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Experimental Study on the Effect of Housing and Feed on Broiler Chicken Carcass Characteristic

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ABSTRACT

This study seeks to analyze the effects of different housing types and feed formulations on broiler chicken carcass weight. The experiment was conducted in a trial facility in Molalahu Village, Pulubala District, Gorontalo Regency, for 45 consecutive days between February and March 2025. A total of 192 two-week-old broiler chickens, including both males and females, were used as experimental animals. The study employed a completely randomized design (CRD) in a 2×6 factorial arrangement with four replications. The first factor was housing type, consisting of litter housing (A1) and slat housing (A2), while the second factor was feed combination with substitution of corn leaf meal and seaweed meal (B0–B5). The data were analyzed using analysis of variance (ANOVA), and significant effects were further examined using Duncan's Multiple Range Test. The results indicated that housing type did not have a significant effect (P>0.05) on broiler carcass weight, whereas feed type had a highly significant effect (P<0.01). The control treatment (B0) produced the highest carcass weight (1,218.04 g), whereas treatments with higher proportions of corn leaf meal and seaweed meal (B3 and B4) resulted in the lowest carcass weights. The reduction in carcass weight at certain feed levels was suspected to be caused by anti-nutritional compounds, such as saponins, flavonoids, and phlorotannins, which inhibit protein absorption and muscle tissue formation. No significant interaction was observed between housing and feed factors on carcass weight (P>0.05). These findings suggest that feed is the dominant factor influencing carcass weight, while housing type can be adjusted according to environmental conditions.

Keywords: broiler chicken, carcass, alternative feed

INTRODUCTION

Broiler chickens are one of the most essential poultry commodities in meeting Indonesia's demand for animal protein. Their advantages include rapid growth, tender meat, large body size with well-developed breast muscles, and high feed conversion efficiency, whereby a large portion of the feed is converted into meat within a relatively short rearing period of approximately 4–5 weeks. Furthermore, to achieve optimal productivity, broilers require effective management systems, particularly regarding housing conditions and appropriate feeding practices (Porimau et al., 2021).

The success of broiler chicken production is generally assessed using growth performance parameters, including mortality rate, feed intake, final body weight, feed conversion ratio (FCR), and performance index (PI). One of the key indicators in evaluating production performance is carcass quality, as it represents the economically valuable outcome of broiler rearing. Carcass quality is influenced by various factors, particularly the management system and the type of feed provided (Soeparno, 2005).

Environmental factors in poultry rearing, such as housing type, play a crucial role in determining growth efficiency and carcass quality. The chicken house serves as a place where broilers carry out their activities and production processes; therefore, comfort and housing design must be carefully managed to prevent stress that may reduce productivity (Porimau et al., 2021). Two housing systems commonly used by farmers are the slatted-floor and litter-floor systems. The slatted-floor system uses bamboo, wooden, or wire slats that improve air circulation, while the litter-floor system uses bedding materials such as sawdust, rice husks, or dried leaves, which are easier to prepare but have a higher potential for ammonia accumulation. These differing housing conditions can affect chicken comfort and feed intake, and ultimately influence carcass weight and quality.

In addition to housing conditions, feed is a critical component that determines carcass quality. Feed costs, which account for approximately 60–70% of total production expenses, make feed utilization efficiency a key factor in broiler production. The use of locally available feed ingredients, such as seaweed meal and corn leaf meal, aims to reduce production costs without compromising the nutritional quality of the feed. Seaweed contains essential nutrients, including protein, fiber, and minerals (Kartika & Mariani, 2021), while corn leaf meal provides relatively high crude protein and fiber that supports the digestive system of chickens (Mukhtar et al., 2023). The balanced nutrient composition of these two feed ingredients has the potential to enhance feed efficiency and promote muscle tissue development, thereby improving carcass weight and overall carcass quality in broiler chickens.

According to Mugiyono (2001), the growth rate and final body weight of broiler chickens are closely related to carcass weight, non-carcass components, and body fat content. Meanwhile, Soeparno (2005) emphasized that excess energy derived from fat is stored in subcutaneous tissue and the abdominal cavity, where a high level of abdominal fat can reduce carcass percentage because the surplus energy is not converted into meat. Therefore, maintaining a proper balance between dietary energy and protein intake, along with optimal rearing conditions, is essential for producing high-quality carcasses.

