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Research Article

Gambier Leaf Extract (GLE) as a Feed Additive Affects the Performance, Carcass Quality, and Blood Profile of Sentul Chickens

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Abstract | Gambier leaves contain bioactive compounds, such as polyphenols, that act as antioxidants, antihyperlipidemic agents, anti-inflammatory agents, and antibacterial agents. This study aimed to determine the optimal content of gambier leaves after fermentation and to identify the optimal level of gambier leaf extract in rations to enhance performance, carcass quality, and the health of Sentul chickens. In the first stage of the research, methanol (P1), ethanol (P2), and N-hexane (P3) were used as solvents for GLE preparation, with maceration times of 24 hours (W1) and 48 hours (W2). This combination aimed to evaluate the best solvent and maceration time using chemical criteria (especially % yield, DPPH IC50 for free radical activity, and catechin content). The best GLE (P1W1) was used as a feed additive in the second stage of *in vivo* testing. In the second stage, 300 experimental chickens, local Sentul breed, aged 12 weeks, with an average body weight of 846.32 g, were used in the in vivo GLE potential test. The experimental chickens were divided into six groups (treatments), with five replications each. The first group was experimental chickens with 100% basal feed/BF (P0); the second group was 100% BF + 75 mg GLE/kg (P1); the third group was 100% BF + 150 mg GLE/kg (P2); the fourth group was 100% BF + 225 mg GLE/kg (P3); the fifth group was 100% BF + 300 mg GLE/kg (P4); and the sixth group was 100% BF + 375 mg GLE/kg (P5). Results from the initial phase indicated that solvent type significantly affected protein percentage, crude fiber, antioxidant levels, tannins, and catechin content ($P < 0.05$), with methanol yielding the best results. However, extraction time had no significant impact ($P>0.05$). The second phase revealed that adding methanol-extracted gambier leaves significantly ($P<0.05$) improved performance, carcass quality, and the health of Sentul chickens. Overall, the addition of Gambier leaf extract at 300 mg GLE/kg (P4) to Sentul chicken feed improved performance (feed conversion ratio 3.99 with final body weight 1492.67 g) and carcass quality (weight = 881.67 g), reduced blood lipid levels (cholesterol = 143.590 mg/dL; TAG = 32.130), and supported health. It is recommended as a feed additive for local chickens.

Keywords | Gambier, Hematology, Phytochemicals, Metabolism, Performance, Carcass quality, Sentul chicken

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INTRODUCTION

Gambier plants are widespread in equatorial regions with annual rainfall of 2,500 to 3,000 mm. In Indonesia, this plant is abundant in West Sumatra, Indragiri, the Riau Islands, the East Coast of Sumatra, Bangka Belitung Island, and West Kalimantan (Aditya and Ariyanti, 2016). Gambier leaves are single, opposite, oval, and serrated, with

a rounded base and a pointed tip. They are generally 8-13 cm long and 4-7 cm wide.

Catechins and tannins are two polyphenolic compounds commonly found in gambier leaves. Catechins can act as effective antioxidants and antibacterial agents and inhibit fatty acid synthesis. The combined content of these two compounds can reach 170.26 µg/ml. Catechins can also help repair cellular damage and support enzyme activity to help prevent inflammation. Tannins neutralize free radicals, protecting cells from harm and preventing disease, and function as antimicrobial and antioxidant agents (Alharthi *et al*., 2023). High catechin content has also been reported to be very effective as an antioxidant (Aditya and Ariyanti, 2016). Tannins account for approximately 52.23% of gambier leaves; however, they contribute to poor nutrient absorption during digestion. A lower tannin content in the ration has a positive impact on the animal.

Maceration techniques are needed to extract antioxidants from gambier leaves; this simple method is particularly suitable for herbal ingredients whose chemical components are readily soluble in organic solvents. Other phytochemicals dominant in gambier leaves include flavonoids, particularly catechins, which constitute approximately 75% of the total flavonoid content and have been reported to exhibit strong antibacterial activity (Damanik *et al*., 2024). These leaves also contain polyphenolic compounds, such as catechins, that act as both antimicrobial and antioxidant agents (Choiri *et al*., 2017).

