

Research article

LOSSES IN PIG FARMS ATTRIBUTABLE TO RESPIRATORY DISEASES

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ISSN 2466-4774

<https://www.contagri.info/>


OPEN ACCESS

Submitted: 15.11.2024.

Reviewed: 27.11.2024.

Accepted: 30.12.2024.

ABSTRACT

The primary objective of this study was to assess the potential economic losses incurred by pig farms as a result of respiratory diseases. These diseases, often arising from the combined effects of viral and bacterial pathogens, can impose significant financial burdens and compromise pig health. The adverse effects of respiratory diseases extend beyond animal health, directly diminishing farm profitability. The research was conducted on five commercial farrow-to-finish pig farms located in the South Bačka District, with sow herd sizes ranging from 300 to 1,150. A comprehensive questionnaire was administered to collect data on farm management practices, health protocols, and production performance. Respiratory diseases in pigs represent a major source of economic losses, undermining both animal welfare and the financial viability of farms. Implementing effective management and preventive measures is essential to mitigating these losses and sustaining the health and productivity of pig operations.

Key words:

respiratory disease, lung, fattening pig, losses

Citation:

Davidov, I., Stevančević, O., Božić, A., Davidov, N., Aleksić Radojković, J. & Galfi Vukomanović, A. 2025. Losses in pig farms attributable to respiratory diseases. *Contemporary Agriculture*, 74(1-2): 28-34. <https://doi.org/10.2478/contagri-2025-0005>

INTRODUCTION

There are numerous pig farms worldwide, with China, Brazil and several European countries playing leading roles in pork production. The primary challenges faced by pork producers include maintaining pig health, preventing diseases, ensuring proper nutrition, and optimizing reproductive performance. A number of studies have identified respiratory and digestive diseases, along with poor immunity, as the primary causes of low birth weight in piglets (Quiniou et al., 2002; Bee, 2004; Gondret et al., 2006; Rehfeldt and Kuhn, 2006). Respiratory diseases result in significant economic losses for pig producers globally. These losses are primarily attributed to reduced productivity, increased production costs, and lower market availability (Nieuwenhuis et al., 2012; Calderón Díaz et al., 2020; Ferraz et al., 2020). The magnitude of economic losses varies considerably across countries due to differences in production systems and the prevalence of specific respiratory pathogens.

Economic losses associated with swine respiratory diseases arise from mortality, reduced growth (Alarcon et al., 2013), poor reproductive performance, impaired feed conversion efficiency, and increased treatment costs (Opriessnig et al., 2004; Nathues et al., 2017; Cornelison et al., 2018). The reduced market value of diseased animals reflects the indirect effects of respiratory diseases encountered by producers. Additional losses occur at the

slaughter line, where the presence of respiratory diseases leads to the discarding of carcass portions or the downgrading of carcass quality (Brombilla et al., 2019). Previous studies have demonstrated that multiple respiratory infections exacerbate the severity and prolong the duration of respiratory disease clinical symptoms (Thacker et al., 1999; Opriessnig and Halbur, 2012). Accurately quantifying production losses is essential for evaluating pig farm profitability. Such data are valuable for producers and extension services aiming to enhance farm profitability (Gonzalez-Bulnes et al., 2016).

Respiratory diseases, often caused by the complex interplay of viral and bacterial pathogens, result in significant economic losses and pose a threat to pig health. The impact of these diseases adversely affects both animal welfare and farm profitability. Moreover, respiratory diseases reduce the overall pig productivity, increase veterinary costs, and contribute to higher mortality rates (Michiels et al., 2015). The objective of this study was to quantify potential losses in pig farms attributable to respiratory diseases. Understanding these losses is crucial for farmers and stakeholders in the agricultural sector, as the insights gained can inform strategies to improve animal welfare and enhance profitability in pig farming (Hansen, 2023).

