

Comparison of Broiler Production Performance Under Closed-House and Open-Housing System

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ABSTRACT

This study compared the production performance of broiler chickens reared in closed-house and open-house systems on partner farms of PT Ciomas Adisatwa in Tenggarong Seberang District, Kutai Kartanegara Regency, East Kalimantan. Data covered three rearing periods per system between December 2024 and February 2025, using Lohmann MB 202 birds harvested up to 35 days of age. Feed consumption, harvest weight, daily body weight gain, feed conversion ratio (FCR), mortality, and performance index (PI) were recorded. Each system was represented by three periods ($n = 3$) and compared with a two-sample t-test. Welch's test, mean differences with 95% confidence intervals, Hedges' g , and Holm correction were added to assess the precision of the estimates. Mortality was lower in the closed house ($2.83 \pm 1.26\%$ vs $5.47 \pm 0.91\%$; $P = 0.042$) and PI was higher (403 ± 12 vs 358 ± 25 ; $P = 0.048$). Neither difference remained after Holm correction ($P = 0.254$), and the PI difference was not significant under Welch's test ($P = 0.073$). FCR (1.507 vs 1.564), feed consumption ($3,019$ vs $3,129$ g/bird), and harvest weight (2.05 vs 2.00 kg) did not differ significantly ($P > 0.05$). Per 1,000 day-old chicks, the closed house yielded about 26 more surviving birds and 98 kg more live weight. The closed house tended to perform better in mortality and PI, but three periods per system are too few to confirm the difference. Follow-up studies need farm-level replication and recorded microclimate data.

Keywords: Broiler, closed house, open house, mortality, performance index

INTRODUCTION

Broiler chickens are one of the most accessible sources of animal protein in Indonesia due to their short production cycle and continuously increasing demand. East Kalimantan recorded a broiler population of 56,780,006 birds in 2022 (Ministry of Agriculture 2023). Broiler meat consumption in the province increased from 65,702 tons in 2021 to 67,609 tons in 2022, while local production met only 84.94% of the demand in 2024, resulting in a deficit of approximately 9,908 tons (East Kalimantan Provincial Livestock Agency 2024). The same agency projected that the deficit could increase to 10,294 tons if the population of the new capital city, Nusantara, increases. Local poultry enterprises therefore need to increase production without increasing the risk of economic losses, and the housing system is one of the manageable factors that can be adjusted by farmers.

Kutai Kartanegara has a humid tropical climate. Modern broilers have difficulty dissipating metabolic heat because of their high metabolic rate and dense feather coverage. High ambient temperature and humidity can reduce feed intake, feed efficiency, and body weight, while increasing mortality (Wasti et al. 2020; Nawaz et al. 2021). A systematic review and meta-analysis by Liu et al. (2020) documented reductions in broiler performance under heat stress, whereas Oke et al. (2024) discussed the impacts of climate change on broiler production.

Two housing systems are used by the partner farms. The closed-house system regulates temperature, humidity, and air movement using exhaust fans and cooling pads while limiting contact between chickens, humans, and the external environment (Viastika 2021). In contrast, the open-house system relies primarily on natural ventilation and manual curtain adjustment, but it remains widely adopted by small-scale farmers because of its lower initial investment cost (Laili et al. 2022). The

partnership system standardizes the chicks, feed, and management practices, making differences between housing systems easier to assess. The performance of the closed-house system among farms partnered with PT Ciomas Adisatwa has previously been evaluated (Wijayanto 2023).

Empirical evidence regarding the differences between the two housing systems remains inconsistent. The closed-house system has been reported to perform better in terms of feed conversion ratio (FCR), mortality, or performance index (IP) in Malang, Trenggalek, Takalar, Madiun, and Bogor (Pakage et al. 2020; Laili et al. 2022; Paly 2023; Arif et al. 2024; Susanto and Nursita 2024). Hamiyanti et al. (2023) found no differences in FCR, IP, or mortality during the dry season, whereas Nuryati (2019) reported better performance under the open-house system in Cianjur. In East Kalimantan, Rizkuna et al. (2025) reported lower FCR values in the closed-house system across four farms; however, their study focused on correlations among production parameters and involved three different broiler strains. These studies generally reported means, P-values, or descriptive statistics. Confidence intervals and effect sizes have rarely been reported, despite the often limited number of production cycles or housing units observed. The frequency of partial harvesting, which can influence mean market weight and slaughter age, has also received little attention.

