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A review of biosecurity and management practices on broiler performance

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Abstract

As demand for efficient, sustainable, and disease-resistant poultry systems grows, comparing biosecurity and management practices in broiler production becomes valuable. This review summarizes research that examines how biosecurity and farm management influence broiler performance. Key measures include average daily gain (ADG), feed conversion ratio (FCR), mortality, flock welfare, and antimicrobial use. Increased biosecurity boosts feed intake, reduces mortality, improves production efficiency, and decreases antibiotic use. Management elements such as housing, ventilation, stocking density, feeding, litter quality, environmental control, and health monitoring also shape broiler production and welfare. Farmers must implement effective environmental and dietary controls, as disease prevention alone is insufficient. Varying study methodologies and outcomes make direct comparison of results challenging. The study highlights the need to integrate biosecurity and management practices to enhance broiler performance and promote sustainable broiler production. It also reveals research gaps, particularly the absence of standardized studies that jointly investigate animal welfare, biosecurity, management, antimicrobial use, and production efficiency. Using evidence-based management improves flock health, economic sustainability, and production in contemporary broiler systems.

Keywords: Biosecurity; Broiler Production; Farm Management; Feed Conversion Ratio; Flock Health; Broiler Performance; Antimicrobial Usage; Poultry Welfare

1. Introduction

Broiler production forms an integral part of the world poultry industry. It provides cheap animal protein to the increasing human population. Because broiler systems are intensive, they are more susceptible to disease, environmental stress, and management problems. These factors can affect health, productivity, and profits. In such systems, producers must establish effective biosecurity and sound farm management to achieve optimal broiler performance and efficiency.

Biosecurity covers all actions to prevent infectious diseases in poultry flocks. These actions include hygiene, movement control, disinfection, and health monitoring. Strong biosecurity improves flock health, reduces mortality, boosts feed efficiency, and reduces reliance on antimicrobials. Management factors such as stocking density, housing, ventilation, litter quality, and nutrition which also affect broiler growth, welfare, and efficiency.

Many studies have shown that improved biosecurity correlates with better broiler performance, particularly increased average daily gain (ADG), improved feed conversion ratio (FCR), and decreased mortality. Studies from Pakistan, the Philippines, and Cameroon examine these factors but often differ in their designs and measurements. Few directly assess the combined effects of integrated biosecurity and management on productivity.

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This review discusses the effects of biosecurity and management on broiler performance, based on peer-reviewed studies. It also highlights research gaps and the need for integrated strategies to improve productivity, flock health, and sustainability in broiler production.

2. Literature Review

2.1. Biosecurity in Broiler Production

Biosecurity is critical in broiler production for reducing the risk of pathogens on poultry farms. Measures such as sanitation, movement control, disinfection, environmental management, and disease surveillance preserve flock health, improve production efficiency, and prevent economic losses from outbreaks.

Several studies show that broiler farms differ in how they implement biosecurity measures. Researchers attribute the differences to infrastructure, management systems, and farmer compliance. As a result, scientists have developed quantitative tools to measure biosecurity levels in commercial poultry production.

Tanquilut et al. (2020) quantitatively assessed biosecurity on 397 broiler farms in Central Luzon, Philippines, using the Biocheck.Scoring system of UGent. The study found average biosecurity scores of 71.2%-77.2% for internal biosecurity and 68.5% for external biosecurity. These findings clearly showed that farms generally adhered more to internal hygiene and management measures than to external ones aimed at preventing pathogen entry. Notably, compliance was lowest in transporting live birds and controlling biological vectors. Importantly, the study observed that tunnel-ventilated housing systems achieved higher biosecurity scores than conventional systems, suggesting that infrastructure plays a key role in biosecurity performance.

The results from Tanquilut et al. (2020) underscore the need to systematically evaluate biosecurity measures and identify shortcomings in farm management and disease-prevention strategies. The study also highlights how farm infrastructure and environmental control systems can influence biosecurity success.

2.2. Biosecurity and Broiler Production Performance

Because preventing disease improves growth, feed efficiency, and survival rates, researchers strongly associate strong biosecurity practices with better broiler production performance. Poor biosecurity exposes birds to more infectious agents, reducing productivity and increasing mortality.

