

Physiological Resilience and Metabolic Response of Broiler Chickens to Graded Level of *Ocimum Gratissimum* and *Vernonia Amygdalina* Leaf Meals as Natural Growth Promoters

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Abstract- This study provides a comparative assessment of the haematological and serum biochemical responses of broiler chickens fed graded levels of *Ocimum gratissimum* (Scent Leaf Meal SLM) and *Vernonia amygdalina* (Bitter Leaf Meal BLM) as natural alternatives to synthetic antibiotics. In two separate trials, a total of 300 day old broiler chicks (Ross 308) were assigned to four dietary treatments (T1: 0%, T2: 0.15%, T3: 0.30%, and T4: 0.45% inclusion) in a Completely Randomized Design. At the end of the 7 weeks (finisher phase), blood samples were collected to evaluate erythrocytic indices, immune response markers, liver enzyme activity, and lipid profiles. Results revealed that SLM significantly ($P < 0.05$) stimulated erythropoiesis, achieving optimal packed cell volume (36.33%) and haemoglobin levels (13.80 g/dL) at the 0.30% inclusion level (T3). In contrast, birds fed BLM maintained lower haematological values, with peak PCV at 28.67% in the control group. Serum biochemistry indicated that SLM possesses superior hepatoprotective and hypolipidemic properties, significantly increasing high density lipoprotein (76.33 mg/dL) while maintaining low liver enzyme activity at high inclusion levels. Conversely, BLM inclusion at 0.45% (T4) induced significant elevations in ALT (86.11 U/L) and AST (44.37 U/L), suggesting a metabolic safety threshold at lower concentrations. Both leaf meals supported robust immune health through maintained lymphocyte counts. It is concluded that while both plants are physiologically compatible with broiler production, *Ocimum gratissimum* offers a higher safety threshold and more effective lipid lowering potential. For optimal performance, an inclusion level of up to 0.45% is recommended for SLM, while BLM should be restricted to a 0.30% inclusion level to avoid hepatocellular stress.

Index Terms- *Ocimum gratissimum*, *Vernonia amygdalina*, Broiler chickens, Haematology, Serum Biochemistry, Phytogetic additives.

I. INTRODUCTION

The poultry industry remains a cornerstone of global food security, providing a high quality, affordable source of animal protein. However, the sector faces significant challenges, including the rising cost of conventional feed ingredients and the global ban on synthetic antibiotic growth promoters (AGPs) due to concerns over antibiotic resistance (Hafez, 2020; Rafiq et al., 2022). In Nigeria, the drive for self sufficiency in meat production has necessitated the exploration of locally available, sustainable, and bioactive alternatives to enhance broiler performance and health (World Health Organization, 2022). Phytogetic feed additives (PFAs), derived from medicinal plants, have emerged as a promising solution due to their safety profile and functional properties.

Among these phytoGENICS, *Vernonia amygdalina* (Bitter Leaf) and *Ocimum gratissimum* (Scent Leaf) are widely recognized for their therapeutic and nutritional potential. *Vernonia amygdalina* is valued for its hepatoprotective and immune boosting bioactivities, often used in ethnoveterinary medicine to support poultry health (Yeap et al., 2010). Similarly, *Ocimum gratissimum* is rich in phytochemicals with potent antibacterial, antioxidant, and hypolipidemic properties, which contribute to improved blood formation and metabolic efficiency (Agwu et al., 2025).

While both plants have been studied individually, their comparative influence on the physiological and metabolic state of broiler chickens is critical for

determining the most effective inclusion strategies. Haematological parameters serve as vital indicators of an organism's nutritional and pathological condition, reflecting the efficiency of oxygen transport and immune resilience (Etim et al., 2014). Concurrently, serum biochemical indices, including liver enzyme activity and lipid profiles, provide insights into the metabolic safety and systemic health of the birds (Ambrosy et al., 2012).

A comparative assessment of these two tropical leaf meals is essential to identify the optimal inclusion levels that balance growth promotion with physiological safety. While scent leaf meal (SLM) has shown a remarkable capacity to enhance erythropoiesis and reduce serum cholesterol (Pelczyńska et al., 2022), bitter leaf meal (BLM) offers strong immune support but may exhibit specific metabolic thresholds at higher concentrations (Tokofai et al., 2021). Therefore, this study aims to compare the haematological and serum biochemical responses of broiler chickens fed graded levels of *Ocimum gratissimum* and *Vernonia amygdalina*, providing a physiological roadmap for their use as natural growth promoters in sustainable poultry production.