This study compared feed intake, market weight, average daily gain (ADG), feed conversion ratio (FCR), mortality, and performance index (IP) of broiler chickens raised in closed-house and open-house systems on partner farms affiliated with the same company in Kutai Kartanegara. Differences in each production parameter were assessed using confidence intervals and effect sizes to provide information on the precision and magnitude of the estimated differences. The null hypothesis stated that there was no difference in production performance between the two housing systems.

MATERIALS AND METHODS

Location and Study Period

The study was conducted at broiler farms operating under a partnership scheme with PT Ciomas Adisatwa in Tenggarong Seberang District, Kutai Kartanegara Regency, East Kalimantan, Indonesia. Data were collected from three production cycles for each housing system, namely the closed-house and open-house systems, from December 2024 to February 2025 (Figure 1). The observation period coincided with the rainy season.

Housing and Livestock

The broilers observed in this study were Lohmann MB 202 strain chickens. The birds were harvested at 35 days of age, with partial harvesting (removal of smaller birds) beginning at 30 days of age. Partial harvesting was recorded three times in the closed-house system and 13 times in the open-house system. One house was observed for each housing system over three consecutive production cycles, resulting in three cycles per system. The closed-house and open-house systems had initial stocking populations of 14,000 and 4,000 birds, respectively. The closed-house building measured 12 × 80 m (approximately 960 m²), whereas the open-house building measured 8 × 50 m (approximately 400 m²). Stocking density was approximately 14–15 birds/m² in the closed-house system and 10–11 birds/m² in the open-house system.

Data Collection

This study employed a comparative observational field-study design. Primary data were obtained through direct observations and measurements, as well as interviews with farm workers and the company's field extension officers (Penyuluh Pertanian Lapangan, PPL). Secondary data were obtained from daily farm records and production reports maintained by PT Ciomas Adisatwa.

Routine management activities included feed and drinking-water provision, weighing, litter turning, house inspection, and carcass collection. Incidental activities included house preparation, partial harvesting, bird selection, and biosecurity procedures. The equipment used consisted of a digital weighing scale, stationery, and a mobile phone for photographic documentation.

Parameter yang diamati

Parameter yang di amati dalam penelitian meliputi: 1) Konsumsi pakan dinyatakan sebagai jumlah pakan yang dikonsumsi per ekor selama satu periode (g/ekor), yaitu pakan yang diberikan dikurangi pakan sisa, kemudian dibagi jumlah ayam; $\text{Feed Conversion Ratio} = (\text{pakan diberikan} - \text{pakan sisa}) / \text{total bobot hidup ayam yang dihasilkan (kg)}$; $\text{Mortalitas (\%)} = (\text{jumlah ayam mati} / \text{jumlah ayam yang dipelihara}) \times 100$; $\text{Pertambahan Bobot Badan Harian} = (\text{bobot panen} - \text{bobot DOC}) / \text{umur panen}$; $\text{Bobot panen (kg/ekor)}$

= total bobot ayam saat panen / jumlah ayam yang dipanen; Index Performance = [daya hidup (%) × bobot panen rata-rata (kg)] / [umur panen (hari) × FCR] × 100; Daya hidup dihitung sebagai 100 dikurangi mortalitas. Persamaan IP mengikuti yang dipakai Laili et al. (2022) dan Paly (2023).

Observed Parameters

The production parameters evaluated in this study were as follows: (1) Feed intake (g/bird) was calculated as the amount of feed consumed per bird during one production cycle. Feed intake was calculated by subtracting the remaining feed from the amount of feed provided and dividing the result by the number of birds.