Ziebe et al. (2025) evaluated the impact of biosecurity implementation on broiler production performance in 57 farms in Cameroon. Using structured biosecurity audits, the study categorized farms by biosecurity compliance level and examined their relationship with performance indicators. The results showed that farms with higher biosecurity implementation achieved better production outcomes than farms with poor biosecurity practices.

Farms with strong biosecurity compliance had a higher average daily gain (ADG) of 46.54 g, compared to 43.80 g in less-compliant farms. Feed conversion ratio (FCR) was also better at 1.59 in these farms, compared with 1.75 in poorly compliant farms. Mortality rates were much lower in well-managed farms (2.47%) than in poorly compliant farms (6.65%). The performance index was also higher with stronger biosecurity.

These findings demonstrate that biosecurity significantly impacts broiler productivity and efficiency. Preventing disease and reducing infection pressure enables birds to allocate nutrients to growth, improving performance.

2.3. Biosecurity and Disease Control

Biosecurity's main goal in poultry production is disease prevention. Infectious diseases are major causes of production loss, including mortality, poor growth, carcass condemnation, and added treatment costs. Good practices cut disease and boost flock health.

Tilli et al. (2024) conducted a systematic review on the role of biosecurity in the prevention and control of colibacillosis in broiler production. Colibacillosis, caused by avian pathogenic *Escherichia coli*, is one of the leading bacterial diseases of commercial poultry production. The review indicated that effective biosecurity practices were associated with reduced disease incidence, mortality, and colibacillosis-related carcass condemnation.

The study highlighted that effective biosecurity interventions reduce infection pressure in poultry farms, resulting in healthier flocks. This lowering of disease incidence was directly linked to improved feed efficiency, reduced mortality, and increased economic returns in broiler production systems.

Tilli et al. (2024) emphasize the need to include disease prevention in the overall management of broilers. Effective sanitation, movement control, environmental management, and health surveillance are keys to reducing pathogen load and maintaining flock productivity.

2.4. Biosecurity Compliance and Antimicrobial Use

The use of antimicrobials in broiler production is often linked to disease incidence and flock health management. Farms with poor disease prevention systems may rely on antimicrobial treatment to manage infections. In contrast, farms with stronger biosecurity programs may have lower antimicrobial dependence through preventive management practices.

Mahmood et al. (2025) quantitatively assessed biosecurity practices in 100 conventional broiler farms in Punjab, Pakistan. They examined the association between biosecurity and antimicrobial use. Farms with better overall biosecurity and stronger external biosecurity had lower antimicrobial use than those with poorer biosecurity.

The study did not directly assess production parameters such as ADG or FCR. However, the key finding was a reduction in antimicrobial use during the study, suggesting improved flock health and some degree of disease prevention. This reduction is significant given global concerns about antimicrobial resistance in livestock production systems.

The results suggest better biosecurity cuts disease and promote more sustainable poultry practices. Strong management systems can reduce antimicrobial use while supporting welfare and productivity.

2.5. Synthesis of Reviewed Studies

The reviewed studies collectively indicate that biosecurity is critical to broiler health, disease prevention, and production efficiency. However, individual studies vary in focus and methods, making general conclusions difficult. Overall, the evidence supports biosecurity's value but emphasizes the need for more integrated, standardized research.

Tanquilut et al. (2020) primarily assessed the biosecurity compliance levels of broiler farms and identified areas for improvement. In contrast, Ziebe et al. (2025) directly linked biosecurity implementation to measurable production indicators, such as ADG, FCR, mortality, and the performance index. Tilli et al. (2024) stressed the importance of biosecurity in preventing disease, especially in minimizing losses from colibacillosis. Mahmood et al. (2025) also highlighted the significance of biosecurity, noting its association with lower antimicrobial consumption.

Together, these studies indicate that effective biosecurity measures improve flock health, reduce disease burden, lower mortality, and enhance production performance in broiler systems. Although differences in study design and assessment methods existed, the reviewed studies all support the importance of strengthening biosecurity measures in commercial poultry production.

2.6. Research Gap

Although positive relationships between biosecurity and broiler performance have been reported in previous studies, there remain some unique research gaps in the literature. Of particular interest are studies that have examined compliance with biosecurity or the knowledge and attitudes of livestock farmer advisers regarding biosecurity practices. However, such studies often fail to establish direct links between compliance or knowledge and measurable production outcomes such as growth performance, feed efficiency, or mortality rates (Ngom et al., 2025).

