the sensor technologies. The NNMA performed better in pens without RFID antenna (F1 score = 0.6059, MCC = 0.5345) than in pens with RFID antenna (F1 score = 0.5054, MCC = 0.3991) because of a better view on EM in pens without RFID antenna. PID's overestimated active use of EM (F1 score = 0.3802, MCC = 0.1921) which might be due to relatively small pen sizes, resulting in piglets lying under or standing/walking/running against the EM without active use of EM. PID's performed better in measuring all contact with EM (active use + touching EM with body; F1 score = 0.5660, MCC = 0.2510) compared to measuring only active use of EM. Further analysis will determine if TAA's or a combination of sensor technologies will show improved performance.