1. Feed conversion ratio (FCR) was calculated as:

$$\text{FCR} = (\text{feed provided} - \text{feed remaining}) / \text{total live body weight produced (kg)}$$

2. Mortality (%) was calculated as:

$$\text{Mortality} = (\text{number of dead birds} / \text{number of birds initially placed}) \times 100$$

3. Average daily gain (ADG) was calculated as:

$$\text{ADG} = (\text{harvest weight} - \text{DOC weight}) / \text{harvest age}$$

4. Harvest weight (kg/bird) was calculated as:

$$\text{Harvest weight} = \text{total live weight at harvest} / \text{number of birds harvested}$$

5. Performance index (PI) was calculated as:

$$\text{PI} = [\text{livability} (\%) \times \text{average harvest weight (kg)}] / [\text{harvest age (days)} \times \text{FCR}] \times 100$$

Livability was calculated as 100 minus mortality. The performance index equation followed the formulation used by Laili et al. (2022) and Paly (2023).

Analisis data

Data setiap parameter diringkaskan sebagai rerata ± simpangan baku dari tiga periode per sistem. Perbedaan diuji dengan uji-t dua sampel dengan asumsi ragam sama (Microsoft Excel 2019), dua sisi, pada taraf 5%. Uji normalitas tidak bermakna pada $n = 3$, sehingga uji t Welch dilakukan sebagai pembandingan (Delacre et al. 2017). Uji nonparametrik tidak dipakai karena nilai P dua sisi terkecil uji Mann-Whitney untuk dua kelompok beranggota tiga adalah 0,10.

Analisis tambahan dihitung dari rerata, ragam, dan jumlah pengamatan hasil uji-t dengan Python 3 dan pustaka SciPy. Analisis itu terdiri atas selisih rerata dengan selang kepercayaan (CI) 95%, ukuran efek Hedges g dengan CI eksak berbasis distribusi t nonsentral, dan koreksi Holm untuk enam pembandingan. Analisis sensitivitas daya menghitung besarnya efek yang dapat dideteksi pada $n = 3$ (Lakens 2022). Selisih IP dipecah menjadi komponen daya hidup, bobot panen, dan FCR, dengan selisih logaritma natural (ln) IP, dengan umur panen dianggap sama; sisa yang tidak dijelaskan oleh ketiga komponen tersebut disebut residual.

Statistical Analysis

The data for each production performance parameter were expressed as mean ± standard deviation based on three production cycles for each housing system. Differences between the closed-house and open-house systems were initially analyzed using a two-sample t-test assuming equal variances, performed using Microsoft Excel 2019. All statistical tests were two-tailed, with a significance level of 5%. Because normality tests have limited statistical utility with a very small sample size ($n = 3$ per group), Welch's t-test was additionally performed as a robustness analysis (Delacre et al., 2017). A nonparametric test was not used because the smallest attainable two-sided P-value for a Mann-Whitney U test with two groups of three observations is 0.10.

Additional statistical analyses were conducted using Python 3 and the SciPy library based on the means, variances, and sample sizes used in the t-tests. These analyses included mean differences with 95% confidence intervals (95% CIs), Hedges' g effect sizes with exact CIs based on the noncentral t distribution, and Holm's correction for six multiple comparisons. A sensitivity power analysis was also performed to estimate the effect size detectable with three observations per group ($n = 3$) (Lakens, 2022). The difference in PI between the two housing systems was further decomposed into the contributions of livability, harvest

body weight, and FCR using differences in the natural logarithm (ln) of PI. Harvest age was assumed to be identical between the two housing systems. The remaining unexplained component was expressed as the residual.

RESULTS AND DISCUSSION

Production Performance

Among the six parameters evaluated, only mortality and performance index (PI) showed significant differences based on the two-sample *t*-test ($P < 0.05$; Table 1 and Figure 2). Mortality was $2.83 \pm 1.26\%$ in the *closed-house* system and $5.47 \pm 0.91\%$ in the *open-house* system. The difference was 2.63 percentage points (95% CI: 0.15 to 5.12), corresponding to a 48% lower relative mortality. The PI was 403 ± 12 in the *closed-house* system and 358 ± 25 in the *open-house* system, with a difference of 45 points (95% CI: 0.6–90.0). The other four parameters showed relatively small differences, and their confidence intervals for the differences included zero.

