Asian Journal of Advanced Research and Reports

Volume 19, Issue 5, Page 483-497, 2025; Article no.AJARR.136952
ISSN: 2582-3248

A Novel Phytogenic Solution for Sustainable Poultry Farming: Exploring the Growth-Promoting and Antimicrobial Potential of *Sesamum radiatum*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajarr/2025/v19i51032

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://pr.sdiarticle5.com/review-history/136952

Original Research Article

Received: 25/03/2025
Accepted: 27/05/2025
Published: 04/06/2025

ABSTRACT

Aims: This study evaluates the nutritional composition and antioxidant capacity of *Sesamum radiatum* extracts, with a focus on their potential application as a functional ingredient in poultry feed to enhance growth performance and promote sustainable farming practices.
Study Design: Laboratory-based experimental research supported by a short-term in vivo poultry feeding trial.
Place and Duration of Study: Conducted at the Integrated Bio Chemical Laboratory, Agro Bio Tech Research Centre Ltd (ABTEC), Poovanthuruth, Kottayam, Kerala, India, in April 2024.

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Cite as: *Gopakumar, Gopika, Hemand Aravind, Shilpa M.A, Niranjana V Renjan, and Treesa K James. 2025. "A Novel Phytogenic Solution for Sustainable Poultry Farming: Exploring the Growth-Promoting and Antimicrobial Potential of Sesamum Radiatum". Asian Journal of Advanced Research and Reports 19 (5):483-97. https://doi.org/10.9734/ajarr/2025/v19i51032.*

Methodology: Proximate analysis was conducted to determine the macronutrient composition of *Sesamum radiatum* leaves. Soxhlet extraction using hexane, chloroform, and methanol was performed to isolate bioactive compounds from the plant.Antioxidant activity was assessed using the Ferric Reducing Antioxidant Power (FRAP) assay. The extract showing the most potent antioxidant profile was incorporated into a custom-formulated poultry feed, which was then evaluated in a controlled feeding trial to measure its impact on growth performance.
Results: The methanolic extract of *Sesamum radiatum* exhibited the highest concentrations of flavonoids and phenolic compounds, contributing to its strong antioxidant capacity. Nutritional analysis revealed a favorable profile rich in protein, crude fiber, and essential micronutrients. Incorporation of the extract into poultry feed resulted in a noticeable improvement in weight gain among the treated group compared to the control, indicating better nutrient utilization and overall feed efficiency.
Conclusion: The findings support the nutritional and antioxidant benefits of *Sesamum radiatum*, positioning it as a promising phytogenic feed additive in poultry production. Its application may contribute to the development of natural, cost-effective, and sustainable feed strategies, encouraging further long-term research to validate its broader efficacy in animal health and performance.

Keywords: Sesamum radiatum; poultry nutrition; antioxidants; antimicrobial activity.

1. INTRODUCTION

The growing demand for sustainable and high-quality poultry feed has intensified research into plant-based substitutes with bioactive properties (Singh *et al*., 2023). As a critical contributor to global food security, the poultry sector has long relied on synthetic feed additives to enhance immunity, growth performance, and overall health (Upadhayay & Vishwa, 2014). However, concerns about antibiotic resistance, residual toxicity, and environmental impact have driven a shift toward natural feed supplements (AlSheikh *et al*., 2020). In this context, *Sesamum radiatum* a lesser-known but highly nutritious plant has emerged as a promising candidate due to its antibacterial and antioxidant properties. However, despite its known medicinal value, its efficacy in live poultry feeding trials remains underexplored, creating a knowledge gap that this study aims to address (Wacal *et al*., 2024).

Oxidative stress is a significant problem in poultry production, frequently resulting in slowed growth, decreased feed efficiency, and heightened susceptibility to illness (Oke *et al*., 2024). In order to stop oxidative damage to cells, antioxidants are essential for neutralizing reactive oxygen species (ROS). Despite their widespread use, synthetic antioxidants like butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) continue to raise questions about their long-term safety (Yehye *et al*., 2015) this has increased interest in antioxidants derived from natural plants, which may provide safer and more efficient substitutes. Sesamum radiatum, which is high in flavonoids and phenolic compounds, offers a good way to boost poultry's antioxidant defences (Oduntan, Olaleye, & Akinwande, 2012).

In addition to oxidative stress, bacterial infections are a serious risk to poultry production, requiring the widespread use of antibiotics to prevent and control disease (Mishra & Jha, 2019). Multidrug-resistant bacteria have emerged as a result of an over-reliance on antibiotics, posing a major threat to human and animal health (Fatima *et al*., 2023). Natural antibacterial substitutes are the subject of more and more research in an effort to lessen this. According to preliminary research, *Sesamum radiatum* has potent antibacterial action against important poultry pathogens, such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* (Shittu *et al*., 2007). Reliance on synthetic antibiotics can be decreased by adding natural antimicrobial agents to poultry feed, which could lessen worries about antibiotic resistance in the poultry sector.

