

Identifying Early-Life Risk Factors for Predicting Pig Survival and Growth in Commercial Farms

Pau Salgado-López¹, Jaume Coma², Mercè Farré³, Josep Gasa¹, David Solà-Oriol¹

¹Animal Nutrition and Welfare Service (SNIBA), Department of Animal and Food Science, Autonomous University of Barcelona, 08193 Bellaterra, Spain

²Vall Companys Group, 25191 Lleida, Spain

³Department of Mathematics, Area of Statistics and Operations Research, Autonomous University of Barcelona, 08193 Bellaterra, Spain

Keywords: binomial logistic regression, body weight, colostrum intake, growth performance, preweaning survival, pigs

This study aimed to identify early-life risk factors associated with poor postnatal growth and mortality during lactation period, with the objective of developing an on-farm, multi-criteria predictive model to classify pigs according to their early growth and survival potential. Two independent pig populations from commercial farms were monitored from birth to weaning. Dataset 1 included 2,138 crossbred pigs (Pietrain × [Landrace × Yorkshire]), and dataset 2 included 1,115 crossbred pigs (Pietrain × [Landrace × Large White]). Pigs were individually weighed at birth, on day 1, day 7, and at weaning. All live-born pigs were assessed at birth for farrowing traits, body conformation indicators, rectal temperature, vitality score, and colostrum intake (**CI**). Pig survival was recorded throughout lactation period. Simple linear regression models were used to determine which early-life growth performance variable best predicted individual pig weaning weight (**WW**). Logistic regression models were then used to classify pigs as either compromised (defined as dead or alive with a body weight (**BW**) below the 15th percentile of the BW distribution on day 7 of life or at weaning) or normal. The classification ability of the competing models was evaluated using the area under the receiver operating characteristic curve (**AUC**) to identify the best-fitting model. The optimal classification threshold of the final model was adjusted to balance sensitivity and positive predictive value (**PPV**). Body weight on day 7 was the strongest predictor of WW ($R^2 = 0.64$ and 0.66 for datasets 1 and 2, respectively), followed by average daily gain during the first week and BW on day 1 (**BW1**). Prediction of compromised pigs on day 7 using a binomial logistic regression model achieved an AUC of 0.910, with a sensitivity of 0.700 and a PPV of 0.703. Significant predictors included BW1 ($P < 0.001$), relative BW on day 1 (**RBW d1**; $P < 0.001$), CI ($P < 0.001$), and parity ($P = 0.002$). Each 100 g increase in BW1 was associated with a 27.6% reduction in the *odds* of being compromised. Greater RBW d1 and CI were also linked to lower risk, while pigs from older sows had higher risk of being compromised. The probability of being compromised decreased as BW1

increased from the 10th to the 30th percentile of the BW1 population distribution. Within each BW1 percentile, pigs with low CI and negative RBW d1 consistently exhibited the highest risk of being compromised. The robustness of the model was confirmed by its consistent performance across both datasets. In conclusion, BW1, RBW d1, CI, and sow parity were identified as key early-life indicators associated with piglet survival and postnatal growth from birth to weaning under commercial conditions. This study further highlights the critical role of early lactation in determining subsequent postnatal performance.