



Grower Feed in the Starter Phase: A Cost-Effective Approach for Broiler Parent Stock Management

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Abstract | This study objective is to know the effect of grower feed on performance, blood profiles, and income over feed cost (IOFC) in the parent stock chickens during the starter phase. The study methods used 4,800 female day-old chicks and 4,800 male day-old chicks reared under three different treatments with two replications, each treatment replications are using 800 birds, as follows: T0 = Starter feed used; T1 = grower feed with 2 days for male and 3 days for female used and then continued with starter feed; T2 = grower feed with 5 days for male and 6 days for female used and then continued with starter feed. The data were analyzed for normality, followed by a Completely Randomized Design (CRD) factorial analysis. The results showed that production parameters did not differ significantly with the highest IP being $169,68 \pm 13,9$ in T1 male, leukocyte levels decreased to $114,95 \pm 6,3$ in T1 male still they remained within the normal range for blood profiles, and income over feed cost increased to Rp 4.403,68 in T1 female. These findings conclude that grower feed can be used for up to six days during the starter phase and produces results comparable to fully used starter feed.

Keywords | Chicken, Feed, Grower, Parent stock, Starter

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INTRODUCTION

The demand for broiler meat in Indonesia has risen sharply alongside rapid population growth. This has led farmers to increase their stock of final broiler chickens (Nurfirdausya *et al.*, 2021). Maintaining broiler parent stock, which serves as the breeding source for broilers, requires low cost feed option to support sustainability supply chain while ensuring profitability for both poultry farms and feed factories.

Optimizing broiler parent stock performance and health necessitates strategic feeding regimens. Phase feeding, incorporating grower feed during the starter phase, enhances weight gain, feed conversion ratio (FCR), and overall growth rates (Loupe and Emmert, 2000; Roush *et al.*, 2004; Salem *et al.*, 2024). Tailored starter and grower diet durations significantly impact broiler chick performance, underscoring the importance of precise nutritional programming (Tony and Fayed 2006). Research indicates that introducing grower feed during the starter phase im-

proves performance, carcass characteristics, and health outcomes, including enhanced hematological parameters and immune response (Loupe and Emmert, 2000). Effective phase feeding strategies require consideration of nutrient requirements, feed formulation, and economic viability to promote optimal broiler health and productivity.

Previously, treatments using low crude protein feed with added amino acids have been explored to tackle the feed cost issues. Trials using low crude protein feed in the starter phase have yielded suboptimal results (Woyengo *et al.*, 2023). However, feeding crude protein during the initial starter phase (0-7 days) then followed by a protein feed tailored to needs has not been tested. On the other hand, phase-feeding programs demonstrate neutral effects on broiler performance, according to Saveewonlop *et al.*, (2019) and Hamden (2015), who evaluated finisher stocks with diverse feed types.

The use of grower feed in the starter phase of broiler parent stock in Indonesia still have many areas to explore. Research at PT. Satwa Indo Perkasa, Gowa Regency, shows that proper management during the grower phase with grower feed enhances production quality and quantity (Pratama, 2022). Additionally, enzyme supplementation in basal diets with varying nutrient content improves starter broiler growth performance (Anu *et al.*, 2024). However, differences in growth performance based on various anti-coagulant combinations must also be considered (Fitriah *et al.*, 2024). Therefore, optimal feeding strategies and effective additive use are crucial for enhancing efficiency and quality in Indonesian broiler parent stock production.

Based on the background and located in Indonesia, this study examines the effect of grower feed, representing lower crude protein, followed by starter feed, representing adequate protein levels, on the parent stock broiler chickens during the starter phase. The parameters evaluated include parent stock performance, blood profile, and income over feed cost, observed from day 1 to day 21. Based on precedent studies (Muchenje *et al.*, 2011; Warren and Emmert, 2000), we hypothesized that providing grower phase feed to broiler parent stock chickens during the starter phase does not affect production performance and blood profile and can increase income over feed cost. This research specific goals is to provide proof of grower phase feed could be used in starter phase of broiler parent stock chickens.