Although *Sesamum radiatum* is known for its medicinal and therapeutic properties, its application as a functional ingredient in poultry nutrition remains largely unexplored. This study aims to address that gap by evaluating its proximate composition, antioxidant and antimicrobial activities, and potential benefits when incorporated into poultry feed (Dossou *et al*., 2023).

Sesamum radiatum has a distinct bioactive content that sets it apart from other sesame

species and makes it ideal for use in poultry feed. According to new research, Sesamum radiatum contains a greater profile of phenolic compounds and flavonoids, which play a crucial role in antioxidant defense, while Sesamum indicum is recognized for its abundant oil content and lignans, including sesamin and sesamolin. (Kamal-Eldin, 2010; Kancharla et al., 2020). Additionally, although *Sesamum indicum* has been associated with enhanced immunity and growth in chicken, its antibacterial qualities pale compared to those of other therapeutic herbs (Wei *et al*., 2022). *Sesamum radiatum*, on the other hand, has strong antibacterial properties that make it a potentially better option for preventing poultry diseases.

Other plant-based feed additives with antibacterial and immunomodulatory properties have been investigated, including oregano (*Origanum vulgare*), garlic (*Allium sativum*), and turmeric *(Curcuma longa*) (Ivanova *et al*., 2024). Curcumin, the active ingredient in turmeric, for instance, has well-established anti-inflammatory and antioxidant properties; nevertheless, its bioavailability in poultry is comparatively poor unless piperine or other boosters are added (Menon & Sudheer, 2007) Similar to this, although extracts of garlic and oregano have been used extensively as antibiotic substitutes, their potent taste and smell frequently make feed less palatable, which restricts their widespread use. However, *Sesamum radiatum* is a more sensible option for commercial poultry feed since it provides a neutral-tasting substitute with equivalent or even better antimicrobial advantages (Florou-Paneri, Christaki, & Giannenas, 2019).

From both an animal health and sustainable agriculture perspective, this research is of critical importance. The use of natural feed additives aligns with global initiatives promoting eco-friendly and organic farming practices. By providing scientific validation of nutritional and functional properties of *Sesamum radiatum's*, this study contributes to the development of safer and more sustainable poultry feed solutions. The findings could have significant implications for both commercial and small-scale poultry farming, offering an innovative and practical solution to current industry challenges.

2. MATERIALS AND METHODS

2.1 Plant Collection & Extraction

Fresh and disease-free *Sesamum radiatum* leaves were collected from Poovanthuruth, Kottayam district, Kerala, India in April 2024. The plant species were identified by experts and a voucher specimen is kept for future references.

2.1.1 Preparation of plant materials and extraction process

Fresh leaves of Sesamum radiatum were thoroughly washed under running tap water to remove dirt and other adhering particles. The cleaned leaves were coarsely chopped and air-dried under shade for three days, followed by further drying in a hot air oven at 60°C. Once dried, the plant material was ground into a fine powder using an electric grinder. The powdered material was sieved through a kitchen strainer to enhance solvent interaction during extraction. A total of 92.17 g of fine powder was collected and stored in a plastic container at room temperature with proper labeling. Fig. 1 shows the processing of *Sesamum radiatum* leaves.

Fig. 1. Processing Stages of *Sesamum radiatum* Leaves *(Fresh Leaf (A), Dried Leaf (B), Dried Leaf Powder (C))*

For extraction, three different solvent systems hexane, chloroform, and methanol were used to target a range of polar and non-polar compounds. Soxhlet extraction was carried out by placing 50 g of powdered leaves in the apparatus with 300 ml of each solvent. The temperature for hexane extraction was maintained between 42–52°C, while chloroform and methanol extractions were conducted at 50°C. After extraction, the solvents were evaporated using a china dish, and the resulting crude extracts were stored at 4°C for future analysis. (Oreopoulou, Tsimogiannis, & Oreopoulou, 2019)

2.2 Phytochemical Screening & Antioxidant Assay

2.2.1 Preliminary Qualitative Screening

The methanol, chloroform, and hexane extracts of *Sesamum radiatum* leaves were subjected to qualitative phytochemical analyses to identify the presence of various bioactive compounds. The following standard tests were conducted. Table 1 presents the results of the preliminary phytochemical screening of *Sesamum radiatum* extracts.

2.2.2 Quantitative analysis

2.2.2.1 Estimation of flavonoids

Flavonoid content was estimated using a colorimetric method. Standard flavonoid solutions (50–250 µg) were prepared by pipetting 0.5–2.5 ml of the standard solution into a series of test tubes. A 0.1 ml aliquot of the sample was added, and the volume was adjusted to 2.5 ml with distilled water. Subsequently, 75 µl of 5% $NaNO_2$ was added, followed by incubation at room temperature for 5 minutes. Then, 150 µl of 10% $AlCl_3$ was introduced, and the mixture was incubated for another 6 minutes. Finally, 0.5 ml of 1 M NaOH was added, and the resulting pink color was measured spectrophotometrically at 415 nm. (Agbo *et al*., 2015).

