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Dietary Inclusion of Combretum micranthum Leaf Powder as a Phytogenic Alternative to Antibiotic Growth Promoters: Effects on Growth Performance, Nutrient Digestibility, Carcass Characteristics, and Hematology in Caribro Naked Neck Chicks

Alagbe, John.O [1], Anorue Daniel, N [2] and Friday Ubong [3]

[1] Department of Monogastric Nutrition and Toxicology, Gandhi College of Agriculture, Rajasthan, India
[1] Department of Animal Science, Center for Distance Learning and Continuing Education, University of Abuja, Gwagwalada, Nigeria
[2] Department of Theriogenology, Faculty of Veterinary Medicine, University of Abuja, Nigeria
[3] Department of Pathology, Faculty of Veterinary Medicine, University of Abuja, Nigeria
*Corresponding Author: john.alagbe@uniabuja.edu.ng

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ABSTRACT

This study evaluated the effects of dietary inclusion of *Combretum micranthum* leaf powder (CMLP) on the performance, nutrient digestibility, carcass characteristics, and hematological traits of Caribro Naked Neck chicks. A total of 250 one-day-old Caribro Naked Neck chicks were randomly allotted to five dietary treatments (T1–T5) in a Completely Randomized Design (CRD). Each treatment comprised 5 replicates of 10 birds each. In a 28-day experimental period. Treatment 1 (control) received a formulated basal diet supplemented with neomycin at 20 g/kg, whereas T2, T3, T4, and T5 received the basal diet supplemented with CMLP at 20, 40, 60, and 80 g/kg diet, respectively. Body weight gain (BWG) was highest ($p<0.05$) in T4 and T5, intermediate in T2 and T3, and lowest in T1. Feed Conversion Ratio (FCR) was significantly improved (lowest) in T4 and T5 compared to T1. Daily feed intake, apparent crude protein (CP), crude fiber (CF), organic matter (OM), ether extract (EE), dry matter (DM) digestibility, carcass weight, and dressing percentage were significantly higher ($p<0.05$) in all CMLP-supplemented groups (T2–T5) than in T1. Hematological indices across all treatments remained within the physiological reference range for healthy birds. Dietary inclusion of *Combretum micranthum* leaf powder up to 60–80 g/kg enhances growth performance, nutrient utilization, and carcass characteristics without compromising systemic bird health, demonstrating its efficacy as a sustainable alternative to conventional antibiotics.

Introduction

The modern poultry industry faces an urgent imperative to identify effective, sustainable alternatives to synthetic antibiotic growth promoters (Hernandez and Alagbe, 2025a; Singh *et al.*, 2022). For decades, sub-therapeutic doses of antibiotics such as neomycin were routinely included in animal feeds to maintain gastrointestinal health, suppress subclinical pathogenic infections, and maximize feed conversion efficiency (Hernandez and Alagbe, 2025b; Rahimi et al., 2011). However, the widespread and indiscriminate application of antibiotic growth promoter has directly contributed to the significant increase in cases of antimicrobial-resistant, toxic chemical residues in poultry products (meat and egg) (Oluwafemi et al., 2021; Ojediran et al., 2024). Consequently, regulatory bans and shifting consumer preferences for antibiotic-free animal products have compelled animal nutritionists to evaluate natural feed additives or plant-derived products comprising whole leaf powders, extracts, and essential oils which are rich in bioactive compounds (Olafadehan et al., 2020a,b).

Among non-conventional, tropical phytogenic candidates, *Combretum micranthum* G. Don (commonly known as Kinkeliba), a shrub native to West Africa, presents significant potential (Baba-Mousa et al., 2016). Historically valued in human ethnomedicine for its antimicrobial, anti-inflammatory, and hepato-protective, antioxidant, anti-tumor, and gastro-protective properties (Ahmed, 2011). Aqueous extract from *Combretum micranthum* have been effectively utilized for the treatment of

wounds, fever, tooth ache, sexually transmitted disease and headache due to its rich bioactive profile (Ajaiyeoba et al., 2006).Quantitative phytochemical analyses reveal that C. micranthum leaves are loaded with polyphenols, particularly flavonoids (such as rutin, orientin, catechin, and myricetin glycosides), gallic acid, piperidine alkaloids (combretine and betaine), and condensed tannins (Fatoba et al., 2003). These bioactive compounds work synergistically to enhance animal performance.

