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Journal of World's Poultry Science. 2025; 4(4): 88-94.

DOI: 10.58803/jwps.v4i4.89

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Research Article

Effects of Cold Aqueous *Jatropha tanjorensis* Leaf Extract on Nutrient Digestibility and Blood Lipid Profile of Broiler Chicken

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ARTICLE INFO

Article History:
Received: 16/09/2025
Revised: 27/10/2025
Accepted: 19/11/2025
Published: 02/12/2025

check for updates

Keywords:
Aqueous extract
Digestibility
Jatropha tanjorensis
Lipoprotein
Triglyceride

ABSTRACT

Introduction: Herbal feed additives in broiler chickens revealed their effects on growth performance and potential as an antibiotic alternative. The present study aimed to evaluate the effects of cold aqueous *Jatropha tanjorensis (J. tanjorensis)* leaf extract on nutrient digestibility and lipid profile in broiler chickens reared in Ekpoma, Edo State, Nigeria.
Materials and methods: A total of 150 male Anak 2000, one-day-old broiler chickens, weighing 37 grams, were assigned to five treatments in a completely randomized design, with three replicates of ten chickens in each replicate. All chickens were provided with basal starter and finisher diets for eight weeks. The control group (T1) received Doxygen at a dosage of 150 g/200 L of water. The second group (T2) was administered 25 mL of cold aqueous leaf extract of *J. tanjorensis* (CALEJ) in 100 L of drinking water, while the third group (T3) received 50 mL of CALEJ/100 L of drinking water. The fourth group (T4) was given 75 mL of CALEJ/100 L of water, and the fifth group (T5) received 100 mL of CALEJ/100 L of water. Daily fecal samples were pooled and analyzed for apparent digestibility, while fresh blood samples were collected at the end of the experiment and analyzed for lipid profile. The present study lasted for 10 weeks.
Results: During the starter and finisher phases, T4 exhibited higher dry matter digestibility, whereas T5 demonstrated higher values in crude protein and fiber digestibility compared to the other treatment groups. Group T2 had the highest ether extract and nitrogen-free extract digestibility, while T3 exhibited the highest ash digestibility at the starter and finisher phases. Lipid profile evaluation revealed the lowest levels of cholesterol in T2, low-density lipoprotein (LDL) in T3, and very low-density lipoprotein (VLDL) and triglycerides in T4. Additionally, T4 exhibited the highest levels of high-density lipoprotein (HDL).
Conclusion: The administration of 25-100 ml/L of CALEJ substantially enhanced nutrient digestibility and lipid profiles in broiler chickens, resulting in reductions of total cholesterol, triglycerides, LDL, and VLDL, whilst elevating HDL levels.

1. Introduction

Chicken meat is popular for its flavor, high protein content, and nutritional value, making it an essential source of animal protein worldwide. Achieving optimal production necessitates a balanced diet that guarantees both the quantity and quality of nutrients[1]. Since 2006, the use of antibiotic growth promoters (AGPs) in poultry feed has been officially banned due to concerns regarding antibiotic resistance in humans. Therefore, scientists have focused on natural alternatives to promote chicken growth and health[2], and enhance immunity[3] during different production phases of poultry. Plant extracts, such as ginger (*Zingiber officinale*), *Moringa oleifera* saponin extract[4], apple cider vinegar, and shear butter meal[5] have gained attention as promising feed additives, exhibiting antifungal, antibacterial, antioxidant, and antimutagenic properties. These plant-derived additives improve

Cite this paper as: Omoikhoje SO, Eguaoje SA, Osayande UD, Akangbe EE, and Obajuluwa OV. Effects of Cold Aqueous *Jatropha tanjorensis* Leaf Extract on Nutrient Digestibility and Blood Lipid Profile of Broiler Chicken. Journal of World's Poultry Science. 2025; 4(4): 88-94. DOI: 10.58803/jwps.v4i4.89