Table 1. Production performance of broiler chickens in *closed-house* and *open-house* systems and results of the difference tests.

Parameter	Closed house	Open house	Difference (CH – OH) [95% CI]	P	P Welch	P Holm	Hedges g [CI 95%] ^b
Feed intake (g/bird)	3,019 ± 138	3,129 ± 108	–110 [–391; 170]	0.337	0.340	1.000	0.71 [–0.69; 2.04]
Harvest body weight (kg/bird)	2,047 ± 0.059	2,000 ± 0.098	+0.047 [–0.137; 0.230]	0.520	0.528	1.000	0.46 [–0.88; 1.75]
ADG (recorded value) ^a	0.726 ± 0.075	0.680 ± 0.121	+0.047 [–0.181; 0.274]	0.600	0.605	1.000	0.37 [–0.95; 1.65]
FCR	1.507 ± 0.047	1.564 ± 0.022	–0.057 [–0.139; 0.026]	0.129	0.157	0.516	1.25 [–0.33; 2.72]
Mortality (%)	2.83 ± 1.26	5.47 ± 0.91	–2.63 [–5.12; –0.15]	0.042*	0.048	0.254	1.92 [0.06; 3.68]
IP	403 ± 12	358 ± 25	+45.3 [0.6; 90.0]	0.048*	0.073	0.254	1.84 [0.01; 3.56]

Note: Data are presented as mean ± standard deviation from three production cycles per system ($n = 3$; $df = 4$). CH = closed house; OH = open house. The *t*-values from the two-sample *t*-test for feed intake, harvest body weight, ADG, FCR, mortality, and PI were –1.09, 0.71, 0.57, –1.91, –2.94, and 2.82, respectively. * $P < 0.05$ based on the two-sample *t*-test. ^a The unit of ADG could not yet be confirmed: a value of 0.73 is inconsistent with a harvest body weight of 2.05 kg at approximately 33–35 days of age (approximately 57–63 g/bird/day). The production records should be verified before submission. ^b The sign was oriented such that a positive value indicates better performance in the closed-house system; lower values of feed intake, FCR, and mortality were considered favorable.