Negative effects of tannins in gambir have been reported, acting as antinutrients that reduce protein digestibility and bind to digestive enzymes, thereby decreasing their activity (Muhammad *et al*., 2023). In addition, flavonoids can stimulate the gallbladder to release bile salts. This ability causes gambier leaves to reduce blood and body fat levels and aid fat digestion (Mushawwir *et al*., 2023; Obinna and Dim, 2026). Similar results have been shown in previous studies. Gambier leaf extract can reduce blood lipid levels in white mice through catechins, which reduce HMG-CoA reductase activity, thereby inhibiting mevalonate synthesis from HMG-CoA. As a result, catechins can also limit cholesterol absorption in the intestine (Rajaei-Sharifabadi *et al*., 2017; Mushawwir *et al*., 2024, 2025). Feeding broiler chickens 0.5-1% gambir leaf powder increases productivity (Singh and Makkar, 2021). In addition, adding 0.5% gambier powder to their feed improved overall performance and inhibited *E. coli* growth in broiler chickens. The results of the previously cited research can serve as a basis for the importance of increasing the effectiveness of its use through extraction techniques.

The benefits of adding gambier leaf extract to Sentul chicken feed have not been widely reported. However, it is strongly suspected to improve performance, reduce lipid levels in meat and blood, and lower lipid levels in meat, suggesting this extract is a promising poultry feed additive. While numerous studies highlight the benefits of gambier leaf, data on its use as an extract and its specific application in local chickens remain limited.

MATERIALS AND METHODS

First stage (I): Gambier leaf extract (GLE) and chemical analysis

GLE preparation

The maceration method is based on Damanik *et al*. (2024) and modified to suit the needs of this research investigation. The GLE preparation procedure used methanol (P1), ethanol (P2), and n-hexane (P3) in precise proportions and applied maceration times of 24 hours (W1) and 48 hours (W2). Therefore, this GLE preparation tested various combinations of solvents and maceration times: methanol with a 24-hour maceration time (P1W1); methanol with a 48-hour maceration time (P1W2); and so on. This method aimed to determine the appropriate solvent type for this herb and the optimal maceration time based on chemical criteria (especially yield percentage, DPPH free radical scavenging activity IC_{50}, and catechin content). The best GLE was used as a feed additive in in vivo tests.

Powdered gambier leaves were extracted with 96% ethanol, methanol, and n-hexane at a 1:3 ratio and soaked for 24 and 48 hours, respectively. Layered filter paper was used to prevent solids from contaminating the filtrate. The filtrate was concentrated in an evaporator set to 60°C and 40 rpm. The resulting solid extract was transferred to pre-weighed vials, and yields were recorded.

GLE chemical analysis

Antioxidant activity

The antioxidant activity of gambier leaf extract was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) method. Antioxidant activity was assessed by observing the color change of each sample after reacting with DPPH during incubation (Sirivibulkovit *et al*., 2018). The absorbance of the samples was then measured at 514 nm using a UV-Vis spectrophotometer.

Catechin content analysis

HPLC determined catechin content. All analytical procedures have been carried out in accordance with Mushawwir *et al*. (2025). The mobile phase consisted of 25% acetonitrile in 75% acetic acid and 0.3% acetic acid. A standard catechin solution was prepared by dissolving 1 mg in 1 mL of methanol, yielding a stock solution of 1000 ppm. Further dilutions were prepared at concentrations of 250, 100, 50, 25, 10, and 5 ppm in 1 mL of methanol, then

filtered through a 0.45 µm membrane filter. The sample was extracted by maceration with 100 mL of 70% solvent at a sample weight of 10 grams, left for 1×24 hours, and then the filtrate and residue were separated. The filtrate was collected, the solvent was removed by rotary evaporation, and the residue was concentrated to obtain a thick extract. The C18 column served as the stationary phase, and the mobile phase was pumped through the column at 30 °C for 10 minutes. The mobile phase flow rate was 0.5 mL/minute at a wavelength of 280 nm to ensure baseline stability. 20 µL of standard solution was injected into the injector at the load position. The injector was activated simultaneously in the inject position, and elution was allowed to occur. This step was carried out for each sample.