nutrient absorption, reduce enteric pathogens, and enhance diet buffering capacity, thereby supporting poultry health and performance[6,7]. Among the wide variety of phytogenic feed additives, *Jatropha tanjorensis (J. tanjorensis)*, a drought-resistant multipurpose plant of the Euphorbiaceae family, has attracted particular interest[8]. In Southern Nigeria, *J. tanjorensis* is known as hospital too far or catholic vegetable, also its leaves are consumed as a vegetable and used in herbal therapy[9]. Phytochemical analyses revealed that *J. tanjorensis* leaves contain bioactive compounds, including tannins, alkaloids, flavonoids, cardiac glycosides, saponins, and anthraquinones, which contribute to its antimicrobial, antihypolipidemic properties[10,11]. In some parts of West Africa, *Jatropha* spp. are found as weeds in rainforest zones, with their leaf extracts traditionally prepared for medicinal purposes[12].

Natural feed additives such as *J. tanjorensis*, ginger, and apple cider vinegar reduce carcass fat content, promote growth, and enhance meat quality by increasing tenderization, offering sustainable alternatives to AGPs in animal nutrition. Regarding lipid profiles, healthy values for broiler chickens include high-density lipoprotein (HDL) between 0.9 and 2.0 mmol/L, low-density lipoprotein (LDL) cholesterol at or below 0.7 mmol/L, and total cholesterol around 3.3 mmol/L. Herbal feed additives can support broilers in achieving these targets[13]. Different herbal medicines can positively influence the lipid profile in broilers. Bitter leaf (*Vernonia amygdalina*) extract enhances HDL cholesterol, lowers LDL cholesterol and total cholesterol, and maintains normal triglyceride levels due to its bioactive compounds such as phenols, alkaloids, flavonoids, tannins, and saponins, as reported by Ilesanmi and Fajilade[14]. Compounds with lipid-modulating, antioxidant, and antibacterial activities have been found in herbs used in broiler diets, such as *Balanite aegyptiaca*, papaya, and mango waste meal, which have been shown to increase beneficial n-3 fatty acids and reduce total fat and certain fatty acids while improving the fatty acid profile[15-17]. The present study aimed to investigate the efficacy of *J. tanjorensis* as a phytogenic feed additive in broiler diets, focusing on its impacts on lipid profiles and overall nutrient digestibility in broiler chickens.

2. Materials and Methods

2.1. Ethical approval

The animals used in the present study were handled and treated humanely, with all procedures conducted in accordance with the guidelines approved by the Animal Welfare and Ethics Committee of the Teaching and Research Farm, Ambrose Alli University, Ekpoma, Nigeria (Approval No. AUE2021/0024689).

2.2. Study area

The experiment was conducted in the Poultry Unit of the Teaching and Research Farm, Ambrose Alli University, Ekpoma, Edo State, Nigeria, which is located in a tropical rainforest zone at latitude 6.44°N, longitude 6.8°E. Ekpoma has a tropical climate with 1556mm mean rainfall, temperatures of 26°C to 4°C, and 61 to 92% relative humidity. The chickens were housed in a (20.25 m^2) deep litter system with East-West orientation, with insulating roofs, walls, and floors to maintain a stable micro-climate, reducing heat gain from sunlight. Adequate spacing was ensure with 5-10 birds/m^2.

2.3. Processing of Jatropha tanjorensis leaves

Fresh *J. tanjorensis* leaves (100g) were rinsed, cut, pulverized, and infused in 1 L of water for 24 hours. The solution was filtered using a sieve cloth to obtain the extract, which was diluted (volume/volume)[18] to create different inclusions. This filtrate was prepared daily and administered in the drinking water of experimental chickens.

