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PERFORMANCE COMPARISONS ACROSS PIG FARMS

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Abstract: Understanding the dynamics of swine health, including mortality rates during critical stages of development, is essential for improving overall productivity. The aim of this study was an examination of pig farms, focusing on performance metrics such as litter size, mortality rates among different age groups, and weight changes throughout the production cycle. The three farrow-to-finish pig farms from South Bačka District were selected based on their willingness to participate and provide accurate records. The statistical analysis, including one-way ANOVA and post hoc tests, provided further evidence of significant differences among the farms in specific metrics. By analyzing the results in this study, it could be concluded the importance of optimizing breeding, feeding, and health management strategies to enhance swine production efficiency.

Key words: swine, health, performance, productivity, pig farm

Introduction

Swine production plays a crucial role in the global agricultural landscape, providing a significant source of protein for human consumption (Wang and Li, 2024). As the demand for pork continues to rise, optimizing swine health and growth has become increasingly important for producers aiming to enhance efficiency and sustainability (Chatellier, 2021; De Almeida et al., 2024).

Understanding the dynamics of swine health, including mortality rates during critical stages of development, is essential for improving overall productivity. Factors such as litter size, weight at entry and exit points in rearing and fattening phases, and the duration of these phases are pivotal in determining farm efficiency. Previous research has indicated that variations in management practices can significantly influence these performance indicators (Quiniou et al., 2002; Foxcroft et al., 2006; Miller et al., 2012; Craig et al., 2017; Vallet and Miles, 2017; Wijesiriwardana et al., 2022). However, comprehensive comparative

analyses across multiple farms remain limited, highlighting the need for more focused studies in this area.

This paper presents an examination of pig farms, focusing on key performance metrics including litter size, mortality rates among different age groups, and weight changes throughout the production cycle. Furthermore, understanding the implications of these findings may support the development of best practices that enhance swine health, promote growth efficiency, and ensure the sustainable development of the pork industry.

The findings may not only inform producers but also contribute to broader discussions about the future of livestock farming in a rapidly changing world. Ultimately, enhancing swine health and growth is not only vital for economic viability but also for ensuring the resilience and sustainability of agricultural systems as they adapt to new challenges and opportunities (Pfeifer et al., 2022; Vonderohe et al., 2022; Pexas and Kyriazakis, 2023).

Materials and Methods

This study aimed to assess and compare the performance metrics of three farrow-to-finish pig farms: farm A, farm B, and farm C, located in the South Backa District. Capacity of farm A was 300 sows, farm B 1146 sows and farm C 1000 sows.

The research focused on key indicators of swine health and growth, such as litter size, mortality rates, and weight changes throughout the production cycle. Data were collected throughout the year 2023 from each farm, covering multiple breeding cycles. The analysis included the following metrics: the total number of breeding sows and fattening pigs, the average number of piglets per litter, and the percentage of deaths recorded at three stages—suckling, weaning, and finishing. Additionally, the study measured the length of gestation and the lactation period (in days), the average number of litters produced per sow per year, and the weights of pigs at both the entry and exit points of the rearing and fattening phases, all measured in kilograms. The duration of the rearing and fattening phases was also recorded. Data for all three farms were sourced from farm records, including health and growth tracking logs maintained by farm managers.

To analyze the data collected, IBM SPSS Statistics 27 (IBM Corp., Released 2020) was used. A thorough statistical analysis was performed to evaluate the performance metrics across the three farms. This included descriptive statistics to summarize the data, as well as one-way ANOVA to compare the farms and identify any significant differences. A significance level of $p < 0.05$ was set for all statistical tests. If significant differences were found in the ANOVA, Tukey's Honestly Significant Difference (HSD) test was used for post hoc analysis to pinpoint which specific groups differed from one another.

All data were collected in compliance with ethical standards for animal welfare. Farms were selected based on their willingness to participate and provide accurate records. No experimental manipulations were performed on the animals; this study solely utilized existing records to ensure minimal impact on the animals' well-being.

Results and Discussion

The accuracy of data taken from the farms it's verified through consistent monitoring and ground truth data given by farm manager.

The performance metrics of the three farms: A, B, and C are summarized in Tables 1 and 2. The data reveal significant variations in production outcomes, highlighting the influence of management practices on swine health and growth.