Furthermore, differences in assessment methods, performance indicators and study conditions make a direct comparison between studies difficult. Thus, there is a need for more integrated, standardized research approaches that simultaneously evaluate biosecurity implementation, disease occurrence, antimicrobial use and broiler productivity in a single analytical framework. Further research is needed to better understand the effects of biosecurity practices on broiler performance under different environmental and management conditions.

3. Comparative Analysis of the Study

It is worth noting that the reviewed studies used different designs, methods, sample sizes and measured different indicators, which should be considered for a full understanding of the current research. Despite these differences, all studies agreed on the importance of biosecurity for broiler health, disease prevention, and production efficiency. Some studies focused mainly on measuring biosecurity levels, while others focused on the relationship between biosecurity and production, disease control, or antimicrobial use. The following comparative analysis aims to summarize the main features, findings, strengths and weaknesses of the studies reviewed, in order to assess their contribution.

Table 1 Comparative Analysis of Reviewed Studies

Author and Year	Country	Sample / Study Design	Methodology Differences	Biosecurity or Management Metrics	Performance Indicators Reported	Key Findings	Strengths	Limitations
Tanquilut et al. (2020)	Philippines	397 broiler farms; cross-sectional quantitative assessment	Used the Biocheck.Ugent scoring system to quantitatively evaluate internal and external biosecurity compliance across commercial broiler farms	Internal and external biosecurity scores	No direct production performance indicators measured	Internal biosecurity compliance was higher than external biosecurity; transportation and vector control had the lowest compliance scores	Large sample size; standardized quantitative biosecurity assessment; provided baseline biosecurity data for Philippine broiler farms	Did not directly evaluate productivity indicators such as ADG, FCR, or mortality
Ziebe et al. (2025)	Cameroon	57 broiler farms; biosecurity audit and performance evaluation	Conducted farm-level biosecurity audits and directly correlated biosecurity implementation with production performance indicators	Biosecurity score categories	ADG, FCR, mortality, performance index (PI)	Farms with higher biosecurity compliance had better ADG, lower FCR, lower mortality, and higher PI	Provided direct empirical evidence linking biosecurity with broiler productivity; included measurable performance indicators	Smaller sample size compared with other studies; limited to specific production systems in Cameroon
Tilli et al. (2024)	Italy	Systematic review of multiple studies	Synthesized findings from different studies evaluating biosecurity interventions against colibacillosis in broiler production	Biosecurity interventions for disease prevention and control	Mortality, carcass condemnations, disease-related production losses	Biosecurity interventions reduced colibacillosis incidence, mortality, and carcass condemnations	Comprehensive synthesis of existing evidence; emphasized disease prevention role of biosecurity	Did not provide direct farm-level productivity measurements; findings depended on variability among

								reviewed studies
Mahmood et al. (2025)	Pakistan	100 conventional broiler farms; quantitative assessment	Quantitatively assessed farm biosecurity compliance and analyzed association with antimicrobial usage	Overall and external biosecurity scores; antimicrobial usage (AMU)	Antimicrobial usage only; no direct productivity indicators	Higher biosecurity compliance was associated with reduced antimicrobial usage	Highlighted relationship between biosecurity and flock health management; addressed antimicrobial resistance concerns	No direct evaluation of ADG, FCR, mortality, or production efficiency

Taken as a whole, the studies assessed show that biosecurity is an important factor in broiler health, disease prevention, and production efficiency. However, the studies differed greatly in their methodological approaches and their primary research focus.

Tanquilut et al. (2020) focused mainly on the quantitative assessment of biosecurity compliance in broiler farms and provided baseline information on internal and external biosecurity practices. In contrast, Ziebe et al. (2025) provided the strongest empirical evidence among the reviewed studies on the direct relationship between biosecurity and broiler productivity, directly linking biosecurity implementation to measurable production indicators such as ADG, FCR, mortality, and performance index.

