

IMPACT OF MUSSEL SHELL AND HERBAL FERMENTATION-BASED FEED
ON GROWTH PERFORMANCE OF BROILER DUCKSNur Aini Mahmudah^{1*}, Hayathul Nufus¹, Rini Muji Astuti¹, Umi Julaikah¹, Nur Agustin Mardiana¹, Aditya Wirawantoro Putra¹, Panji Purnomo¹¹Department of Poultry Product Processing, State Community College of Putra Sang Fajar Blitar - IndonesiaCorresponding author: aini@akb.ac.id**Article history,**

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ABSTRACT

This study investigates the effects of alternative feed formulations comprising mussel shell powder and herbal fermentation additives (empon-empon) on the growth performance of broiler ducks. The research was conducted at Hayathul Farm, Blitar, Indonesia, employing 480 ducks divided into control and treatment groups. The treatment feed included a mixture of mussel shell powder and fermented empon-empon, while the control group was fed a standard commercial diet. Results showed a significant increase in the average body weight of the treatment group, with a 16.8% improvement compared to the control. These findings demonstrate the potential of local feed resources to enhance growth performance while reducing feed costs, providing a sustainable solution for small-scale farmers.

1. Introduction

The increasing global demand for animal protein has positioned broiler ducks as a valuable resource in the poultry industry. Known for their adaptability and resilience, broiler ducks contribute significantly to the economy by serving as an efficient source of high-quality meat. Compared to other poultry, broiler ducks are favored for their robustness, disease resistance, and ability to thrive in diverse environmental conditions. In Indonesia, with its growing population and rising protein consumption, broiler ducks have become an integral part of the nation's food security strategy. In 2021, the duck population in Indonesia surpassed 58 million, emphasizing their economic and nutritional importance (Anonymous, 2022).

Broiler ducks also have a very good level of productivity (faster and higher production rate) so they are expected to be able to meet the demand for meat (Ali and Febrianti, 2009). Broiler ducks have advantages in size, relatively large body weight and rapid body weight gain. In order to have these advantages, the important thing that needs to be considered is the matter of feeding.

However, the intensive farming of broiler ducks is not without challenges. Feed costs represent up to 80% of total production expenses, largely driven by dependence on commercial feed (Allaily et al., 2017).

This reliance often limits the profitability of small-scale farmers, creating an urgent need for cost-effective and locally available feed alternatives. Exploring these alternatives is not just economically advantageous but also aligns with sustainable agricultural practices.

Among the potential alternatives, mussel shells (*Anadara granosa*) stand out due to their nutrient-rich profile. Mussel shell powder, containing 30-40% calcium and 2-3% protein, has been proven to enhance skeletal development and overall growth in poultry (Mahary, 2017). The use of mussel shells as a feed additive has been explored in various studies, highlighting their role in improving feed efficiency and reducing reliance on synthetic supplements (Jonsson & Elwinger, 2009).

Complementing this, fermented herbal additives, locally known as empon-empon, have gained recognition for their multifaceted benefits. These herbs, including turmeric (*Curcuma longa*), ginger (*Zingiber officinale*), and kencur (*Kaempferia galanga*), are rich in bioactive compounds with antioxidant, antimicrobial, and anti-inflammatory properties. Fermentation of these herbs enhances their efficacy by improving digestibility and bioavailability. Fermented empon-empon not only boosts immunity and gut health but also enhances

feed palatability, making it a promising addition to poultry diets (Bidura et al., 2016).

Integrating these two feed components—mussel shell powder and fermented empon-empon—offers a synergistic approach to address the nutritional needs of broiler ducks. This study aims to evaluate the impact of this alternative feed formulation on the growth performance of broiler ducks. By leveraging locally available resources, the research seeks to reduce feed costs while maintaining or enhancing production efficiency, ultimately benefiting small-scale farmers and promoting sustainable practices.

2. Research Materials and Methods

2.1. Experimental design

A total of 480 broiler ducks (Day-Old Ducks, DOD) were divided into two groups: a control group (P1) and a treatment group (P2). Each group consisted of 240 ducks housed in separate pens measuring 18 m x 5 m. The control group received a standard commercial feed, while the treatment group was fed a diet supplemented with mussel shell powder and fermented herbal (empon-empon).

2.2. Feed preparation

The feed for the treatment group was prepared as follows:

- Mussel shells were cleaned, dried, and ground. The grounded shells was mixed with other feed components at a concentration of 25 kg per batch.
- Fermented herbal (empon-empon): ingredients included ginger, turmeric, galangal, garlic, molasses, and EM4 (*Effective Microorganisms*

starter). These were blended (**Table 2**), mixed with water, and fermented for seven days. The fermentation product was added to the feed as a wetting agent at a ratio of 2.5 liters of fermented product to 10 liters of water.

2.3 Data collection

Body Weight Measurement: Ducks were weighed individually at the beginning (DOD stage) and at the end of the six-week period. The total feed consumed by each group was recorded.

3. Results and Discussion

3.1. Growth performance

The results showed that ducks in the treatment group (P2) had significantly higher body weights compared to the control group (P1). The total body weight for P2 was 482.4 kg, while P1 was 413 kg. This corresponds to an average body weight of 2.01 kg per duck for P2 and 1.72 kg for P1, as shown in **Table 1**.