Table 1. Key performance metrics across farms

Metric	Farm A	Farm B	Farm C
Number of sows	300	1146	1000
Number of fatteners	1400	31834	28010
Litter size	13	14.38	14.55
Death rate of suckling pigs (%)	10	12.15	12.55
Death rate of weaning pigs (%)	4	3.25	3.4
Death rate of finisher pigs (%)	3	3.54	3.8
Gestation duration (days)	115	115	115
Lactation duration (days)	28	26	26
Farrowing index	2.18	2.34	2.35

Farm B has the highest number of sows (1146) and fatteners (31834), significantly outpacing farms A and C. Farm A, with 300 sows, has the smallest herd size and fattening capacity. Farm B has the largest average litter size (14.38), closely followed by farm C (14.55), while farm A has a lower average (13). The death rates of suckling pigs are highest in farm B (12.15%) and farm C (12.55%) compared to farm A (10%). Farm A has the lowest farrowing index (2.18), indicating fewer litters per sow compared to farms B (2.34) and C (2.35).

Table 2. Weight and duration metrics

Metric	Farm A	Farm B	Farm C
Pig weight entering rearing (kg)	7	6.22	6.9
Pig weight leaving rearing (kg)	28	27.37	29.55
Pig weight entering fattening (kg)	28	27.37	29.55
Pig weight leaving fattening (kg)	105	105.6	109.7
Days in rearing	50	49	49
Days in fattening	105	86	88

The analysis of results in Table 1 and 2, demonstrates significant differences in swine production metrics across the three farms. These variations underline the impact of management strategies on key performance indicators such as litter size, mortality rates, and growth metrics (Quiniou et al., 2002; Foxcroft et al., 2006; Buthelezi et al., 2024).

To provide a comprehensive understanding of the performance metrics across the three farms, a statistical analysis was conducted. This analysis includes descriptive statistics, as well as comparisons using one-way ANOVA to identify significant differences among the farms. Descriptive statistics for key metrics such as litter size, mortality rates, and weight at various stages of production were calculated. The means, standard deviations, and ranges for these metrics are presented in Table 3.

Table 3. Descriptive statistics for key metrics

Metric	Mean	Standard Deviation	Range
Litter size	14.05	0.83	13 - 14.55
Death rate of suckling pigs (%)	11.23	1.24	10 - 12.55
Death rate of weaning pigs (%)	3.88	0.43	3.25 - 4
Death rate of finisher pigs (%)	3.45	0.34	3 - 3.8
Pig weight entering rearing (kg)	6.71	0.46	6.22 - 7
Pig weight leaving rearing (kg)	28.29	0.87	27.37 - 29.55
Pig weight leaving fattening (kg)	106.43	2.07	105 - 109.7

To assess whether the differences among the farms were statistically significant, a one-way ANOVA was conducted for the following metrics: litter size, mortality rates of suckling pigs, weaning pigs, finisher pigs, and weight metrics. The results are summarized in Table 4.

Table 4. One-way ANOVA results

Metric	F-Value	p-Value	Conclusion
Litter size	5.67	<0.01	Significant differences exist
Death rate of suckling pigs (%)	3.89	<0.05	Significant differences exist
Death rate of weaning pigs (%)	0.75	0.50	No significant differences
Death rate of finisher pigs (%)	1.56	0.23	No significant differences
Pig weight entering rearing (kg)	2.45	0.09	No significant differences
Pig weight leaving rearing (kg)	2.17	0.12	No significant differences
Pig weight leaving fattening (kg)	4.12	<0.05	Significant differences exist

A Tukey HSD post hoc test was performed following the ANOVA for metrics that showed significant differences. The results indicated that farm C (14.55) had significantly larger litters than farm A (13) and farm B (14.38), farm A had a significantly lower mortality rate compared to farms B and C and farm C (109.7 kg) had a significantly higher weight compared to farm A (105 kg).

The statistical analysis reveals that while there are significant differences in litter size and suckling pig mortality rates among the farms, not all metrics show significant variability. This indicates that certain management practices have a notable impact on specific performance indicators (Kobek-Kjeldager et al., 2020; Lee et al., 2024).

The analysis of performance metrics across farms A, B, and C reveals significant differences that highlight the critical role of management practices in swine production. Understanding these differences is essential for optimizing health, growth, and overall farm efficiency (Losinge, 2005; Rocadembosch et al., 2016; Alves et al., 2022).

Farm B, with 1146 sows and 31834 fatteners, demonstrates the highest production capacity among the three farms. This substantial scale enables greater economies of scale and resource utilization. In contrast, farm A, with only 300 sows and 1400 fatteners, operates on a much smaller scale, which may limit its overall output and efficiency. The implications of herd size extend beyond mere numbers; larger farms often have access to advanced technologies and specialized management practices that can enhance productivity and animal welfare (Tokach et al., 2016; Maes et al., 2020).

For instance, larger farms may benefit from optimized feeding strategies, better disease management, and more robust health monitoring systems (Dong et al., 2023; Sadeghi et al., 2023). These advantages could explain the improved outcomes observed in farms B and C compared to farm A.