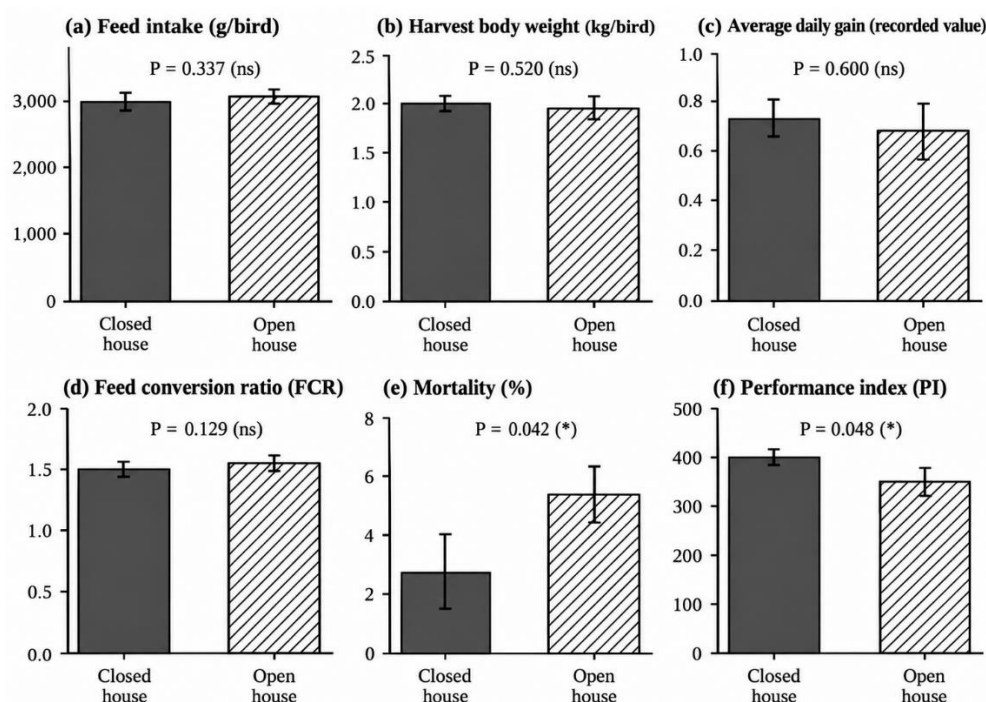


Figure 1. Mean ± standard deviation ($n = 3$) for six production parameters in the *closed-house* and *open-house* systems. *P*-values were obtained from the two-sample *t*-test; $P < 0.05$; ns = not significant.

The precision of the estimates was low because each housing system was represented by only three production cycles. In the Welch test, mortality remained significantly different ($P = 0.048$), whereas PI was not significantly different ($P = 0.073$). After Holm correction for the six comparisons, both parameters had $P = 0.254$. The lower bounds of the 95% CIs for Hedges' g for the two parameters were close to zero (0.06 and 0.01, respectively; Figure 3). With $n = 3$ per group, the statistical power to detect a large effect ($d = 1.5$) was only approximately 29%, and an effect of approximately $d = 3.1$ would be required to achieve 80% power. Significant differences in such a small sample tend to overestimate the magnitude of the true effect; therefore, the g values in Figure 3 are more appropriately interpreted as optimistic upper-bound estimates. Accordingly, the following results are treated as estimates of the direction and magnitude of the effects rather than as evidence of definitive differences.

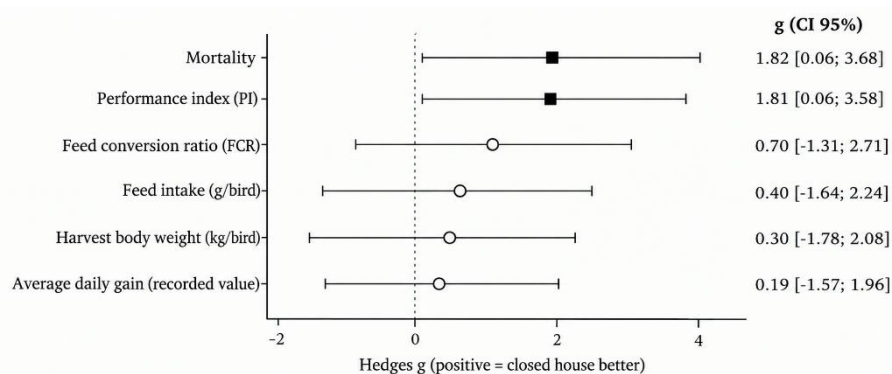


Figure 2. Hedges' g effect sizes (95% CI) for the closed-house versus open-house systems. Positive values indicate better performance in the closed-house system. Black squares indicate confidence intervals that do not include zero.

Mortality

Mortality in the closed-house system (2.83%) was below the 4–5% threshold commonly used as an indicator of good production management, whereas mortality in the open-house system (5.47%) exceeded this range. Susanto and Nursita (2024) reported 2–5% as a target range for good commercial broiler management. The magnitude of the difference was comparable to previous reports. Laili et al. (2022) recorded depletion rates of 2.82% in the closed-house system and 4.21% in the open-house system, whereas Susanto and Nursita (2024) reported depletion rates of 3.93% in a modern closed-house system and 5.37% in a semi-enclosed housing system. Setiadi et al. (2021) reported a much larger difference, with mortality rates of 0.98% and 11.5%, respectively. Nuryati (2019) reported the opposite pattern, with mortality rates of 13.07% in the closed-house system and 7.70% in the open-house system; both systems in that study had PI values below 300, indicating relatively low production performance in both systems.