II. MATERIALS AND METHODS

1. Experimental Site

The experiments were carried out at the Poultry Unit of the Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The area falls within the tropical rain forest zone, it is located at latitude 50 210N and longitude 70 330E, its elevation is about 112m above sea level. It has annual rainfall of 2177mm, temperature range between 20-30oC, with relative humidity of 50-59%, depending on season (NRCRI, 2020).

Collection and Preparation of Leaf Meals

Fresh leaves of bitter leaf (*Vernonia amygdalina*) and Scent Leaf Meal (*Ocimum gratissimum*) were collected from the university environment and local farms in Umudike, Ikwuano Local Government Area of Abia State, Nigeria. Upon collection, the leaves were air-dried in the shade at room temperature (approximately 25–30°C) for eight days to reduce moisture content. The dried leaves were then

processed using a local mill and ground into a fine meal, ensuring homogeneity for easy incorporation into the experimental diets.

III. EXPERIMENTAL DIET FOR BITTER LEAF MEAL (*Vernonia amygdalina*) AND SCENT LEAF MEAL (*Ocimum gratissimum*)

A straight diet containing 22% crude protein (CP) and 2800 kcal/kg metabolizable energy (ME) was formulated according to the recommendations of NRC (1994) for broiler chickens. Bitter leaf meal (*Vernonia amygdalina*) and Scent Leaf Meal (*Ocimum gratissimum*) were incorporated into the straight diet at 0%, 0.15%, 0.30%, and 0.45%, giving a total of four treatments: T₁, T₂, T₃, and T₄, respectively. each treatment group was replicated three times, with 10 birds per replicate. Treatment 1 served as the control, Treatment 2 contained 0.15% bitter leaf meal, Treatment 3 contained 0.30% bitter leaf meal, and Treatment 4 contained 0.45% bitter leaf meal.

Table 1: Dietary Composition for Broiler Chickens Fed With Bitter Leaf Meal (*Vernonia amygdalina*)

Ingredients	T ₁ (control)	T ₂ (0.15%)	T ₃ (0.30%)	T ₄ (0.45%)
Maize	48.00	48.00	48.00	48.00
Wheat offal	5.00	5.00	5.00	5.00
PKC	13.00	12.85	12.70	12.55
Bitterleaf meal	0.00	0.15	0.30	0.45
Soyabean meal	27.00	27.00	27.00	27.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100	100	100	100

ME (kcal/kg)	2826.30	2828.30	2820.30	2820.30
CP (%)	22.00	22.16	22.15	22.14
CF (%)	4.02	4.86	4.88	4.89
EE (%)	3.99	3.94	3.90	3.88

PKC= Palm kernel cake, ME= Metabolizable Energy, CP= Crude Protein, CF= Crude Fiber, EE= Ether Extract

Table 2: Dietary composition for broiler chickens fed with scent leaf meal (Ocimum gratissimum)

Ingredients	T ₁ (control)	T ₂ (0.15%)	T ₃ (0.30%)	T ₄ (0.45%)
Maize	48.00	48.00	48.00	48.00
Wheat offal	5.00	5.00	5.00	5.00
PKC	13.00	12.85	12.70	12.55
Scent leaf meal	0.00	0.15	0.30	0.45
Soya bean	27.00	27.00	27.00	27.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	100	100	100	100
ME (kcal/kg)	2826.30	2825.30	2825.30	2820.30
CP (%)	22.00	22.23	22.15	22.14
CF (%)	4.02	4.55	4.86	5.05
EE (%)	3.99	3.92	3.86	3.84

PKC= Palm kernel cake, ME= Metabolizable Energy, CP= Crude Protein, CF= Crude Fiber, EE= Ether Extract

Experimental Birds and Management

A total of 300 day old broiler chicks (Ross 308 strain) were used for each trial. Before the arrival of the birds, the brooding house and the entire farm were thoroughly washed and fumigated using formaldehyde solution. The drinkers and feeders were washed. Wood shaving was used as their litter material. On the arrival of the chicks, they were given anti-stress solution. The brooding lasted for one week after which they were randomly shared into their individual pens according to treatments. Feed and water were given ad-libitum, they were routinely vaccinated against newcastle and gumboro diseases. The experiment lasted for 7 weeks