2.4. Experimental design

A total of 150 day-old Anak 2000 male broiler chickens, each weighing around 37 g, were utilized for the present study. Chickens were randomly divided into five treatment groups with three replicates and ten chickens per replicate. The groups consisted of a control group (T1), which received Doxygen 150 g/200 L of water, Group T2, which received 25 mL of cold aqueous leaf extract of *J. tanjorensis* (CALEJ) in 100 L of drinking water, Group T3, which received 50 mL of CALEJ in 100 L of drinking water, Group T4 had 75 mL of CALEJ in 100 L of drinking water, and Group T5 received 100 mL of CALEJ in 100 L of drinking water[18]. The study design and dosage levels were adapted from the methodology of Omoikhoje et al.[18], but with modification; whereas Omoikhoje et al.[18] used aqueous extract of *Senna occidentalis* leaves, the present study utilized CALEJ at the same dosage concentrations. The chickens were brooded for four weeks; during this period, they received a commercial starter diet (Ultima Feeds Limited, Nigeria) devoid of experimental treatments for one week to facilitate acclimatization. Subsequently, the chickens were fed a finisher diet (Table 1) for four-week intervals. The control group was administered synthetic antibiotics (Doxygen, Crushbase®, Holland) weekly, according to the manufacturer's guidelines, and the entire experiment spanned eight weeks. The basal diets satisfied the nutritional requirements for broiler chickens. On the first day, Marek's vaccine (HVT, Zoetis, USA) was administered subcutaneously. From days 5 to 7, Newcastle disease vaccine (ND; LaSota, Boehringer Ingelheim, USA) and infectious bursal disease (IBD) vaccine (Lukert, MSD, France) were administered via drinking water. Additionally, the infectious bronchitis (IB) vaccine (Ceva, Netherlands) was given on days 10-14 through drinking water. A booster dose of ND and IB vaccines (MSD, Netherlands) was administered on day 28 to ensure a robust immune response suitable for tropical conditions, such as those found in Nigeria. The present study lasted for 10 weeks. Chickens were purchased at one day old and raised for eight weeks, then digestibility was tested at the starter and layer stages for one week. The study was conducted from April to the second week of June 2025.

Table 1. Nutrient composition of the formulated starter (1-4 weeks) and finisher (4-8 weeks) broiler chickens' diets

Nutrient composition (%)	Starter	Finisher
Maize	55.00	58.00
Soya bean meal	32.00	25.00
Fish meal	1.50	1.50
Palm kernel cake	3.50	4.50
Wheat offal	3.30	5.30
Bone meal	1.50	3.00
Limestone	2.50	2.00
Premix*	0.25	0.25
Lysine	0.10	0.10
Methionine	0.10	0.10
Salt	0.25	0.25
Total	100.00	100.00
Content analysis		
Crude protein (%)	21.33	19.07
Metabolizable energy (Kcal/kg)	2886	2869

Vitamin premix* provided per kilogram of diet: vitamin A: 3000000 IU, vitamin D3: 600000 IU, vitamin E: 4000 mg, vitamin K: 500 mg, vitamin B1: 200 mg, vitamin B2, 1000 mg, vitamin B6: 400 mg, vitamin B12: 4 mg, Manganese: 80 mg, Iron: 8000 mg, Zinc: 10000 manesium, Copper: 2000 mg, Methionine: 200000 mg, Lysine: 78000 mg, Se: 20 mg, DM: Dry matter.

2.5. Apparent digestibility

During the fourth and eighth weeks of the feeding trial, two chickens were randomly chosen from each replicate, totaling six per treatment group, and housed in metabolic cages. After a two-day adaptation period, chickens received starter and finisher diets with varying dosages of CALEJ (T1-T5). The daily fecal samples were collected for five days, weighed fresh, and oven-dried at 60°C for 24 hours. Pooled dried samples and basal feed were analyzed following the methods of AOAC[19]. Apparent nutrient digestibility was calculated using the following formula[20].

$$\text{Apparent digestibility} = \frac{\text{Nutrient in feed} - \text{Nutrient in faeces}}{\text{Nutrient in feed}} \times 100$$

2.6. Serum lipids

At the eighth week of the feeding trial, fresh blood samples of 2.5 ml were collected into heparinized tubes from the decapitated necks of three chickens, which were randomly selected from each treatment group, for lipid profile analysis. total cholesterol (mg/dL), triglycerides, and HDL (mg/dL) were measured utilizing standard kits (Randox®, United Kingdom). Concurrently, LDL (mg/dL) and VLDL (mg/dL) were estimated[21].

2.7. Statistical analysis

The data generated were subjected to a one-way analysis of variance (ANOVA), and treatment means that differed significantly ($p < 0.05$) were compared using Duncan's Multiple Range Test (DMRT), using the SPSS package, IBM version 20[22], with standard error of the mean (SEM), representing the variability of the sample mean from the true population mean.

