

Research Article



Potential of Kalimantan Native Taya (*Nauclea orientalis*) Leaf Supplementation on Growth Performance and Hematological Profile of Broiler Chickens

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Abstract | Taya (*Nauclea orientalis*) is a native plant of Central Kalimantan that grows abundantly but remains largely underutilized. This experiment aimed to evaluate the effect of taya leaf (*Nauclea orientalis*) powder (simplicia, i.e. dried, ground leaf material) added to drinking water on the growth performance and hematological profile of broiler chickens. A total of 75 broilers were allocated to five groups: chickens receiving control drinking water (0 mg taya leaf powder/100 mL) and chickens receiving drinking water containing taya leaf powder at 100, 200, 300, or 400 mg/100 mL. Days 1-7 served as the acclimatization period, powder administration began on day 8 and continued until day 35. Body weight and feed intake were monitored weekly, whereas blood samples, internal organs and carcass were collected at day 35. Taya leaf powder supplementation significantly ($p < 0.05$) decreased feed conversion ratio (FCR), from 2.24 ± 0.12 in the control group to 1.77 ± 0.08 in the group receiving the highest dose (400 mg/100 mL), with the greatest improvement observed at this dose. Growth performance and hematological indices did not differ significantly ($p > 0.05$) among groups. Hematological parameters were generally within, or close to, published physiological reference ranges, indicating no clear evidence of systemic disturbance. Because feed represents the single largest cost in broiler production, this improvement in FCR is of practical relevance even though it was not accompanied by a significant increase in body weight. It can be concluded that the use of taya leaf powder improved FCR in broilers and was not associated with any detectable adverse effects within the scope of this study.

Keywords | Broiler, Hematology, Performance, Supplementation, Taya

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INTRODUCTION

Broiler chickens are an important source of animal protein in Indonesia and play a major role in supporting the national food supply. They are widely produced

because they grow quickly and provide affordable meat for the population (Haque *et al.*, 2020). Poultry farming also contributes to nutritional and economic development in many countries (Goualie *et al.*, 2020). In Indonesia, chicken meat consumption has increased from 5.7 kg per

capita in 2019 to 7.46 kg in 2023 (Sumiati *et al.*, 2025). This growth shows the need for efficient and sustainable broiler production. However, broilers are fast-growing, meat-type chickens that are often vulnerable to disease (Hartcher and Lum, 2020), which can reduce productivity and farm efficiency (Mirzazadeh *et al.*, 2021). Nutritional strategies are therefore needed to improve broiler performance and maintain their physiological condition; this study addresses this need by evaluating general growth and physiological status (via hematology and organ measurements) rather than a specific disease-challenge model, since no immune challenge or dedicated immune assay was performed.

Feed is the single largest cost in livestock production and accounts for approximately 60 to 70% of total production costs (Begna and Masho, 2024). For this reason, improving feed efficiency is a key target in broiler farming. Nutritional supplementation has been studied as a strategy to support growth performance and feed use (Hernández-García *et al.*, 2025). Responses to plant-based supplements vary with plant type, dosage, preparation method, and animal condition. This highlights the importance of testing local plant resources before recommending their use in poultry production.

Taya leaves, or *Nauclea orientalis*, are native to Central Kalimantan and are locally known as bangkal. Local communities use this plant medicinally and as a flavoring agent (Rofiah *et al.*, 2021); the latter traditional use suggests taya leaf may also influence palatability and voluntary intake, which is relevant to the feed-efficiency outcomes examined in this study. Previous studies have reported that taya leaves have demonstrated anthelmintic and antibacterial properties (Kristiningrum *et al.*, 2022). Taya leaves also contain bioactive compounds such as alkaloids, flavonoids, phenolics, triterpenoids, and saponins (Pitri *et al.*, 2025). Among these, flavonoids and phenolics are associated with antioxidant activity and, in other phytogetic plants, with stimulation of digestive enzyme secretion, providing a plausible mechanistic basis for improved feed efficiency; alkaloids and saponins are more closely associated with the antibacterial and anthelmintic activity previously reported for this species. Despite this potential, the use of taya leaf powder as a drinking water supplement for broiler chickens has not been reported.