Earlier studies have demonstrated that phytogenics have beneficial effects on birds. For example, Sugiharto et al. (2018) and Oleforuh-Okoleh et al. (2014) found that adding Moringa oleifera and garlic powder to the diet of birds can influence the duration of feed retention in the intestine and promote the stimulation and release of natural digestive enzymes to support growth. Research by Abdel-Wareth et al. (2019) demonstrated that plant extracts can reduce lipid peroxidation in enterocyte membranes, damage the cell membranes of opportunistic pathogens (like Escherichia coli and Clostridium perfringens), while promoting the growth of beneficial lactic acid bacteria (Lactobacillus spp.). Hematological factors such as packed cell volume (PCV), red blood cell count (RBC), hemoglobin (Hb), and white blood cell count (WBC) were also reported to remain within the normal physiological limits when given under optimal thresholds. Nevertheless, there is minimal or no research on the use of Combretum micranthum as a dietary supplement for birds. This data will offer an eco-friendly and natural substitute for antibiotics. Thus, this research was conducted to assess the dietary addition of Combretum micranthum leaf powder as a phytogenic substitute for antibiotic growth promoters: impacts on growth performance, nutrient digestibility, carcass traits, and blood parameters in Caribro naked neck chicks.

Materials and Methods

Study Site, Ethical Approval and Pre-Trial Management

The experimental trial was conducted at the Poultry Research Division, Gandhi College of Agriculture, Rajasthan, India. The study site lies between latitude 8° 550N and 9° 000E and longitude 7° 060N and 7° 088E. The mean annual rainfall and temperature range from 1000 to 1350 mm and 29.8 to 37.1°C, respectively. Relative humidity is about 60 % during the raining season and 30 % during the dry season. All experimental procedures involving live birds were reviewed, approved, and conducted under strict accordance with the guidelines of the Institutional Animal Ethics Committee (IAEC) of Gandhi College of Agriculture, Rajasthan (Approval Reference: GCA//2025/AC-008).Prior to chick placement, the battery cage housing unit was thoroughly washed, and disinfected three weeks before the trial commenced.

Plant Material Collection and Preparation

Fresh *Combretum micranthum* leaves were harvested from different plants in Rajastham during the month of April, 2025. The sample was identified and authenticated at Herbarium Unit of Botany Department, Singh College, Rajasthan by a certified Taxonomist (Mr. Amit Ram) screened to remove undesirable materials and air-dried for 11 days until a constant weight was achieved, after which it milled into powder (CMLP) kept in an air-tight polythene bags until needed for analysis. Phytochemical components in CMLP was conducted based on the procedure established by Singh et al. (2022).

Care of Experimental Animals

In May 2025, a reputable breeding farm in Rajasthan, India, supplied 250 unsexed 1-day-old Caribro naked neck chicks. Upon arrival, chicks were unpackaged, weighed using a digital precise scale, and randomly distributed into five dietary treatments; each treatment included 5 replicates, with 10 birds in each replicate. Chicks were housed in enclosures that measured 500 cm by 350 cm by 200 cm (length × width × height). The electric brooder was set to an initial temperature of 36℃, which was decreased by 2℃ each week. A fluorescent lamp was positioned at various locations in the pen to create a continuous lighting system aimed at enhancing feed consumption. Daily, drinkers were cleaned, and birds received vaccinations for Newcastle disease and Gumboro (infectious bursal disease) based on local disease occurrences. The trial continued for 28 days, and robust biosecurity measures along with regular management practices were closely followed.