3. Results and Discussion

3.1. Apparent digestibility at the starter phase

Different dosages of CALEJ significantly affected the digestibility of dry matter, crude protein, crude fibre, ether extract, ash, and nitrogen-free extract (NFE) in broiler chickens during the starter phase ($p < 0.05$; Table 2). Dry matter digestibility was significantly the highest in T4 (76.40%), followed by T2 (74.62%), T3 (72.55%), T5 (70.94%), and the lowest in the control group (67.50%). Apparent crude protein digestibility was significantly higher in T5 (81.60%), compared to T4 (74.57%), T2 (72.44%), T1 (67.86%), and T3 (65.39%; $p < 0.05$). Crude fibre digestibility was significantly higher in T5 (59.63%), compared to T3 (59.18%), T4 (57.94%), T2 (57.71%; $p < 0.05$), and the lowest in T1 (53.37%). The ether extract level was the highest in T2 (70.50%), followed by T3 (55.08%), T4 (51.66%), T5 (49.02%), and T1 (47.18%). The NFE digestibility levels were significantly higher in T2 (79.75%) compared to T5 (72.39%), T1 (68.86%), T4 (67.56%), and T3 (65.70%; $p < 0.05$). The highest cumulative ash digestibility was observed in T3 (75.84%). Group T5 demonstrated enhanced absorption of crude protein, thereby indicating the efficacy of protein digestion and utilization by the poultry. This improvement may be attributed to the concentration of protein present in the basal diet provided to the poultry, as well as their capacity to digest protein efficiently. The digestibility of protein was affected by the type and quantity of protein contained within the diet[23]. The enhanced crude fibre digestibility in all treatment groups except the control group, particularly T5, was likely due to the high fibre content of the extract, which may stimulate gastroduodenal motility, thereby improving nutrient-enzyme interactions and digestive efficiency, as reported in Europe and Indonesia[9,24], where broiler chickens were fed with fibre, whole wheat, and cumin inclusion. These findings also supported the report of González-Alvarado et al.[25], who indicated that fiber-rich diets improve nutrient absorption by increasing the intestinal surface area and absorptive capacity in broiler chickens. The present findings are consistent with the report of Ilaboya et al.[26] on improved nutrient digestibility in broiler chickens supplemented with phytase and cholecalciferol in the tropical rainforest of southern Nigeria. The significant improvements in digestibility across multiple nutrients suggested that CALEJ enhanced gastrointestinal function, likely by optimizing nutrient absorption, which aligns with the dietary efficacy of fibre's role in poultry nutrition[9].

Table 2. Nutrient digestibility of broiler chickens fed cold aqueous *Jathropha tanjorensis* leaf extract at the starter phase (1-4 weeks)

Groups	T1	T2	T3	T4	T5
Parameters (%)					
Dry matter	67.50 ± 1.93^{e}	74.62 ± 2.13^{b}	72.55 ± 2.07^{c}	76.40 ± 2.18^{a}	70.94 ± 2.03^{d}
Crude protein	67.86 ± 1.94^{d}	72.44 ± 2.07^{c}	65.39 ± 1.87^{e}	74.57 ± 2.13^{b}	81.60 ± 2.33^{a}
Crude fibre	53.37 ± 2.18^{e}	57.71 ± 2.36^{d}	59.18 ± 2.42^{b}	57.94 ± 2.37^{c}	59.63 ± 2.44^{a}
Ash	75.43 ± 2.29^{ab}	71.40 ± 2.36^{e}	75.84 ± 2.39^{a}	72.28 ± 2.44^{c}	71.57 ± 2.41^{d}
Ether extract	47.18 ± 1.35^{e}	70.50 ± 2.28^{a}	55.08 ± 1.58^{b}	51.66 ± 1.48^{c}	49.02 ± 1.40^{d}
NFE	68.86 ± 1.97^{c}	79.75 ± 2.28^{a}	65.70 ± 1.88^{e}	67.56 ± 1.93^{d}	72.39 ± 2.07^{b}

T1 (Control group): Doxygen 150 g/200 L of water, T2: 25 mL of CALEJ in 100 L of drinking water, T3: 50 mL of CALEJ in 100 L of drinking water, T4: 75 mL of CALEJ in 100 L of drinking water, T5: 100 mL of CALEJ in 100 L of drinking water. NFE: Nitrogen-free extract. Data presented as mean ± SEM. [a, b, c, d, and e] Means different superscript letters in the same row differ significantly ($p < 0.05$).