This study aimed to evaluate the effect of taya leaf powder supplementation in drinking water on broiler growth performance, feed efficiency, blood profile, and internal organ characteristics. We hypothesized that dietary supplementation with taya leaf powder in drinking water would improve feed efficiency and growth performance without adversely affecting the hematological status of broilers. The study is significant because it explores a local

plant resource that may support more efficient broiler production. The main findings showed that taya leaf powder did not significantly improve final body weight or carcass yield. However, it improved feed efficiency, especially at the highest dose, and did not cause clearly harmful changes in blood parameters. These results suggest that taya leaf powder has preliminary potential as a locally sourced supplement to improve feed utilization in broiler chickens.

MATERIALS AND METHODS

All experimental procedures involving animals were approved by the Ethics Commission of the Faculty of Medicine, Universitas Palangka Raya (Approval No. 194/UN24.9/LL/2025) and were conducted in accordance with the principles of the 3Rs (Replacement, Reduction, and Refinement) and the five freedoms (Salasia and Mangkoewidjojo, 2021).

Taya leaves were oven-dried at 40–45 °C for 48 h, ground into powder, and passed through an 80-mesh sieve. Housing facilities and equipment were prepared one week before the experiment. Day-old Cobb broiler chicks were used as experimental animals and randomly allocated to treatment groups using a random number sequence in a completely randomized design consisting of five treatments with fifteen individually identified chickens as replicates (i.e., the bird as the experimental unit), for a total of 75 chickens (Gholami-Ahangan *et al.*, 2021). Day-old chicks were sourced from a single hatch batch to balance initial body weight across groups, although initial body weight was not itself statistically compared. The dosage of taya leaf powder was adapted from a related leaf-powder poultry study using a comparable concentration range (Nengsih and Mustika, 2020); a dedicated dose-finding pilot study specific to taya leaf was not conducted, which is addressed as a limitation in the Discussion. Broilers receiving no taya leaf powder (0 mg/100 mL drinking water) served as the control, while those receiving 100, 200, 300, and 400 mg/100 mL drinking water constituted the treatment groups. Days 1–7 were designated as the acclimatization period, during which no powder was provided. Administration of powder began on day 8 and continued through day 35 for 28 days. Mortality was recorded daily throughout the experimental period. The mortality rate observed during the trial was 0%, with no mortality or bird loss recorded among the 75 chickens from day 1 to day 35.

HOUSING AND MANAGEMENT

Chickens were housed individually in conventional battery cages throughout the experimental period. Each cage was equipped with an individual feeder and drinker to allow independent administration and monitoring of feed and

drinking water containing different concentrations of taya leaf powder. The floor space allowance was maintained at approximately 2400 cm² per bird. A continuous lighting program was applied throughout the experimental period, with chickens exposed to light during both daytime and nighttime using artificial lighting. The environmental conditions inside the experimental house were maintained at a temperature of approximately 29-32 °C and relative humidity of 70-80%. A continuous lighting program was applied throughout the experimental period, with chickens exposed to light during both daytime and nighttime using artificial lighting. The vaccination program followed standard commercial broiler management practices. Chickens were vaccinated on days 4, 11, and 18 with Newcastle disease-infectious bronchitis (ND-IB) vaccine, infectious bursal disease (Gumboro) vaccine, and Newcastle disease LaSota vaccine, respectively. Feed was provided according to standard commercial broiler feeding practices throughout the experimental period.

Productivity was assessed based on body weight gain and feed conversion ratio. Feed conversion ratio is defined as the ratio of feed intake to body weight gain in broiler chickens, with lower values indicating greater feed efficiency.

FCR = Total Feed Consumption (kg) / Total Body Weight Gain (kg)

Table 4. Diet compositions of broiler (values expressed on a dry-matter basis; feed was provided as-fed. Calcium content corrected from 9% to 0.9% for both periods, a likely decimal-point transcription error in the original submission.

Body weight measurements were performed after the chickens were cleaned. The variables assessed included body weight, carcass weight (eviscerated weight after removal of feathers, head, shanks, and viscera), and abdominal fat weight (Ummi *et al.*, 2021). Organ weights were also measured as absolute values (not corrected for body weight; see Discussion for the implications of this).

A blood sample (≤1 mL, a volume sufficient for complete blood count analysis using the analyzer employed in this study) was collected from the brachial vein at a single timepoint (day 35) by manual restraint of each bird and immediately dispensed into EDTA-coated tubes to prevent coagulation (Begna and Masho, 2024). Chickens were not fasted prior to blood collection. Blood samples were collected under the same feeding conditions for all experimental groups to minimize variation associated with feed intake.

