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Effects of Local Ingredient-Based Diets on Feed Intake, Egg Production, and Body Weight in Laying Hens

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Abstract
This study aimed to evaluate the efficiency of commercial feed compared with a non-concentrate formulated diet on the productivity of laying hens. The experiment was carried out for 14 days at PT Sitinrola Organik, Bone Regency, using 64 laying hens assigned to two treatments: P0 (commercial feed) and P1 (non-concentrate feed), with 32 replications each. The measured parameters included feed intake, body weight gain, and egg production percentage. The results showed that feed intake in the P1 group was significantly lower than in P0 ($p < 0.05$). Body weight gain did not differ significantly between treatments ($p > 0.05$), although a slight increase was observed in P1. In contrast, egg production percentage in P1 was markedly lower than in P0 ($p < 0.05$). The reduction in feed intake and egg production in P1 was likely related to the lower feed quality and palatability resulting from the absence of concentrate, as well as potential effects of feed storage. In conclusion, the non-concentrate diet was not able to fully replace commercial feed in supporting optimal laying hen productivity over the short experimental period.

INTRODUCTION

Laying hens are a strategic poultry commodity in providing animal protein for the Indonesian population. Egg production serves as one of the key indicators of success in layer farming, where feed efficiency plays a crucial role in determining production performance and business profitability. Egg production is a key factor in the poultry industry, with feed representing one of the largest cost components, accounting for approximately 60–70% of total production expenses. The limited supply and fluctuating prices of concentrate ingredients have driven the search for alternative non-concentrate feed formulations that are affordable and based on local resources, without compromising egg production performance (Maslami et al., 2023).

Commercial or concentrate feeds are commonly used because they are formulated with complete nutrient content tailored to the requirements of laying hens. However, the relatively high price of commercial feed and the dependency on manufacturers pose significant challenges, particularly for small- and medium-scale farmers. Therefore, the development of alternative feeds based on local ingredients without concentrates has been introduced as a solution to reduce production costs and promote feed self-sufficiency at the farmer level (Sutrisno et al., 2021). Adequate feed formulation involves not only nutrient composition but

also technical aspects such as ration form, texture, and feeding management, particularly in tropical regions where heat stress is a common challenge (Juni et al., 2025). In a practical context, recent studies utilizing alternative sources such as Distillers Dried Grains with Solubles (DDGS) have demonstrated the potential to improve laying hen productivity through non-concentrate formulations while still considering proper nutrient composition (Sudarisman et al., 2025).

The use of non-commercial rations compared with commercial controls has shown that certain non-commercial formulations result in lower feed conversion ratios (more efficient) and higher egg weights than the control, although variations depend on the nutritional balance of the diet (Fikgiannisa et al., 2025). The effect of non-concentrate formulations on egg productivity is therefore highly relevant. This approach not only offers an economical solution for farmers but also supports food security through the utilization of local ingredients, sustainable feed strategies, and the application of appropriate formulation technologies (Agustono et al., 2025).

However, previous studies have predominantly focused on partial substitution of concentrate ingredients or specific alternative feedstuffs, rather than evaluating fully formulated non-concentrate diets as complete feeding systems for laying hens. Moreover, quantitative comparisons between fully non-concentrate rations and commercial diets in terms of feed intake, body weight gain, and egg productivity remain limited. This lack of comprehensive evaluation represents a critical research gap, particularly in tropical production systems where feed cost efficiency and local resource utilization are essential.

Therefore, the novelty of this study lies in the evaluation of a fully formulated non-concentrate diet based on local ingredients as a complete alternative feeding strategy, directly compared with commercial feed under practical production conditions. This study provides integrated performance indicators including feed intake, body weight gain, and egg production to determine whether non-concentrate formulations can achieve comparable or superior efficiency to commercial diets.

Based on these conditions, this study was conducted to address a fundamental question: Can non-concentrate formulated feed provide production performance equal to or more efficient than commercial feed? The objective of this research was to evaluate the effect of non-concentrate feed on feed intake, body weight gain, and egg productivity of laying hens, thereby offering an alternative solution for farmers in selecting a more efficient and sustainable feeding system.

RESEARCH METHODS

This study was conducted at the laying hen facility of PT Sitinrola Organik, located in Kajaolaliddong Village, Barebbo District, Bone Regency, South Sulawesi, Indonesia. The experiment was carried out for 14 days in February 2025.