2.2.2.2 Estimation of carbohydrates

Carbohydrate content was estimated using the anthrone reagent method. A series of test tubes was prepared containing varying glucose concentrations, with tube 1 serving as the blank and tubes 2–7 used for constructing a standard curve. Each tube received 5 ml of anthrone reagent, and the mixtures were vortexed thoroughly. After cooling, the tubes were covered and incubated in a boiling water bath for 10 minutes. The absorbance was then recorded at 620 nm against the blank (Patel *et al*., 2022).

Table 1. Preliminary phytochemical screening

SL.NO	Phytochemical	Test Method	Observation	Reference
1	Flavonoids	Alkaline Reagent Test	Yellow coloration indicates presence	(Sawant & Godghate, 2013)
2	Alkaloids	Wagner's Test	Reddish brown precipitate indicates presence	(Sawant & Godghate, 2013)
		Mayer's Test	White precipitate indicates presence	(Sawant & Godghate, 2013)
		Dragendorff's Test	Red precipitate indicates presence	(Sawant & Godghate, 2013)
3	Phenols	Ferric Chloride Test	Intense blue color indicates presence	(Sawant & Godghate, 2013)
		Lead Acetate Test	Bulky white precipitate indicates presence	(Rashid, Wani & Devi, n.d.)
4	Tannins	Ferric Chloride Test	Dark green color indicates presence	(Sawant & Godghate, 2013)
5	Glycosides	Anthrone Test	Dark green coloration indicates presence	(Rashid, Wani & Devi, n.d.)
6	Protein	Biuret Test	Bluish-violet color indicates presence	(Rashid, Wani & Devi, n.d.)
7	Saponins	Frothing Test	Froth formation indicates presence	(Sawant & Godghate, 2013)
8	Coumarins	NaOH Test	No dark yellow colour absence	(Sawant & Godghate, 2013)

2.2.2.3 Estimation of crude fiber

The crude fiber content was determined by hydrolyzing non-fibrous components. A fat-free sample was treated with 200 ml of H_2SO_4, heated under reflux for 30 minutes, filtered, and washed until neutral. The residue was then digested with 200 ml of boiling NaOH, followed by further filtration and washing. The residue was dried at 130°C for 1 hour, and its dry weight was recorded. Ashing was performed by placing the sample in a furnace at 600°C for 2 hours, after which the weight of the remaining residue was recorded (Madhu *et al*., 2017).

2.2.2.4 Estimation of phenols

Total phenolic content was estimated using the Folin-Ciocalteu method. A 1 ml aliquot of the sample or standard gallic acid (10–100 µg/ml) was added to a test tube, followed by 5 ml of distilled water and 0.5 ml of Folin-Ciocalteu reagent. After 5 minutes, 1.5 ml of 20% sodium carbonate was added, and the volume was adjusted to 10 ml with distilled water. The solution was incubated for 2 hours at room temperature, allowing an intense blue color to develop. Absorbance was then measured at 765 nm. (Lamuela-Raventós, 2018).

2.2.2.5 Estimation of vitamin C

Vitamin C content was determined using an iodine-based titration method. A 5 g methanolic extract was taken in a 250 ml conical flask, to which 10 ml of 30% potassium iodide (KI) solution was added and mixed thoroughly. 5 ml of 1 M sulfuric acid (H_2SO_4) was then added to maintain an acidic medium. Four drops of 1% starch solution were introduced as an indicator. The mixture was titrated against 0.005 M iodine (I_2) solution until a stable blue-black color appeared, indicating the endpoint. The amount of Vitamin C was calculated based on the volume of iodine consumed in the titration. (Dioha *et al*., 2011).

2.2.2.6 Estimation of protein (Kjeldahl Method)

Protein content was determined using the Kjeldahl method. Four Kjeldahl digestion tubes were used two for the samples and two as blanks. Sample 1 contained 0.250 g of the test material, and Sample 2 contained 0.252 g. A catalyst mixture consisting of potassium sulfate and copper sulfate in a 5:1 ratio was added to each tube (approximately one spoonful). Then, 5 ml of concentrated sulfuric acid (H_2SO_4) was added to each tube to facilitate the conversion of organic nitrogen to ammonium sulfate. The tubes were heated to ensure complete digestion of the protein content. For the blank samples, only the catalyst mixture and sulfuric acid were added. After digestion, a mixed indicator was introduced to aid in visual endpoint detection. The digested solution was then titrated against 0.02 N hydrochloric acid (HCl) until a green color endpoint was observed, indicating the completion of the reaction. (Baker & Thompson, 1992).

2.2.3 Bioactivity assays

2.2.3.1 Antioxidant assay

Ferric Reducing Antioxidant Power (FRAP) assay:

FRAP solution (3.6 ml) add to distilled water (0.4 ml) and incubated at 37˚C for 5 minutes. Then this solution mixed with certain concentration of the plant extract (80 ml) and incubated at 37˚C for 10 minutes. The absorbance of the reaction mixture was measured at 593 nm. For construction of the calibration curve, five concentrations of $FeSO_4$, $7H_2O$ (0.1, 0.4, 0.8, 1, 1.12, 1.5 mM) were used and the absorbance values were measured accordingly. (Gohari *et al*., 2011).