Experimental Design and Diets

Diets were formulated in accordance with National Research Council (NRC, 1994) requirements for birds. Water and feed was offered at all times and a Completely Randomized Experimental Design was adopted. The 5 treatment comprise:

T1: Basal diet + Neomycin at 20 g/kg diet (Antibiotic control)
T2: Basal diet + Dried *C. micranthum* leaf powder at 20 g/kg diet
T3: Basal diet + Dried *C. micranthum* leaf powder at 40 g/kg diet
T4: Basal diet + Dried *C. micranthum* leaf powder at 60 g/kg diet
T5: Basal diet + Dried *C. micranthum* leaf powder at 80 g/kg diet

Experimental (basal diet) was determined using Near-Infrared (NIR) Feed Analyzer: FOSS NIRS DS2500 (FOSS Analytical, Hellerud, Denmark). The Monochromator was set to a spectral range 400–2500 nm used for rapid chemical verification.

Performance Data Collection

Chicks were weighed at the start of the experiment and body weight gain was estimated as the difference between the final and initial body weight. Feed intake was computed as the difference between the feed offered and refused. Feed conversion ratio was calculated by dividing the total feed intake by the weight gain.

Digestibility Trial

On day 21, total fecal collection was initiated for a 7-day nutrient digestibility trial. 2 birds were randomly selected per replicate and transferred into individually to a metabolic cages with raised wire floors for a 3 day adjustment period followed by a 4 day collection phase. Feed intake and total faeces were recorded daily, wet samples were oven dried at 60℃ for 24 hours and sent to the laboratory for proximate analysis. Samples of excreta was analyzed using Automated Near Infra-Red Feed Analyzer (FOSS Analytical; Model DS200A, Denmark) which features a measuring wavelength (1100 – 1650 nm), recovery rate > 99.5 %, reproducibility (<1 %) and analysis time of 3 to 5 minutes. Apparent digestibility coefficient was computed as:

$$\text{Apparent Digestibility Coefficient} = \frac{\text{Nutrient Intake} - \text{Nutrient Excreted}}{\text{Nutrient Intake}} \times 100$$

Carcass Evaluation

At day 28, ten birds per treatment (2 per replicate) were randomly selected for carcass evaluation. Birds were fasted for 12 hours prior to slaughter, weighed, bled, manually de-feathered, and eviscerated to evaluate carcass weight and dressing percentage. Weights of cut parts were weighed using sensitive scale. Dressing percentage was computed using the formula below:

$$\text{Dressing \%} = \frac{\text{Eviscerated weight}}{\text{Live weight}} \times 100$$

Haematological evaluation

Blood samples (3 mL) were drawn from the brachial vein into sample bottles containing EDTA- for hematological analysis. Samples were collected into an ice pack and transferred immediately to the laboratory. Parameters analyzed includes: Pack cell volume, red blood cell, haemoglobin, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, white blood cells were analyzed using Sysmex KX-21N (Sysmex Corporation, Kobe, Japan). Cyanide-free lyse method for hemoglobin (Hb); electrical impedance detection for Red Blood Cells (RBC), Packed Cell Volume (PCV), and White Blood Cells (WBC). Micro-Hematocrit Centrifuge: Remi RM-12C (Remi Lab World, Mumbai, India). Used for verification of Pack cell volume at 12,000×g for 5 minutes.

Data Analysis and Experimental Model

All the data collected were subjected to analysis of variance (ANOVA) for completely randomized designs using the General Linear Models (GLM) Procedure of Statistical Analysis System (SAS, version 9.3). Treatment means were compared with Duncan's Multiple Range Test (DMRT). All means of statistical differences were based on $P<0.05$. The following model was employed for the data analysis.

$Yij = \mu + Ti + eij$

Where, Yij = individual measurement on each bird, μ = overall mean, Ti = effect due to the ith dietary treatment, eij = random error.

Results

Quantitative composition of *Combretum micranthum* leaf powder (CMLP) is presented in Table 1. *Combretum micranthum* leaf powder had a high concentrations of flavonoids (808 mg/g), total phenols (652 mg/g), terpenoids (320 mg/g), steroids (200.6 mg/g), tannins (157.6 mg/g), saponins (60.9 mg/g), and alkaloids (59.4 mg/g).