Haematological Indices for Bitter Leaf Meal (*Vernonia amygdalina*) and Scent Leaf Meal (*Ocimum gratissimum*)

At the end of Experiments, blood samples (10 mL) were collected from the jugular vein using sterile needles and syringes. Five millilitres (5 mL) of each sample was transferred into tubes containing Ethylene Diamine Tetra Acetic Acid (EDTA) as an anticoagulant to prevent clotting. The blood samples

were placed into properly labelled and sterilized tubes and transported to the laboratory for haematological analysis. The following parameters were determined: Packed Cell Volume (PCV), Red Blood Cells (RBC), White Blood Cells (WBC), haemoglobin (Hb), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), and Mean Corpuscular Haemoglobin Concentration (MCHC).

Packed cell volume (PCV) determination: The Packed Cell Volume (PCV) was determined using the microhaematocrit method. A microcapillary tube was nearly filled with the blood sample and sealed at one end. The tube was centrifuged at 10,000 revolutions per minute (rpm) for 5 minutes using a microhaematocrit centrifuge. After centrifugation, the PCV was read using a microhaematocrit reader, and the value was expressed as a percentage of the total blood volume.

Haemoglobin concentration determination: The haemoglobin (Hb) concentration of the blood samples was determined using the cyanomethaemoglobin method (Kachmar, 1970). Five millilitres (5 mL) of Drabkin's haemoglobin reagent was added to a clean test tube, followed by 0.02 mL of the blood sample. The mixture was allowed to react for 20 minutes, after which the absorbance was measured at a wavelength of 540 nm against a reagent blank using a digital colorimeter. Standard solutions were prepared in the same manner and read at 540 nm. The haemoglobin concentration of the blood sample was obtained by multiplying the absorbance and concentration of the standard.

Haemoglobin concentration (g/100ml) =

$$\frac{\text{Reading of test tube} \times \text{haemoglobin standard conc.}}{\text{Reading of standard}}$$

Red blood cell count (erythrocyte count) determination: A volume of 0.02 mL of blood was pipetted from each blood sample and added to 4 mL of red blood cell (RBC) diluting fluid in a clean test tube to achieve a 1:200 dilution. The diluted blood sample was loaded into a Neubauer counting

chamber, and all red blood cells in the five groups of 16 small squares in the central area of the chamber were enumerated using a light microscope at 40× magnification. The number of cells counted for each sample was multiplied by 10,000 to obtain the red blood cell count per microlitre (µL) of blood.

Mean corpuscular haemoglobin (MCH)

$$\frac{\text{Hb} \times 10}{\text{RBC}}$$

Mean corpuscular volume (MCV)

$$\frac{\text{PCV} \times 10}{\text{RBC}}$$

Mean corpuscular haemoglobin concentration (MCHC)

$$\frac{\text{Hb} \times 100}{\text{PCV}}$$

White blood cell count determination: A volume of 0.02 mL of blood was pipetted into a small test tube containing 0.38 mL of white blood cell (WBC) diluting fluid to achieve a 1:20 dilution of the blood sample. The diluted blood sample was loaded into a Neubauer counting chamber, and all cells in the four corner squares were enumerated using a light microscope at 10× magnification. The number of cells counted for each sample was multiplied by 50 to obtain the white blood cell count per microlitre (µL) of blood.

Total protein determination: This was determined using the method described by RANDOX®

Equal volume (0.02 ml) of each of distilled water, serum and standard were pipetted into different test tubes. Then 1 ml of biuret and blank reagent were added to all the test tubes and the solutions were thoroughly mixed and incubated at 25°C for 30 minutes. The absorbance was read at 546 nm against a reagent blank and total protein was determined by using the formula

$$\frac{\text{Absorbance of test} \times \text{concentration of standard}}{\text{Absorbance of standard}} \times \frac{100}{1}$$

The biuret reagent contained 100mmol/L NaHO, 16 mmol/L Na-K-tartrate, 15 mmol/L potassium iodide and 6 mmol/L /1 CuSO₄. Blank reagent contained 100mmol/L NaHO and 16 mmol/L Na-K-tartrate. The concentration of the standard was 5.85 g/dl.