The experimental population consisted of 64 Isa Brown laying hens aged 32 weeks, representing the early peak production phase. The hens had relatively uniform body weight and production performance at the start of the experiment. Each hen was housed individually

in battery cages to facilitate accurate recording of feed intake, body weight, and egg production.

The study was arranged in a Completely Randomized Design (CRD) with two dietary treatments and 32 replications per treatment. The treatments were defined as follows:

P0 = Commercial diet containing incorporated concentrate

P1 = Locally formulated diet without added commercial concentrate

Both diets were provided in mash form to ensure uniform consumption and to minimize feed selection by the hens.

The P0 diet consisted of corn, rice bran, soybean meal, commercial concentrate, $CaCO_3$, grit, molasses, and feed additives (herbal mix, larvatox, and citrum). In contrast, the P1 diet was formulated from local ingredients, including corn, rice bran, soybean meal, fish meal, $CaCO_3$, grit, vegetable oil, molasses, and the same additives, without the inclusion of commercial concentrate.

To ensure comparability, both diets were formulated to meet the nutrient requirements of laying hens according to standard feeding guidelines. The approximate nutrient composition of the experimental diets is presented as follows:

Table 1. Nutrient Composition of Experimental

Nutrient	Composition Range
Crude protein (%)	16–17
Metabolizable energy (kcal/kg)	2,700–2,800
Crude fiber (%)	5–7
Calcium (%)	3.5–4.0
Available phosphorus (%)	0.40–0.45

Data were collected on three main parameters: feed intake (g/hen/day), body weight (kg/hen), and egg production (% hen-day production). Feed intake and egg production were recorded daily, while body weight was measured weekly throughout the experimental period.

Data were analyzed using an independent samples t-test to determine significant differences between treatments for each parameter, as the experiment was arranged in a Completely Randomized Design (CRD) with independent experimental units. Each replicate served as an independent observation. Statistical analyses were performed using Microsoft Excel and SPSS software, and differences were considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

Feed Intake

Feed intake refers to the amount of feed consumed by the animal within a specific period of time. The average feed intake was:

Table 2. Average feed intake during the experiment (g/hen/day)

Treatment	Mean
P0	110.06 ± 6.03
P1	96.57 ± 17.33

The average feed intake in the P0 treatment was 110.06 ± 6.03 g/hen/day, whereas in the P1 treatment it was 96.57 ± 17.33 g/hen/day. These values were calculated from total feed consumption over the 14-day experimental period. The t-test revealed a calculated t-value of 2.884 with a significance level of 0.013 ($p < 0.05$), indicating a significant difference in feed intake between treatments P0 and P1.

The higher feed intake observed in P0 suggests that the hens consumed more of this diet, possibly due to differences in palatability, texture, aroma, or nutrient density compared to the non-concentrate formulation (P1).

Nevertheless, feed intake should not be interpreted solely in terms of quantity but rather in relation to feed efficiency and production outcomes, including feed conversion ratio (FCR) and egg production. Differences in feed formulation, particularly energy density and protein balance, can influence voluntary intake as hens adjust their consumption to meet nutrient requirements (Juni et al., 2025). In the present study, the lower intake observed in the non-concentrate diet (P1) may indicate a higher nutrient density or improved nutrient utilization compared to the commercial diet.

Previous studies have reported that diets with lower metabolizable energy levels tend to increase average daily feed intake (ADFI) and FCR as birds consume more feed to meet their energy needs (Noetzold et al., 2023). This supports the interpretation that feed intake responses are closely linked to dietary energy balance rather than palatability alone. Furthermore, the use of locally available alternative ingredients in non-concentrate formulations has been shown to maintain productive performance while reducing reliance on commercial feed inputs, thereby improving economic efficiency and supporting sustainable poultry production systems (Ahmad et al., 2025).

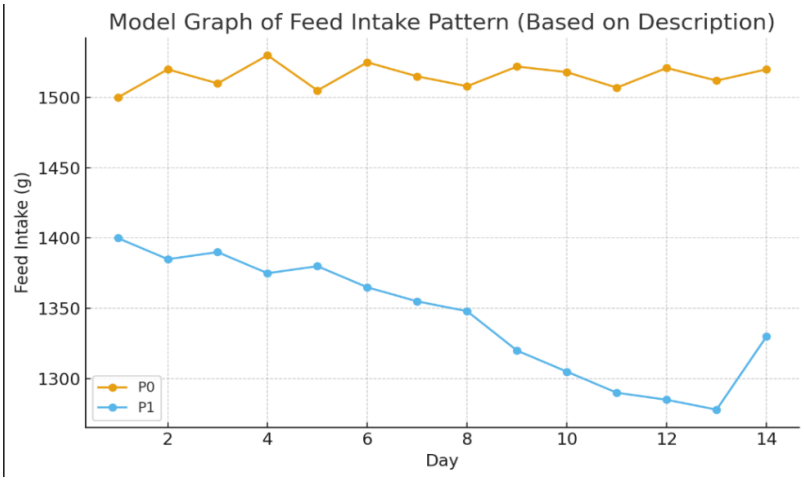

Figure 1. Feed intake of laying hens in the P0 (commercial diet with incorporated concentrate) and P1 (local-ingredient-based diet without concentrate) groups during the 14-day rearing period.