MATERIAL AND METHODS

MATERIAL AND LOCATION

The research was conducted from February 7, 2024, to July 7, 2024, at the Darawati Farm Unit, owned by PT Karya Indah Pertiwi (KIP) and leased by PT Berdikari. The farm is located in Darawati Village, Payungagung Village,

Panumbangan District, Ciamis Regency, West Java. Animal used was 4,800 DOC (day-old chicks) female parent stock broiler chickens of the Cobb strain and 4,800 DOC male parent stock broiler chickens of the Cobb strain. Feed used was complete broiler breeder grower in crumble form with nutrient content: 13% moisture, 15% protein, 3% fat, 5% crude fiber, 8% ash, 0.9–1.2% calcium, 0.6–0.8% total phosphorus with enzymes, undetectable urea, 40 µg/kg max aflatoxin, 0.64% lysine, 0.27% methionine, 0.52% methionine + cysteine, and 0.11% tryptophan. Housing and Equipment was postal litter house with rice husk bedding, baby chick drinkers, scales (Salter brand), brooding equipment, paranet nets, zinc rolls, and gas heaters.

ETHICAL CONSIDERATION

All experimental procedures applied in this research were approved by the Research Ethics Committee of the Veterinary Medicine Faculty, Universitas Gadjah Mada with number 063/EC-FKH/int./2024. The sentences are included here.

The Research Ethics Committee, Faculty of Veterinary Medicine, Gadjah Mada University, Yogyakarta, having reviewed the research proposal, confirms its approval of the title. According to the review, this research proposal satisfies ethical standards and is hereby approved. The UGM Faculty of Veterinary Medicine Research Ethics Committee reserves the right to conduct ongoing monitoring.

RESEARCH STAGES

2.5% of DOC females and 5% of DOC males were weighed and observed for behavior and uniformity when arrived. Chicks were housed in small brood pens (4m x 4m), with brooding temperatures adjusted from 34°C on day one to 25°C by day 14. Density was adjusted every three days, reaching 1:13 chickens per m² by day 21. The henhouse was sealed with plastic at night and opened during the day, supplemented by positive pressure fans for airflow. Temperature and relative humidity were recorded at various times throughout the day. Continuous lighting was provided until feed was consumed. Rice husk litter was used, and drinking water was provided ad libitum with antibiotics and vitamins according to program schedules through the starter phase.

EXPERIMENTAL TREATMENTS

Each sex was divided into three feed treatment groups, with each treatment replicated twice using 800 birds: Female Group as follows; T0: Starter feed for 21 days (1600 birds); T1: Grower feed for 3 days, then starter feed for 18 days (1600 birds); T2: Grower feed for 6 days, then starter feed for 15 days (1600 birds). Male Group as follows; T0: Starter feed for 21 days (1600 birds); T1: Grower feed for 2 days, then starter feed for 19 days (1600 birds); T2: Grower feed for 5 days, then starter feed for 16 days (1600 birds).

T0 is using as treatment 0 as control, then T1 as treatment 1 and T2 as treatment 2. The treatment duration was informed by Woyengo *et al.* (2023), who reported suboptimal outcomes in trials utilizing low crude protein feed during the initial starter phase (0-7 days). Additionally, Maynard *et al.* (2022) guided our decision to adjust feeding durations, considering gender-based differences in feed consumption.

EXPERIMENTAL DESIGN, STATISTICAL ANALYSIS AND OBSERVATION PARAMETERS

The data were analyzed for normality, followed by a Completely Randomized Design (CRD) factorial analysis with the following mathematical model:

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

Where Y is the individual observation, μ is the overall mean, α is the effect of sex, β is the effect of feed treatment, $\alpha\beta$ is the interaction between the two factors, and ϵ is the error term. If significant differences were found, Duncan's new multiple-range test was conducted. The design reference is based on (Dzuhri *et al.*, 2022). The independent variable used is grower feed. The dependent variables include feed Intake, body weight, Weight gain, Feed Conversion Ratio (FCR), Index Performance (IP), blood profile, and Income Over Feed Cost (IOFC). Production performance and blood profile data were analyzed using a factorial CRD. If significance was found, Duncan's new multiple-range test was applied. Income Over Feed Cost was calculated based on (Fidianti *et al.*, 2023) methodology. Additionally, all data were compared using the SPSS program and the test were considered significant when the p-value was less than 0,05 and the value is considered not significant when the p-value was above 0,05.