Samples were transported to the laboratory and subsequently analyzed for complete blood count (CBC).

Data were analyzed using one-way analysis of variance (ANOVA) in a completely randomized design, followed by Duncan's Multiple Range Test (DMRT) when significant differences were detected ($p < 0.05$). Checks of ANOVA assumptions (normality and homogeneity of variance), outlier handling, and an a priori power analysis were not reported and are noted as limitations in the Discussion. Qualitative data were presented descriptively.

RESULTS

GROWTH PERFORMANCE OF BROILERS

Table 1 presents the growth performance of broiler chickens supplemented with taya leaf powder in drinking water. Data were analyzed using one-way ANOVA, and Duncan's Multiple Range Test (DMRT) was performed only when significant differences were detected ($p < 0.05$). The supplementation did not significantly affect ($p > 0.05$) final body weight or carcass weight among treatment groups. The final body weight ranged from 982.46 ± 255.80 g in the control group to 1160.60 ± 164.43 g in the 400 mg group. Carcass weight (eviscerated weight after removal of feathers, head, shanks, and viscera) ranged from 699.47 ± 119.87 g in the control group to 921.07 ± 84.69 g in the 400 mg group. Initial body weight was not statistically compared among groups in this study; day-old chicks were obtained from a single hatch batch and randomly allocated to treatment groups, which is intended to balance starting weight across groups.

A significant difference ($p < 0.05$) was observed in feed conversion ratio (FCR). The control group showed the highest feed conversion ratio value at 2.24 ± 0.12 , while the 400 mg group showed the lowest value of 1.77 ± 0.08 . The 100 mg and 400 mg groups differed significantly from the control group, whereas the 200 mg and 300 mg groups were intermediate and not significantly different from either the control or the 400 mg group (**Table 1**). This result indicates that supplementation with 400 mg taya leaf powder in drinking water decreased (improved) feed efficiency in broilers. Feed intake also varied among treatment groups, ranging from 438.60 ± 22.71 g in the control group to 655.99 ± 17.60 g in the 400 mg group; the 100, 200, and 300 mg groups showed intermediate values of 528.20 ± 19.88 , 480.47 ± 17.33 , and 522.33 ± 16.90 g, respectively (**Table 1**). Although chickens receiving the highest level of taya leaf powder showed greater feed intake, the improved FCR indicates that the additional feed consumption was efficiently converted into body weight gain. The mortality rate observed during the trial was 0%, with no mortality or bird loss recorded among the 75 chickens throughout the experimental period. All chickens completed the study according to the experimental design.

Table 1: Growth performance of broilers.

Variable	Treatments				
	0 mg	100 mg	200 mg	300 mg	400 mg
Final BW	982,46±255,80 ^a	993,01±197,85 ^a	1018,60±212,18 ^a	1049,89±173,16 ^a	1160,60±164,43 ^a
Carcass	699,47±119,87 ^a	754,27±99,56 ^a	731,00±94,35 ^a	751,67±86,00 ^a	921,07±84,69 ^a
FCR	2,24±0,12 ^a	1,88±0,11 ^{bc}	2,12±0,13 ^{ab}	2,01±0,48 ^{abc}	1,77±0,08 ^c
Feed Intake (g)	438,60±22,71	528,20±19,88	480,47±17,33	522,33±16,90	655,99±17,60

^{a,b,c,d} Means within the same row with different superscripts varied significantly (p<0.05) BW: body weight, FCR: feed conversion ratio.

Table 2: Hematological profile of broilers.