Tannin content analysis

Tannin content was quantified using a spectrophotometer, measured at 750 nm absorbance. All analytical methods were carried out according to established protocols (Wang *et al*., 2019).

Crude protein content analysis

Determining crude protein content begins by calculating the nitrogen percentage using the formula:

$$N = \frac{formol\ titration}{B \times 100} \times N\ NaOH \times 14.008 \times 100\%$$

Description: N: Nitrogen Content; Formol Titration: Sample Titrant Volume – Blank Titrant Volume; N NaOH: NaOH Normality; B: Sample Weight.

Protein Formula: $\%\ protein = FK \times \%N$

Description: FK: Correction Factor; N: Nitrogen Content.

Crude fiber

The crude fiber content of Gambir was determined using the analytical procedure described by Adriani et al. (2015). In this analysis, a 250 mL Erlenmeyer flask containing 2.5 g of sample was mixed with 100 mL of H_2SO_4 and refluxed for 30 minutes. The residue was filtered and washed with distilled water until neutral. 100 mL of NaOH was added, the mixture was refluxed for 30 minutes, and then filtered through filter paper. The crude fiber content was calculated using the following formula:

$$\text{Crude Fiber} = \frac{A - B}{\text{Sample Weight}} \times 100\%$$

Description: A: Weight of Sediment on Filter Paper (g); B: Weight of Ash (g).

Phase two (II): *In-vivo* test

Three hundred experimental chickens, a local Sentul breed, aged 12 weeks and averaging 846.32 g, were used in an in vivo GLE potential test. The chickens were divided into six treatment groups, each with five replicates. The first group received 100% basal feed (BF) (P0); the second group received 100% BF + 75 mg GLE/kg (P1); the third group received 100% BF + 150 mg GLE/kg (P2); the fourth group received 100% BF + 225 mg GLE/kg (P3); the fifth group received 100% BF + 300 mg GLE/kg (P4); and the sixth group received 100% BF + 375 mg GLE/kg (P5).

The GLE used in this in vivo test was obtained from the first phase of the study, which combined methanol with 48 hours of solvent and maceration time (P1W2). The antioxidant capacity, high catechin content, and lower tannin content are the main factors in selecting the extract results with this combination. The basal feed was a commercial ration. The experimental ration, including drinking water, was provided ad libitum.

Recording performance and blood sampling

Body weight was measured weekly throughout the study using a DLE Crane Scale (model DLE-75). Feed consumption was calculated by dividing the amount of feed given by the amount remaining. Blood samples were collected at the end of the study. Blood samples were drawn from the external pectoral vein using EDTA tubes and 3 mL syringes.

Hematology, blood chemistry, and meat analysis

Blood levels were determined using a hematology analyzer. A 10 µL automated blood injection was performed, and the results were displayed on the screen and stored in the device's memory. A portion of whole blood was prepared to obtain plasma for blood chemistry testing. All chemistry analyses followed the Biolabo kit protocol, using a wavelength of 450–650 nm.

At the end of the study, meat samples were collected, from the chest and thigh muscles 10 grams, respectively. The samples were dried and then blended into a uniform powder. Fat and protein contents were analyzed using standard procedures (Tanuwiria *et al*., 2023).

Data analysis

All data from the current experiment were tabulated in MS Excel 2016 and analyzed using a completely randomized design in SAS JMP Pro version 14 to assess treatment effects. Significant differences among treatments were evaluated using the Duncan Multiple Range Test. All analyses were conducted at the 95% level of significance ($\alpha = 0.05$).

Table 1: Yield, free radical scavenging activity, and chemical compositions of GLE with different solvent combinations and maceration times.