Growth performance of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder is presented in Table 3. Body weight gain, cumulative feed intake and feed conversion ratio were influenced ($p<0.05$) by the treatment. Body weight gain value was lower in T1 (665.06 g) than T2 (935.33 g), T3 (936.51 g), T4 (1075.7 g) and T5 (1082.6 g) ($p<0.05$). Cumulative feed intake was more in T2 – T5 and lower in T1 ($p<0.05$). Conversely, feed conversion ratio was lowest in T4 and T5, intermediate in T2 and T3, highest in T1 ($p<0.05$). Nutrient digestibility of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder is presented in Table 4. Dry matter (69.18 – 76.09 %), crude protein (70.84 – 81.13 %), ether extract (66.81 – 78.55 %), organic matter (70.13 – 79.14 %), crude fibre (36.18 – 46.09 %) and ash digestibility (40.06 – 54.98 %) was more in T2 – T5 and lower in T1 ($p<0.05$).

In Table 5, Carcass characteristics of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder. Eviscerated weight (370.7 – 785.0 g), dressing percentage (72.81 – 86.23 %), weights of head (21.49 – 26.17 g), breast (96.57 – 136.9 g), neck (27.88 – 32.17 g), back (76.66 – 107.8 g), shank (21.87 – 29.83 g), wing (48.12 – 56.17 g), drumstick (51.93 – 63.19 g) and thigh (55.32 – 61.86 g) were affected ($p<0.05$) by the treatment. Values obtained follow similar pattern and were more in T4 and T5, intermediate in T2 and lower in T1 ($p<0.05$). Haematological indices of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder is revealed in Table 6. Pack cell volume, red blood cell, haemoglobin and white blood cell count were more ($p<0.05$) for T2 – T5 than T1.

Discussion

The withdrawal of artificial antibiotic growth promoters like neomycin from poultry farming has accelerated investigations into plant-based feed additives that can improve gut health, nutrient uptake, and overall performance (Omokore and Alagbe, 2019; Shittu et al., 2024; Hernandez and Alagbe, 2025a). In this research, the addition of Combretum micranthum leaf powder (T2 – T5) in the diet showed a notable improvement compared to the neomycin-treated control (T1). The enhancement in body weight gain (BWG) and feed conversion ratio (FCR) observed in birds consuming CMLP (most notable at 60 g/kg in T4 and 80 g/kg in T5) is due to the high levels of phytochemical compounds in Combretum micranthum, particularly flavonoids and phenolic compounds. These bioactive substances demonstrate strong antimicrobial and antioxidant effects in the gastrointestinal system (Hernandez and Alagbe, 2025b; Daniel et al., 2023; Singh et al., 2021). CMLP inhibits the growth of harmful microbes in the gut flora, preventing metabolic issues and enabling absorbed nutrients to focus on tissue maintenance and development. Neomycin, in contrast, eliminates both harmful and helpful gut bacteria, leading to dysbiosis. The findings align with the report by Tabari et al. (2016), which documented an increased average daily weight gain in birds given varying amounts of Nettle root extract and pumpkin seed oil. Reda et al. (2020) noted an increased body weight gain in broilers that received a diet enriched with red pepper oil. Guray et al. (2011) also noted a feed conversion range of 1.70 – 2.50 when broiler chicks consumed a diet containing green tea extract. The increased feed intake noted in T2–T5 compared to T1 suggests that CMLP preserved high palatability without adversely impacting the feed's aroma, in contrast to certain phytogenics, which can have a bitter flavor from elevated alkaloid levels. The findings of this research indicate that the alkaloid concentration in CMLP falls within the tolerable level for birds.

The apparent digestibility of Dry Matter (DM), Crude Protein (CP), Crude Fiber (CF), Organic Matter (OM), and Ether Extract (EE) was notably greater in all CMLP treatments (T2–T5) than in the neomycin-fed group (T1). This indicates that CMLP may promote the release of natural digestive enzymes (pancreatic lipase, amylase, and trypsin) and bile salts from the liver. Additionally, phenols safeguard intestinal microbiota from oxidative damage, increasing the height of villi and the absorptive surface area of the mucosa. The increased CF digestibility in diets supplemented with CMLP indicates that bioactive compounds in C. micranthum might promote advantageous fiber-degrading gut bacteria, enhancing the efficient breakdown of structural carbohydrates. The outcome achieved aligns with the

findings of Scheuermann et al. (2009) and Nkukwana et al. (2014) when Moringa oleifera leaf meal was added to the diets of quails and broiler chicks, respectively.