Feed was calculated weekly based on feed consumption. The formula used based on the research reference (Setiyono *et al.*, 2015), is as follows: Feed Consumption = amount of feed consumed (g): chicken populations at the beginning of each week (tail). Weekly depletion percentage was recorded by the formula based on the research reference (Setiyono *et al.*, 2015), which is as follows: depletion percentage = amount of dead and culling chicken (tail): chicken population at the beginning of each week x 100%. Weighing was conducted on days 1, 3, 7, 14, and 21. Weighing was conducted with a 5% population sampling method for females and 10% for male. In accordance with Fattori *et al.*, (1992), our study adopted a 1% sample size, demonstrating non-significant differences between 5% and 10% proportions. Our weighing sampling also according to (Cobb, 2022) that suggest weighing female at 5% and male at 10% is enough and statistically representatives to looking at all chicken in flock. Weight gain observation was calculated also every week. FCR was calculated weekly. The FCR cal-

culation formula based on the research reference (Setiyono *et al.*, 2015), is as follows: FCR = Total feed consumption (g) : total body weight (g). IP was calculated based on feed consumption, FCR, depletion, and body weight attainment. IP calculation formula based on the research reference by Setiyono *et al.* (2015), is as follows:

$$IP = \frac{(100\% - \text{Depletion}) \times \text{Average Body Weight} \times 100\%}{FCR \times \text{Average Age}}$$

Blood samples were analyzed for erythrocytes, leukocytes, hemoglobin, hematocrit, and heterophile/lymphocyte ratio. Blood samples were taken through the wing (*vena axillaris*) which was located under the chicken wing. Blood samples were taken 2-3 ml after that infused into a *vacuum tube* with anticoagulant EDTA (*Ethylene Diamine Tetraacetic Acid*). Blood profile observation was done based on a reference (Martin *et al.*, 2022). Income over feed cost was calculated from revenue minus feed cost according to the formula by (Fidianti *et al.*, 2023).

$$IOFC = (CW \times CP) - (FC \times FP)$$

Where:

CW = Chicken weight (kg).
CP = Chicken price (Rp/kg).
FC = Feed consumed (kg).
FP = Feed price (Rp/kg).

- Starter feed price is Rp 9703 of each kilogram. Grower feed price is Rp 8941 of each kilogram.
- Income is based on multiplication of chicken weight and chicken price
- Feed cost is based on the multiplication of feed consumed and feed price.
- Income over feed cost represent the difference between income and feed cost.

RESULTS AND DISCUSSION

PRODUCTION PARAMETERS

Production parameters were measured during the starter phase over three weeks. The average results across these three weeks are presented in the Table 1.

Results for feed consumption showed no significant difference among groups. Feed consumption results indicated that lowering crude protein did not lead to an increase in feed intake to meet energy and protein needs. For chicks under 7 days, feed regulation is influenced mainly by crop capacity rather than protein and energy needs (Richards *et al.*, 2010). Consumption rates align with Cobb standards (2022) of 29 grams per bird per day for females and 31.3 grams per bird per day for males, indicating that feed intake was within acceptable limits.

Table 1: Production parameters.

Variable	Female			Male			Significance		
	T0	T1	T2	T0	T1	T2	Sex	TG	Sex* ^a TG
Feed Consumption (g/bird/day)	28,86±6,05	28,76±6,53	26,46±9,28	33,06±10,04	33,16±10,25	33,33±9,71	ns	ns	ns
Depletion (%)	1,04±0,83	1,19±1,47	1,50±1,73	0,68±0,38	1,34±1,39	1,32±1,42	ns	ns	ns
Body Weight (g/bird)	274±164,52	291,1±167,08	269±155,69	315,6±188,98	323,33±188,00	300,33±174,83	ns	ns	ns
Weight Gain (g/bird)	132,66±55,32	140,43±48,39	126,66±51,73	155,33±62,07	155,66±56,04	145,66±53,26	ns	ns	ns
Feed Conversion Ratio	1,43±0,06	1,27±0,06	1,20±0,1	1,30±0,1	1,30±0,12	1,40±0,1	ns	ns	*
Index Performance	127,70±21,49 ^b	154,1±8,1 ^b	147,42±11,08 ^b	163,99±5,97 ^a	169,68±13,98 ^a	143,03±3,19 ^a	*	ns	*

Key: **a, b:** Different superscripts in the same row indicate significant differences ($P < 0.05$); **ns:** Not significant; *****: Significantly different. **T0;T1;T2:** Treatment; **TG:** Treatment Group; **Sex*^aTG:** Sex combined with Treatment Group; **g:** gram.

Table 2: Blood profile.