Albumin determination: This was determined using the method described by RANDOX®

The measurement of serum albumin was based on its quantitative binding to the green bromocresol green (BCG) indicator. The albumin–BCG complex absorbs maximally at 578 nm, with the absorbance being directly proportional to the concentration of albumin in the sample. Equal volumes (0.01 mL) of distilled water, serum, and albumin standard were pipetted into separate test tubes. Thereafter, 3.00 mL of reagent (75 mmol/L succinate buffer, pH 4.2; 0.15 mmol/L bromocresol green, Brij 35, and preservative) was added to each test tube. The solutions were vigorously mixed and incubated at 25°C for 5 minutes. The absorbance was measured at 623 nm against a reagent blank, and the albumin concentration was calculated using the appropriate formula.

$$\frac{\text{Absorbance of sample} \times \text{concentration of standard}}{\text{Absorbance of standard}}$$

Globulin determination: The values of the serum globulin was obtained by subtracting the value of serum albumin from that of the total protein, since total protein is made up of albumin and globulin.

Serum urea determination:

Reagents:

- i. Reagent A–Urease/Salicylate which contained urease, sodium salicylate, sodium nitroprussiate, EDTA-Na₂ and phosphate buffer pH 6.8.
- ii. Reagent B–Alkaline hypochlorite contained alkaline hypochlorite in NaOH
- iii. Reagent C–Standard contained aqueous

solution of urea equivalent to 40mg/dl.

Procedure:

- i. Prepare reagent A by dissolving one vial of the urea-salicylate in 100 mls of deionized water
- ii. Prepare reagent B by mixing the alkaline hypochlorite supplied in 500 mls of deionized water
- iii. To a test tube, add 1.0 ml of reagent A.
- iv. Then add 0.01 ml of serum sample to the test tubes and 0.01 ml of standard to the two test tubes labelled 'standard 1' and 'standard 2'. Leave one test tube for blank
- v. Mix and incubate for 5 minutes at room temperature
- vi. After, add 1.0 ml of reagent B to all (both samples, standards and blank)
- vii. Incubate for 5 minutes at room temperature
- viii. Read the absorbance at 578 nm against the blank

Calculation: The urea in mg/dl was obtained using the formula:

$$\frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \frac{40}{1}$$

Serum creatinine determination:

Reagents:

- i. Reagent A=Alkaline solution containing NaOH and Na₂CO₃
- ii. Reagent B=Picric acid solution
- iii. Reagent C=Standard; an aqueous solution equivalent to 2mg/dl of creatinine

Material: Spectrometer

IV. STATISTICAL ANALYSIS

All data generated were subjected to analysis of variance (ANOVA) and treatment means that were significantly different were separated using Duncan's Multiple Range Test (Duncan, 1955) according to Steel and Torrie (1980) using computer software IBM SPSS Statistic version 20 (SPSS, 2009).

V. RESULT AND DISCUSSION

Physiological and Metabolic Safety: A Multi Plant Hematological and Serum Biochemical Profile

VI. HAEMATOLOGICAL PARAMETERS OF BROILER CHICKENS FED DIET CONTAINING (*Vernonia amygdalina*) BITTER LEAF MEAL

The haematological parameters of broiler chickens fed bitter leaf meal are presented in Table 3

Table 3: Haematological Parameters of Broiler Chickens fed Bitter Leaf Meal

Parameters	T1 (Control)	T2 (15%)	T3 (30%)	T4 (45%))	SE M
RBC (x10 ⁶ /mm ³)	19.73	19.50	14.97	16.00	1.36
PCV (%)	28.67 ^a	22.33 ^b	25.33 ^a _b	13.67 _c	1.84
Hb (g/dl)	6.47 ^a	5.27 ^{ab}	5.60 ^{ab}	4.53 ^b	0.28
WBC (x10 ⁶ /mm ³)	20.97	30.97	17.03	10.63	3.40
MCV (fl)	15.76 ^{ab}	11.38 ^a _b	18.60 ^a	8.64 ^b	1.62
MCH (pg)	3.61	2.69	4.04	3.01	0.29
MCHC (%)	22.85 ^b	23.99 ^b	22.13 ^b	33.11 _a	1.61
Neutrophils (%)	34.33 ^a	32.00 ^b	30.33 ^c	30.67 _c	0.51
Lymphocytes (%)	64.33 ^c	66.67 ^b	68.00 ^a	66.33 _b	0.41
Monocytes (%)	0.33	0.33	0.67	1.00	0.15
Eosinophils (%)	1.00 ^b	1.00 ^b	1.33 ^b	2.00 ^a	0.14
Basophils (%)	0.00	0.00	0.00	0.00	0.00

^{a,b,c} Means with different superscripts in the same row are significantly different (p<0.05), S.E.M: Standard Error of mean, RBC=Red Blood Cell, PCV=Packed Cell Volume, Hb=Haemoglobin, WBC=White Blood Cell, MCV=Mean Corpuscular Volume, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration.