Perlakuan	Parameters						
	Yield (%)	antioxidant activity (ppm)	Catechins (µg/mL)	Tannin (%)	pH extract	Crude fiber (%)	Crude protein (%)
P1W1	22.13^{b}	7.07^{a}	322.83^{f}	8.71^{ab}	4.39^{b}	1.50^{a}	0.42^{a}
P1W2	26.05^{c}	6.69^{a}	326.76^{e}	5.80^{a}	4.38^{b}	0.67^{a}	1.10^{a}
P2W1	21.00^{b}	8.22^{a}	276.83^{d}	10.62^{c}	4.26^{ab}	1.08^{a}	0.66^{a}
P2W2	22.22^{b}	8.23^{b}	229.47^{c}	10.80^{bc}	4.45^{b}	0.85^{a}	1.21^{a}
P3W1	7.53^{a}	1883.87^{c}	127.10^{b}	22.93^{d}	5.15^{c}	0.89^{a}	0.35^{a}
P3W2	7.68^{a}	4501.34^{d}	118.40^{a}	21.60^{d}	4.10^{a}	1.05^{a}	0.82^{a}

Means followed by different superscripts in the same column indicate significant differences (P<0.05).

RESULT AND DISCUSSION

Phytochemical analysis of GLE

Table 1 presents the yield, free radical-scavenging capacity, and chemical compositions of GLE across different solvent combinations and maceration times.

The Statistical analysis indicates that both solvent type and extraction duration significantly influence the yield and levels of bioactive compounds in GLE. Using polar solvents such as methanol and ethanol for specific extraction times yields higher yields than non-polar solvents. For instance, P1W2 achieves the highest yield at 26.047%, while P3W2 has a lower yield of 7.681% (see Table 1). This variation is primarily due to the solvent's effectiveness in extracting secondary metabolites, such as phenolics, tannins, and catechins.

This is consistent with Wahed *et al.* (2023); polar solvents such as methanol and ethanol are more effective at extracting phenolic compounds due to their similar solubility, thereby increasing extraction efficiency and biological activity. The catechin and tannin compounds produced in high-yield treatments also correlate with antioxidant activity. In Table 1, the highest catechin content (P1W2, 326.767 µg/mL) indicates greater antioxidant activity than in the other treatments (P1W2, 6.688 µg/mL). The analysis results also showed that methanol extraction yielded the best results, thereby increasing antioxidant activity and preventing damage to antioxidant compounds from external influences. The free radical-scavenging ability of GLE from P1W2 had the lowest IC50 and differed significantly from those of the other combinations. The results of this study were more effective than those reported by Alharthi et al. (2023), who reported an antioxidant activity of 39.566 (ppm) for the ethanol extract of Uncaria gambir Roxb.

Antioxidant activity is indicated by the IC50 value, with lower values indicating higher antioxidant activity (Rusmana *et al.*, 2025). Catechins and tannins primarily contribute to free radical scavenging due to their hydroxyl-rich chemical structures. Across all treatments, the pH of the extracts ranged from 4.0 to 5.5; this acidity helps preserve phenolic compounds, which are more stable under low-pH conditions (Mullenix *et al.*, 2024). The low levels of crude fiber and crude protein, along with minimal differences between treatments, suggest that GLE prioritizes bioactive metabolites over macromolecular nutrients. Overall, the study indicates that solvent choice and processing duration are crucial for maximizing the extraction of antioxidant compounds (Ormilla *et al.*, 2025). These compounds can serve as natural antioxidants in herbal medicines or as feed additives in AGP replacement feeds. The use of methanol appears to be superior to other solvents.

The effect of adding GLE on the performance of sentul chickens

The impact of GLE in the ration on the performance of Sentul chickens is shown in Table 2.

Table 2: Performance of sentul chickens with GLE in the ration.

Treatments	Parameters			
	Body weight gain (g/head/day)	Feed consumption (g/head/day)	Feed conversion ratio	Final body weight (g)
P0	10.27^{a}	60.46^{a}	5.79^{e}	1139.17^{ab}
P1	11.14^{a}	59.37^{a}	5.35^{d}	1118.33^{ab}
P2	11.76^{a}	59.20^{a}	5.04^{cd}	1176.17^{ab}
P3	13.19^{b}	59.23^{a}	4.55^{bc}	1273.67^{ab}
P4	13.92^{c}	59.30^{a}	3.99^{b}	1492.67^{b}
P5	13.54^{c}	58.90^{a}	3.38^{a}	1485.50^{a}

Means followed by different superscripts in the same column indicate significant differences (P<0.05).