Variable	Female			Male			Significance		
	T0	T1	T2	T0	T1	T2	Sex	TG	Sex* ^a TG
Erythrocytes ($10^6/\mu\text{l}$)	2,71±0,21	2,61±0,17	2,42±0,24	2,65±0,18	2,57±0,28	2,58±0,16	ns	ns	ns
Leukocytes ($10^3/\mu\text{l}$)	127,14±7,77 ^a	124,56±10,51 ^b	115,88±8,99 ^b	128,48±8,93 ^a	114,95±6,3 ^b	117,45±6,16 ^b	ns	*	*
Hemoglobin (g/dL)	10,95±0,73	10,70±0,52	10,50±0,74	10,81±0,69	10,78±0,98	10,54±0,40	ns	ns	ns
Hematocrit (%)	35,4±2,17	34,2±1,75	33,2±2,70	34,7±2,16	34,2±3,16	33,8±1,55	ns	ns	ns
H/L Ratio	0,148±0,28	0,163±0,30	0,136±0,21	0,167±0,26	0,156±0,32	0,145±0,21	ns	ns	ns

Key: **a, b:** Different superscripts in the same row indicate significant differences ($P < 0.05$); **ns:** Not significant; *****: Significantly different. **T0;T1;T2:** Treatment; **TG:** Treatment Group; **Sex*^aTG:** Sex combined with Treatment Group; **g:** gram.

Table 3: Income over feed cost (IOFC).

Variable	Female			Male		
	T0	T1	T2	T0	T1	T2
IOFC Parameter	T0	T1	T2	T0	T1	T2
Chicken Price (Rp)	Rp 21,000	Rp 21,000	Rp 21,000	Rp 21,000	Rp 21,000	Rp 21,000
Body Weight (Kg)	0,44	0,46	0,42	0,51	0,51	0,48
Income (Rp)	Rp 9,240	Rp 9,723	Rp 8,820	Rp 10,752	Rp 10,710	Rp 10,101
Feed Cost (Rp)	Rp 5,392,93	Rp 5,319,32	Rp 5,811,52	Rp 6,798,89	Rp 6,709,74	Rp 6,723,54
Income Over Feed Cost (Rp)	Rp 3,847,07	Rp 4,403,68	Rp 3,008,48	Rp 3,953,11	Rp 4,000,26	Rp 3,377,46

Key: **T0;T1;T2:** Treatment; **Kg:** Kilogram.

The study also found no significant differences in depletion rates among groups. This indicates that lowering crude protein did not affect chicken survival rates. Depletion may result from environmental and management stress factors, such as heat stress, viral infections, and competition among chickens in the same pen (Jahja *et al.*, 2024). Depletion rates observed align with Cobb standards (2022), which recommend a weekly depletion rate of 0.20% or 0.60% over three weeks. Body weight results also showed no significant differences among groups. This suggests that re-

duced crude protein did not affect body weight attainment. Body weight is a conversion result of the total amount of feed consumption by the chicken (Leeson and Summer, 2008). The body weight achieved was consistent with Cobb standards (2022), which recommend a body weight of 282 grams for females and 335 grams for males at three weeks. The study also found no significant differences in weekly weight gain among groups. Consistent weekly feed intake supported stable weight gain across groups, aligning with Cobb standards (2022) of 122–155 grams per three weeks.

Weight gain is a result of differentiation between today's weight. The increase in chicken weight is obtained by subtracting the previous week's weight from the current week's weight gain (Syaifudin *et al.*, 2015). With such results, a key factor that can play an important role is achieving a stable feed consumption to obtain optimal resulted each week. Stable feed consumption ensures predictable growth patterns, improved feed conversion ratio, and optimized production costs.

Results showed no significant difference in FCR among groups. This result also within normal range according to (Siqueira *et al.*, 2013) with 1,26-1,38. This means the chicken can adapt to lower protein levels without compromising growth performance. The non-significant difference in results indicates that the reduction in crude protein levels did not affect the FCR. With these results, key factors that can play an important role in determining FCR are achieving body weight, feed intake, and depletion. Greater body weight with minimal feed intake and depletion will improve FCR, resulting in a lower FCR indicator. Focusing on body weight, feed intake, and depletion rates can improve feed efficiency, leading to better FCR values (Kidd and Tilmann, 2016). The analysis also revealed an interaction between sex and treatment group, with males in this study showing a more efficient FCR. The performance index differed significantly based on sex, with male groups showing higher IP values. The significant difference in the Index Performance Index (IP) is attributed to gender differences. This marked difference is possibly due to key factors such as male and female characteristics, where males consume more feed, have a greater body weight, and exhibit a lower depletion rate. These results indicate that gender has a significant impact on performance achievement, aligning with (Maynard *et al.*, 2022) statement that males have a better FCR and achieve greater body weight. The analysis also revealed an interaction between gender and treatment group, with males in this study showing a higher IP.