Based on the feed intake observations over the 14-day experimental period, the P0 treatment exhibited a relatively stable consumption pattern, with only minor fluctuations from day 1 to day 14. In contrast, hens in the P1 group showed a gradual decline in intake, particularly between days 9 and 13, followed by a slight increase on day 14. Overall, the average feed intake of the P1 group remained lower than that of the P0 group.

The lower feed intake observed in P1 may be associated with differences in diet composition, particularly the absence of commercial concentrate and variations in nutrient density. Diet palatability and physical characteristics, such as texture and particle size of locally sourced ingredients, may also influence voluntary intake. However, reduced feed intake does not necessarily lead to decreased production performance when feed conversion efficiency remains optimal, as improved nutrient utilization can allow hens to maintain productive output with lower feed consumption (de Verdal et al., 2025).

The decreased intake in the non-concentrate formulation may also be related to dietary energy density. Previous studies have reported that increasing metabolizable energy levels in the diet reduces daily feed intake, as hens regulate their energy balance through compensatory mechanisms (Alagawany et al., 2023). Conversely, when dietary energy density is lower, hens may increase feed intake to meet their energy requirements, although intake can be limited by gut capacity (Lemme et al., 2019). Variations in feed particle size and physical form have also been shown to influence intake rate and digestibility (Liu et al., 2022), which may contribute to the intake patterns observed in diets formulated from ground local ingredients.

Body Weight of Laying Hens

Body weight gain refers to the change in body weight, including the growth of internal organs, bones, and the development of muscle mass.

Table 2. Body Weight Gain of Laying Hens (kg)

Treatment	Mean
P0	1,7294 ± 0,04498
P1	1,7508 ± 0,06955

Based on the t-test results, the mean body weight of hens in the P0 treatment was 1.7294 ± 0.04498 kg, whereas in the P1 treatment it was 1.7508 ± 0.06955 kg. The analysis yielded a t-value of –1.938 with a significance level of $p = 0.059$. Since $p > 0.05$, it can be concluded that there was no statistically significant difference in body weight between hens fed the P0 and P1 diets.

The body weight trend over the 14-day observation period showed a slightly higher mean value in the P1 group compared to P0. However, this difference should be interpreted cautiously, as body weight changes in laying hens over a short experimental period are typically minimal, particularly during the production phase when body weight tends to be relatively stable. The limited duration of the study may therefore have constrained the detection of significant treatment effects.

The slightly higher body weight observed in P1 may be associated with differences in nutrient composition, particularly protein supply from local ingredients such as fish meal included in the formulation. Adequate dietary protein is essential for maintaining tissue integrity and physiological condition during the laying period, as nutrient balance plays a critical role in sustaining productive performance. These findings suggest that non-concentrate diets formulated with balanced energy and protein levels can maintain body weight comparable to commercial diets, without negatively affecting hen condition.

