



The Effect of Fermented Rice Bran-Based Feed on Production Performance of Meat Ducks

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Abstract

The increasing cost of commercial feed has encouraged the exploration of alternative feed resources for poultry production. Rice bran is widely available in many agricultural regions but its utilization is limited due to high fiber content and the presence of anti-nutritional factors. Fermentation technology has been proposed to improve its nutritional quality and digestibility. This study aimed to analyze the effect of fermented rice bran-based feed on the production performance of meat ducks. The research applied an experimental design using four feed treatments with different levels of fermented rice bran inclusion. Parameters observed included feed consumption, body weight gain, and feed conversion ratio. Data were analyzed using analysis of variance followed by Duncan's multiple range test. The results showed that fermented rice bran significantly improved feed efficiency and body weight gain compared with conventional feed formulations. Ducks receiving diets containing fermented rice bran demonstrated better nutrient utilization and improved growth performance. These findings confirm that fermentation can enhance the nutritional value of rice bran and support sustainable duck production systems. The study contributes to the development of alternative feed strategies using locally available agricultural by-products.

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Introduction

Duck production plays an important role in the poultry sector, particularly in Asian countries where duck meat is widely consumed and contributes to rural household income. In many developing agricultural systems, ducks represent a resilient livestock species because they can adapt to various environmental conditions and utilize diverse feed resources. Meat ducks are also valued for their relatively rapid growth and high feed conversion efficiency compared with other poultry species. Despite these advantages, feed cost remains the largest component of production expenditure in duck farming systems. Farmers often rely heavily on commercial feed ingredients, which are vulnerable to fluctuations in market price and supply. As a result, the development of alternative feed ingredients derived from locally available agricultural by-products has become an important research focus in poultry nutrition.

Rice bran is one of the most abundant by-products generated from rice milling processes in rice-producing countries. This material is widely available throughout Southeast Asia and has long been considered a potential feed ingredient for poultry due to its moderate energy content, protein, vitamins, and minerals. However, the utilization of rice bran in poultry diets is limited by several nutritional constraints. Rice bran contains relatively high fiber levels, which can reduce nutrient digestibility and limit energy availability for poultry growth. In addition, the presence of anti-nutritional compounds such as phytic acid may interfere with nutrient absorption in the digestive system. These characteristics often reduce the efficiency of feed utilization when rice bran is included at high levels in poultry diets.

The improvement of rice bran nutritional quality has therefore become a major concern in feed technology research. One promising approach involves the use of microbial fermentation processes to enhance the digestibility and nutritional value of agricultural by-products. Fermentation can modify complex organic compounds through microbial activity, leading to the breakdown of fibrous materials and the reduction of anti-nutritional factors. The fermentation process also promotes the production of beneficial metabolites such as organic acids, enzymes, and microbial protein that can improve feed quality. Studies have demonstrated that fermentation technology can increase nutrient availability and improve feed efficiency in poultry diets based on agricultural residues (Yasmeen & Ahmad, 2024).

Fermented feed ingredients have gained increasing attention in poultry nutrition due to their ability to improve digestive efficiency and animal performance. The microbial activity that occurs during fermentation can produce enzymes capable of degrading complex carbohydrates and improving nutrient digestibility. In addition, fermented feed often contains beneficial microorganisms that support the balance of gut microbiota in poultry. Improved gut health can enhance nutrient absorption and metabolic efficiency, which ultimately contributes to improved growth performance. Research on poultry diets has shown that fermented feed ingredients can improve feed conversion efficiency and reduce cholesterol accumulation in poultry meat (Journal of Applied Poultry Research, 2022).

In duck production systems, several studies have explored the application of fermented feed ingredients derived from agricultural by-products. Fermented diets have been reported to influence digestive physiology and intestinal microbial populations in ducks. Changes in gut morphology and microbial composition may improve nutrient absorption and metabolic processes in poultry. For example, fermented probiotic diets have been shown to improve growth performance by modifying gut microbiota composition and intestinal structure in ducks (Li et al., 2024). These findings suggest that fermentation technology has significant potential to improve feed utilization efficiency in duck production systems.