The cause of the mortality difference observed in the present study cannot be determined with certainty because temperature, humidity, and ammonia concentrations were not measured. The literature points to heat and humidity loads as potential contributing factors. Heat stress can impair immunocompetence and increase mortality (Wasti et al. 2020), while high ammonia concentrations have been associated with respiratory disorders, reduced feed intake, and mortality (Bist et al. 2023). Field observations by the authors suggested that mortality in both housing systems was associated with wet litter during the rainy season; however, this assumption was not supported by direct measurements. The closed-house system is also not necessarily more humid or cooler under all conditions. In negative-pressure tunnel ventilation systems in tropical regions, air temperature and enthalpy were lower than those under positive-pressure ventilation, whereas relative humidity was higher (Sakamoto et al. 2024).

The timing of mortality is also important. In the open-house system observed by Laili et al. (2022), weekly mortality increased from 110 birds in the first week to 270 birds in the fifth week, whereas in the closed-house system, the highest mortality occurred during the first week (187 birds) during the brooding period. Atapattu et al. (2017), in Sri Lanka, found that the periods with the highest mortality risk were the first week and days 29–35, with higher total mortality and incidence of bird defects in the open-house system. The present study did not include weekly mortality data; therefore, it is not possible to determine whether the 2.63-percentage-point difference occurred during the early or late production period. The open-house system also underwent 13 partial harvests compared with three in the closed-house system. Repeated catching and handling may increase disturbance among the remaining birds, but this relationship was not tested. In more practical terms, the mean mortality rates corresponded to approximately 972 surviving birds per 1,000 DOC in the closed-house system and 945 birds per 1,000 DOC in the open-house system, representing a difference of 26 birds per 1,000 DOC (Table 2).

Performance Index

The PI in the closed-house system was 12.7% higher than that in the open-house system (403 vs. 358), with a relative difference similar to those reported by Susanto and Nursita (2024; 380 vs. 340; +11.9%) and Laili et al. (2022; 366.5 vs. 319.4; +14.7%). Nuryati (2019) again reported the opposite pattern, with PI values of 213 in the closed-house system and 255 in the open-house system. The reported PI values were higher than those calculated from the mean performance parameters at a fixed age of 35 days (377 and 345). This difference was consistent with an implied average harvest age of approximately 33 days, as partial harvesting began on day 30.

Decomposition of the difference in $\ln(\text{PI})$ showed that mortality accounted for approximately one-quarter of the difference in PI (Table 2, Figure 4). The largest contributions came from FCR (31%) and harvest body weight (19%), two parameters for which the differences were not statistically significant. The residual component of 27% may reflect differences in mean harvest age between the housing systems and the use of mean PI values calculated for each production cycle rather than PI calculated from the overall mean values. Thus, the higher PI in the closed-house system was not attributable to a single factor. Instead, it resulted from the combined effects of small differences in three components, all in the same direction. Consequently, the higher PI was more susceptible to variation among production cycles, as indicated by the higher standard deviation of PI in the open-house system (25) and the loss of statistical significance in the Welch test.

Table 2. Decomposition of the difference in PI between the closed-house and open-house systems.

Component	CH/OH Ratio	Difference in $\ln \times 100$	Proportion of Total (%)
Livability (100 – mortality)	1.028	2.75	23
Harvest body weight	1.023	2.31	19
FCR (inverse)	1.038	3.69	31
Residual (harvest age, mean PI per production cycle)	-	3.19	27
Reported PI (403 vs. 358)	1.127	11.93	100

Note: Decomposition of $\ln(\text{PI})$, assuming identical harvest ages. CH = closed house; OH = open house.