The significant weight gain observed in P2 can be attributed to the high nutritional value of mussel shell powder, which is rich in calcium and protein, essential for bone development and muscle growth (Mahary, 2017). Additionally, the fermented empon-empon enhanced nutrient absorption and overall gut health, as supported by Bidura et al. (2016). Moreover, the synergistic effects of these feed components align with recent advancements in functional feeds, which prioritize animal health and productivity. The enhanced immune response observed in previous studies involving fermented herbal supplements suggests potential long-term benefits for disease resistance and overall flock health (Wijayanti et al., 2019).

Table 1. Moisture content of bread during storage

Parameter	Control (P1)	Treatment (P2)
Total Body Weight (kg)	413	482.4
Average Weight (kg)	1.72	2.01

Table 1. Feed composition

Feed Ingredient	Control (P1) (kg)	Treatment (P2) (kg)
Feed Concentrate	250	225
Rice Smooth-Bran (Kebi)	400	350
Kentucky Flour	550	475
Rice Bran (Bekatul)	75	63
Mussel Shell	-	25
Total Feed Weight	1275	1138

Note: The quantities listed are totals for four production cycles, covering one full rearing cycle.

The key to success in the rearing of broiler ducks lies in the amount and manner of feeding. Feeding management is an effort to maximize the use of feed for growth. The feed provided must be highly nutritious and support growth. The feed provided must be in accordance with the needs and on time to get maximum production (Irawan et al., 2022). The animal feed provided must meet the needs of animal feed substances (Lestariningsih, 2020).

The natural alternative feed used is empon-empon (herbal) fermentation. According to Jay et al. (2005), fermentation is a chemical change process, from complex compounds to simpler with the help of enzymes produced by microbes. Giving herbal fermentation to livestock has an impact on increasing appetite, livestock becomes healthier, and does not cause a non-pungent odor. In addition, there are other advantages, namely the occurrence of feed efficiency which has the impact of reducing production costs and increasing duck weight.

According to Wahju (2004) feed consumption is the most important aspect in the formation of body tissues so as to increase body weight gain. High feed consumption should be followed by high weight gain and vice versa. This happens if the food substances consumed can be absorbed properly in order to produce appropriate weight gain. This is related to the metabolic process that occurs in the body of livestock which is finally used for growth and production. The final body weight produced can affect the amount of income received by the farmer, because the final body weight will determine the sales results (Retnani et al., 2009).

3.2. Alternative fermented feed

The results demonstrate the efficacy of mussel shell powder and fermented herbal (empon-empon) in improving broiler duck performance (**Table 1**). Mussel shell powder, as a natural calcium source, supports structural integrity and meat quality. Calcium-rich diets have been extensively studied, and their role in skeletal health and enzymatic functions is well-documented (Jonsson & Elwinger, 2009).

Fermented empon-empon played a crucial role in enhancing gut health and feed efficiency. The fermentation process increases the bioavailability of herbal nutrients, enabling better absorption in the digestive tract (Bidura et al., 2016). This is further supported by Herlina et al. (2021), who found that fermented herbal feed additives significantly enhance poultry growth rates and immune responses.

The observed improvements in growth performance and feed efficiency highlight the complementary roles of mussel shell powder and fermented empon-empon. Mussel shell powder, as a calcium source, supports bone mineralization and structural integrity, essential for optimal weight gain. Calcium's role in enzymatic functions and muscle contraction further underscores its importance in poultry nutrition (Jonsson & Elwinger, 2009).

The fermentation process of herbal (empon-empon) enhances the bioavailability of nutrients, promoting better digestion and absorption. Herbal components like turmeric and ginger, rich in bioactive compounds, provide antioxidant and anti-inflammatory benefits that improve gut health and metabolic efficiency (Bidura et al., 2016; Herlina et al., 2021). These properties likely contributed to the superior feed conversion ratio observed in the treatment group. According to Rositawati et al. (2010), the addition of turmeric flour within feed also provides the best response to body weight gain and increases duck feed conversion.

The observed weight gain and improved feed efficiency underscore the potential of integrating natural and fermented feed components in broiler duck farming. However, further studies focusing on long-term health impacts and meat quality are warranted. Economic implications are particularly relevant. By integrating locally available materials like mussel shells and herbal plants, farmers can reduce dependency on expensive commercial feeds. This aligns with findings by Purnamasari et al. (2021), who demonstrated the cost-efficiency of alternative feed formulations.

Future studies should explore the scalability of these formulations in diverse farming settings. Long-term assessments of animal health, environmental impacts, and market acceptance will provide comprehensive insights into the viability of such sustainable practices.

4. Conclusion

Alternative feed comprising mussel shell powder and fermented herbal (empon-empon) significantly improves the growth performance of broiler ducks. The approach provides a cost-effective solution for enhancing productivity while reducing reliance on expensive commercial feeds. Further research should evaluate the long-term effects of this feed formulation on meat quality and duck health. Farmers are encouraged to adopt this feeding strategy to enhance profitability and sustainability in duck farming.

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