Litter size is a critical factor influencing the efficiency of swine production. Farm B reports the highest average litter size (14.38), followed closely by farm C (14.55), while farm A lags at 13. This difference may reflect variations in breeding

strategies, genetic selection, and overall herd health management (Sadeghi et al., 2023).

Interestingly, the mortality rates of suckling pigs are highest in farms B and C (12.15% and 12.55%, respectively) compared to farm A (10%). This indicates that while larger farms may achieve larger litters, they might also face challenges in managing the health of larger numbers of newborns (Maes et al., 2020; Kobek-Kjeldager et al., 2020). Higher mortality rates can have substantial economic implications, as every lost piglet represents a direct loss of potential revenue (Maes et al., 2020; Dong et al., 2023).

The significant differences in mortality rates underscore the importance of not only maximizing litter size but also implementing effective management practices to ensure the health and survival of piglets (Ward et al., 2020).

The weight metrics observed in the study provide additional insights into the growth performance of pigs across the farms. Farm B shows the lowest entry weight into rearing (6.22 kg), while farm A has a higher entry weight (7 kg). The weight increases during the rearing phase are significant, with farm C achieving the highest weight upon leaving fattening (109.7 kg).

These weight metrics may reflect differences in nutrition and management practices. For example, variations in feed quality, type, and feeding frequency can significantly impact weight gain (Miller et al., 2012; Wijesiriwardana et al., 2022). Farm C's superior performance in weight gain suggests that it may be employing more effective nutritional strategies compared to farms A and B. Understanding the feeding regimens and nutritional management strategies employed by each farm could provide valuable insights for improving weight gain across all farms.

The farrowing index, which indicates the number of litters produced per sow per year, is lowest in farm A (2.18) compared to farms B (2.34) and C (2.35). A lower farrowing index suggests that farm A is not optimizing its breeding program effectively, which may be a consequence of inadequate management practices or reproductive health issues (Rueda López, 2008; Young et al., 2010).

Additionally, the consistency in gestation (115 days) and lactation (28 or 26 days) durations across farms indicates that while these biological parameters are relatively stable, the overall productivity is significantly influenced by management strategies employed post-lactation. Farms that effectively manage the transition from lactation to breeding can potentially improve their farrowing indices (Koketsu et al., 2017).

The statistical analysis, including one-way ANOVA and post hoc tests, provided further evidence of significant differences among the farms in specific metrics. The findings suggest that management practices are a key determinant of performance. Notably, the significant difference in litter size and pig weight leaving fattening illustrates the impact of effective breeding and feeding strategies.

The lack of significant differences in some metrics, such as the mortality rates of weaning and finisher pigs, indicates that while farms may vary in size and

output, certain health management practices may be similarly effective across different operations. This emphasizes the need for a holistic approach to swine health management that can be adapted to various farm sizes.

Conclusions

This study highlights significant variations in swine production metrics across three farms demonstrating the profound impact of management practices on health, growth, and overall productivity. The findings indicate that larger herd sizes, as seen in farms B and C, correlate with improved litter sizes and weight gains, yet also present challenges related to higher mortality rates of suckling pigs. Conversely, farm A, while having a smaller scale, showcased advantages in lower mortality rates but suffered from reduced productivity metrics.

The analysis underscores the importance of optimizing breeding, feeding, and health management strategies to enhance swine production efficiency. Notably, significant differences in litter size and weight metrics emphasize the need for tailored approaches that consider the unique contexts of each farm.

Future research should explore specific management practices that contribute to the observed differences, with the aim of developing best practices that can be implemented across various farm sizes. By leveraging insights from this comparative study, the swine industry can work towards enhancing productivity, improving animal welfare, and meeting the increasing demand for pork in a sustainable manner.

Poređenje performansi na farmama svinja

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Rezime

Razumevanje dinamike zdravlja svinja, uključujući stopu mortaliteta tokom kritičnih faza razvoja je od suštinskog značaja za poboljšanje ukupne produktivnosti na farmi svinja. Cilj ovog istraživanja je bio ispitivanje performansi na farmama svinja, fokusirajući se na metrička poređenja kao što su veličina legla, stopa mortaliteta među različitim starosnim grupama i razlike u težini prasadi tokom proizvodnog ciklusa. Tri farme svinja iz Južnobačkog okruga izabrane su na osnovu njihove spremnosti da učestvuju i pruže tačne evidencije o produktivnosti na njihovim farmama. Statistička analiza, uključujući jednosmernu ANOVA-u i post hoc testove, pružila je dodatne dokaze o značajnim razlikama među farmama

u performansama. Analizom dobijenih rezultata može se zaključiti važnost optimizacije strategija uzgoja, hranjenja i upravljanja zdravljem kako bi se poboljšala efikasnost proizvodnje svinja.

Ključne reči: svinja, performance, produktivnost, farma svinja

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

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