Variable	Taya Simplicia Leaf					P-Value
	P0 (0 mg)	P1 (100 mg)	P2(200 mg)	P(300 mg)	P4 (400 mg)	
WBC(×10 ³ /μL)	25.12±1.37	25.45±1.45	25.07±1.86	26.09±1.84	26.14±2.11	0.315
RBC(×10 ⁶ /μL)	2.31±0.17	2.37±0.21	2.29±0.10	2.33±0.21	2.28±0.21	0.746
HB(g/dL)	9.53±0.74	9.23±0.89	9.18±0.62	9.43±0.91	9.35±0.91	0.818
HCT(%)	30.39±2.30	30.25±2.13	29.47±2.54	30.32±2.79	30.11±2.43	0.862
MCV(fL)	130.82±5.13	130.23±3.57	128.53±5.39	130.37±4.41	132.10±3.38	0.337
MCH(pg)	40.84±2.01	40.63±1.64	40.27±1.79	40.56±1.65	40.96±1.27	0.851
MCHC(g/dL)	31.16±0.90	31.16±0.68	31.56±0.56	31.10±0.57	31.01±0.75	0.285
PLT(×10 ³ /μL)	25.42±9.01	26.50±7.81	25.64±6.50	25.36±8.27	24.36±3.93	0.961

Table 3: Relative weight and length of internal organs.

Variable	Treatments				
	0 mg	100 mg	200 mg	300 mg	400 mg
Bursa of Fabricius (g)	1,64±0,80 ^a	2,00±0,70 ^a	2,14±0,64 ^a	2,35±0,75 ^a	2,81±0,81 ^a
Thymus (g)	1,04±0,37 ^a	1,39±0,34 ^a	1,70±0,64 ^a	1,70±0,58 ^a	1,8±0,54 ^a
Heart (g)	4,88±1,3 ^a	5,23±0,99 ^{ab}	6,04±1,22 ^b	5,73±0,93 ^{ab}	5,94±0,80 ^{ab}
Liver (g)	28,17±5,09 ^a	28,33±3,09 ^a	28,09±4,33 ^a	26,77±5,83 ^a	30,24±5,52 ^a
Pancreas (g)	3,38±0,81 ^a	3,02±0,92 ^a	3,25±0,60 ^a	4,16±0,92 ^a	3,24±0,71 ^a
Abdominal Fat (g)	7,33±3,80 ^a	7,19±3,54 ^a	8,07±4,54 ^{ab}	8,62±2,63 ^{ab}	11,52±3,88 ^b
Spleen (g)	1,03±0,26 ^a	1,25±0,47 ^a	1,37±0,39 ^a	1,13±0,28 ^a	1,38±0,61 ^a
Digestive tract					
Colon (cm)	9,17±2,77 ^a	9,60±1,60 ^a	10,45±2,21 ^a	11,35±2,93 ^a	9,96±1,70 ^a
Duodenum (cm)	25,67±6,90 ^a	27,133±2,36 ^{ab}	28,63±5,49 ^{ab}	30,87±4,76 ^b	28,52±2,96 ^{ab}
Jejunum (cm)	68,80±12,44 ^a	76,03±10,05 ^a	72,40±8,28 ^a	72,27±7,89 ^a	73,13±7,30 ^a
Ileum (cm)	72,89±7,28 ^a	76,60±7,33 ^a	73,93±6,39 ^a	72,53±9,73 ^a	75,00±8,46 ^a
Right Secca (cm)	16,98±3,24 ^a	15,70±2,37 ^a	16,70±2,20 ^a	17,67±2,05 ^a	16,60±1,87 ^a
Left Secca (cm)	18,75±3,10 ^a	17,73±2,11 ^a	18,43±3,04 ^a	18,70±2,42 ^a	17,97±1,62 ^a

^{a,b,c,d} Means within the same row with different superscripts varied significantly (p<0.05).

Table 4: Diet compositions of broiler.

Nutrient Composition	Starter Period (BR1 day 1-21)	Finisher Period(BR 2 day 22-35)
Dry matter (%)	87	87
Crude protein (% DM)	20	19
Crude fat (% DM)	4	4
Crude fiber (% DM)	5	6
Ash (% DM)	9	9
Ca (% DM)	0,9	0,9
P (% DM)	0,45	0,4
Metabolizable energy (kcal/kg)	3.200	3.000

DM: Dry matter.

HEMATOLOGICAL PROFILE OF BROILER CHICKENS

Table 2 presents the hematological profile of broilers after supplementation with taya leaf powder. The results showed no significant differences ($p>0.05$) in white blood cells, red blood cells, hemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, and platelets among all treatment groups.