Haematological evaluation revealed that dietary inclusion of bitter leaf meal significantly influenced most parameters (P<0.05), with the exception of RBC, WBC, monocytes, and basophils. Birds in T1 exhibited the highest PCV (28.67%), Hb (6.47 g/dl),

and neutrophils (34.44%), while T3 and T4 showed peak values for MCV (18.60 fl) and MCHC (33.11%), respectively. Although Hb and PCV values were slightly below the standard ranges established for poultry (Onunkwo *et al.*, 2021). they remained within functional thresholds to support nutritional status and oxygen transport without inducing clinical anaemia (Erasmus, 2022).

The stability of the total white blood cell count and the significantly higher lymphocyte levels in T3 (68.00%) indicate that the immune system was not compromised (Eroschenko, 2013). This aligns with findings by Osho *et al.* (2014) and Onunkwo *et al.* (2021), who observed that medicinal plant extracts support haemopoietic tissues. Furthermore, the highest eosinophil count in T4 (2.00%) suggests an enhanced capacity to combat potential infections, as these cells play a primary role in the body's defense system (Frandsen, 1986).

The observed fluctuations in MCV and MCHC, particularly the increases in T3 and T4, suggest a physiological adaptation to the phytogenic additives. While some values were lower than those reported in similar studies (Isika *et al.*, 2012), the overall profiles for neutrophils, monocytes, and basophils remained within normal ranges for healthy birds (Archetti *et al.*, 2008). These results suggest that bitter leaf meal can be incorporated effectively, with T3 representing a potential optimal threshold for maintaining blood health and immune resilience in broiler chickens.

VII. SERUM INDICES OF BROILER CHICKENS FED DIET CONTAINING BITTER LEAF MEAL (*Vernonia amygdalina*)

The serum indices of broiler chickens fed bitter leaf meal are presented in Table 2.

Table 4: Serum Indices of Broiler Chickens fed Bitter Leaf Meal

Parameters	T1 (Contro l)	T2 (15%)	T3 (30%)	T4 (45%)	SE M
Total Protein (g/dl)	4.07	3.81	3.86	3.71	0.09

Albumin (g/dl)	2.07	1.99	1.94	1.78	0.07
Globulin (g/dl)	2.02	1.82	1.92	1.93	0.04
ALT (U/L)	83.24 ^b	85.44 ^{ab}	84.67 ^{ab}	86.11 ^a	0.43
AST (U/L)	41.50 ^b	42.42 ^{ab}	41.34 ^b	44.37 ^a	0.50
ALP (U/L)	72.92 ^{ab}	71.14 ^b	72.92 ^{ab}	74.89 ^a	0.53
Bilirubin (mg/dl)	0.45 ^b	0.47 ^{ab}	0.45 ^b	0.54 ^a	0.02
Urea (mg/dl)	9.75 ^b	10.53 ^{ab}	10.23 ^{ab}	11.15 ^a	0.21
Creatinine (mg/dl)	1.01	1.00	1.01	1.04	0.02
Total Cholesterol (mg/dl)	120.17 ^a	108.43 ^{ab}	110.76 ^{ab}	100.0 ^{7b}	2.99
Triglycerides	72.64	73.07	74.49	75.97	0.66
HDL C	46.17	45.43	44.67	43.54	0.65
LDL C	41.61 ^b	58.31 ^a	44.03 ^b	61.48 ^a	2.85
VLDL C	23.55	14.58	14.88	15.20	2.27

a,b Means with different superscripts in the same row are significantly different ($p < 0.05$), S.E.M. = Standard Error of mean, AST = Aspartate Transferase, ALT = Alanine aminotransferase, ALP = Alanine aminophosphatase, HDL C = High Density Lipoprotein Cholesterol, LDL C = Low Density Lipoprotein Cholesterol, VLDL C = Very Low Density Lipoprotein Cholesterol

Dietary supplementation with *Vernonia amygdalina* leaf meal (BLM) significantly influences the serum biochemical profile and metabolic health of broiler chickens. While core parameters such as total protein, albumin, and creatinine remained stable—indicating maintained nutritional status and a lack of muscle wasting. Higher inclusion levels (T4) led to significant elevations in liver enzymes (ALT, AST, ALP) and bilirubin. These increases suggest a potential threshold for hepatocellular stress, contrasting with the traditional hepatoprotective reputation of the plant (Tokofai *et al.*, 2021). Furthermore, the observed alkaline phosphatase (ALP) levels were notably lower than standard poultry references (Obianwuna *et al.*, 2024), which may reflect a physiological slowdown in bone mineralization or skeletal growth (Lumeij, 2008).