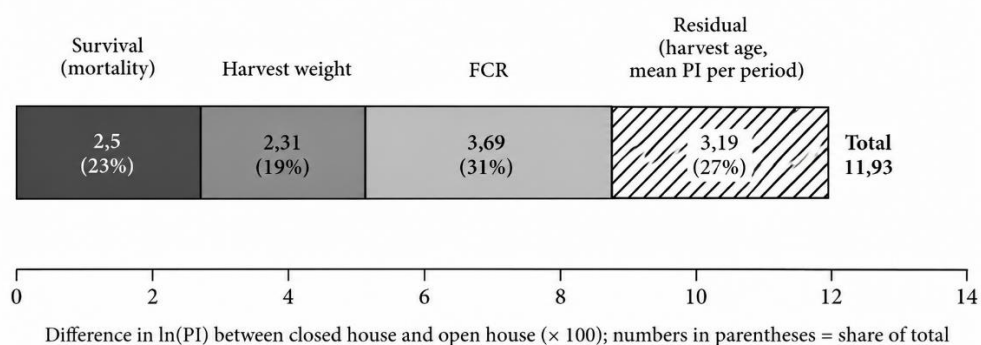


Figure 3. Decomposition of the difference in $\ln(\text{PI})$ between the closed-house and open-house systems into livability, harvest body weight, FCR, and residual components.

FCR and Feed Intake

The FCR in the closed-house system (1.507) and open-house system (1.564) differed by 0.057 (3.6%), with $P = 0.129$ and a confidence interval for the difference that included zero. Both values were below the company's standard for 35-day-old broilers (1.61), indicating good production performance in both housing systems. The direction of the difference was consistent with other reports: 1.574 vs. 1.646 (Susanto and Nursita 2024), 1.416 vs. 1.605 (Laili et al. 2022), and 1.40 vs. 1.49 (Arif et al. 2024). The magnitude of the differences in these studies, ranging from 0.07 to 0.19, was comparable to the difference observed in the present study. The main difference lies in statistical power: Susanto and Nursita (2024) compared 17 and 13 farms, whereas the present study compared three production cycles per housing system. A difference of 0.057 in FCR is equivalent to approximately 113 kg of feed per 1,000 DOC when the

live body weight produced is the same, indicating that the economic impact could be substantial if the difference were confirmed to be real.

Cumulative feed intake per bird was 3,019 g in the closed-house system and 3,129 g in the open-house system, representing a difference of 110 g (3.5%; $P = 0.337$), equivalent to approximately 86 and 89 g/bird/day when divided by 35 days. High temperatures generally reduce feed intake (Wasti et al. 2020; Nawaz et al. 2021). The similar feed intake between the two systems suggests that heat load in the open-house system did not substantially suppress appetite from December to February, although this assumption could not be tested in the absence of temperature data. Susanto and Nursita (2024) likewise found no difference in feed intake between modern closed-house and semi-enclosed systems, while Hamiyanti et al. (2023) found no difference in feed intake among three housing types during the dry season. Broilers in the open-house system consumed 110 g more feed but produced 47 g less harvest body weight, resulting in a slightly higher FCR. Feed spillage, as observed in the field, may also have contributed to the higher recorded feed intake without increasing body weight.

Harvest Body Weight and ADG

Harvest body weight in the closed-house system (2.05 kg) and open-house system (2.00 kg) did not differ significantly ($P = 0.520$). This parameter is difficult to compare directly because it was calculated from all harvested birds, including those obtained through partial harvesting. Partial harvesting removes birds at an earlier age and reduces the mean harvest body weight (Girsang et al. 2023), and the open-house system underwent 13 partial harvests compared with three in the closed-house system. Therefore, the mean harvest body weight in the open-house system represented a mixture of birds harvested at different ages, whereas comparisons at a fixed age were not performed.

Measurements at a fixed age may provide a different perspective. Arif et al. (2024) recorded body weights of 1,630 g in the closed-house system and 1,520 g in the open-house system at 30 days of age, with total harvest body weight being 5.21% higher in the closed-house system. Hamiyanti et al. (2023), in contrast, found higher body weights in the open-house and semi-enclosed systems during the first to third weeks. Susanti et al. (2016) reported the highest body weight gain in the closed-house system. The recorded ADG values were 0.73 in the closed-house system and 0.68 in the open-house system ($P = 0.600$). The relative difference (6.9%) was greater than the difference in harvest body weight (2.3%), suggesting that the denominator, namely harvest age, differed between the housing systems.