3.2. Apparent digestibility at finisher phase

The administration of CALEJ significantly influenced nutrient digestibility in broiler chickens during the finisher phase ($p < 0.05$; Table 3). The dry matter digestibility was significantly higher in T4 (80.58%), compared to T2 (78.96%), T3 (77.05%), T5 (75.62%), and T1 (72.50%; $p < 0.05$). Crude protein digestibility was significantly higher in T5 (78.73%) compared to T4 (70.02%), T2 (68.15%), T1 (62.85%), and T3 (60.00%; $p < 0.05$). Crude fibre digestibility reached its maximum in T5 (73.03%). A significant difference was observed in the cumulative ash digestibility in T3 (87.93%), T1 (87.72%), T4 (86.15%), T5 (85.79%), and T2 (85.70%; $p < 0.05$). The NFE digestibility was the highest in T2 (79.75%), with no significant differences compared to T5 (75.93%; $p > 0.05$), but significantly higher than those in T3, T1, and T4 ($p < 0.05$). The enhanced digestibility of ether extract and NFE in CALEJ-treated groups was likely due to phytochemicals in the extract, as observed for herbal plants and their derivatives in animal nutrition[27]. Similar reports noted that *Moringa oleifera* leaf meal and *eucalyptus* extract improved digestive enzyme secretion in broiler chickens reared in Asia and Eastern Europe, respectively[28,29]. The high crude fibre digestibility in T5 may result from the fibre content of CALEJ, which likely promoted gastroduodenal motility and nutrient-enzyme interactions, aligning with findings of Biswas et al.[30], Qaid et al.[31], and Ekwe et al.[16] that fibre-rich diets enhance intestinal surface area and absorptive capacity in pre-starter, starter, and mature broiler chickens. The consistent improvement in nutrient digestibility across CALEJ treatments might support its potential as a sustainable alternative to synthetic antibiotics, addressing concerns about antimicrobial resistance[32] and chemical residues in poultry products.

3.3. Lipid profile

The lipid profile of broiler chickens supplemented with CALEJ at different dosages exhibited significant differences in total cholesterol, triglycerides, HDL, LDL, and VLDL (Table 4; $p < 0.05$). The total cholesterol levels were significantly decreased in T2 (86.67 mg/dL) compared to T4 (208.67 mg/dL), T5 (143.67 mg/dL), T1 and T3 (both 123.67 mg/dL; $p < 0.05$). The values obtained for triglyceride concentrations peaked in T3 (100.67 mg/dL), while T4 indicated the lowest triglyceride concentrations at (18.67 mg/dL), followed by T1 (34.67 mg/dL), T2 (73.67 mg/dL), and T5 (75.67 mg/dL; $p < 0.05$). The HDL levels were highest in T4 (89.67 mg/dL), comparable to T1 (88.67 mg/dL), followed by T3 (79.67 mg/dL), T5 (54.67 mg/dL), and T2 (39.67 mg/dL; $p < 0.05$). The LDL concentrations were within the physiological range for chickens in T4 (116.67 mg/dL), followed by T5 (74.67 mg/dL), T2 (33.67 mg/dL), T1 (27.67 mg/dL), and T3 indicated the lowest LDL concentration (24.67 mg/dL; $p < 0.05$). The lowest VLDL level was observed in T4 (3.73 mg/dL) compared to T1 (6.93 mg/dL), T2 (14.73 mg/dL), T3 (20.13 mg/dL), and T5 (15.13 mg/dL).