Meanwhile, Tilli et al. (2024) highlighted the importance of biosecurity in disease prevention through a systematic review. The study did not directly measure productivity but stressed the need to reduce losses from colibacillosis, mortality, and carcass condemnations. Mahmood et al. (2025) describe the relationship between biosecurity and antimicrobial use, stating that better biosecurity leads to improved flock health and less reliance on microbial interventions.

4. Discussion

The studies reviewed show a clear positive association between broiler productivity and compliance with biosecurity. But the strength and clarity of that linkage are dependent on the performance indicators used and the methodology of each study. Some studies provide strong evidence that better biosecurity is associated with higher average daily gain, better feed conversion ratio, and lower mortality. Others use more general or indirect measures, making it harder to compare results. This is an example of why it is important to examine the tools and research designs in detail when assessing and comparing study findings.

Among the studies selected, Ziebe et al. (2025) provide relatively strong empirical support for the association between higher biosecurity compliance and improved performance indicators such as average daily gain (ADG), feed conversion ratio (FCR), and reduced mortality. Their results quantify production-related outcomes directly, making the link between biosecurity and performance more explicit than in other studies.

In contrast, Tanquilut et al. (2020) focused mainly on quantifying the level of biosecurity compliance on farms, without directly quantifying the production efficiency outcomes. This precludes direct comparison with productivity indicators, but their study is still important because it establishes baseline compliance levels necessary to identify gaps in management practices and potential areas for improvement.

Further to this, Tilli et al. (2024) find that the biosecurity-performance link may not always be a direct one but an indirect one via disease reduction and, finally, improved productivity. For instance, reducing the incidence of colibacillosis through improved biosecurity practices can help lower mortality and carcass condemnation rates, thereby improving overall production efficiency and economic returns. This suggests that biosecurity is a direct and indirect driver of flock performance.

When comparing across studies, it becomes evident that management practices are not consistently measured using the same performance frameworks. While Ziebe et al. (2025) integrate biosecurity with measurable production outcomes, other studies, such as Tanquilut et al. (2020), primarily focus on descriptive assessments of farm practices. This difference limits direct cross-study comparisons but highlights a broader gap in the literature regarding standardized evaluation of management practices.

Similarly, although management practices are compared, it is evident that the same performance frameworks are not consistently used to measure them. Ziebe et al. (2025) link biosecurity to measurable production indicators, whereas other studies, such as Tanquilut et al. (2020), focus on descriptive assessments of farm practices. This difference limits the ability to make direct comparisons across studies, but points to a wider gap within the literature on the standardized assessment of management practices.

Management practices are also recognized as important determinants of broiler performance, but are not always quantified alongside productivity metrics such as FCR, ADG, or mortality within a unified analytical framework. Current research, including Amin et al. (2025), provides descriptions of management practices but does not systematically connect these practices to quantifiable production results. This emphasizes the need for more integrated research designs that combine management assessment and performance evaluation to better understand causal relationships in broiler production systems. We are aware of the importance of factors that influence broiler performance, but they are not always analyzed alongside productive parameters such as FCR, ADG, and mortality, nor are they analyzed using a common analytical approach. For example, current management practices are described in studies such as Amin et al. (2025), but these practices are not always linked with quantifiable production outcomes. This suggests the need to develop more integrated research approaches that combine management assessment with performance evaluation to better understand causal relationships in broiler production systems.

5. Conclusion

This review shows that biosecurity rules and good management practices are generally associated with better broiler production, especially in average daily gain (ADG), feed conversion ratio (FCR) and mortality rates. This is supported by studies such as Ziebe et al. (2025) and Tanquilut et al. (2020), which used biosecurity scoring systems to demonstrate a strong link between higher biosecurity and better production outcomes. In addition, other studies have shown that nutrition, stocking density, housing, environmental control and health monitoring all contribute to influencing broiler productivity and flock welfare.

But the degree to which management practices are associated with performance measures varies across studies due to differences in design, methods, and measurement. Some studies describe biosecurity and farm management, but do not directly link them to measurable production outcomes. This highlights the need for more standardized, integrated research to study management, biosecurity, and productivity within a single framework.

Future studies are needed to integrate multiple fields to better understand the impact of biosecurity and management practices on broiler performance, both individually and in combination. These approaches will help develop more complete, evidence-based management strategies that support productivity, animal welfare, disease prevention, and sustainability in broiler production.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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