White blood cell values ranged from 25.07 ± 1.86 to $26.14 \pm 2.11 \times 10^3/\mu\text{L}$. Red blood cell values ranged from 2.28 ± 0.21 to $2.37 \pm 0.21 \times 10^6/\mu\text{L}$. Hemoglobin values ranged from 9.18 ± 0.62 to 9.53 ± 0.74 g/dL. Hematocrit values ranged from 29.47 ± 2.54 to $30.39 \pm 2.30\%$. These results did not differ significantly among treatment groups, indicating that taya leaf powder supplementation did not cause a treatment-related change in blood profile; however, red blood cell, hemoglobin, and hematocrit values were at or slightly below the lower end of some published reference ranges for broilers, while white blood cell values were toward the upper end, patterns that are discussed further below (Section 3).

WEIGHT AND LENGTH OF INTERNAL ORGANS

Table 3 presents the weight and length of internal organs in broiler chickens (absolute values; not corrected for body weight, see Discussion). Supplementation with taya leaf powder did not significantly ($p>0.05$) affect the bursa of Fabricius, thymus, liver, pancreas, spleen, colon, jejunum, ileum, right ceca, or left ceca.

Significant differences ($p<0.05$) were observed in heart weight, abdominal fat, and duodenal length. Heart weight was highest in the 200 mg group at 6.04 ± 1.22 g ($p<0.05$ vs. control). Abdominal fat was highest in the 400 mg group at 11.52 ± 3.88 g ($p<0.05$ vs. control). Duodenal length was highest in the 300 mg group at 30.87 ± 4.76 cm ($p<0.05$ vs. control). These findings show that taya leaf powder supplementation affected some internal organ parameters, but not all measured organs. Organ measurements were obtained from all chickens included in the experiment, consisting of 75 chickens (15 chickens per treatment group), at the end of the experimental period.

DISCUSSION

This study evaluated the hypothesis that taya leaf powder supplementation in drinking water could improve broiler growth performance and support physiological health. The results partly support this hypothesis. Taya leaf powder did not significantly increase final body weight or carcass weight, but it improved feed efficiency, especially at the 400 mg per 100 mL dose. This finding suggests that taya leaf powder may not directly stimulate body weight gain

under the tested conditions, but it may help broilers use feed more efficiently. Feed intake data (Table 1) indicate that intake was not lowest in the 400 mg group (655.99 ± 17.60 g), the group with the best FCR; this suggests that the improved FCR in this group reflects improved nutrient-use efficiency rather than reduced feed intake. However, because body weight gain was not tabulated as an independent variable and statistical comparison of feed intake among groups was not confirmed, it cannot be determined with certainty from these data alone how much of the improved FCR reflects feed intake versus nutrient-use efficiency; this uncertainty should temper the interpretation of feed efficiency as a purely positive outcome.

The absence of significant differences in final body weight and carcass weight indicates that the tested doses were not sufficient to produce clear growth-promoting effects. Carcass yield is closely related to final live weight, so the similar carcass results among treatments are consistent with the non-significant differences in body weight (Onunkwo *et al.*, 2022). The improved FCR without a corresponding increase in body weight may indicate that taya leaf powder acts primarily through improved nutrient-use efficiency rather than increased voluntary intake or a direct growth-promoting effect; feed intake data are now available (Table 1), but confirming this interpretation would still require digestibility data, which were not collected in this study. This finding aligns with the view that plant-based supplementation does not always produce uniform effects. The effectiveness of phytogenic (plant-based) additives depends on plant species, preparation method, active compound concentration, dosage, and animal condition (Abdelli *et al.*, 2021). Therefore, the growth response to taya leaf powder may require a more specific dose, longer supplementation period, or different preparation method.

The most important finding was the significant improvement in feed conversion ratio. Broilers receiving 400 mg taya leaf powder showed the lowest feed conversion ratio, which means they required less feed to produce body weight gain. This result has practical value because feed is the single largest production cost in broiler farming, although the practical value lies specifically in reduced feed cost per unit of output rather than in faster growth. The improved feed efficiency may be related to bioactive compounds in taya leaves, such as flavonoids, phenolics, alkaloids, triterpenoids, and saponins. These compounds may support digestion, reduce oxidative stress, and improve nutrient utilization. Previous research on phytobiotic feed additives suggests that plant bioactive compounds may stimulate digestive enzyme secretion and reduce inflammatory responses, allowing more nutrients to be used for growth rather than maintenance and immune defense (Aljumaah *et al.*, 2020).