MATERIAL AND METHODS

This study was conducted on five commercial farrow-to-finish pig farms located in the South Bačka District, representing typical operations in the region. These farms encompassed all phases of pig production, including breeding, gestation, farrowing, lactation, weaning, and growing pigs to market weight. The farms were randomly selected, although all exhibited clinical signs of respiratory diseases affecting up to 3% of their total herds. The sow herd sizes on the farms ranged from 300 to 1,150, with Farm A housing 300 sows, Farm B 1,146 sows, Farm C 1,000 sows, Farm D 487 sows, and Farm E 1,100 sows.

All the farms included in the study followed standardized management and health protocols to ensure consistency in vaccination and disease prevention practices. At each of the five farms, piglets were vaccinated with a commercial *Mycoplasma hyopneumoniae* monodose vaccine at three weeks of age. This vaccine is widely used to reduce the incidence and severity of respiratory diseases caused by *M. hyopneumoniae*, a well-documented pathogen in swine production. In addition to the *Mycoplasma* vaccine, the piglets were vaccinated against *Erysipelothrix rhusiopathiae* and porcine parvovirus using commercially available vaccines, administered according to the manufacturer's recommendations. These vaccinations formed part of the routine health management program at each farm, aimed at controlling a range of infectious diseases that could adversely affect pig health and growth performance.

A comprehensive questionnaire was distributed to all five farms to collect detailed information on farm management practices and herd health. The questionnaire gathered data on several parameters, including the number of sows, the number of fattening pigs, the farrowing index (litters per sow per year), litter size (average number of piglets born per sow), and mortality rates among the suckling, weaning, and finishing pigs. Additional reproductive performance data, such as gestation length, lactation period, and estrous intervals, were also recorded. Furthermore, the veterinarians from each farm provided specific data on the mortality rates attributed to respiratory diseases among the weaning and finishing pigs. This information was essential for evaluating the impact of respiratory diseases on the herd health and overall productivity.

The data collected were analyzed using IBM SPSS Statistics 27 (IBM Corp. Released 2020). The statistical analysis aimed to examine relationships between various farm management factors, the occurrence of respiratory diseases, and productivity indicators. The Pearson correlation coefficient was employed to determine the strength and direction of linear relationships between the variables. This coefficient ranges from -1 to 1, where a value of 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no correlation. Such analytical approach facilitated the identification of key factors influencing the prevalence of respiratory diseases and their effects on the pig health and growth performance.

RESULTS AND DISCUSSION

Respiratory diseases in pigs pose a significant challenge to the swine industry, particularly in regions such as the South Bačka District, where intensive agricultural production is prevalent. These diseases result in substantial financial losses and are among the most critical health and welfare concerns in intensive pig farming globally. The data from the five pig farms in the South Bačka District are summarized in Table 1.

Table 1. Summary of key parameters from pig farms A, B, C, D, and E in the South Bačka District

	Farm A	Farm B	Farm C	Farm D	Farm E
Number of sows	300	1,146	1,000	487	1,100
Number of fattening pigs	1,400	31,834	28,010	11,372	26,952
Farrowing index	2.18	2.34	2.35	2.23	2.15
Litter size	13	14.38	14.55	12.84	13.45
Mortality rate of suckling pigs	10%	12.15%	12.55%	11.4%	10.38%
Mortality rate of weaning pigs	4%	3.25%	3.4%	5%	3.2%
Respiratory diseases in weaning pigs	2.6%	1.56%	2.38%	3%	1.76%
Mortality rate of finishing pigs	3%	3.54%	3.8%	2.8%	2%
Respiratory diseases in finishing pigs	1.65%	1.84%	2.2%	1.37%	1.34%
Gestation	115 days	115 days	115 days	117 days	115 days
Lactation	28 days	26 days	26 days	28 days	25 days
Estrous interval	7 days	5 days	5 days	7 days	6 days

The results presented in [Table 1](#) underscore the differences in production and health outcomes across the five farms. A focus on health management and productivity practices has the potential to enhance both operational efficiency and animal welfare. According to [Table 1](#), Farm B, despite having the highest number of sows and fattening pigs, demonstrates high productivity, evidenced by a farrowing index of 2.34, which indicates efficient production. However, Farm B exhibits elevated mortality rates among suckling and weaning pigs compared to the other farms, suggesting potential deficiencies in health management. The mortality rates among suckling pigs are notably high across all the farms, with Farm C recording the highest rate (12.55%), which may reflect issues related to maternal care or environmental factors ([Pandolfi et al., 2017](#); [Spörri-Vontobel et al., 2023](#)). In contrast, Farm E reports the lowest weaning mortality rate (3.2%), indicating the implementation of effective management practices during this critical developmental period.