Based on the aforementioned background, this study was conducted to analyze the carcass characteristics of broiler chickens reared under different housing types and feed formulations, particularly those incorporating seaweed meal and corn leaf meal as local feed ingredients. The findings of this study are expected to contribute to improving production efficiency and carcass quality in broiler chickens by applying appropriate housing and feeding management strategies.

MATERIALS & METHODS

Time and Location of the Study

This study was conducted in an experimental poultry facility located in Molalahu Village, Pulubala Subdistrict, Gorontalo Regency. The research was carried out over a 45-day period, from February to March 2025. The study site was selected for its environmental conditions, which were suitable for broiler rearing, and for the availability of alternative feed ingredients used in the experiment.

Experimental design

This study employed a Completely Randomized Design (CRD) with a 2 × 6 factorial arrangement and four replications. The first factor (A) was the type of housing, consisting:

- A1: Slatted-floor housing

- A2: Litter-floor housing

The second factor (B) was the feed substitution using corn leaf meal and seaweed meal, consisting of six levels as follows:

- B0: Commercial feed
- B1: 10% corn leaf meal
- B2: 10% seaweed meal
- B3: 5% corn leaf meal + 15% seaweed meal
- B4: 10% corn leaf meal + 10% seaweed meal
- B5: 15% corn leaf meal + 5% seaweed meal

Each treatment combination was replicated four times, with four chickens per experimental unit, yielding a total of 192 broilers in the study, as shown in Table 1.

Table 1. Treatment Combinations

Treatment	B1	B2	B3	B4	B5
A1	A1B1	A1B2	A1B3	A1B4	A1B5
A2	A2B1	A2B2	A2B3	A2B4	A2B5

Notes: A1–A2 = Housing types
B1–B5 = Feed substitution treatments

Preparation of Seaweed Corn Leaf Meal

The preparation of seaweed meal followed the method adapted from Agusman et al. (2014). *Eucheuma cottonii* seaweed obtained from local fishermen was thoroughly washed, finely chopped, and dried in the sun or in a mechanical dryer for approximately 10 hours until the moisture content was below 10%. The dried seaweed was then ground into powder and sieved to obtain consistently fine particles.

The preparation of corn leaf meal followed the procedure described by Mukhtar et al. (2022). Young corn leaves, approximately 45 days old, were collected from farmers in the study area, chopped into 1–3 cm pieces, dried in the sun, ground into a powder, and sieved to separate coarse particles.

Broiler Rearing Procedure

Prior to the arrival of the chickens, the housing units were cleaned and disinfected. The litter-floor cages were prepared with rice husk bedding, while the slatted-floor cages used bamboo slats. Each pen was labeled according to the assigned treatment and replication. Feed was provided twice daily at 08:00 and 16:00 Central Indonesia Time (WITA), adjusted to meet the broilers' daily requirements, while drinking water was supplied *ad libitum*. Lighting was provided using 50-watt fluorescent lamps operated for 12 hours per day to support optimal growth.

Feed Composition and Nutrient Content

The composition of feed ingredients and nutrient content for each treatment is presented in Table 2.

Table 2. Feed Ingredient Composition and Nutrient Content of Each Treatment

Feed Ingredient	P0	P1	P2	P3	P4	P5
Corn leaf meal (%)	0	10	0	5	10	15
Seaweed meal (%)	0	0	10	15	10	5
BR-1 (%)	100	90	90	85	85	80
Total (%)	100	100	100	100	100	100
EM (kkal/kg)	3125	2848	3098	2946	2821	2696
Crude protein (%)	21.00	20.27	19.16	17.88	18.43	18.99
Crude fat (%)	5.00	4.99	4.54	4.30	4.53	4.75
Crude fiber (%)	5.00	7.28	4.59	5.53	6.87	8.22
Calcium (%)	1.00	0.90	1.05	1.03	0.95	0.88
Phosphorus (%)	0.50	0.48	0.48	0.46	0.46	

Rearing Procedure

Before housing the chickens, the pens were cleaned and disinfected. The litter-floor cages used rice husks as bedding, while the slatted-floor cages used bamboo flooring. Each cage unit was labeled according to its treatment and replication. Feed was provided twice daily, at 08:00 and 16:00 Central Indonesia Time (WITA), while clean well water was supplied *ad libitum* for drinking. Illumination was provided by 50-watt incandescent lamps operated for 12 hours per day. Ambient temperature and humidity were recorded daily to maintain optimal environmental conditions throughout the experimental period.