2.2.3.2 Antimicrobial assay

Isolation and Identification of Target Organisms:

The bacterial strains used in this study *Staphylococcus aureus, Pseudomonas aeruginosa,* and *Escherichia coli* were obtained from the microbial culture collection of the Integrated Bio Chemical Laboratory, Agro Bio Tech Research Centre Ltd (ABTEC), Kottayam, Kerala, India. These strains are routinely maintained in the laboratory for research purposes and were revived on selective media under aseptic conditions prior to antimicrobial testing. All procedures involving microbial handling followed standard biosafety protocols.

For the isolation of *Staphylococcus aureus*, Mannitol Salt Agar (MSA) was prepared by dissolving 2.22 g of MSA medium and 0.52 g of agar in 20 ml of sterile water, followed by sterilization at 21°C for 12–20 minutes. The prepared medium was poured into sterile Petri

plates. The bacterial strain was streaked using the quadrant streak method and incubated for 24 hours, after which pure colonies were subcultured for further experiments. (Kateete *et al*., 2010)

For the isolation of *Escherichia coli*, MacConkey Agar was prepared by dissolving 2.5 g of MacConkey medium and 1.3 g of agar in 50 ml of distilled water, followed by sterilization at 21°C for 12–21 minutes. The bacterial strain was streaked using the quadrant streak method and incubated. Pure cultures were subcultured for further analysis. (Bozaslan *et al*., 2016).

Pseudomonas aeruginosa was cultured on Nutrient Agar, as it is an obligate aerobe capable of anaerobic growth in the presence of nitrates. The organism was incubated at 37°C, its optimal growth temperature. Fig. 2 display bacterial strains cultured on selective media: *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.

2.2.3.3 Agar disc diffusion method for antimicrobial susceptibility testing

The disc diffusion method is based on the diffusion of an antimicrobial agent from an impregnated disc placed on an agar plate pre-inoculated with the test bacterium. The antibiotic diffuses radially, creating a concentration gradient. If the antimicrobial agent is effective, a clear zone of inhibition appears around the disc.

Mueller-Hinton Agar (MHA) was prepared according to the manufacturer's instructions using distilled or deionized water. The medium was boiled, autoclaved at 121°C for 15 minutes, and cooled to 40–50°C before being poured into sterile Petri plates to a uniform depth of 4 mm. The plates were dried at 30–37°C in an incubator with lids partially open to remove excess moisture, preventing bacterial swarming and ensuring accurate results. (Jorgensen & Turnidge, 2015).

For inoculum preparation, bacterial suspensions were prepared from pure cultures not older than 48 hours. Four to five colonies were transferred using a sterile wire loop into 5 ml of Trypticase soy broth or 0.9% saline.

For plate inoculation, a sterile cotton swab was dipped into the bacterial suspension and used to evenly spread the inoculum over the MHA plate. The plate was rotated 60° and streaking was repeated to ensure uniform bacterial distribution. The inoculated plates were allowed to dry for 3–5 minutes before applying antimicrobial discs. Three different concentrations of the plant extract were introduced as antimicrobial agents, and the plates were incubated under optimal conditions for the test organism. The zones of inhibition were measured to assess antimicrobial efficacy.

2.3 Formulation of Nutritional Feed Mix

A nutritional feed mix was formulated using 400 g of wheat mixed with 30 g of starch, 50 g of turmeric and 10 g of *Sesamum radiatum* powder, and 10 ml of distilled water. The ingredients were thoroughly mixed and then dried at 50°C for minimize the moisture content. Fig. 3 illustrates the formulated poultry feed.

Fig. 2. Streak Plate Cultures of Bacterial Strains on Selective Media: (*Staphylococcus aureus* on MSA (A), *Escherichia coli* on MacConkey Medium (B), *Pseudomonas aeruginosa* on nutrient agar Medium (C), respectively.)

Fig .3. *Sesamum radiatum* Feed for poultry

3. RESULTS

3.1 Phytochemical Screening

3.1.1 Preliminary phytochemical tests

The results indicated that methanolic extracts have the highest number of phytochemicals, including flavonoids, phenols, tannins, glycosides, proteins, and coumarin. Table 2 summarizes the presence (+) or absence (–) of key phytochemicals across different solvent extracts.

The presence of individual phytochemicals were further confirmed through qualitative tests. The characteristic color changes were observed

3.2 Quantitative Analysis of Bioactive Compounds

The total carbohydrate, phenol, and flavonoid content of *Sesamum radiatum* extracts were estimated using spectrophotometric methods. The results are shown in Tables 3–4.

3.2.1 Estimation of carbohydrates

Carbohydrate content was determined by measuring optical density (OD) at 620 nm.

From the calibration curve, the carbohydrate content was estimated as 59.5 µg/ml

3.2.2 Estimation of Phenol Content

Phenol content was determined using OD measurements at 765 nm.

