Summary: Assessing pig farm biosecurity measures for the control of Salmonella on European farms

Key Findings:
- A cross-sectional study was performed on 250 farms from nine European countries to identify key biosecurity measures for controlling Salmonella in pig farms.
- Lower Salmonella risk farms were associated with fewer sows, using rodent baits, isolating sick pigs, maintaining proper hygiene practices, implementing downtime between batches, and utilizing fully slatted flooring in fattener buildings.

Introduction
Salmonella spp. is a common zoonotic pathogen, causing gastrointestinal infections in people. Pigs and pig meat are a major source of infection. Although farm biosecurity is believed to be important for controlling Salmonella transmission, robust evidence is lacking on which measures are most effective. This study aimed to conduct a structured and comprehensive European-wide risk factor analysis for the identification of farm biosecurity measures that are relevant for limiting the probability of introduction and transmission of Salmonella within pig farms.

Material & Methods
A cross-sectional study was performed on 250 farms from nine European countries between January 2020 and November 2021. From each farm, 20 pooled fecal samples were collected and analyzed for Salmonella presence. Based on the proportion of positive results, farms were categorized as at higher or lower Salmonella risk, and associations with variables from a comprehensive questionnaire were investigated. Multivariable analysis using a forwards-stepwise logistic model, was used to evaluate the associations between the binary Salmonella risk status and the exposure variables of interest.

Results
A total of 250 questionnaires were received from farms that had corresponding Salmonella results, with between 18 and 38 questionnaires received from farms in each of the nine European countries. Most farms were either farrow-to-finish (46.0%) or fattener farms (31.2%). A total of 199 farms were sampled specifically for this study. From the 199 farms, Salmonella was detected in pooled fresh faces from 69 farms (34.7%). Results by farm type showed that farrow-to-finish farms had, on average, a significantly lower number of samples positive for Salmonella (5.8%, compared to 9.3% for breeding farms and 9.7% for fattener farms; Chi-squared p < 0.001).

Multivariable analysis results in table 1 indicated that farms were less likely to be in the higher-risk category if they had <400 sows; used rodent baits close to pig enclosures; isolated stay-behind (sick) pigs; did not answer that the hygiene lock/ante room was easy to clean; did not have a full perimeter fence; did apply downtime of at least 3 days between farrowing batches; and had fully slatted flooring in all fattener buildings.

Discussion
The study highlights several prioritized biosecurity measures for controlling Salmonella on European pig farms. However, recruitment processes may have introduced selection bias, with variations in farm types and regions hindering inter-country comparisons. Participating farms might have been more proactive in Salmonella control or already facing issues, potentially leading to observation bias.

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