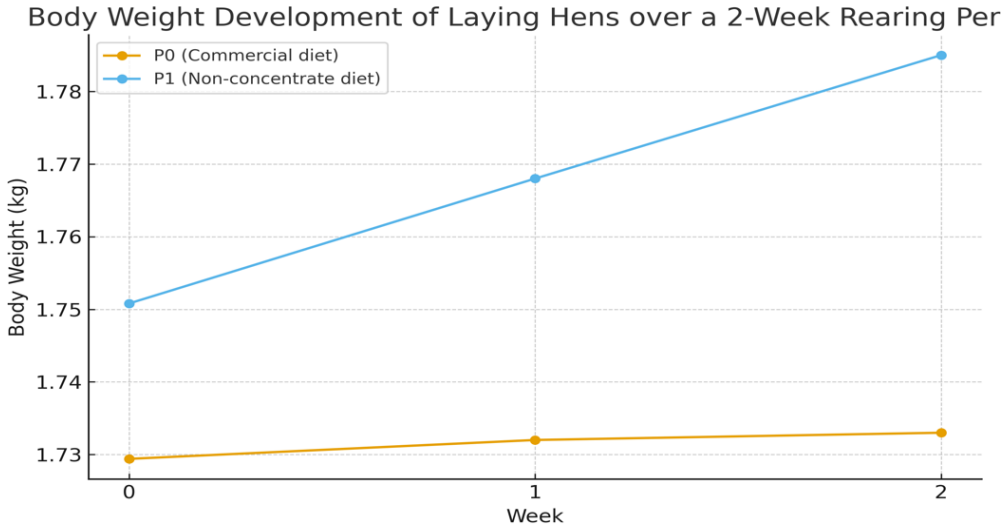

Figure 2. Body weight of laying hens in the P0 (commercial diet with incorporated concentrate) and P1 (local-ingredient-based diet without concentrate) groups during the 14-day rearing period.

Egg Production (%)

Egg production percentage refers to the proportion of eggs produced across all replications for each treatment.

Table 3. Egg Production Percentage of Laying Hens by Treatment

Treatment	Mean
P0	83,36% ± 5,77
P1	65,93% ± 10,01

The t-test results indicated a significant difference between the P0 and P1 treatments in egg production percentage. The mean egg production in P0 was 83.36% ± 5.77, whereas in P1 it was 65.93% ± 10.01. The paired t-test yielded a t-value of 5.667 with a significance level of 0.000 ($p < 0.05$), confirming a statistically significant reduction in egg production in hens fed the non-concentrate diet.

The lower egg production observed in P1 is likely associated with reduced nutrient intake, particularly metabolizable energy and crude protein, which are essential for egg formation. Egg production requires a continuous supply of nutrients to support yolk deposition, albumen synthesis, and shell formation. The lower feed intake recorded in P1 may have limited nutrient availability, thereby constraining egg production performance.

In addition to energy and protein, adequate calcium and available phosphorus are critical for eggshell formation and overall laying performance. Although the diets were formulated to

meet standard nutrient requirements, differences in nutrient density and digestibility between the commercial and non-concentrate diets may have influenced nutrient utilization efficiency. Previous studies have demonstrated that imbalanced nutrient intake during the laying period can directly reduce egg production, particularly when energy and protein supply are insufficient to meet physiological demands (Leeson & Summers, 2018; Lara & Rostagno, 2013).

These findings indicate that while non-concentrate diets offer potential economic and sustainability benefits, their formulation must ensure adequate nutrient density and bioavailability to support optimal egg production. The results suggest that the current non-concentrate formulation has not yet fully matched the nutritional effectiveness of commercial feed in sustaining laying performance over the short experimental period.

CONCLUSION

Non-concentrate diets were associated with reduced feed intake and egg production in laying hens, while body weight remained comparable to those fed the commercial diet. These findings indicate that the non-concentrate formulation used in this study has not yet matched the nutritional effectiveness of commercial feed in supporting optimal laying performance. However, the comparable body weight suggests that, with improved nutrient balance and formulation, non-concentrate diets may have potential as alternative feed strategies.

The interpretation of these results should consider the limitations of the study, particularly the short experimental duration and the lack of complete nutrient equivalence between the diets. Further long-term studies using nutritionally balanced formulations are necessary to more accurately evaluate the potential of non-concentrate diets in sustaining laying hen productivity.

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Author Contributions

M. A. H conceptualized and designed the study, supervised the research process, and critically revised the manuscript. The research team collected the data and conducted the experiment. Data analysis was performed collaboratively by the authors. The first draft of the manuscript was prepared by the primary author, and all authors reviewed and approved the final version of the manuscript.

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Ethical Statement

All experimental procedures involving animals were conducted in accordance with standard animal welfare guidelines and ethical principles for the use of animals in research. The study followed institutional and national regulations for the care and management of laying hens during the experimental period.

Declaration of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Data Sharing Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

REFERENCE

Abd El-Hack, M. E., Abdelnour, S. A., Alagawany, M., Abdo, M., Sakr, M. A., Khafaga, A. F., & Elnesr, S. S. (2019). Microalgae in modern poultry nutrition: Effect on performance, immunity, and meat quality. Animals, 9(9), 573. https://doi.org/10.3390/ani9090573

Agustono, B., Yunita, M. N., Lokapirnasari, W. P., Warsito, S. H., Marbun, T. D., & Windri, S. (2025). Optimizing male layer chicken performance and health with probiotic supplementation: A sustainable alternative to antibiotic growth promoters. Open Veterinary Journal, 15(2), 668–679.