The study results indicated that adding gambier leaf extract (GLE) to the feed significantly improved broiler chicken growth, as evidenced by increased body weight gain (BWG), higher final weight, and an improved feed conversion ratio (FCR) (Table 2). Data showed that treatment groups receiving moderate-to-high GLE levels

(P3 to P5) had higher BWG than the control group (P0). This notable improvement is attributed to the natural feed additive derived from gambier leaves, which enhances feed efficiency and yields greater BWG than P0. The phytochemicals in gambier leaves such as flavonoids, tannins, and saponins aid nutrient absorption and energy metabolism (Mushawwir *et al*., 2010). These compounds also serve as natural antioxidants, reducing oxidative stress in poultry, which are highly responsive to environmental factors (Mushawwir *et al*., 2025; Lal *et al*., 2020).

This is consistent with the findings of Kamil *et al*. (2020), who reported that herbal feed additives act as growth promoters and improve feed efficiency in broiler chickens. Gambier leaf extract is used to increase polyphenolic compounds, such as catechins. Based on the results of this research, catechins can increase PBB (Performance-Based Growth/Food Production) in chickens. This mechanism can be explained by catechins' ability to act as antioxidants, antibacterials, and anti-inflammatories. These roles promote intestinal health, improve nutrient absorption efficiency through absorptive cells, and reduce oxidative stress, ultimately contributing significantly to optimal chicken growth (Aditya and Ariyanti, 2016).

Feed consumption across treatments showed a relatively stable pattern, indicating that adding GLE did not reduce feed palatability. This aligns with research by Zhang et al. (2024), which found that feed consumption is not always directly proportional to growth performance, particularly when feed contains bioactive compounds that enhance metabolic efficiency. In this study, although feed consumption did not differ significantly, body weight gain was higher in the GLE treatment, indicating improved nutrient utilization.

The increase in FCR across all treatments indicates that chickens convert feed into meat more efficiently when supplemented with GLE. The lowest FCR values were observed in treatments P4 and P5, with the highest efficiency in P5. These results indicate that supplementation at this level produces an optimal physiological response in terms of nutritional efficiency. These results are consistent with the findings of Purwanti *et al*. (2024), who reported that herbal plants containing bioactives can increase digestive enzyme activity and suppress pathogenic microorganisms in the digestive tract, thereby directing nutrients more toward growth. The final weight of broiler chickens also tended to increase with higher GLE levels, reaching the optimum at P4 (300 mg/kg), while a slight decrease was observed in treatment P5 (375 mg/kg). This pattern indicates that birds' physiological response to phytochemicals tends to follow a dose-response curve, with excessively high doses causing antinutritional effects that inhibit growth performance (Mushawwir *et al*., 2023; Paredes *et al*., 2024).

Thus, adding GLE at an optimal level to feed can improve growth performance through two main mechanisms: increasing nutrient absorption and modulating the microbiota and the body's antioxidant system. Overall, adding GLE at 375 mg/kg to the ration appears to be the optimal dose to improve the performance of Sentul chickens without disrupting feed intake or adversely affecting feed efficiency. The potential of GLE as a natural growth promoter is safe and environmentally friendly, and it can serve as an alternative to synthetic antibiotics whose use has been restricted (Wang *et al*., 2019; Manin *et al*., 2024).

The carcass, lipid, and protein composition of Sentul chicken meat after GLE administration in the feed are shown in Table 3.

Table 3: Effect of GLE administration in the ration on carcass, abdominal fat, lipid, and meat protein composition of Sentul chicken.

