Title: Validation of non-invasive sensor technologies to measure interaction with the enrichment material in weaned piglets

Speaker: Fleur Veldkamp

Fleur Veldkamp1,2*, Tomas Izquierdo Garcia-Faria1 , Vivian L. Witjes3 , Johanna M.J. Rebel1 , Ingrid C. de Jong1

1 Wageningen Livestock Research, Wageningen University and Research, Wageningen 6700 AH, The Netherlands
2 Adaptation Physiology Group, Wageningen University and Research, Wageningen 6700 AH, The Netherlands
3 Farm Animal Health, Department Population Health Sciences, Veterinary Medicine, Utrecht University, Utrecht 3584 CL, The Netherlands

*Presenting author: fleur1.veldkamp@wur.nl

Measuring animal behaviour is important in the assessment of animal welfare. In this study, novel non-invasive sensor technologies were validated for measuring the 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 semicommercial farm. Pens were provided with EM (a ball and piece of wood connected to a chain) according to the standard procedures of the farm. Three different sensor technologies were tested: passive infrared detectors (PID's), tri-axial accelerometers (TAA) and a neural network model algorithm (NNMA). Per pen, a PID was placed above the EM which detected movement of body heat around the chain (ø20 cm) in Volts every second. A TAA was attached to the EM (top of the chain) and measured acceleration based on the 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. 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 21,612 observation points in total, of which 4,032 points were active use of EM (shake, carry, beak, bite, chew, root or >1 type). Manually scored interaction with the EM (gold standard) was compared with data from the PID, the TAA and the NNMA. To be more specific about the performance of the sensors, two categories were made namely only active interaction with the EM (shake, carry, nose, bite, chew, root, more than one type) and movement of EM (shake, carry, nose, bite, chew, root, more than one type, interaction with EM plus lay, interaction with EM plus body, only lay, only body, lay and body). F1 scores were calculated to measure the performance of the sensor technologies. The NNMA performed best in the category 'only active interaction with EM' (F1= 0.5542), followed by the accelerometer (X-axis (F1 = 0.4822), Y-axis (F1 = 0.5237), Z-axis (F1 = 0.4653), XYZ-avg (F1 = 0.4741)) and the PID (F1 = 0.3802). PID's overestimated active interaction with the EM which might be due to relatively small pen sizes, resulting in piglets lying under or standing/walking/running against the EM without interaction with the EM. In the category 'Movement of EM', TAA's performed best (X-axis (F1 = 0.7182), Y-axis (F1 = 0.6757), Z-axis (F1 = 0.7087), XYZ-avg (F1 = 0.6934)), followed by the PID (F1 = 0.5660) and the NNMA (F1 = 0.4888). Data filtering may result in higher performance of the TAA by removing data of acceleration after active interaction with the EM (swinging of EM). Further analysis will determine if a combination of sensor technologies, by measuring the movement of body heat (PID) and movement of the EM (TAA), will result in higher performance parameters.