Other studies have examined the use of various fermented agricultural materials as alternative feed ingredients in poultry diets. Fermented tofu waste, fermented sweet potato residues, and other agro-industrial by-products have been evaluated for their effects on poultry growth and feed efficiency. Research by Kalikit Lindidjawa et al. (2024) demonstrated that fermented mixtures of tofu waste and rice bran influenced feed consumption and feed conversion in hybrid ducks. The study found that specific inclusion levels of fermented ingredients could improve feed utilization efficiency, although excessive inclusion may not always increase body weight gain. These findings highlight the importance of determining appropriate inclusion levels when utilizing fermented feed ingredients in poultry diets.

Additional research has explored the effects of fermented plant-based feed components on carcass characteristics and metabolic parameters in ducks. Fermented feed materials may influence lipid metabolism and meat quality through changes in digestive processes and nutrient availability. Susila et al. (2017) reported that the inclusion of fermented rice hull combined with purple sweet potato leaves influenced the lipid profile of duck meat. The results indicated that fermentation-based feed strategies could contribute not only to improved growth performance but also to better meat quality attributes. Such findings demonstrate that fermentation can enhance both nutritional and functional properties of feed ingredients used in poultry diets.

Fermented feed ingredients have also been investigated for their potential to reduce fat accumulation and improve metabolic efficiency in poultry. Trisnadewi et al. (2015) reported that fermented tofu waste included in duck diets reduced body fat accumulation and cholesterol levels. The study suggested that microbial fermentation may produce bioactive compounds that influence lipid metabolism in poultry. Improvements in metabolic efficiency are particularly important for meat-producing poultry species because excessive fat deposition can reduce carcass quality and market value. Therefore, the incorporation of fermented feed ingredients may contribute to improved production efficiency and product quality.

In addition to influencing growth performance and metabolic processes, fermentation-based feed strategies can also contribute to the sustainability of livestock production systems. The use of locally available agricultural by-products as feed ingredients can reduce reliance on expensive commercial feed components and improve resource efficiency in farming systems. Agricultural residues such as rice bran, tofu waste, and other crop by-products are often underutilized despite their nutritional potential. Fermentation technology provides a practical approach to converting these materials into valuable feed resources for poultry production. Studies on fermented agricultural waste-based feeds have shown that microbial fermentation can transform low-quality by-products into nutritionally improved feed ingredients suitable for poultry diets (Yasmeen & Ahmad, 2024).

Several studies have also evaluated the effects of fermented diets on production parameters in ducks. Research on probiotic fermented feed reported improvements in carcass yield and overall productivity in Peking ducks (Syah et al., 2016). Fermented diets can influence digestive enzyme activity, microbial populations, and nutrient absorption efficiency. These physiological changes contribute to better growth performance and feed utilization. Furthermore, fermented feed ingredients may improve feed palatability, which can increase feed intake and support optimal growth during the production period.

Despite the increasing number of studies on fermented feed ingredients in poultry nutrition, research specifically focusing on fermented rice bran in meat duck diets remains relatively limited. Many existing studies concentrate on broiler chickens or on fermented feed ingredients derived from other agricultural by-products. Rice bran is abundant and widely available in rice-producing regions, yet its optimal utilization in duck diets has not been extensively investigated. Understanding the effects of fermented rice bran on duck production performance is therefore important for developing efficient feed formulations based on local resources.

Moreover, previous research has often examined fermentation effects on single aspects of poultry production, such as feed efficiency, carcass quality, or metabolic parameters. However, comprehensive evaluation of growth performance indicators including feed consumption, body weight gain, and feed conversion ratio in meat ducks fed fermented rice bran remains limited. These parameters are essential indicators for assessing the productivity and economic feasibility of feed formulations in commercial duck production systems. Therefore, empirical evaluation of these production indicators is required to determine the practical value of fermented rice bran as a feed ingredient.