Research Variable

The primary variable observed in this study was the carcass weight of broiler chickens. Carcasses were obtained after slaughter by removing the blood, viscera, feathers, head, neck, and lower legs. Carcass weight was measured after separating the commercial body parts, as described by Massolo et al. (2016). The observation of carcass weight aimed to determine the effects of housing type and feed substitution on broiler chicken carcass quality.

Data Analysis

The collected data were statistically analyzed using a Completely Randomized Design (CRD) with a 2×6 factorial arrangement, as specified in the predetermined experimental design. The mathematical model applied was as follows:

$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk}$

Details:

Y_{ijk} = the effect of factor A at the i-th level, factor B at the j-th level, and the k-th replication

μ = the overall mean

α_i = the effect of factor A at the i-th level.

β_j = the effect of factor B at the j-th level

$(\alpha\beta)_{ij}$ = the interaction effect between factor A and factor B.

ε_{ijk} = the effect of factor A at the i-th level, factor B at the j-th level, and the k-th replication.

When a significant effect was detected, further comparisons were conducted using Duncan's Multiple Range Test (DMRT), following the statistical procedures described by Sastrosupadi (2013).

RESULT & DISCUSSION

Carcass Weight Observation Result

Live weight is a critical parameter that strongly influences the carcass weight of broiler chickens. Physiologically, the higher the live weight, the greater the proportion of muscle tissue contributing to carcass formation (Subekti et al., 2012). This relationship is supported by Haroen (2003) and Nahashon et al. (2005), who reported that an increase in live weight is positively correlated with carcass weight, as efficient feed conversion enhances muscle tissue deposition. Therefore, analyzing live weight in broiler chickens provides an essential foundation for understanding final carcass production outcomes across different housing types and feed substitution treatments.

Table 3. Average Live Weight of Broiler Chickens under Different Housing Systems and Feed Treatments

Housing System	Feed Treatment	Mean ± Std
	B0	**B1**
A1 (Litter)	1803.75 ± 249.82	1502.02 ± 184.93
A2 (Slat)	1802.65 ± 110.45	1640.98 ± 50.97
Mean ± Std	1803.20 ± 178.82	1571.50 ± 145.90

Details: A1 = Litter housing; A2 = Slat housing; B0 = Commercial concentrate feed; B1 = corn leaf meal; 10%; B2 = seaweed meal; 10%; B3 = corn leaf meal; 5% + seaweed meal; 15%; B4 = corn leaf meal; 10% + seaweed meal; 10%; B5 = corn leaf meal; 15% + seaweed meal; 10%.

Factor A Analysis (Type of Housing)

The analysis of variance indicated that the type of housing system had no significant effect (P>0.05) on the live weight of broiler chickens. The average live weight in the litter housing (A1) was 1425.66 g/broiler, while that in the slat housing (A2) was 1479.08 g/broiler. Although the slat housing system showed a slightly higher numerical value, the difference was not statistically significant.

This finding can be attributed to microclimatic factors within the housing environment, such as temperature and humidity. The slat housing system provides better air circulation due to its perforated flooring, allowing heat and ammonia gases to dissipate more effectively. In contrast, litter housing tends to retain higher humidity due to the accumulation of bedding material and feces, which can increase ammonia levels and induce heat stress in broilers (Budiarta et al., 2014). Similarly, Puspani et al. (2008) reported that broilers raised in slat-floor housing exhibited improved growth performance, likely due to more stable temperatures and enhanced ventilation that promote overall comfort and welfare.

Factor B Analysis (Type of Feed)

The analysis of variance indicated that feed type had a highly significant effect (P<0.01) on the live weight of broiler chickens. Variations in the composition of corn leaf meal and seaweed meal produced a significant influence on broiler growth performance.

Table 4. Mean Values of Duncan's Multiple Range Test for Factor B (Feed Treatments)

Factor B	Mean ± Std
B0	1803.20 ± 178.82^{f}
B1	1571.50 ± 145.90^{e}
B2	1375.69 ± 120.11^{c}
B3	1234.89 ± 119.80^{a}
B4	1301.93 ± 46.29^{b}
B5	1427.01 ± 92.15^{d}

Note: Means followed by the same letter are not significantly different.

The control treatment (B0) produced the highest live weight of 1803.20 g, whereas treatment B3 (containing 5% corn leaf meal and 15% seaweed meal) resulted in the lowest live weight of 1234.89 g. The descending order of mean live weight values was B0 > B1 > B5 > B2 > B4 > B3.