DOC and Comparison with Other Studies

Mean mortality and harvest body weight can be converted into output per 1,000 DOC (Table 3). The closed-house system produced approximately 26 more surviving birds and 98 kg more total live body weight (5.2%), while total feed use was only approximately 1.4% higher. Therefore, the additional live body weight was primarily attributable to the greater number of surviving birds. These figures are estimates based on the system means rather than direct observations and do not account for investment costs, electricity costs, or selling prices.

Table 3. Estimated output per 1,000 DOC based on the mean values for each housing system.

Output per 1,000 DOC	Closed house	Open house	Difference
Surviving birds (birds)	972	945	+26
Total live body weight (kg)	1,989	1,891	+98 (+5.2%)
Total feed, FCR × live body weight (kg)	2,997	2,956	+41 (+1.4%)

Table 4 summarizes studies that compared the two housing systems. The results of the present study were most similar to those reported by Laili et al. (2022) and Susanto and Nursita (2024), in which mortality and PI were better in the closed-house system, while feed intake and body weight were similar between systems. A different pattern was observed in studies involving weaker management conditions (Nuryati 2019) or during the dry season (Hamiyanti et al. 2023). Comparisons across studies should be made with caution because stocking density, broiler strain, harvest age, and season varied among studies. For example, in Laili et al. (2022), 20,000 birds were housed in 1,200 m² in the open-house system and 1,600 m² in the closed-house system, resulting in different stocking densities. Stocking density can also affect temperature and CO₂ and NH₃ concentrations inside closed-house facilities (Zakaria et al. 2024).

Table 4. Comparison with studies evaluating closed-house and open-house housing systems.

Study (location)	Design	Mortality CH vs. OH (%)	FCR CH vs. OH	PI CH vs. OH	Notes
Present study (Kutai Kartanegara)	3 production cycles per system	2.83 vs. 5.47*	1.507 vs. 1.564	403 vs. 358*	Rainy season; $P < 0.05$ without correction
Laili et al. 2022 (Trenggalek)	Two farms, 20,000 birds per farm, 4 weeks	2.82 vs. 4.21 (depletion)	1.416 vs. 1.605	366,5 vs 319,4	Descriptive; different stocking densities
Susanto and Nursita 2024 (Madiun)	17 modern <i>closed-house</i> farms vs. 13 semi-enclosed farms	3.93 vs. 5.37*	1.574 vs. 1.646*	380 vs. 340*	Not an <i>open-house</i> system; feed intake and body weight were similar
Arif et al. 2024 (Bogor)	Two houses × two production cycles, 3,000 birds per house	Not reported	1.40 vs. 1.49	Not reported	Total harvest body weight +5.21%
Nuryati 2019 (Cianjur)	6 production cycles	13.07 vs. 7.70	1.78 vs. 1.62	213 vs. 255	<i>Open-house</i> system showed better performance; PI < 300 in both systems
Hamiyanti et al. 2023 (Malang)	Two units per housing type (open, semi-enclosed, closed)	Not different	Not different	Not different	Dry season; body weight differed

Note: CH = closed house; OH = open house. *Significantly different according to the authors of the respective studies. Values were obtained from the abstracts or main text of the publications.

Conclusion

Across the three observation periods in Tenggaraong Seberang, the closed-house system recorded lower mortality (2.83% vs. 5.47%) and a higher PI (403 vs. 358) than the open-house system ($P < 0.05$). These differences were not robust: neither remained significant after Holm correction, and the difference in PI was not significant in the Welch test. FCR, feed intake, harvest body weight, and ADG did not differ significantly between the two systems. These data indicate a direction toward better performance in the closed-house system and are consistent with several reports from Indonesia, but they are insufficient to establish a definitive difference.

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