



환경 및 축산 기타

Social stability-related behavioural profiles linked to maternal performance and piglet outcomes, and reproductive feasibility of intermittent suckling in a communal farrowing system

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Sows are highly social animals, but modern farrowing systems typically restrict social interactions between sows and piglets, which may increase stress, impair maternal behaviour, and limit early social development in piglets. Communal farrowing systems have therefore been proposed as an alternative housing strategy that may improve behavioural adaptation and welfare, but their practical implementation may depend on stable post-regrouping group formation and reproductive performance. This study aims to investigate whether stable social relationships formed in communal housing are associated with maternal performance and piglet outcomes, while also evaluating the reproductive feasibility of intermittent suckling during prolonged lactation. In this prospective observational study, a total of 20 multiparous sows (Landrace × Large White) will be assigned to two communal pens across two batches. Framework 1 includes (1) quantification of prepartum social behaviours (e.g., nosing, allogrooming, aggression, avoidance) with group stability indicators (e.g., lesion scores, spatial integration), (2) classification of socio-positive behavioural patterns using principal components derived from social behaviours and group stability indicators, and (3) evaluation of whether these behavioural patterns are associated with maternal behaviour, farrowing process, and piglet performance. Framework 2 includes (1) application of intermittent suckling from 28 days after farrowing for 7 days with late weaning at 9 weeks, and (2) assessment of oestrus rate, follicular growth, and conception. This study may provide practical behavioural indicators for supporting social adaptation and stable farrowing and lactation processes, while evidence on the reproductive feasibility without separation between sows and piglets may support productivity and welfare in communal housing systems.

Key words : communal group housing, farrowing and lactation process, maternal behaviour, social behaviour, social cohesion

Estimation of annual volatile solid excretion from pigs for the calculation of methane emission from manure in Korea

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The Intergovernmental Panel on Climate Change (IPCC) reported volatile solid (VS) excretion of pigs to estimate the annual methane emissions from pig manure. The National Greenhouse Gas Inventory Report of Korea (2024) used the Western European values suggested by the IPCC. Therefore, the objective of this study was to estimate annual VS excretion from market pigs in Korea. The Gompertz model with days of age was used to calculate body weight (BW). Daily gross energy (GE) intake was calculated using a polynomial model. Daily total GE output was calculated as the sum of fecal and urinary GE output. Daily VS excretion was estimated using the following equation suggested by the IPCC (2006): $\text{daily VS excretion (kg/day)} = [\text{daily GE intake (MJ/day)} \times \{1 - \text{energy digestibility (\%)} \div 100\} + \text{daily GE intake (MJ/day)} \times \text{urinary energy excretion rate (\% of GE intake)} \div 100] \times [\{1 - \text{ash (\% in feed dry matter)} \div 100\} \div 18.45 \text{ (MJ/kg dry matter)}] = \text{daily GE output (MJ/day)} \times \{\text{organic matter content (\% in feed dry matter)} \div 100\} \div 18.45 \text{ (MJ/kg dry matter)}$. The average daily fecal GE output, urinary GE output, and daily total GE output were 2.84, 0.70, and 3.54 MJ/day, respectively. The average daily VS excretion from market pigs was 0.18 kg/day which less than 0.30 kg/day suggested by the IPCC (2006). Therefore, methane emissions from pig manure in Korea using VS excretion suggested by the IPCC were overestimated.

Key words : energy output, intergovernmental panel on climate change, methane, swine, volatile solid

Multiclass acoustic monitoring in pigs: From model development to environmental respiratory stress detection

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This study developed and deployed a multiclass AI acoustic framework for pig respiratory and welfare monitoring. Audio was annotated into five classes: coughing, sneezing, aggressive vocalizations, normal vocalizations, and silence. The dataset included 8,094 clips evaluated as 1.0 s segments with a stratified 70/10/20 split. Among multiclass pipelines, Audio Spectrogram Transformer (AST) achieved highest validation macro-F1 (0.953), test accuracy (0.949), and test macro-F1 (0.947), outperforming XGBoost, Mel-CNN, and MFCC-CNN. In 48 h continuous-audio validation, AST ranked highest for deployment suitability (mean primary rank 1.667; composite score 0.897). The selected AST was applied in a 28-day room-level study of 52 growing pigs in standard-ventilation and ventilation-restricted rooms, showing agreement with 24 h manual annotations (Pearson $r = 0.976$ – 0.998). The ventilation-restricted room showed higher coughing, aggressive and normal vocalizations, lower silence, poorer growth, and degraded air quality. Coughing clustered at 19:00–22:00, peaked at 20:00 (2.84 standardized detections), and co-varied positively with NH_3 , temperature, and CO_2 . These findings support AST-based acoustic monitoring as a non-invasive room-level tool for respiratory-stress surveillance, while replicated multi-room validation remains necessary.

Key words : precision livestock farming, environmental stress, bioacoustic monitoring, pig respiratory health, cough detection

Comparative effects of different noise stressors on growth performance and behavior in growing and finishing pigs

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Anthropogenic noise around pig farms, including construction, industrial/environmental, and traffic noise, may impair pig productivity and welfare. This study evaluated the effects of different noise stressors on growth performance and behavior in growing and finishing pigs under practical farm conditions. In growing pigs, noise exposure showed a negative tendency in productivity, with final body weight, average daily gain, and average daily feed intake reduced by 3.35%, 15.84%, and 5.35%, respectively, while feed conversion ratio increased by 6.50%. Drinking water intake increased by 19.52%, and behavioral analysis showed altered activity patterns, including higher standing and drinking frequencies. In finishing pigs, the effects were smaller, with final body weight, average daily gain, and average daily feed intake reduced by 1.28%, 5.17%, and 3.14%, respectively, while feed conversion ratio increased by 2.19%. Behavioral responses were also less pronounced than in growing pigs. These findings indicate that noise stress effects differ by growth stage, with growing pigs more sensitive than finishing pigs. Environmental noise should therefore be considered an important management factor in swine production systems.