The gestation periods were consistent across the farms, with most averaging 115 days. However, Farm D exhibited a longer gestation period of 117 days, warranting further investigation. The lactation periods ranged from 25 to 28 days, with Farm E reporting the shortest duration. This could negatively impact piglet growth and survival if not adequately managed ([Spörri-Vontobel et al., 2023](#)). The estrous intervals varied among the farms, with Farms B and C recording the shortest intervals (5 days). While shorter intervals may facilitate more frequent breeding cycles, they could impose additional physiological strain on sows if not effectively managed. [Table 2](#) presents data on the pig mortality at various stages of production and the incidence of respiratory diseases in the weaning and finishing pigs.

Table 2. Mortality rates and prevalence of respiratory diseases across the farms

Metric	Farm A	Farm B	Farm C	Farm D	Farm E
Mortality rate of suckling pigs (%)	10	12.15	12.55	11.4	10.38
Mortality rate of weaning pigs (%)	4	3.25	3.4	5	3.2
Respiratory diseases in weaning pigs (%)	2.6	1.56	2.38	3	1.76
Mortality rate of finishing pigs (%)	3	3.54	3.8	2.8	2
Respiratory diseases in finishing pigs (%)	1.65	1.84	2.2	1.37	1.34

According to [Table 2](#), the prevalence of respiratory diseases was notably higher in Farm D for the weaning pigs (5%) and in Farm C for the finishing pigs (3.8%), suggesting the presence of potential environmental stressors or deficiencies in health management practices ([Jayaraman and Nyachoti, 2017](#); [Assavacheep and Thanawongnuwech, 2022](#)). Further investigation, particularly in the farms with elevated mortality rates, is essential to enhance the overall performance. [Table 3](#) presents the descriptive statistics for mortality and disease rates across all five pig farms.

Table 3. Descriptive statistics for mortality and disease rates across the farms

Metric	Mean (%)	Median (%)	Standard Deviation (%)	Min (%)	Max (%)
Mortality rate of suckling pigs	11.096	11.4	1.095	10	12.55
Mortality rate of weaning pigs	3.762	3.4	0.734	3.2	5
Respiratory diseases in weaning pigs	2.18	2	0.584	1.56	3
Mortality rate of finishing pigs	3.236	3	0.681	2	3.8
Respiratory diseases in finishing pigs	1.684	1.65	0.345	1.34	2.2

According to [Table 3](#), the average suckling pig mortality rate across all the farms is 11.10%, with Farm C exhibiting the highest rate at 12.55% and Farm A the lowest at 10.00%. A median value of 11.40% is close to the mean, indicating that the data is relatively symmetrical. A standard deviation of 1.10% reflects some variability in the mortality rates among the farms, though the variation is not excessively high. The rates are relatively consistent across the farms, ranging from 10.00% to 12.55%, indicating only slight differences in mortality.

The average mortality rate of weaning pigs is 3.762%. Farm D exhibits the highest mortality rate (5.00%), while Farm E reports the lowest (3.20%). The median value of 3.40% is close to the mean, suggesting a moderate level of consistency in the weaning pig mortality across the farms. A standard deviation of 0.734% indicates moderate variations in the mortality rates, with some farms, such as Farm E, demonstrating significantly lower mortality, whereas others, such as Farm D, exhibit higher rates. The mortality rates range from 3.20% to 5.00%, reflecting slightly greater variability compared to the suckling pig mortality.