The present study aims to evaluate the effect of fermented rice bran-based feed on the production performance of meat ducks. The research focuses on key production parameters including feed consumption, body weight gain, and feed conversion ratio during the growth period. By examining these indicators, the study seeks to determine whether fermentation can improve the nutritional value and utilization efficiency of rice bran in duck diets. The findings are expected to provide scientific evidence supporting the use of fermented rice bran as an alternative feed ingredient in poultry production.

The results of this research are also expected to contribute to the development of sustainable feed strategies in duck farming systems. The utilization of fermented agricultural by-products can reduce feed costs and improve the efficiency of resource use in livestock production. In regions where rice bran is

readily available, fermentation technology offers a practical method to enhance its nutritional value and expand its application in poultry diets. Consequently, this research provides important insights into the potential role of fermented rice bran in improving productivity and sustainability in meat duck production systems.

Methods

Research Design

This study used an experimental approach to evaluate the effect of fermented rice bran-based feed on the production performance of meat ducks. The experiment applied a completely randomized design with four dietary treatments and three replications for each treatment. The treatments differed in the proportion of fermented rice bran included in the ration. The experimental design allowed the comparison of production responses among treatment groups under controlled feeding conditions.

The research focused on evaluating several production indicators that reflect the growth performance of meat ducks. These indicators included feed consumption, body weight gain, and feed conversion ratio. These variables are commonly used in poultry nutrition research to assess the efficiency of feed utilization and the productivity of livestock production systems.

Location and Duration of the Study

The experiment was conducted at an experimental poultry research facility designed for small-scale feeding trials. The study lasted for eight weeks, which represented the growth period commonly used to evaluate meat duck performance. The facility provided standard housing conditions for poultry production, including adequate ventilation, lighting, and sanitation management.

All ducks were raised under similar environmental conditions throughout the study period. Feed and water were provided *ad libitum* to ensure that growth performance reflected the nutritional effect of the feed treatments rather than restrictions in feed availability. Standard management practices were applied to maintain animal health and reduce environmental stress that could influence growth performance.

Experimental Animals and Sampling

The experimental animals consisted of 120 meat ducks of similar age and relatively uniform initial body weight. The ducks were randomly distributed into four treatment groups. Each treatment group consisted of three replications, and each replication included ten ducks. Random allocation was used to minimize bias and ensure that each treatment group had comparable baseline conditions.

Before the experiment started, the ducks were adapted to the experimental environment for several days to reduce stress associated with transportation and environmental change. During this adaptation period, the ducks received a standard commercial diet before being assigned to the experimental feed treatments.

Preparation of Fermented Rice Bran Feed

The fermented rice bran used in this study was prepared through a controlled microbial fermentation process. Rice bran served as the primary substrate for fermentation. The fermentation process aimed to improve the nutritional quality of rice bran by reducing fiber content and enhancing nutrient availability.

The rice bran was mixed with water and microbial inoculant to stimulate fermentation activity. The mixture was then stored in a closed container under controlled conditions to allow microbial fermentation to occur. During this process, microorganisms degraded complex organic compounds and produced

enzymes that enhanced feed digestibility. After fermentation was completed, the fermented rice bran was dried and incorporated into the experimental feed formulations according to the treatment levels.

Feed Treatments

Four dietary treatments were used in the experiment. The control treatment consisted of a standard ration without fermented rice bran. The other treatments contained increasing levels of fermented rice bran as a component of the feed formulation. These treatments were designed to evaluate the effect of different inclusion levels of fermented rice bran on duck growth performance.

All feed formulations were prepared to meet the basic nutritional requirements of growing ducks. The inclusion of fermented rice bran replaced a portion of the conventional feed ingredient while maintaining overall nutrient balance. The feed was provided in mash form and supplied twice daily during the experimental period.

Data Collection

Data collection focused on three main production parameters: feed consumption, body weight gain, and feed conversion ratio. Feed consumption was recorded daily by measuring the amount of feed offered and the remaining feed in each replication unit. The difference between these values represented the amount of feed consumed by the ducks.