Key words : noise stress, growing pigs, finishing pigs, growth performance, behavior

Integrated computer vision and machine learning framework for multi-class anomaly detection in group-housed growing pigs

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This study proposed a multi-class anomaly detection framework for group-housed pigs by integrating computer vision and machine learning. Nine classification algorithms were trained to identify five pig conditions—normal, heat stress, poor ventilation, infection, and recovery—using 10 combinations of feeding, drinking, and posture variables. Distinct behavioral patterns were observed across stress conditions. Among the tested models, Linear Discriminant Analysis (LDA) using all feeding and drinking variables achieved strong performance, with precision, recall, F1-score, and accuracy of 96.2%, 96.0%, 96.0%, and 96.0%, respectively, and an AUC of 98.7%. However, Random Forest and XGBoost trained on feeding and drinking variables achieved perfect classification. These results indicate that feeding and drinking behaviors alone are sufficient for robust anomaly detection when paired with suitable classifiers. Although posture variables did not consistently improve accuracy, they enhanced the interpretability of behavioral responses. Overall, the findings demonstrate that stressor-specific anomaly detection based on behavioral data is feasible and offers a practical, scalable approach for early stress detection, improved health and welfare monitoring, and more efficient precision livestock management.

Key words : smart farm, health monitoring, object detection, automatic system, artificial intelligence

Environmental enrichment and agonistic behavior in post-weaning pigs: A pilot study using artificial intelligence

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Weaning is a major stressor for pigs, often increasing agonistic behaviors such as aggression, ear biting, and tail biting, which can impair growth and welfare. This study evaluated the combined effect of rubber sticks and Italian ryegrass hay as environmental enrichment (EE) on growth performance, agonistic behavior, ear and tail biting lesion development, fecal consistency, and blood biochemical parameters. A total of 64 pigs (8 pigs × 4 pens × 2 groups) at 7 weeks of age were assigned to control (without EE) and treatment (with EE) groups for four weeks. Pens were the experimental unit for growth, fecal scores, lesion scoring, and behavioral outcomes. Growth and fecal consistency were measured weekly, while ear and tail lesions were scored at the end. Agonistic behavior was quantified using overhead RGB cameras and a YOLOv8-based AI system with high accuracy, mAP50 = 0.953, validated against manual observations, with behavioral outputs aggregated at the pen level from a single representative pen per group. Combined EE reduced lesion severity, lowered free fatty acids, improved fecal consistency, and decreased agonistic behavior, without affecting growth. AI-based monitoring offers a promising tool for quantifying social stress, although further studies with greater pen-level replication are warranted.

Key words : environmental enrichment, agonistic behavior, pig, AI monitoring, welfare

ICT 장비 도입에 따른 양돈 농가의 경제성 분석

Economic analysis of swine ICT equipment adoption on pig farm productivity

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본 연구는 ICT 장비(8종)를 도입한 96개 양돈 농가를 대상으로 장비 도입이 농가 생산성, 노동 효율, 경제성에 미치는 효과를 실증적으로 분석하였다. 도입 전·후 지표를 대응시킨 Wilcoxon 부호순위 검정(비모수)과 Cohen's d 효과 크기를 활용하여 통계적 유의성을 확보하였으며, 장비·규모·도입개수·활용연수로 세분화 분석과 함께 증분순이익 기반의 경제성 분석을 수행하였다. 분석결과, LSY[Litters per Sow per Year] (+4.15%, $p = 0.001$), PSY [Pig per Sow per Year] (+6.00%, $p < 0.001$), MSY[Marketed-pigs per Sow per Year] (+6.97%, $p = 0.002$), 1등급 출현율(+7.40%, $p < 0.001$), 출하 두당 사료량(-4.49%, $p = 0.023$), 1인당 관리두수(+24.68%, $p < 0.001$)에서 통계적으로 유의한 개선이 확인되었다. FCR[Feed Conversion Ratio] ($p = 0.613$)과 분만율($p = 0.168$)은 유의성에 미치지 못하였다. 장비별로는 포유모돈자동급이기($N = 72$, PSY +5.74%, $p < 0.001$), 환경관리기($N=65$, PSY +6.56%, $p < 0.001$), 임신돈군사급이기($N = 33$, PSY +7.10%, $p < 0.001$)의 효과가 높게 나타났다. 2종의 장비 도입 농가에서 성과가 크게 도출되었으며, 도입 1년 후 유의한 시차 효과가 확인되었다. 농장의 경제효과 총액은 평균 상시모돈수 385두 기준 연간 약 1억 4,553만 원으로 산출되었으며, 수입 증가(출하증가 4,008만 원 + 등급 개선 146만 원)가 28.5%, 비용 감소(사료비 절감 8,838만 원 + 노동비 절감 1,560만 원)가 71.5%를 차지하였다. 본 연구는 국내 양돈 ICT 경제성 실증 연구로서 양돈 ICT장비 도입을 위한 의사결정에 활용성 될 것으로 기대한다.

Key words : 양돈, ICT, 스마트팜, 경제성분석