The estimated phenol content was 28 µg/ml

3.2.3 Estimation of Flavonoid Content

Flavonoid concentration was analyzed using OD readings at 415 nm.

The flavonoid content was estimated to be 449 µg/ml.

Table 2. Preliminary phytochemical screening of *Sesamum radiatum* extract

Preliminary analysis of *Sesamum radiatum*	Hexane	Chloroform	Methanol
Flavanoid	+	-	+
Terpenoid	-	-	-
Phenol	-	-	+
Tannin	-	-	+
Resin	-	-	-
Glycoside	-	+	+
Protein	+	+	+
Reducing sugar	-	-	-
Saponin	-	-	-
Coumarin	+	-	+

(+: Presence, -: Absence)

Table 3. Total carbohydrate estimation

Concentration (µg/ml)	OD Values at 620 nm
10	0.051
20	0.103
40	0.166
60	0.251
80	0.351
100	0.406
150	0.654
200	0.864

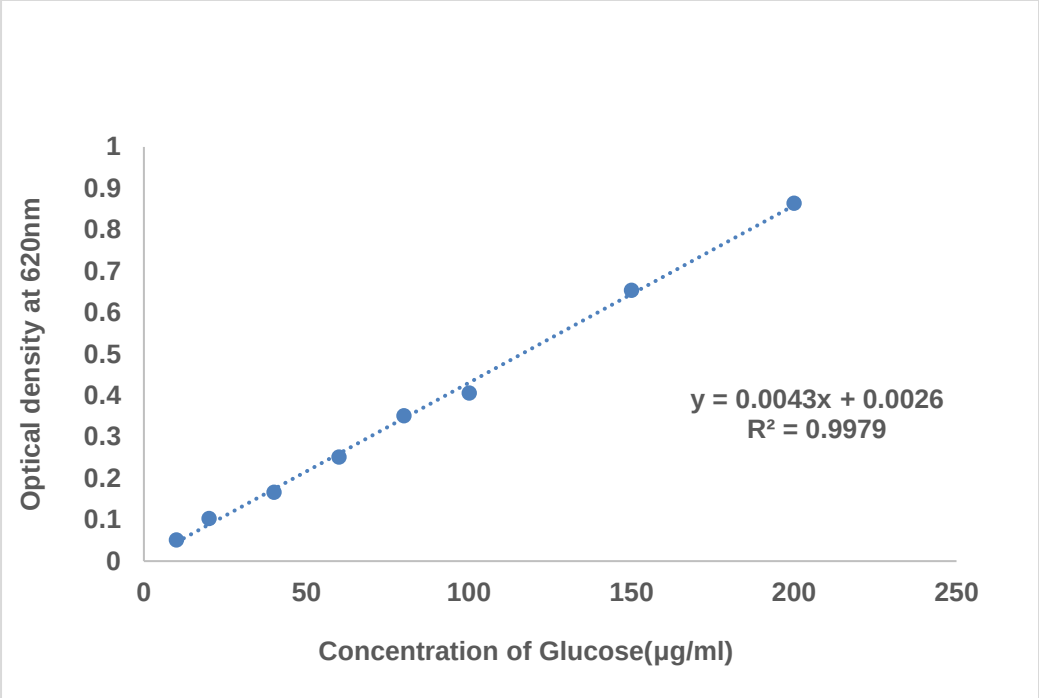

Fig. 3. Estimation of total carbohydrate

Table 4. Total phenol estimation

Concentration (µg/ml)	OD Values at 765 nm
10	0.241
20	0.406
40	0.651
60	0.924
80	1.221
100	1.462

Table 5. Total flavonoid estimation

Concentration (µg/ml)	OD Values at 415 nm
50	0.060
100	0.128
150	0.182
200	0.232
250	0.300