On average, 2.18% of the weaning pigs are affected by respiratory diseases. Farm D reports the highest incidence at 3%, while farm B has the lowest at 1.56%. A median value of 2% is fairly close to the mean, indicating a relatively consistent level of respiratory disease prevalence across the farms. A standard deviation of 0.584% reflects moderate variability in the disease rates across the farms. Farms B and E exhibit lower incidences of respiratory diseases compared to the other farms. The rates range from 1.56% to 3.00%, suggesting that while the prevalence is moderate, some variation exists among the farms.

The average mortality rate of finishing pigs is 3.236%, with Farm E reporting the lowest rate at 2% and Farm C the highest at 3.8%. A median value of 3% is close to the mean, indicating that the distribution of mortality rates is relatively balanced across the farms. A standard deviation of 0.68% suggests moderate variability in the finishing pig mortality rates. The mortality rates range from 2.00% to 3.8%, representing a moderate variation compared to other metrics.

The average prevalence of respiratory diseases in the finishing pigs is 1.684%. Farm E reports the lowest rate (1.34%), while Farm C has the highest (2.20%). A median value of 1.65% is very close to the mean, indicating a relatively consistent rate across the farms. A standard deviation of 0.35% reflects low variability in the incidence of respiratory diseases among the finishing pigs. The rates range from 1.34% to 2.20%, suggesting that while the prevalence is generally low, some variability exists, particularly in Farm C.

Overall, the mortality rates of suckling and weaning pigs are relatively consistent across the farms, with the suckling pig mortality exhibiting less variation compared to other metrics. Respiratory diseases in the weaning pigs show greater variability than the mortality rates, with Farms B and E reporting lower disease prevalence relative to the other farms. The finishing pigs exhibit lower mortality and respiratory disease rates compared to the younger pigs, particularly in Farm E, which stands out for its lower mortality rates across multiple categories.

While some variability is observed in the data, most of the metrics (particularly the suckling pig mortality and the finishing pig respiratory diseases) exhibit moderate consistency across the farms. However, specific farms (such as Farm C with higher suckling pig mortality and Farm D with elevated respiratory disease rates in the weaning pigs) emerge as outliers in certain categories. This variability may reflect differences in management practices, health protocols, or environmental conditions across the farms ([Jayaraman & Nyachoti, 2017](#); [Paz-Sánchez et al., 2021](#); [Boyle et al., 2022](#)).

To examine the correlation between respiratory disease prevalence and mortality rates in the weaning and finishing pigs, the Pearson correlation coefficient was calculated. The analysis includes data for both the weaning and finishing pigs, highlighting the relationship between respiratory disease prevalence and respective mortality rates. The results are presented in [Tables 4 and 5](#).

Table 4. Correlation between the respiratory disease prevalence and mortality rates in weaning pigs

	Respiratory disease prevalence in weaning pigs	Mortality rates in weaning pigs
Farm A	2.6	4
Farm B	1.56	3.25
Farm C	2.38	3.4
Farm D	3	5
Farm E	1.76	3.2
Pearson correlation coefficient		0.429

A correlation of 0.429 indicates a moderate positive relationship between the respiratory diseases and mortality rates in weaning pigs. This finding suggests that an increase in respiratory diseases tends to be associated with higher

mortality rates. However, as the correlation is not strong, a number of additional factors may also contribute to the pig mortality rates.

Table 5. Correlation between the respiratory disease prevalence and mortality rates in finishing pigs

	Respiratory disease prevalence in finishing pigs	Mortality rates in finishing pigs
Farm A	1.65	3
Farm B	1.84	3.54
Farm C	2.2	3.8
Farm D	1.37	2.8
Farm E	1.34	2
Pearson correlation coefficient		0.715

A correlation of 0.715 indicates a moderately strong positive relationship between the respiratory diseases and mortality rates in finishing pigs. This suggests that an increase in respiratory diseases is associated with a higher mortality rate. The stronger correlation in the finishing pigs compared to the weaning pigs suggests that respiratory diseases may be a more significant contributor to mortality rates at this stage.