Treatments	Parameters				
	Carcass weight (g)	Abdominal fat (g)	Cholesterol (mg/dL)	Meat fat (%)	Meat protein (%)
P0	716.33^{c}	2.07^{d}	41.29^{c}	8.15^{c}	21.73^{ab}
P1	715.57^{c}	1.77^{bc}	37.65^{b}	5.22^{b}	21.77^{b}
P2	750.57^{b}	1.63^{bc}	39.34^{b}	5.68^{b}	24.80^{c}
P3	771.40^{b}	0.33^{a}	34.00^{a}	4.86^{a}	20.74^{ab}
P4	772.20^{b}	1.10^{ab}	35.79^{a}	4.69^{a}	21.34^{ab}
P5	881.67^{a}	1.03^{ab}	36.33^{a}	4.77^{a}	21.46^{a}

Means followed by different superscripts in the same column indicate significant differences (P<0.05).

The addition of GLE appeared to significantly reduce meat cholesterol levels, especially in treatments P3, P4, and P5 compared with the control (P0), indicating hypocholesterolemic activity attributed to flavonoids, saponins, and tannins present in gambier leaves (Alharthi *et al*., 2023; Aritonang *et al*., 2025).

Thus, administering GLE at the optimal level (300 mg/kg of ration) is considered capable of improving the quality of Sentul chicken carcasses by enhancing the chemical composition of meat and reducing fat and cholesterol content. The use of feed ingredients that have undergone extraction can apparently suppress cholesterol formation by inhibiting HMG-CoA reductase activity.

Effect of GLE on hematology and metabolite profile of Sentul chickens

The hematology profile and plasma metabolite levels of Sentul chicken following GLE administration in the feed are shown in Table 4.

Table 4: Effect of GLE administration on the hematology profile and blood plasma metabolites of Sentul chicken.

Treatments	Parameters								
	Hb (g/dL)	RBC (j/mm³)	WBC (j/mm³)	HCT (%)	Cholesterol (mg/dL)	TAG (mg/dL)	Glucose (mg/dL)	HDL (mg/dL)	LDL (mg/dL)
P0	12.56^{a}	2.50^{a}	27.79^{a}	27.53^{a}	153.11^{d}	49.30^{f}	334.84^{a}	37.18^{a}	38.10^{f}
P1	12.54^{a}	2.65^{b}	27.90^{a}	28.10^{b}	149.00^{c}	46.26^{e}	335.31^{b}	40.86^{b}	35.42^{e}
P2	12.63^{ab}	2.66^{bc}	27.91^{a}	29.52^{c}	148.38^{bc}	42.84^{d}	335.81^{c}	48.71^{c}	31.80^{d}
P3	12.74^{b}	2.72^{b}	28.50^{b}	30.24^{d}	147.88^{b}	38.31^{c}	336.55^{d}	53.50^{d}	27.75^{c}
P4	13.07^{c}	2.80^{d}	28.82^{c}	30.29^{d}	146.74^{b}	36.15^{b}	337.02^{e}	66.31^{e}	24.55^{b}
P5	13.256	2.89^{e}	29.45^{d}	30.40^{d}	143.59^{a}	32.13^{a}	338.21^{f}	78.83^{f}	23.10^{a}

Means followed by different superscripts in the same column indicate significant differences (P<0.05); Hb = Hemoglobin; RBC = Erythrocytes; WBC = Leukocytes; HCT = Hematocrit; TAG =Triglyceride; HDL = High Density Lipoprotein; LDL = Low Density Lipoprotein.

The results showed that adding GLE to the ration significantly altered the hematological and metabolic profiles of Sentul chickens. Hematological parameters, including hemoglobin (Hb), erythrocyte (RBC) count, and hematocrit (HCT), increased in the treatment group, particularly from P3 to P5, compared with the control group (P0) (Table 4). The bioactive components of GLE are believed to stimulate the synthesis of blood cells or hematopoietic factors. This is supported by the presence of sulfate-bound polysaccharides and essential minerals, which stimulate hematopoiesis, or the formation of blood cells (Lal *et al*., 2020; Adriani *et al*., 2024). The increase in plasma HDL levels, along with the increase in GLE administration levels and, conversely, the decrease in LDL, is a valuable finding from this study. These results may be the main reason for the decrease in lipid levels in the meat of experimental chickens.