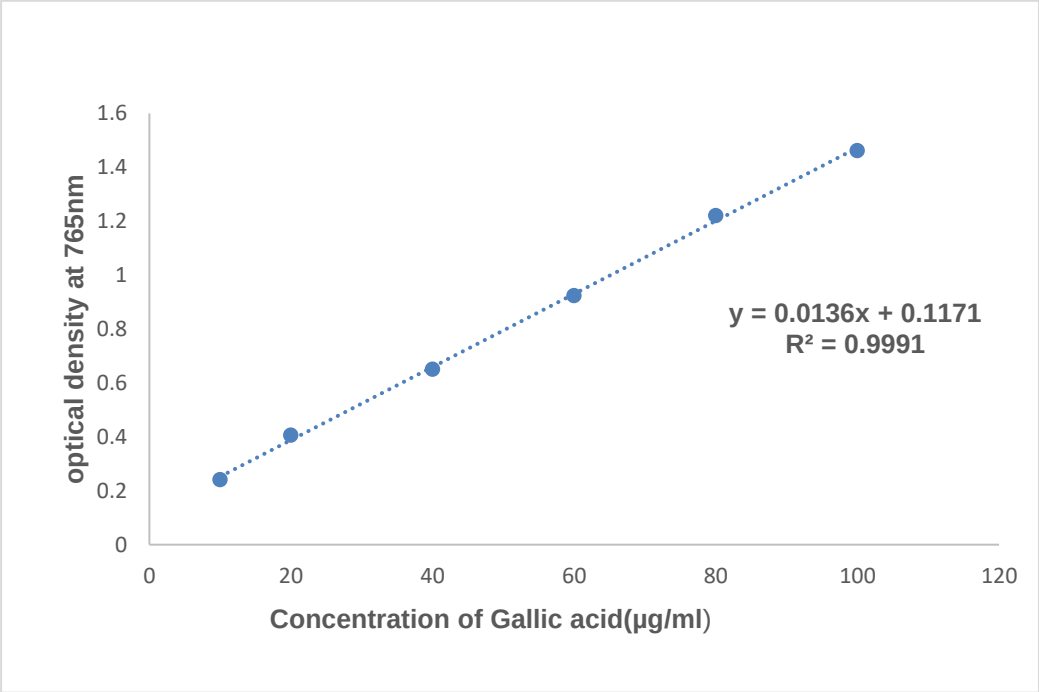

Fig .4. Estimation of Phenol content

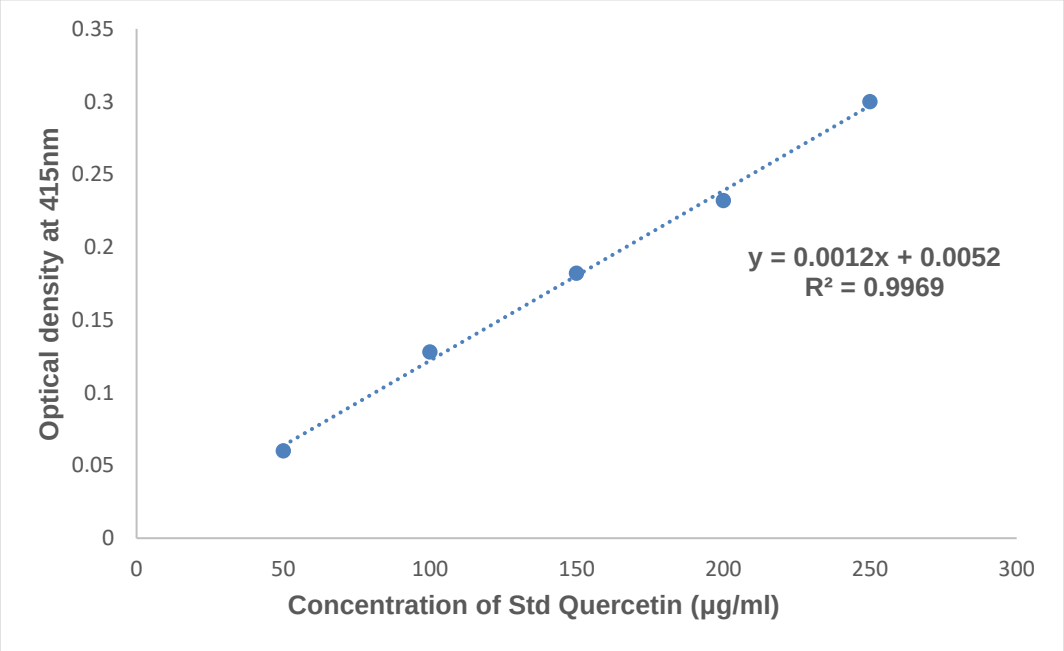

Fig .5. Estimation of Flavonoid content

3.3 Antioxidant Activity by FRAP Assay

The antioxidant potential of *Sesamum radiatum* was evaluated using the Ferric Reducing Antioxidant Power (FRAP) assay. Fig. 6 shows the antioxidant activity of *Sesamum radiatum* extracts using the FRAP assay. The results (Table.7) show a concentration-dependent increase in reducing power.

The methanolic extract exhibited the highest antioxidant activity, correlating with its high phytochemical content.

3.4 Antimicrobial Activity

3.4.1 Isolation and identification of target organisms

The selected bacterial strains obtained from microbiology lab were isolated and cultured on respective agar media.

3.4.2 Agar disc diffusion assay

The antibacterial activity of different extracts was evaluated using the disc diffusion method (Fig. 7 - 9). The results are summarized in Table 8.

3.5 Evaluation of Poultry Feed

The *Sesamum radiatum* feed formulation and field trials are shown in Fig. 10 -11. The test group showed 15.25% weight gain, compared to 10.41% in the control group, indicating its potential as a poultry feed supplement.

Table 6. Proximate Composition of Sample

Component	Percentage (%)
Crude Fibre	4.6
Protein	22.4
Lipid	3.68

Table 7. Antioxidant activity of *Sesamum radiatum* extracts.