The lipid profile analysis revealed that while total cholesterol and LDL increased at higher BLM concentrations, they remained within established healthy ranges (Jiang et al., 2024). Crucially, the non significant differences in HDL C and triglycerides represent a desirable health outcome, supporting the anti atherogenic potential of the leaf. High HDL levels are vital for heart health as they facilitate reverse cholesterol transport and counteract the oxidation of LDL, which otherwise contributes to atherosclerotic plaque (Unigwe et al., 2024). Consequently, while BLM effectively supports various physiological functions, inclusion levels must be carefully calibrated to optimize the balance between its lipid lowering potential and its impact on liver enzyme activity.

VIII. HAEMATOLOGICAL PARAMETERS OF BROILER CHICKENS FED DIETS CONTAINING (*Ocimum gratissimum*) SCENT LEAF MEAL

The haematological parameters of birds fed different levels of scent leaf meal are presented in Table 5.

Table 5: Haematological Parameters of Broiler Chickens Fed Scent Leaf Meal

Parameters	T1 (Control)	T2 (15%)	T3 (30%)	T4 (45%)	SE M
RBC ($\times 10^6/\text{mm}^3$)	3.28 ^b	2.78 ^c	3.79 ^a	3.43 ^{ab}	0.12
PCV (%)	31.00 ^{bc}	27.00 ^c	36.33 ^a	32.67 ^a	1.17
Hb (g/dl)	12.87 ^b	11.43 ^c	13.80 ^a	13.33 ^a	0.29
WBC ($\times 10^6/\text{mm}^3$)	22.03	22.70	23.10	23.63	0.38
MCV (fl)	94.53	97.32	95.91	95.23	0.50
MCH (pg)	38.73 ^b	41.25 ^a	36.54 ^b	38.34 ^b	0.58
MCHC (%)	40.97 ^{ab}	42.35 ^a	38.12 ^b	40.96 ^a	0.61
Neutrophils (%)	31.00 ^a	28.33 ^a	26.67 ^b	30.00 ^a	0.62
Lymphocytes (%)	63.00 ^b	65.33 ^a	67.00 ^a	65.00 ^a	0.64
Monocytes (%)	4.33	4.67	4.33	5.00	0.15
Eosinophils (%)	1.67	1.33	2.00	1.67	0.14

Basophils (%)	0.00	0.00	0.00	0.00	0.00
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^{a,b,c} Means with different superscripts in the same row are significantly different ($p < 0.05$). S.E.M: Standard Error of mean, RBC=Red Blood Cell, PCV=Packed Cell Volume, Hb=Haemoglobin, WBC=White Blood Cell, MCV=Mean Corpuscular Volume, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration.

Dietary supplementation with scent leaf meal (SLM) significantly influences the haematological profile of broiler chickens, providing a clear indication of their physiological and nutritional status (Ewa et al., 2023). In this study, parameters including RBC, PCV, Hb, and lymphocytes were significantly affected ($P < 0.05$), with birds in the T3 group exhibiting optimal values for RBC ($3 \times 10^9/\text{mm}^3$), PCV (36.33%), and Hb (13.80 g/dL). While these findings contrast with some previous reports that observed no significant impact from scent leaf (Olobatoke and Okaragu, 2021), they align with the work of Agwu et al. (2025), who noted steady improvements in erythrocytic indices with SLM supplementation.

The observed haemoglobin levels (11.43–13.80 g/dL) remained within or above established reference ranges for healthy poultry, ensuring efficient oxygen transport and the capacity to manage respiratory stress. Although variations in MCH and MCV at certain inclusion levels might suggest a mild suppression of the haemopoietic system—possibly due to the antibacterial properties of scent leaf (Odoemelam et al., 2018)—the overall results indicate a robust physiological response.