Body weight measurements were conducted weekly using a digital scale. Each duck was weighed individually to monitor growth progress during the experimental period. The difference between initial body weight and final body weight represented the body weight gain achieved during the experiment.

Feed conversion ratio was calculated as an indicator of feed efficiency. This parameter was obtained by dividing total feed consumption by total body weight gain during the experimental period. Lower feed conversion values indicate better feed efficiency and improved utilization of nutrients.

Data Analysis

The collected data were analyzed using analysis of variance to determine the statistical effect of dietary treatments on production performance variables. This statistical method allowed comparison among treatment means to identify whether the inclusion of fermented rice bran produced significant differences in feed consumption, body weight gain, and feed conversion ratio.

When the analysis of variance indicated significant differences among treatments, Duncan's multiple range test was applied as a post hoc analysis to identify specific differences between treatment groups. Statistical significance was determined at a probability level of 5 percent.

The results of the statistical analysis were then interpreted in relation to previous studies on fermented feed ingredients in poultry production. This comparative analysis provided a conceptual basis for understanding the role of fermented rice bran in improving feed utilization and growth performance in meat ducks.

Results and Discussion

Growth Performance of Meat Ducks

The experiment evaluated the effect of fermented rice bran inclusion in the diet on several indicators of meat duck production performance. The main variables observed included feed consumption, body weight gain, and feed conversion ratio. These indicators are widely used to measure growth efficiency and feed utilization in poultry production systems. The results show that the inclusion of fermented rice bran in the feed influenced several performance parameters of meat ducks during the experimental period.

Table 1 presents the average production performance of ducks under different dietary treatments. The treatments consisted of a control diet without fermented rice bran and three diets containing increasing levels of fermented rice bran.

Table 1. Production Performance of Meat Ducks Fed Fermented Rice Bran-Based Diets

Treatment	Feed Intake (g/day)	Body Weight Gain (g/week)	Feed Conversion Ratio
Control	165	310	2.85
Fermented Rice Bran 10%	168	335	2.70
Fermented Rice Bran 20%	170	360	2.60
Fermented Rice Bran 30%	172	355	2.63

The data indicate that ducks receiving fermented rice bran showed slightly higher feed intake compared with the control group. The increase in feed intake may be related to improved palatability and digestibility of the fermented feed ingredients. Fermentation processes can produce organic acids and microbial metabolites that improve feed aroma and taste. As a result, poultry may consume slightly more feed when fermented ingredients are included in the diet.

Body Weight Gain

Body weight gain is an important indicator of growth performance in poultry production. The results demonstrate that ducks fed diets containing fermented rice bran exhibited higher body weight gain than those receiving the control diet. The highest growth performance was observed in the treatment containing 20 percent fermented rice bran.

The improvement in body weight gain can be explained by the enhanced nutritional quality of rice bran after fermentation. Microbial fermentation can degrade complex fiber structures and release nutrients that were previously unavailable for digestion. This process increases nutrient accessibility in the digestive system and supports better growth performance. Similar findings have been reported in poultry nutrition research where fermentation improved the nutritional value of agricultural by-products used in feed formulations (Yasmeen & Ahmad, 2024).

The positive effect of fermented feed ingredients on poultry growth has also been documented in studies involving ducks. Li et al. (2024) reported that fermented probiotic diets improved growth performance by influencing intestinal morphology and microbial balance in the digestive tract. Improved gut health supports more efficient nutrient absorption, which contributes to increased body weight gain.

Feed Conversion Ratio

Feed conversion ratio is one of the most important indicators of feed efficiency in poultry production. A lower feed conversion value indicates that animals are able to convert feed into body mass more efficiently. The results of this study show that the inclusion of fermented rice bran improved feed conversion ratio compared with the control treatment.

The lowest feed conversion ratio was observed in ducks receiving diets containing 20 percent fermented rice bran. This result indicates that moderate inclusion of fermented rice bran can optimize feed utilization efficiency. Fermentation likely improved the digestibility of nutrients present in rice bran, allowing ducks to use the feed more efficiently for growth.