Table 6 presents a summary of the correlation results between respiratory diseases and mortality rates in both weaning and finishing pigs.

Table 6. Summary of correlation results

Pair	Pearson Correlation Coefficient	Correlation Strength
Respiratory diseases in weaning pigs vs. mortality rates in weaning pigs	0.429	Moderate positive correlation
Respiratory diseases in finishing pigs vs. mortality rates in finishing pigs	0.715	Moderately strong positive correlation

There is a moderate positive correlation between the respiratory diseases and mortality rates in weaning pigs, suggesting that while respiratory diseases contribute to their mortality rates, other factors are also likely involved. However, the moderately strong positive correlation in finishing pigs indicates that respiratory diseases may play a more direct and substantial role in their mortality rates. The farms with higher rates of respiratory diseases in finishing pigs also tend to experience higher mortality rates. These findings suggest that respiratory diseases are a significant factor in pig mortality, with a slightly greater impact on finishing pigs than on weaning pigs. However, further investigation is necessary to fully understand the range of factors influencing these outcomes.

A limited number of studies have investigated the relationship between respiratory disease and pork quality. However, some findings suggest that severe pneumonia is associated with lower live weights at slaughter and can negatively impact pork quality. These effects may include alterations in pH, water-holding capacity, color, flavor, and cooking properties (Pagot et al., 2007; Permentier et al., 2015; Karabasil et al., 2017; Driessen et al., 2020). Moreover, research has indicated that significant lung damage in slaughter pigs correlates with decreased live and carcass weights (Permentier et al., 2015; Teixeira et al., 2016). These outcomes are likely due to reduced growth rate, feed efficiency, and daily weight gain in pigs with respiratory lesions during the fattening phase (Donkó et al., 2005). No significant difference in carcass weight was observed between animals with and without lesions, likely because carcass weight was a primary criterion for slaughter selection. However, the observed difference of approximately 3.5 kg between the two groups could have substantial economic implications, particularly in carcass sales. Additionally, the affected animals remained on the farm for nearly six extra days, resulting in further economic losses (Paz-Sánchez et al., 2021).

Vaccination against *Mycoplasma hyopneumoniae* is a widely adopted practice in pig farming worldwide. It aims to reduce clinical symptoms and lung lesion severity, thus improving average daily weight gain (DWG) and feed conversion efficiency while shortening the time required to reach slaughter weight (Kritas et al., 2007; Maes et al., 2008; Ferraz et al., 2020; López-Lorenzo et al., 2021). The partial protection observed in this study, likely influenced by the presence of other respiratory pathogens and management practices, may explain the reduced growth performance.

CONCLUSION

Respiratory diseases in pigs cause substantial economic losses for farmers, affecting both animal welfare and farm profitability. These diseases impair the individual health and growth performance of animals while posing broader challenges for entire herds and farming operations. Their impact is particularly significant on pig farms, leading to financial losses through reduced growth rates, increased veterinary expenses, and diminished reproductive performance. Implementing effective management and prevention strategies is essential to mitigating these losses and ensuring the overall health and productivity of pig farms.

Authors' Contribution: Conceptualization – I.D. & O.S.; Data curation – A.G.V.; Formal analysis – I.D.; Funding acquisition – I.D. & J.A.R.; Investigation – I.D. & O.S.; Methodology – I.D. & O.S.; Project administration – O.S.; Resources – O.S. & N.D.; Software – N.D.; Supervision – A.B.; Validation – I.D. & O.S.; Visualization – A.G.V.; Writing – original draft – I.D.; Writing – review & editing – O.S. & A.B. All authors have read and approved the final version of the manuscript for publication.

Acknowledgements: This work was supported by the Provincial Secretariat for Higher Education and Scientific Research of the Autonomous Province of Vojvodina, Republic of Serbia (Project Number: 142-451-2573/2021-01).

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Conflict of interest: The authors declare that they have no conflict of interest.

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