The results of the current study also confirmed increased leukocyte (white blood cell) counts at GLE doses of 150 mg/kg to 375 mg/kg, underscoring GLE's ability to induce an adaptive immune response. Similar findings have been reported by Muhammad *et al*. (2023), who found that polysaccharides from various natural extracts can act as natural immunostimulants in animals. Meanwhile, the results of this study showed a significant decrease in total cholesterol and triglycerides across all treatments, particularly in P4 and P5. This pattern supports the hypothesis that GLE supplementation can modulate lipid metabolism by enhancing fat absorption in ileal absorptive cells and increasing bile acid excretion into the digestive tract (Mullenix *et al*., 2024). The hypolipidemic properties of plants and natural extracts, as stated by Muhammad *et al*. (2023), are mainly related to the content of bioactive compounds such as catechins, tannins, flavonoids, alkaloids, phenolic acids, saponins, terpenoids, and other bioactives. These compounds effectively lower blood triglyceride levels through various mechanisms, including inhibition of fat absorption, regulation of lipid enzymes such as HMG-CoA reductase, anti-inflammatory and antioxidant effects, and binding to cholesterol.

The catechin content in gambier plays a strategic role. Several prior studies have demonstrated its ability to suppress liver enzymes that promote fat production (Obinna and Dim, 2026). Ormilla *et al*. (2025) also reported that falovonoid from a natural extract increases lipoprotein lipase activity and reduces Microsomal Triglyceride-Transfer Protein (MTP) activity.

The effectiveness of lipoprotein lipase was also confirmed by Ormilla *et al*. (2025), who noted its ability to reduce lipoprotein-bound triglyceride levels in the bloodstream by approximately 90%, leaving chylomicrons with cholesterol and cholesterol ester bonds. This metabolic state can improve the cardiometabolic health of poultry (Aritonang *et al*., 2026).

Additional results from the current study showed consistent glucose levels across all groups, indicating that GLE supplementation up to 375 mg/kg is safe and does not disrupt glucose regulation (Kamil *et al*., 2020; Dudi *et al*., 2023; Obinna and Dim, 2026). Overall, these findings also confirm previous studies showing that GLE administration at optimal levels (225–375 mg/kg feed) can improve hematological health, enhance immune function, and improve blood lipid profiles without adverse physiological effects.

CONCLUSION

Phytochemical identification, performance metrics, carcass quality, and blood test results indicate that both solvent type (especially methanol) and extraction duration significantly affect extract quality and animal physiological responses and performance. Polar solvents such as methanol and ethanol yield higher catechin and tannin levels than n-hexane. A greater number of bioactive compounds is associated with enhanced antioxidant activity, suggesting that polyphenolic substances in the extract are crucial for

free radical scavenging. Overall, this GLE can promote growth, improve blood parameters, and reduce fat deposition in the meat of Sentul chicken.

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NOVELTY STATEMENT

Natural extracts are widely used, but the use of fig leaves as a feed additive, especially in extract form, remains limited. This study showed that methanol-extracted gambier leaf extract is a strong antioxidant that scavenges free radicals. It promotes growth and prevents excessive carcass fattening without hindering overall growth. Additionally, its metabolic stimulation can improve the growth of local chickens (Sentul).

AUTHORS CONTRIBUTION

The contributions of all authors have been demonstrated through harmonious and balanced portions and participation, from the beginning of the research, sample and data analysis, data calculation and interpretation, to the drafting of this article.

Ethical approval

Before conducting this research, the researchers/authors submitted an evaluation and assessment to the Animal Ethics Committee of the Directorate of Research License Management, with a certificate (No. 1047/KEP.04/SK/07/2025). It was carefully determined that the implementation of this research, with all applied treatments, was deemed appropriate in accordance with the principles of animal welfare.

Generate AI and AI-assisted technology statement

The authors solemnly declare that during the preparation and writing of this article, no assistance or facilities from AI software or similar technologies were used in any form.

Conflict of interest

The author have declared no conflict of interest related to the publication of all data in this article.

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