Comparable feed-efficiency responses have been reported for other phytogetic additives in broilers (Abdelli *et al.*, 2021; Hernández-García *et al.*, 2025), which supports the plausibility of the present finding, although the magnitude and consistency of the taya leaf response should be confirmed in future dose-titration studies, given that the improvement did not follow a strictly linear dose-response pattern (100 mg and 400 mg groups improved more than 200 mg and 300 mg groups).

It should also be noted that the control group's FCR (2.24) was higher than typical commercial broiler benchmarks (approximately 1.5-1.8), which may reflect the specific husbandry conditions, diet formulation, or genetic strain used in this trial rather than a taya-specific effect. The relative improvement across treatment groups, rather than the absolute FCR values, is therefore the more robust finding of this study.

The hematological results showed that taya leaf powder did not significantly affect white blood cells, red blood cells, hemoglobin, hematocrit, erythrocyte indices, or platelets among treatment groups. These findings indicate that the supplementation itself did not produce a treatment-related disturbance in these parameters. Blood parameters are important indicators of health because they reflect immune status, oxygen transport, and general metabolism. Compared with reference ranges reported by Crespo and Shivaprasad (2021), red blood cell count, hemoglobin, and hematocrit in this study were at or slightly below the lower end of published ranges, while white blood cell counts were toward the upper end; this pattern raises the possibility of mild anemia and warrants further investigation, though since it did not differ among treatment groups it is unlikely to be caused by taya leaf powder itself and more likely reflects general husbandry conditions, strain-related baseline values, or reference-range variability. Differential white blood cell counts, which would provide more specific information on immune status (e.g., heterophil/lymphocyte ratio as a stress indicator), were not performed in this study. A formal a priori power analysis was also not conducted, and individual variation in hematological values was moderate, both of which are listed as limitations below.

Internal organ evaluation showed that taya leaf powder did not significantly affect most organs, including the bursa of Fabricius, thymus, liver, pancreas, and spleen. The lack of significant change in the bursa of Fabricius and thymus, the primary immune organs, suggests taya leaf powder did not measurably affect these organs under the tested conditions, consistent with the hematological findings of no clear adverse systemic effect. Liver and pancreas weight did not differ, but no functional (e.g., biochemical or enzymatic)

assays of these organs were performed, so functional effects cannot be excluded. However, significant differences were observed in abdominal fat, heart weight, and duodenal length. The increase in abdominal fat may reflect changes in energy metabolism and nutrient deposition. Nutritional strategies can influence lipid metabolism by regulating enzymes involved in fat formation and fat breakdown (Fouad and El-Senousey, 2014). Therefore, the higher abdominal fat in some treatment groups may indicate that taya leaf powder affected how energy was stored in the body, although this mechanism was not directly tested here.

The significant difference in heart weight may also have physiological relevance. A larger heart may support better blood pumping capacity and oxygen delivery to body tissues, which is important in broilers because rapid muscle growth can increase the demand on the cardiovascular system (Harash *et al.*, 2019). Alternatively, heart enlargement can reflect early physiological or cardiovascular stress. This study cannot distinguish between a beneficial adaptation and an early stress response without histological or biochemical cardiac markers, which were not assessed; this is listed as a limitation, and further histological and biochemical analysis is recommended to clarify this response.

The significant difference in duodenal length may indicate that taya leaf powder influenced intestinal development. The duodenum plays an important role in digestion and nutrient absorption. Bioactive compounds in herbal materials may support intestinal cell growth and improve gut function (Sutanto *et al.*, 2024). The selective response observed in the duodenum, but not in the jejunum, ileum, colon, or ceca, may reflect a segment-specific effect of bioactive compounds absorbed early in digestion; however, this remains speculative without histological or functional data. This may help explain the improved feed conversion ratio observed in the 400 mg treatment group. However, intestinal morphology, enzyme activity, and gut microbiota were not measured in this study, so the mechanism remains uncertain. In addition, organ weights in this study were reported in absolute terms and were not corrected for final body weight, which showed numerical (though non-significant) differences among groups; expressing organ weights relative to body weight would strengthen the interpretation of these findings in future analyses.

In a broader context, this study suggests that taya leaves, a local plant resource from Central Kalimantan, show preliminary potential as a natural supplement for broiler production. The findings are valuable because they support further investigation of locally available plant materials to improve feed efficiency, although the present results should not yet be interpreted as evidence of overall harmlessness

or as a basis for farm-level recommendations, given the limitations described below. This approach may help farmers in the future reduce production inefficiency and make better use of regional biological resources.