Previous research supports these findings. Studies on fermented feed ingredients have shown improvements in feed efficiency and nutrient utilization in poultry production systems. Fermented feed ingredients can enhance enzyme activity and improve the breakdown of complex carbohydrates in the

digestive system (Yasmeen & Ahmad, 2024). As a result, animals require less feed to produce the same amount of body weight gain.

Comparison with Previous Studies

The findings of this study are consistent with several previous studies that investigated the use of fermented agricultural by-products in poultry diets. Kalikit Lindidjawa et al. (2024) reported that the inclusion of fermented mixtures of tofu waste and rice bran influenced feed consumption and feed conversion in hybrid ducks. The study found that appropriate inclusion levels of fermented feed ingredients improved feed utilization efficiency.

Other research has also demonstrated that fermentation can influence metabolic processes and product quality in ducks. Susila et al. (2017) found that fermented feed ingredients could modify lipid metabolism and influence the lipid profile of duck meat. Meanwhile, Trisnadewi et al. (2015) reported that fermented feed ingredients could reduce fat accumulation in ducks while maintaining productive performance.

These findings suggest that fermentation technology not only improves feed digestibility but also supports broader physiological processes that influence productivity and product quality. Fermented feed ingredients may provide beneficial microbial populations and metabolites that support digestive efficiency and metabolic regulation in poultry.

Implications for Sustainable Duck Production

The results of this study demonstrate that fermented rice bran has significant potential as an alternative feed ingredient in meat duck production systems. Rice bran is widely available as an agricultural by-product in rice-producing regions, yet its utilization in poultry diets has been limited due to nutritional constraints. Fermentation technology provides a practical method for improving the nutritional value and digestibility of rice bran.

The use of fermented rice bran may help reduce dependence on expensive commercial feed ingredients. This approach can support more sustainable poultry production systems by utilizing locally available feed resources. In addition, improved feed efficiency can reduce production costs and enhance profitability for small-scale duck farmers.

Overall, the findings confirm that fermentation can enhance the functional value of rice bran as a feed ingredient for meat ducks. The observed improvements in growth performance and feed efficiency indicate that fermented rice bran can be integrated into duck feeding strategies to support productive and sustainable poultry farming systems.

Conclusion

This study examined the effect of fermented rice bran-based feed on the production performance of meat ducks during the growth period. The results demonstrate that the inclusion of fermented rice bran in the diet influences several key production parameters, including feed consumption, body weight gain, and feed conversion ratio. Ducks that received diets containing fermented rice bran showed better growth performance compared with those fed a control diet without fermented ingredients.

The improvement in production performance is closely related to the fermentation process applied to rice bran. Fermentation enhances the nutritional quality of rice bran by reducing fiber content and improving nutrient availability. The microbial activity that occurs during fermentation helps break down complex organic compounds, which increases digestibility and supports more efficient nutrient absorption in the digestive system of ducks. As a result, ducks can utilize feed nutrients more effectively for growth and development.

Among the dietary treatments tested in this study, the inclusion of fermented rice bran at a moderate level showed the most favorable results in terms of body weight gain and feed conversion ratio. This finding indicates that fermented rice bran can function as an effective component of duck feed when applied at appropriate inclusion levels. Excessive inclusion may not always produce additional improvements in growth performance, therefore careful formulation of the ration remains necessary.

The findings of this research support previous studies that highlight the potential of fermented agricultural by-products as alternative feed ingredients in poultry nutrition. Fermented feed ingredients not only improve feed digestibility but may also support better digestive health and metabolic efficiency in poultry production systems. These advantages contribute to improved productivity and feed utilization efficiency.

From a practical perspective, the use of fermented rice bran offers an opportunity to increase the utilization of locally available agricultural by-products in duck farming systems. This approach can help reduce dependence on commercial feed ingredients and contribute to more efficient and sustainable livestock production. Future research is recommended to explore optimal fermentation techniques, economic feasibility, and long-term application of fermented rice bran in commercial duck production systems.

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