Concentration of standard and test (µg/ml)	O.D of standard ascorbic acid	Methanol extract of *Sesamum radiatum*
Blank	**0.021**	**0.039**
0.2	0.286	0.224
0.4	0.344	0.265
0.6	0.391	0.323
0.8	0.452	0.331
1	0.476	0.375
1.2	0.561	0.401
1.4	0.6	0.454
1.6	0.68	0.506

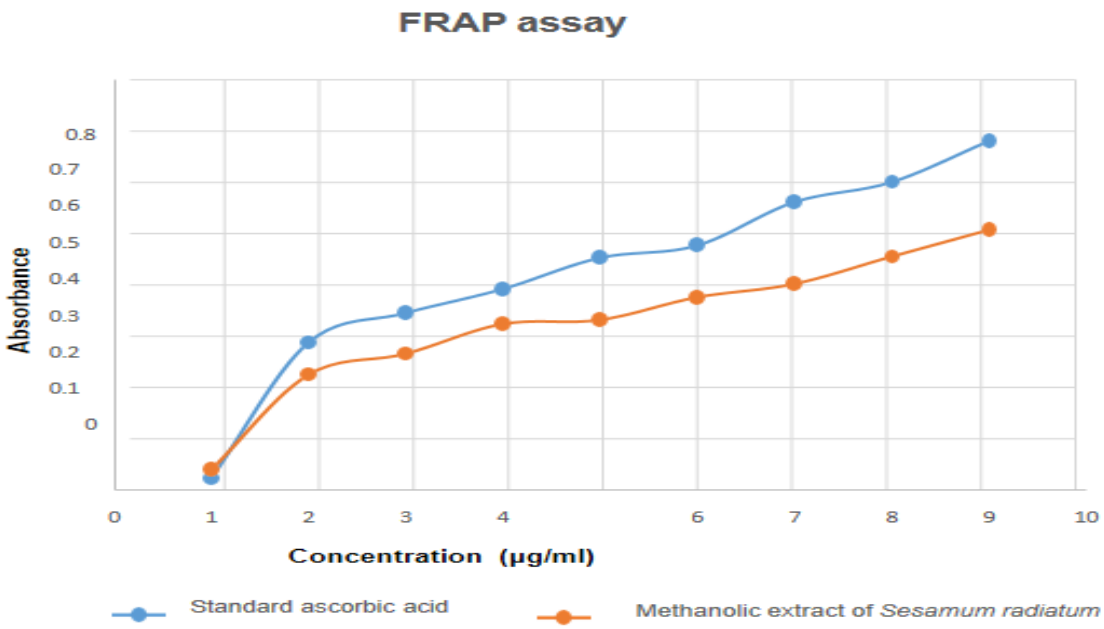

Fig. 6. Ferric Reducing Antioxidant Power (FRAP) Assay of *Sesamum radiatum* Extracts

Fig.7. Antibacterial Activity of *Sesamum radiatum* Extracts (Methanol (A), Chloroform (B), and Hexane(C) Against *Staphylococcus aureus*

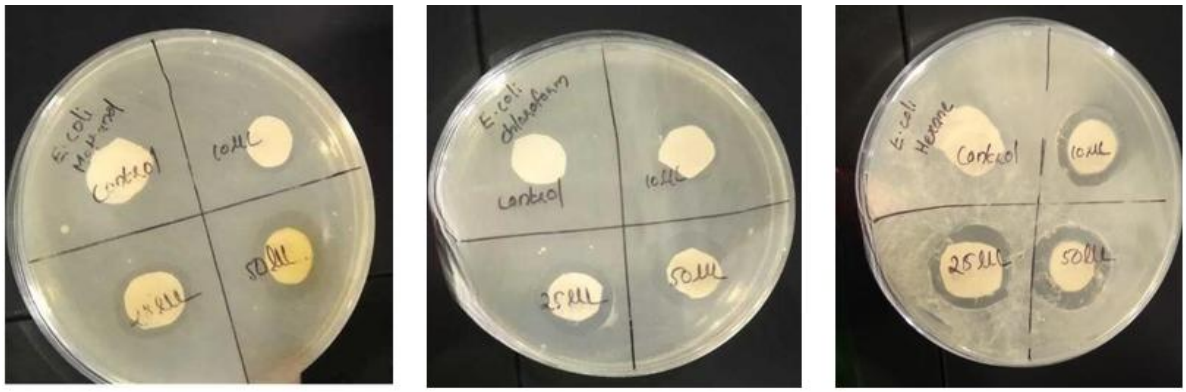

Fig. 8. Antibacterial Activity of *Sesamum radiatum* Extracts (Methanol (A), Chloroform (B), and Hexane (C) Against *Escherichia coli*