The decline in live weight with increasing proportions of alternative feed ingredients was attributed to the presence of anti-nutritional compounds. Seaweed meal is known to contain natural salt (NaCl) levels ranging from 10% to 13% (Mahata et al., 2015), which exceed the optimal range for poultry feed (0.25–0.5%) (Berger, 2006). Excessive salt content reduces feed palatability, causes diarrhea, and increases water intake, ultimately lowering feed conversion efficiency (Dewi et al., 2018). In addition, phlorotannins in seaweed can bind to proteins and minerals, forming complexes that are difficult to digest (Moen et al., 1999).

Similarly, corn leaf meal (Zea mays L.) contains secondary metabolites, including saponins, flavonoids, and alkaloids (Pangemanan et al., 2020). Although these compounds have antioxidant properties, they may also act as anti-nutrients by inhibiting digestive enzymes such as protease and amylase (Harborne, 1987). Consequently, the availability of metabolizable energy decreases, leading to suboptimal muscle development. The combination of these two ingredients at higher proportions, particularly in treatments B3 and B4, significantly reduced live weight.

Interaction Analysis (Factor A × B)

The analysis of variance indicated that there was no significant interaction between cage type and feed type on the live weight of broiler chickens (P> 0.05). This finding suggests that both factors operated independently. The broilers' response to the type of feed was not influenced by the cage type, and vice versa.

Nevertheless, numerically, broilers reared in slatted cages exhibited slightly higher live weights compared to those in litter cages across most treatments. For instance, in treatment B0, the live weight of broilers in slatted cages was 1802.65 g, whereas those in litter cages reached 1803.75 g. This minor difference indicates that cage type did not affect the feed's effectiveness of the feed on broiler growth.

These results support previous findings that the primary factor determining broiler live weight is feed quality rather than cage type (Setiadi et al., 2013; Dewi et al., 2018). Therefore, optimizing feed formulation remains a key strategy for improving growth performance and production efficiency in broiler chickens.

Carcass Weight Observation

The effect of different cage types and feed formulations on broiler carcass weight is presented in Table 5. The data show variations in carcass weight resulting from the combination of treatments applied in both litter and slatted cage systems.

Table 5. Average Carcass Weight of Broilers Reared in Different Cage Types and Feed Treatments (grams)

Cage Type	Feed Treatment	Mean ± SD
	B0	**B1**
A1 (Litter)	1232.86 ±174.72	1009.61 ±106.44
A2 (Slat)	1203.21 ±73.82	1091.70 ±69.54
Mean ± SD	1218.04 ±125.18	1050.66 ±94.09

Details: A1 = Litter cage; A2 = Slatted cage; B0 = Commercial feed; B1 = 10% corn leaf meal; B2 = 10% seaweed meal; B3 = 5% corn leaf meal + 15% seaweed meal; B4 = 10% corn leaf meal + 10% seaweed meal; B5 = 15% corn leaf meal + 5% seaweed meal.

Table 6. Duncan's Multiple Range Test for Carcass Weight Based on Feed Treatments

Factor B	Mean ± SD (gram)
B0 (Control)	1218.04 ±125.18^{f}
B1 (10% corn leaf meal)	1050.66 ±94.09^{e}
B2 (10% seaweed meal)	882.81 ±70.47^{c}
B3 (5% corn leaf meal + 15% seaweed meal)	751.86 ±82.79^{a}
B4 (10% corn leaf meal + 10% seaweed meal)	817.06 ±57.26^{b}
B5 (15% corn leaf meal + 5% seaweed meal)	886.45 ±45.19^{d}

Details: Different superscript letters indicate significant differences among treatments (Duncan's test, P<0.05).

Effect of Cage Type on Carcass Weight (Factor A)

The analysis of variance showed that cage type had no significant effect on carcass weight (P>0.05) in broiler chickens. The average carcass weight in the litter cage was 921.27 grams, while that in the slatted cage was 947.68 grams. Although broilers raised in slatted cages exhibited numerically higher carcass weights, the difference was not statistically significant.

The absence of a significant effect can be attributed to similar microenvironmental conditions in both cage types, including temperature, humidity, and air circulation, that did not cause substantial physiological differences in chicken growth. According to Rasyaf (2012), environmental comfort plays a more critical role in determining poultry performance than the cage flooring type. If environmental conditions are well-regulated, the cage system, whether litter or slatted, has minimal influence on growth rate and muscle development.