Furthermore, the significant increase in lymphocytes (peak 67.00% in T3) demonstrates that SLM supports immune health and antibody production without compromising the birds' defense systems (Banks, 2014). These results suggest that while dietary SLM modifies haematological indices, it maintains broiler chickens in a stable and healthy physiological condition within recommended safety thresholds (Safamehr, 2008).

Serum Indices of Broiler Chickens fed Diets

containing (*Ocimum gratissimum*) Scent Leaf Meal

The serum indices of broiler chickens fed scent leaf meal are presented in Table 6.

Table 6: Serum Indices of Broiler Chickens fed Diets containing Scent Leaf Meal

Parameters	T1 (Control)	T2 (15%)	T3 (30%)	T4 (45%)	SE M
Total Protein (g/dl)	3.80 ^a	3.04 ^b	4.00 ^a	3.88 ^a	0.12
Albumin (g/dl)	1.70 ^a	1.41 ^b	1.77 ^a	1.72 ^a	0.04
Globulin (g/dl)	2.10 ^a	1.62 ^b	2.24 ^a	2.16 ^a	0.08
ALT (U/L)	27.33 ^b	35.33 ^a	25.33 ^b	27.00 ^b	1.27
AST (U/L)	30.00 ^c	40.33 ^a	31.33 ^{bc}	33.67 ^b	1.27
ALP (U/L)	68.00	66.33	63.33	63.67	0.94
Bilirubin (mg/dl)	0.58 ^b	0.73 ^a	0.55 ^b	0.56 ^b	0.02
Urea (mg/dl)	6.83	7.27	7.29	7.39	0.13
Creatinine (mg/dl)	0.39 ^b	0.44 ^{ab}	0.44 ^{ab}	0.48 ^a	0.01
Total Cholesterol (mg/dl)	117.60 ^a	96.37 ^c	100.70 ^{bc}	101.5 ^{3^b}	2.49
Triglycerides	78.47 ^a	71.27 ^b	73.87 ^b	73.73 ^b	0.97
HDL C	72.60 ^b	74.57 ^{ab}	75.23 ^a	76.33 ^a	0.52
LDL C	60.69 ^a	36.14 ^b	40.24 ^b	40.47 ^b	2.94
VLDL C	15.69	14.53	14.71	11.93	0.84

a,b,c Means with different superscripts in the same row are significantly different ($p < 0.05$), S.E.M. = Standard Error of mean, AST = Aspartate Transferase, ALT = Alanine aminotransferase, ALP = Alanine aminophosphatase, HDL C = High Density Lipoprotein Cholesterol, LDL C = Low Density Lipoprotein Cholesterol, VLDL C = Very Low Density Lipoprotein Cholesterol

Dietary inclusion of scent leaf meal (*Ocimum gratissimum*) significantly modulates the serum biochemical profile of broiler chickens, reflecting enhanced nutrient utilization and physiological resilience. Elevated levels of total protein, albumin,

and globulin in groups T3 and T4 suggest superior protein digestibility and improved hepatic synthesis, consistent with findings that equate high serum protein with adequate nutritional intake (Mathew et al., 2023). Furthermore, the increase in globulin levels underscores a robust immune response and efficient nutrient transport. While creatinine values remained below levels associated with muscle wastage (Odunitan-Wayas et al., 2018), they fell within established safety ranges for poultry (Aikpitanyi and Egweh, 2020), indicating stable renal function.

The plant's hepatoprotective properties are evidenced by the reduction of liver biomarkers (ALT and AST) at higher inclusion levels, likely driven by bioactive antioxidants that mitigate hepatocellular stress. Moreover, the study highlights a potent hypolipidemic effect; total cholesterol, triglycerides, and LDL C were significantly lower in the treated groups compared to the control. This reduction is attributed to the synergistic action of saponins—which inhibit cholesterol absorption—and minerals like calcium and magnesium, which regulate lipid metabolism (Desai et al., 2009). The significant rise in HDL C further supports the role of scent leaf as a natural agent for improving cardiovascular health and preventing hyperlipidemia related complications in poultry (Agwu et al., 2025). Collectively, these findings demonstrate that scent leaf meal can be integrated into broiler diets to optimize growth and metabolic health without deleterious physiological effects.

A comparative analysis of the two Leaf Meal

A comparative analysis of Scent Leaf Meal and Bitter Leaf Meal reveals that while both tropical phytonutrients are viable antibiotic alternatives, they influence the physiological and metabolic health of broiler chickens through distinct pathways.