Table 3. Nutrient digestibility of broiler chickens fed cold aqueous *Jathropha tanjorensis* leaf extract at the finisher phase (4-8 weeks)

Groups	T1	T2	T3	T4	T5
Parameters (%)					
Dry matter	72.50 ± 2.07^{e}	78.96 ± 2.26^{b}	77.05 ± 2.20^{c}	80.58 ± 2.30^{a}	75.62 ± 2.16^{d}
Crude protein	62.85 ± 1.80^{d}	68.15 ± 1.95^{c}	60.00 ± 1.72^{e}	70.02 ± 2.00^{b}	78.73 ± 2.25^{a}
Crude fibre	61.14 ± 2.45^{e}	67.93 ± 2.55^{d}	69.07 ± 2.66^{c}	71.14 ± 2.76^{b}	73.03 ± 2.98^{a}
Ash	87.72 ± 1.43^{ab}	85.70 ± 1.86^{e}	87.93 ± 1.58^{a}	86.15 ± 1.50^{c}	85.79 ± 1.47^{d}
Ether extract	60.35 ± 2.51^{e}	70.50 ± 2.45^{a}	68.26 ± 2.43^{b}	64.83 ± 2.46^{c}	62.20 ± 2.45^{d}
NFE	72.96 ± 2.00^{b}	79.75 ± 2.28^{a}	73.13 ± 2.07^{b}	71.67 ± 2.04^{b}	75.93 ± 2.17^{ab}

T1 (Control group): Doxygen 150 g/200 L of water, T2: 25 mL of CALEJ in 100 L of drinking water, T3: 50 mL of CALEJ in 100 L of drinking water, T4: 75 mL of CALEJ in 100 L of drinking water, T5: 100 mL of CALEJ in 100 L of drinking water. NFE: Nitrogen-free extract. Data presented as mean ± SEM. [a, b, c, d, and e] Means different superscript letters in the same row differ significantly ($p < 0.05$).

Table 4. Lipid profile of broiler chickens fed cold aqueous *Jathropha tanjorensis* leaf extract at the finisher phase (4-8 weeks)

Groups	T1	T2	T3	T4	T5
Parameters (mg/dL)					
Total cholesterol	123.67 ± 10.71[c]	86.67 ± 7.51[d]	123.67 ± 10.71[c]	208.67 ± 18.07[a]	143.67 ± 12.44[b]
Triglycerides	34.67 ± 3.00[d]	73.67 ± 6.38[c]	100.67 ± 8.72[a]	18.67 ± 1.62[e]	75.67 ± 6.55[b]
HDL	88.67 ± 7.68[a]	39.67 ± 3.44[d]	79.67 ± 6.90[b]	89.67 ± 7.77[a]	54.67 ± 4.73[c]
LDL	27.67 ± 2.40[d]	33.67 ± 2.92[c]	24.67 ± 2.14[e]	116.67 ± 10.10[a]	74.67 ± 6.47[b]
VLDL	6.93 ± 0.60[d]	14.73 ± 1.28[c]	20.13 ± 1.74[a]	3.73 ± 0.32[e]	15.13 ± 1.13[b]

T1 (Control group): Doxygen 150 g/200 L of water, T2: 25 mL of CALEJ in 100 L of drinking water, T3: 50 mL of CALEJ in 100 L of drinking water, T4: 75 mL of CALEJ in 100 L of drinking water, T5: 100 mL of CALEJ in 100 L of drinking water. HDL: High density lipoprotein, LDL: Low density lipoprotein, VLDL: Very low density lipoprotein. Data presented as mean ± SEM. [a, b, c, d, and e] Means different superscript letters in the same row differ significantly ($p < 0.05$).