Ahmad, S., Ali, R., Abbas, M., Javed, A., Khalid, M. A., Rafiq, K., Irfan, M., & Ahmed, Z. (2025). Maize substitution with bread by-products and broken biscuits in layer diets: A step toward a circular economy. Frontiers in Veterinary Science, 12, 1557640. https://doi.org/10.3389/fvets.2025.1557640.

Ajala, L., et al. (2021). Effect of feeding frequency on feed intake and productivity of layers. Journal of Applied Poultry Research, 0(1), 100134.

Alagawany, M., et al. (2023). Energy density and its effect on feed intake and performance of laying hens. Animal Nutrition, 15, 71–87.

Bozkurt, M., Aysul, N., Küçükyilmaz, K., Aypak, S., Ege, G., Çatlı, A. U., & Seidavi, A. (2018). The effect of supplementing laying hen diets with mannan-oligosaccharide or an essential oil mixture on performance and egg quality during hot summer season. Poultry Science, 97(1), 217–228. https://doi.org/10.3382/ps/pex291

De Verdal, H., et al. (2025). Residual feed intake: Behavioral, nutritional and economic aspects in poultry. Animals, 15(8), 1115. https://doi.org/10.3390/ani15081115.

Fikgiannisa, V. T., Wibawa, A. A. P. P., & Astawa, I. P. A. (2025). The effect of replacement of commercial ratio with non-commercial ratio on layer productivity ISA Brown. Jurnal Harian Regional.

Hy-Line International. (2020). Hy-Line Brown commercial layers: Management guide. https://www.hyline.co.uk/uploadedfiles/1592407567-brn_com_eng.pdf.

Juni, P., Elisia, R., & Annisa. (2025). Review literatur: Pengaruh formulasi dan manajemen pakan terhadap produktivitas ayam petelur di daerah tropis. Jurnal Tropicalanimal, 3(1). https://doi.org/10.24036/jeta.v3i1.76.

Lara, L. J., & Rostagno, M. H. (2013). Impact of heat stress on poultry production. Animals, 3(2), 356–369. https://doi.org/10.3390/ani3020356.

Leeson, S., & Summers, J. D. (2018). Commercial poultry nutrition (5th ed.). Nottingham University Press.

Leke, J. R., Ani, A. O., Ozung, P. O., & Agiang, E. A. (2019). The characteristics and quality of egg from commercial laying hens (MB 402 strain) fed graded levels of garlic (Allium sativum) meal. International Journal of Agricultural Science and Food Technology, 5(2), 037–042. https://doi.org/10.17352/2455-815X.000043.

Lemme, A., Ravindran, V., & Bryden, W. L. (2019). Nutrition and feeding of poultry. Animal Feed Science and Technology, 255, 114203. https://doi.org/10.1016/j.anifeedsci.2019.114203.

Liu, Z., et al. (2022). Effects of feed particle size and physical form on laying hen performance. Poultry Science, 101(3), 101654.

Maslami, et al. (2023). Evaluation of feed nutritional content on laying hen productivity in East Lombok Regency. Jurnal Biologi Tropis, 23(4), 113–119.

National Research Council. (2021). Nutrient requirements of poultry (11th rev. ed.). National Academies Press. https://doi.org/10.17226/25819.

Noetzold, K., Peña, J. E. M., Elze, K. J., & Schilling, M. A. (2023). Impact of dietary metabolizable energy levels on productive performance, body composition, and nutrient accretion rates in pullets: A meta-analysis. Poultry, 2(4), 486–499. https://doi.org/10.3390/poultry2040036.

Nur Adli, D. (2021). Use of insects in poultry feed as replacement soya bean meal and fish meal in developing countries: A systematic review. Livestock Research for Rural Development, 33(10).

SNI 8173.4:2015. (2015). Ayam ras petelur – Bagian 4: Pedoman pemeliharaan dan produksi. Badan Standardisasi Nasional.

Sudarisman, S., Yunianta, Y., & Suryayuliana, I. D. (2025). Diet formulation using distillers dried grain solubles at different levels on performance of laying chicken growers. Jurnal Ilmu Peternakan Terapan, 8(2), 95–99. https://doi.org/10.25047/jipt.v8i2.5586.

Sutrisno, B., Hartono, B., & Wulandari, A. (2021). Pengaruh penggunaan pakan alternatif terhadap performa produksi ayam petelur. Jurnal Ilmu Peternakan Terapan, 5(1), 23–29.