This discussion compares the physiological impact of *Ocimum gratissimum* (Scent Leaf Meal SLM) and *Vernonia amygdalina* (Bitter Leaf Meal BLM) to determine their optimal inclusion levels for sustainable broiler production.

Haematological Optimization and Erythropoiesis

The comparative analysis of blood parameters reveals that while both leaf meals support stable physiological conditions, SLM exhibits a more pronounced effect on erythropoiesis. Birds supplemented with SLM reached peak PCV (36.33%) and Hb (13.80 g/dL) at moderate inclusion levels (T3), values that align with the high performance ranges established for healthy birds. This suggests that SLM effectively enhances oxygen carrying capacity, supporting better nutrient transport and resistance to respiratory stress.

In contrast, the haematological response to BLM was more conservative. While BLM maintained birds within functional thresholds, the PCV (28.67%) and Hb (6.47 g/dL) values were significantly lower than those observed in the SLM groups. This implies that while BLM is safe and supports the immune system—as evidenced by stable white blood cell counts and increased lymphocytes (Eroschenko, 2013)—it does not stimulate red blood cell production as vigorously as SLM. Therefore, for farmers aiming to maximize blood health and metabolic vitality, SLM offers a higher physiological ceiling.

Liver Health and Metabolic Safety Thresholds

The liver biomarker data serves as a critical guide for establishing inclusion limits. SLM demonstrates a clear hepatoprotective profile, with liver enzymes (ALT and AST) remaining stable or even decreasing at higher inclusion levels. This is likely due to the antioxidant properties of scent leaf, which prevent hepatocellular leakage. Consequently, SLM can be safely incorporated at higher percentages, potentially up to T4, without inducing metabolic distress.

BLM, however, exhibits a distinct safety threshold. While lower inclusion levels (T1–T3) are associated with healthy liver function, the transition to T4 resulted in a significant spike in ALT, AST, and bilirubin. This elevation suggests the onset of hepatocellular stress or potential toxicity when Bitter Leaf is fed in excess (Tokofai et al., 2021). Thus, the optimal inclusion level for BLM should be capped at T3 to harness its immune boosting benefits while avoiding liver injury.

Comparative Lipid Regulation and Anti Atherogenic Potential

The most significant metabolic differentiation lies in lipid modulation. SLM functions as a potent hypolipidemic agent, significantly lowering LDL C and triglycerides while increasing HDL C ("good cholesterol"). This is facilitated by its high mineral content—specifically calcium and magnesium—which inhibits the absorption of saturated fats and regulates energy metabolism. This makes SLM particularly valuable for producing leaner broiler carcasses with lower abdominal fat.

BLM also contributes to heart health by maintaining cholesterol within reference ranges and providing desirable outcomes for triglycerides. However, it lacks the aggressive HDL boosting capacity of SLM.

IX. CONCLUSION

The comparative evaluation of *Ocimum gratissimum* (Scent Leaf Meal) and *Vernonia amygdalina* (Bitter Leaf Meal) demonstrates that both tropical plants are potent, sustainable alternatives to synthetic growth promoters in broiler production. While both leaf meals maintain the physiological stability of the birds, their metabolic impacts follow distinct paths. Scent leaf meal stands out for its superior ability to enhance erythropoiesis and cardiovascular health, consistently improving red blood cell indices and optimizing the lipid profile by significantly boosting high density lipoprotein (HDL) levels while reducing harmful cholesterol. Furthermore, its robust hepatoprotective properties allow for higher inclusion levels without compromising liver integrity.

Bitter leaf meal remains a valuable additive, particularly for its strength in supporting the immune system and maintaining white blood cell function. However, its use requires more precise calibration, as higher inclusion levels can reach a metabolic threshold that triggers elevated liver enzyme activity. For optimal results, scent leaf meal can be integrated into broiler diets at levels up to 0.45%, whereas bitter leaf meal is best utilized at a maximum of 0.30% to ensure the benefits of immune stimulation are achieved without inducing hepatocellular stress.

Ultimately, integrating these phyto-genic additives

into poultry nutrition offers a dual advantage: it supports the global shift away from antibiotic reliance while promoting the production of healthier, leaner meat. These findings provide a clear physiological roadmap for farmers and nutritionists to harness locally available flora to improve broiler health, metabolic efficiency, and overall flock resilience.

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