The significant reduction in total cholesterol in T2 was aligned with the findings in Isa Brown layers reared in the Niger Delta area of Southern Nigeria[33], thereby suggesting that CALEJ had the potential to modulate cholesterol metabolism at finisher phases in broiler chicken production during the present study. However, the high level of cholesterol in the chickens that were treated with 75 mL of CALEJ/100 L of drinking water (T4) contrasted with other studies on how higher doses of herbal additives, such as pepper, *Berberis lycium*[34], and garlic, can lower cholesterol, possibly due to differences in bioactive compounds or dosages[35]. The low triglyceride levels in T4 aligned with the findings of Giannenas et al.[36] and Idahor et al.[37], who observed reduced triglycerides with herbal supplementation in broiler chickens and grower rabbits raised in Thessaloniki, Greece, and the lowland climate of northern Nigeria. This reduction in triglyceride in T4 may be due to enhanced lipid metabolism by the plants containing these phytochemicals. Elevated HDL in T4 and T1 supported the role of CALEJ in promoting HDL, which facilitates reverse cholesterol transport, enhances vascular health, and exerts antioxidant and anti-inflammatory effects[38]. The current findings suggested that meat derived from chickens treated with T4 may offer health benefits to consumers. The decreased LDL in the group that was treated with 50 mL of CALEJ/100 L of water (T3) aligns with the findings of Jachimowicz et al.[39], indicating a lower atherogenic risk, as LDL contributes to the formation of arterial plaques. Similarly, the low VLDL in T4 suggested a hypolipidemic effect, reducing the risk of atherosclerotic plaque formation, as VLDL primarily transports triglycerides[40,41]. The observed alternations in lipid profile were likely attributable to the secondary metabolites of CALEJ, including alkaloids, tannins, steroids, saponins, and flavonoids. These compounds were reported to enhance digestive enzyme activity and lipid metabolism, as documented for phytogenic feed additives in broiler chickens and moringa saponin extract in grower Wistar rats rats[42-44]. The current findings supported the role of CALE as a phytogenic feed additive, enhancing poultry health and meat quality while addressing concerns about antimicrobial resistance and chemical residues[45,46,]. As the global demand for antibiotic-free poultry products increases, the capability of CALEJ to enhance lipid profiles and improve nutrient digestibility establishes it as a sustainable alternative to synthetic additives, thereby promoting both animal health and food safety within poultry production systems.

4. Conclusion

The cold aqueous leaf extract of *J. tanjorensis* (CALEJ) significantly enhanced nutrient digestibility and altered lipid profiles in broiler chickens in the starter and finisher phases. At the starter phase, adding 75 mL/L and 100 mL/L of cold aqueous leaf extract of CALEJ improved dry matter, crude protein, and crude fibre digestibility, likely due to CALEJ's fibre content and phytochemicals stimulating gastrointestinal function. In the finisher phase, 75 ml/L and 100 ml/L of CALEJ similarly enhanced nutrient assimilation, supporting sustainable poultry nutrition. Lipid profiles indicated reduced cholesterol at 25 ml/L, triglycerides and VLDL at 75 ml/L, and LDL at 50 ml/L of CALEJ. Elevated HDL at 75 ml/L of CALEJ, indicating improved lipid metabolism and reduced cardiovascular risks. These effects could be driven by bioactive compounds and position CALEJ as a viable alternative to synthetic antibiotics, enhancing broiler health and meat quality. Future studies could explore the optimal dosage and long-term effects of CALEJ on broiler chickens, focusing on varying concentrations beyond 100 ml/L to determine potential toxicity or adverse side effects.

Declarations

Competing interests

All authors involved in the present study declared no competing interests that influence the objectivity or integrity of the present study.

Authors' contributions

Stanley Omoh Omoikhoje and Stanley Abiodun Eguaoje were involved in the conceptualization, design, and data collection. Omoikhoje Stanley Omoh, Stanley Abiodun Eguaoje, Unity Daniel Osayande, Eghosa Esther Akangbe, and Olusola Victor Obajuluwa were involved in the analysis, interpretation, and manuscript preparation. Omoikhoje Stanley Olusola, Stanley Abiodun Eguaoje, and Unity Daniel Osayande reviewed and approved the final edition of the manuscript for publication.

Acknowledgments

All authors wish to express gratitude to the poultry unit staff of the Teaching and Research Farm, Ambrose Alli University, Ekpoma, Nigeria, who assisted during the study, including those who assisted with data collection on-farm and laboratory analyses.

Ethical considerations

All authors confirmed that this manuscript was originally prepared for the Journal of World's Poultry

Science and is not under review elsewhere. The final draft was thoroughly checked for plagiarism, data fabrication, and duplication to ensure scientific integrity. The authors confirmed that no AI tools were used to conduct the present study.

Availability of data and materials

Formative data from this study are available upon request. Indications may contact the corresponding author by email or any possible communication method to access the data.

Funding

The authors did not receive any funding support for the present study.

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