BLOOD PROFILE

The blood profile parameters evaluated in this study include erythrocytes, leukocytes, hemoglobin, hematocrit, and H/L (heterophil/lymphocyte) ratio as mentioned by (Martin *et al.*, 2022). Blood profile parameters has to be evaluated as the health status of the chicken that has key importance in production performance of chicken (Ali *et al.*, 2013). The results are presented in the Table 2.

The study results showed no significant difference in erythrocyte levels across groups. These levels is within the normal range of 2.49 ± 0.05 , indicating a normal oxygen and carbon dioxide transport function in the chickens (Bilal *et al.*, 2021). Erythrocytes have function to carry oxygen and carbon dioxide and with this rate it could be indicate that these

function operate well in chicken body (Bilal *et al.*, 2021). Results reveal significant inter-group differences in leukocyte levels, indicating that crude-protein level reduction substantially influences blood leukocyte counts. The leukocyte levels are within the normal range, consistent with the findings of (Astuti *et al.*, 2020) in $118,25 \pm 9,46$ to $126,83 \pm 4,55$. Leukocytes function as part of the immune response and play a role in fighting diseases. Results indicate normal functional performance and absence of biological symptoms in chickens. The significant difference in the treatment groups is thought to be influenced by the availability of the amino acid Lysine, which functions as an antibody in the body (Khwatenge *et al.*, 2020). Compared to another treatments, the T0 group received fed supplemented with higher lysine availability.

No significant differences in hemoglobin levels were observed across groups. These levels fall within the normal range, indicating normal oxygen-carrying capacity in chickens with $7,69 \pm 0,10$ to $11,48 \pm 0,33$ (Bilal *et al.*, 2021). Hemoglobin function is to carry oxygen and nutrition and with this rate, it indicates that function of hemoglobin operates well in chickens (Bilal *et al.*, 2021). Hematocrit levels showed no significant differences across groups. These levels are within the normal range of 32.20–48.60% and suggest normal blood oxygen-carrying capacity in the chickens (Bahman *et al.*, 2011). Hematocrit function as a measure of blood's ability to carry oxygen which is usually called oxygen-carrying capacity (Alfian *et al.*, 2017). This rate also, it is indicated that function doing well in the chicken body. The heterophil/lymphocyte (H/L) ratio showed no significant difference across groups. An H/L ratio closer to 1 indicates higher stress, while lower values suggest less stress. The observed ratios indicate that the chickens experienced minimal stress during the study period (Apriliyani *et al.*, 2013).

INCOME OVER FEED COST (IOFC)

The income over feed cost results are shown in the Table 3, with the market price for chickens set at Rp 21,000. The calculated IOFC values at the end of the 21-day starter phase are presented Table 3.

The income for the 21-day parent stock starter phase indicates that the highest income over feed cost (IOFC) was achieved by group T1, with females and males receiving grower feed for 3 and 2 days, respectively. This group achieved optimal body weight gain, resulting in the highest revenue. Comparative analysis indicates feed consumption exerted a profound impact on feed conversion ratio. Notably, T0 and T2 groups, characterized by disparate feed consumption rates, failed to attain body weight parity with T1. This suggests strategic utilization of grower feed during the starter phase can enhance Feed Conversion Ratio, optimizing production costs. Relative saving could be achieved

when comparing T1 with T0 and T2. For females, switching from T0 to T1 improves IOFC by Rp 556.61, then for males, switching from T0 to T1 improves IOFC by Rp 47.15.

These findings suggest that using grower feed during the initial starter phase in adequate proportion can improve IOFC, a key factor in poultry farming profitability by indicating the feed cost required to achieve the desired production results (Fidianti et al., 2023).

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study, the use of grower feed during the starter phase in broiler parent stock chickens does not impact production parameters, reduces leukocyte count but still within normal range, and increases income over feed cost. Further research on the practical applications in poultry farmers is recommended to gain a more comprehensive understanding of the effects of grower feed on broiler parent stock chicken.

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NOVELTY STATEMENT

This study is the first research in Indonesia using growing feed in the starter phase of a broiler breeder in large amounts of chicken and was conducted in chicken open-house.

AUTHOR'S CONTRIBUTIONS

All authors did the manuscript together and the contribution is distributed equally.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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