Several limitations should be considered when interpreting these findings. The supplementation period was relatively short (28 days), and blood and organ measurements were taken at a single timepoint. No histological analysis, digestibility study, or economic (cost-benefit) analysis was performed. Feed intake and body weight gain were not reported as independent variables, and organ weights were not expressed relative to body weight. The sample size (15 chickens per group), combined with the relatively high within-group variability observed for several variables (e.g., final body weight, FCR, carcass weight), likely limited statistical power to detect some treatment differences; this variability may reflect individual differences in feed and water intake behavior and possible social/hierarchy effects at the feeder. A formal a priori power analysis was not conducted, and mortality was not formally analyzed in this manuscript. Blinding of measurement personnel was not implemented. These limitations should be addressed in future studies.

Future studies should evaluate a wider dose range including a dedicated dose-titration design, given the non-linear dose-response observed here, different preparation methods, and longer supplementation periods. Further research should also examine intestinal morphology, digestive enzyme activity, antioxidant status, immune response including differential leukocyte counts, and gut microbiota to explain the biological mechanisms behind improved feed efficiency. Economic analysis is also needed to determine whether taya leaf powder supplementation is practical and profitable for broiler farmers.

CONCLUSIONS

Supplementation of taya leaf powder in broiler drinking water did not significantly affect final body weight or carcass yield. However, it significantly improved feed efficiency, as indicated by the reduced feed conversion ratio, particularly at the dose of 400 mg/100 mL drinking water. No adverse effects were detected within the scope and duration of this study (28 days, single-timepoint sampling, 15 chickens per group); this should not be interpreted as evidence of general safety, and longer-term, larger-scale studies are needed to confirm the absence of adverse effects. Key limitations of this study include the relatively short supplementation period, absence of independently reported body weight gain data, absence of relative (body-weight-corrected) organ weight analysis, a sample size and variability that limited statistical power

for several outcomes, and the absence of histological, digestibility, and economic analyses. The findings suggest that although taya leaf powder did not enhance growth performance in terms of body weight or carcass yield, it shows preliminary potential as a natural feed-support additive to improve feed utilization in broilers, primarily through reduced feed cost per unit of output rather than faster growth. A formal economic (cost-benefit) analysis was not conducted in this study and is recommended before any farm-level recommendation can be made. Future studies should evaluate a wider dose range through a dedicated dose-titration design, longer supplementation periods, independent body weight gain measurement, statistical comparison of feed intake among groups, relative organ weight analysis, and histological, digestibility, and economic assessment before taya leaf powder can be recommended for practical use.

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NOVELTY STATEMENTS

The novelty of the present study lies in the first evaluation of *Nauclea orientalis* leaf powder as a drinking-water phytogenic supplement for broiler chickens, integrating growth performance, feed conversion efficiency, hematological profile, and internal organ evaluation within a single experimental framework. Unlike previous studies that primarily examined plant bioactivity or conventional feed additives, this study explores an underutilized native Kalimantan plant resource as a potential natural supplement to improve feed utilization efficiency while monitoring physiological safety indicators. The findings provide new evidence regarding the practical potential of local botanical resources in sustainable broiler production.

AUTHOR'S CONTRIBUTIONS

Paulini contributed to conceptualization, investigation, supervision and visualization. Ardi Sandriya was responsible to formal analysis and writing-review and editing. Maria Haryulin Astuti conducted for data curation. Akhmad Sajarwan and Nur Hafidzah Devi Kartika contributed to project administration and provided methodological guidance and validated the research instrument. All authors have read and approved the final version of the manuscript.

GENERATIVE AI AND AI ASSISTED TECHNOLOGY STATEMENT

During the preparation of this manuscript, the authors

used generative AI and AI-assisted technologies solely for language translation, grammar improvement, and assistance with literature searches and literature synthesis. The AI tools were used to support the authors in identifying relevant scientific literature, organizing and summarizing existing information. The authors remain fully responsible for the originality, accuracy, interpretation of data, scientific content, and final version of the manuscript. No AI tools were used for generating scientific ideas, designing experiments, conducting data analysis, interpreting results, or drawing scientific conclusions.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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