

ANIMAL SCIENCE

Title: Improving net returns in pork production by improving our management of the fallback pig: Characterizing biological and physiological differences in fallback pigs to determine optimal management and handling practices – **NPB #09-250** **revised**

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Scientific abstract: The last decade's unprecedented rise in litter size has resulted in an increase in the number of fallback pigs. However, there is little peer-reviewed data available regarding the physiological differences between fallback pigs and their normal cohorts. Therefore, the objectives of this experiment were to: 1) Identify differences in the biology and physiology, and thus the growth and metabolism, between fallback pigs and their heavier counterparts; 2) determine if these differences result from variations in ileal morphology and nutrient transport capacity; and 3) determine the role of blood chemistry and immune status in fallback from normal performance. To accomplish these objectives, 120 weanling pigs (PIC C22/C29 × 337) were utilized in growth, metabolism, and comparative slaughter experiments. Forty barrows from each of the lightest, median, and heaviest 10% pigs at weaning were placed in individual metabolism crates. Eight pigs from each weaning weight category were harvested on d 5 post-weaning as the initial slaughter group. The remaining 32 pigs in each category were part of the metabolism group, and were utilized in a 27-d growth and metabolism experiment and harvested on d 32 and 33 post-weaning. After the completion of the live animal component of the experiment, pigs within each initial body weight (BW) category were further stratified into the slowest, median, or fastest 33% average daily gain (ADG) categories. This resulted in a total of nine treatments. Fallback pigs were designated as those belonging to the slowest ADG category from either the lightest or median BW categories. Data were analyzed using the GLIMMIX procedure of SAS. There was no effect ($P = 0.30$) of BW(ADG) category on feed efficiency, which suggests that ADG improvements were primarily driven by ADFI. All tissue deposition rates, which were calculated as the difference between tissue nutrient concentrations of the metabolism and initial slaughter groups, were maximized ($P < 0.0002$) by BW(ADG) category, even when equalized per unit of body weight. The apparent digestibility of dry matter, gross energy, nitrogen, and ash, as well as the related dietary energy content, were maximized ($P < 0.01$) by the median ADG categories of pigs at the end of the experiment. Interestingly, the energy efficiency for both protein and lipid deposition were not altered ($P > 0.87$) by BW(ADG) category. There was no effect ($P > 0.16$) of BW(ADG) category on active ileal glucose, lysine, or glutamine transport. Meanwhile, measures of ileal morphology were highly affected ($P < 0.0001$) by BW(ADG) category, but not in a consistent manner. Among the measures in a standard blood chemistry panel, bicarbonate, creatinine, and albumin concentrations were significantly affected ($P < 0.03$) by BW(ADG) category, which may indicate poor physiological regulation among fallback pigs, and

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is an area that warrants further exploration. Pigs from the slowest ADG, heaviest BW category had the lowest ($P < 0.05$) hemoglobin concentration compared to pigs from the fastest ADG categories, which may indicate anemia. No other measures, including white blood cell or lymphocyte concentrations, were affected ($P > 0.10$), suggesting that pigs had similar health status. In summary, this report confirms that biological and physiological differences exist among pigs with varying weaning weight and ADG during the early nursery period. These data suggest that the underlying cause for fallback from performance lies jointly with poor feed intake and poorer utilization of absorbed nutrients. There is still little explanation as to the root cause of poorer nutrient utilization. While this experiment has made immense strides toward identifying management strategies that are more calculated and economical, the next phase of research must be undertaken in a commercial environment, in order to answer questions that could not be addressed in this experiment. Indeed, we are currently collaborating with veterinary pathologists, an Iowa pork producer, and IPPA to evaluate the broader factors affecting fallback from performance in a commercial facility. In this experiment, we have characterized the biological and physiological differences in fallback pigs and identified the underlying causes for fallback from performance. This, combined with our understanding of factors in a commercial environment, will allow us to determine management strategies that may be critical to maintaining profitability in the pork sector.