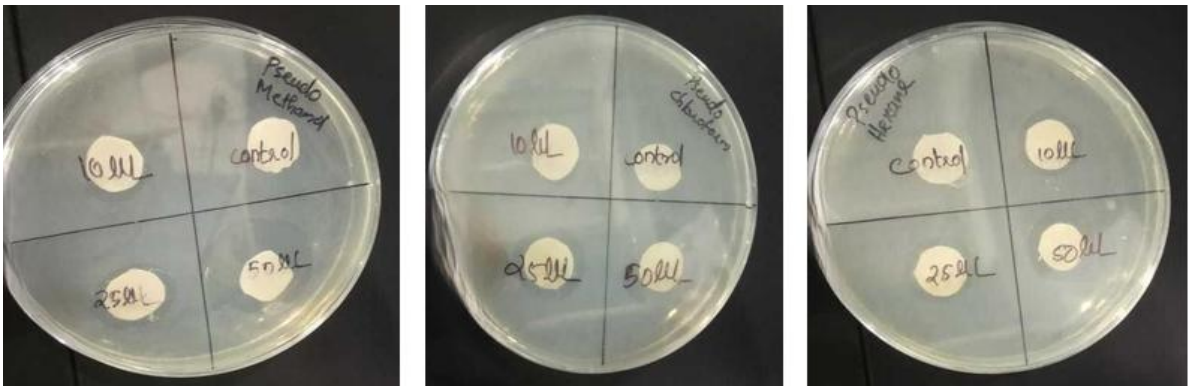

Fig. 9. Antibacterial Activity of *Sesamum radiatum* Extracts (Methanol (A), Chloroform (B), and Hexane (C) Against *Pseudomonas aeruginosa*

Table 8. Antimicrobial activity of *Sesamum radiatum* extracts

Plant extract			Microorganism		
Hexane	**Chloroform**	**Methanol**	***Staphylococcus aureus***	***Escherichia coli***	***Pseudomonas aeruginosa***
10 µL	10 µL	10 µL	Resistant	Resistant	Resistant
25 µL	25 µL	25 µL	Resistant	Resistant	Resistant
50 µL	50 µL	50 µL	Resistant	Resistant	Resistant

Table 9. Field trial for feed in Poultry farm

Test		Control	
Initial weight	Final weight	Initial weight	Final weight
590 g	680 g	480 g	530 g

Fig. 10. Field Trial for Feed in Poultry Farm: Field trial before feed (Test and control)

Fig. 11. Field Trial For Feed In Poultry Farm: Field trial after feed (Test and control)

4. DISCUSSION

A rich phytochemical profile comprising flavonoids, phenols, tannins, glycosides, proteins, and coumarins were found in the methanolic extract of *Sesamum radiatum*. These molecules are present in diverse solvent extracts, most likely as a result of variations in the solvent's polarity and capacity to dissolve particular phytochemicals. Hexane extracts, for instance, contained proteins, coumarins, and flavonoids, whereas chloroform extracts possess proteins and glycosides. But the best solvent for extracting a wider variety of bioactive substances was methanol.

The methanolic extract contains flavonoids and tannins, which are known to have antibacterial and anti-inflammatory qualities. Plants produce flavonoids in reaction to microbial infection, which combine with bacterial cell walls and proteins to produce antimicrobial effects (Rice-Evans et al., 1997). Conversely, tannins have the ability to attach to proteins that are high in proline, which can interfere with protein synthesis and have the ability to repair wounds (Jorgensen et al., 1991).

The disc diffusion method was used to assess the antibacterial activity of *Sesamum radiatum* extracts against *Pseudomonas aeruginosa, Escherichia coli,* and *Staphylococcus aureus.* The rich phytochemical components indicates

potential efficacy at larger dosages, despite the weak antibacterial impact at the studied concentrations.

The extract's ability to neutralize free radicals was further supported by antioxidant activity measured using the Ferric Reducing Antioxidant Power (FRAP) assay, which further supports its usage as a natural medicinal agent.

Results from a field trial with 30-day-old chicks during a 30-day period were encouraging. The methanolic extract-fed chickens showed improved immunological response and increased body weight by 15.25%, suggesting greater metabolic efficiency and food absorption. These results highlight the potential in poultry production of *Sesamum radiatum* as a natural immune-boosting and growth-promoting agent.

In summary, the findings support the traditional application of *Sesamum radiatum* and offer a rationale for its inclusion in organic poultry feed. To fully realize its potential as a sustainable substitute for synthetic chemicals, future research should examine the precise mechanisms of action, ideal doses, and long-term safety.

5. CONCLUSION

This study evaluated the nutritional composition, antioxidant capacity, and antimicrobial activity of *Sesamum radiatum* leaf extracts for potential application in poultry feed. The methanolic extract, in particular, exhibited a high concentration of bioactive compounds such as flavonoids, phenols, and proteins, contributing to its strong antioxidant performance as evidenced by the FRAP assay. Although no zones of inhibition were observed in the disc diffusion assay indicating resistance of the tested bacterial strains to the crude extracts at the applied concentrations, the phytochemical profile suggests that antimicrobial potential may still exist at higher doses or in purified fractions. Notably, the in vivo poultry feed trial demonstrated a significant improvement in weight gain among birds supplemented with *Sesamum radiatum*-enriched feed, highlighting its promise as a natural growth-promoting additive. These findings support the incorporation of *Sesamum radiatum* as a functional ingredient in sustainable poultry nutrition, particularly for its nutritional and antioxidant benefits. Further research should focus on optimized extraction protocols, the isolation of active constituents, and expanded in vivo antimicrobial testing to better understand its potential as a phytogenic alternative to synthetic additives.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://pr.sdiarticle5.com/review-history/136952