Furthermore, Alwi et al. (2021) reported that the optimal temperature for broiler growth ranges between 25 and 29°C, as excessive heat or cold stress can reduce feed conversion efficiency. In this study, temperature was controlled using incandescent lamps and adequate ventilation, maintaining the broilers' thermal balance and minimizing potential differences caused by cage type.

Effect of Feed Type on Carcass Weight (Factor B)

The analysis of variance revealed that feed composition had a highly significant effect (P<0.01) on broiler chicken carcass weight. The mean values from Duncan's multiple range test for each feed treatment are presented in Table 6.

Treatment B0 (control) resulted in the highest carcass weight at 1218.04 grams, whereas B3 produced the lowest carcass weight at 751.86 grams. Overall, carcass weight tended to decrease as the proportion of alternative feed ingredients, such as corn leaf meal and seaweed meal, increased in the diet.

This reduction is closely related to decreased feed utilization efficiency and protein digestibility due to the presence of anti-nutritional compounds in these substitute ingredients. Dewi et al. (2018) explained that brown seaweed (*Phaeophyceae*) contains high salt (NaCl) levels and polyphenolic compounds such as phlorotannins, which can bind proteins and minerals to form complexes that are difficult to digest. As a result, muscle protein synthesis decreases, leading to lower carcass weights.

Meanwhile, Pangemanan et al. (2020) reported that corn leaves (Zea mays L.) contain saponins, flavonoids, and alkaloids, which at high concentrations act as anti-nutritional compounds. Saponins can bind cholesterol and proteins, interfere with the absorption of essential nutrients, and irritate the digestive tract, reducing digestive efficiency. Flavonoids are also known to inhibit protease enzyme activity, thereby decreasing the availability of amino acids for muscle tissue growth.

Therefore, as the level of corn leaf and seaweed substitution in the feed increases, the resulting carcass weight decreases. This finding aligns with Haroen (2003) and Nahashon et al. (2005), who reported that carcass weight is strongly influenced by live body weight; the greater the live weight, the higher the proportion of carcass produced. Additionally, Subekti et al. (2012) noted that carcass formation is affected by genetic factors, feed, age, sex, and abdominal fat content, while Setiadi et al. (2013) emphasized the importance of adequate protein intake in supporting carcass muscle development.

Interaction between Type of Housing and Feed (Factor A × B)

The analysis of variance indicated that the interaction between housing type and feed type had no significant effect on carcass weight (P>0.05) in broiler chickens. This suggests that the impact of feed was consistent across both housing types. The absence of a significant interaction suggests that the housing system (litter or slat) does not modify the nutritional effect of feed on growth and carcass formation.

Therefore, feed type is the dominant factor influencing carcass weight compared to housing type. This finding is supported by Wahyu and Chadijah (2017), who stated that feed nutrient composition, particularly the balance of energy and protein, contributes most substantially to muscle growth compared to environmental management factors.

Overall, this study demonstrates that the use of alternative feed ingredients, such as corn leaf meal and seaweed meal, should be limited to avoid reducing broiler production performance. High levels of anti-nutritional compounds and salt can decrease protein metabolism efficiency and muscle tissue formation, resulting in lower carcass weights. In contrast, differences in housing systems (litter versus slats) did not produce meaningful effects, indicating that both can be used effectively as long as environmental conditions and management practices are properly maintained.

CONCLUSION

The results of this study indicate that the type of housing (litter or slat) does not have a significant effect on broiler carcass weight (P>0.05), suggesting that both housing systems can be used effectively as long as environmental conditions are maintained optimally. In contrast, feed type has a highly significant effect on carcass weight ($P<0.01$). The control treatment (B0) produced the highest carcass weight, whereas high-level combinations of seaweed meal and corn leaf meal (B3 and B4) reduced carcass weight. This reduction is likely caused by anti-nutritional compounds such as phlorotannins, saponins, and flavonoids, which inhibit protein digestibility and the absorption of essential nutrients, thereby limiting muscle tissue growth.

Based on these findings, it is recommended that the inclusion of seaweed meal and corn leaf meal in feed formulations should not exceed 10% of the total ration to maintain feed efficiency and broiler carcass weight. Housing type can be selected according to environmental conditions and available facilities, provided that comfort and hygiene standards are met. Further research is required to explore processing methods for local feed ingredients, such as fermentation or reduction of anti-nutritional compounds, to optimize their potential without compromising broiler productivity or carcass quality.

Declaration by Authors

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