The higher carcass weight and dressing percentage seen in birds fed CMLP (T2–T5) versus T1 directly indicate better CP and OM digestibility. Improved crude protein uptake supplies the essential components for breast and thigh muscle. This suggests that substituting synthetic antibiotics with C. micranthum leaf powder results in a greater amount of edible meat while maintaining dressing yield. The results achieved align with the findings of Toghyani et al. (2011) when cinnamon and garlic were utilized as antibiotic growth alternatives in broiler diets. Hematological parameters (such as red blood cell count, white blood cell count, hemoglobin, and packed cell volume) stayed within the normal reference range for hens across all treatments, indicating that Combretum micranthum leaf powder shows no toxicity at inclusion rates of up to 80 g/kg. The consistency of blood parameters indicates that CMLP functions as a reliable medicinal plant that preserves normal physiological balance, surpassing traditional neomycin supplementation. The packed cell volume, hemoglobin, and red blood cell count measured in this study fell within the normal ranges of 27.00–36.00%, 8.00–13.00 g/dL, and 2.5–5.00 (10^{12}/L) established by Feldman et al. (2000). Reduced packed cell volume, hemoglobin levels, and red blood cell counts indicate anemia (Muritala et al., 2022). The values for white blood cells ranged from 11.00 to 25.00 (10^{9}/L) as referenced by Café et al. (2012).

Conclusion

The results of this 28-day study show that Combretum micranthum leaf powder (CMLP) serves as a potent, natural plant-based substitute for synthetic antibiotic growth promoters such as neomycin in avian nutrition. The dietary addition of CMLP at optimal levels (60–80 g/kg) notably enhanced body weight gain, feed conversion efficiency, apparent nutrient digestibility (DM, CP, CF, OM, EE), and total carcass yields, while not causing negative impacts on systemic health, as verified by physiological and hematological profiles. Adding C. micranthum leaf powder to animal feed is a secure, eco-friendly, and natural feed supplement that removes dependence on antibiotic growth enhancers.

Table 1: Quantitative composition of *Combretum micranthum* leaf powder (CMLP)

Phyto-constituents	Composition (mg/g)
Flavonoids	808
Phenols	652
Terpenoids	320
Steroids	200.6
Tannins	157.6
Saponins	60.9
Alkaloids	59.4

Table 2: The composition (%) of the experimental diet for Caribro Naked Neck Chicks (0-28 days)

Feed Ingredients	Inclusion (%)
Maize	50.00
Corn barn	2.00
Soybean meal	36.35
Fish meal	3.00
Limestone	2.50
Bone meal	5.00
Min-Vitamin Premix	0.25
Methionine	0.20
Lysine	0.20
Salt	0.35
Toxin binder	0.15
Total	100.0

Analyzed values (%)	
Crude protein	23.17
Ether extract	4.25
Crude fibre	3.92
Calcium	1.11
Phosphorus	0.52
Methionine	0.55
Lysine	1.21
Energy (kcal/kg)	2968.6

2.5 kg of vitamin premix contains vitamin A: 10,000,000 IU; vitamin D3: 2,000,000 IU; vitamin E: 20,000 IU; vitamin K: 2,250 mg; thiamine B1: 1750 mg; riboflavin B2: 5000 mg; pyridoxine B6: 2750 mg; niacin: 27,500 mg; vitamin B12: 15 mg; pantothenic acid: 7500 mg; folic acid: 7500 mg; biotin: 50 mg; choline chloride: 400 g; antioxidant: 125 mg; magnesium: 80 g; zinc: 50 g; iron: 20 g; copper: 5 g; iodine: 1.2 g; selenium: 200 mg; cobalt: 200 mg

Table 3: Growth performance of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder

Parameters	T1	T2	T3	T4	T5	SEM
Initial Live Weight (g/bird)	45.14	45.07	45.19	45.03	45.01	0.01
Final Live Weight (g/bird)	710.2^{c}	980.4^{b}	981.7^{b}	1120.8^{a}	1127.7^{a}	120.3
Body Weight Gain (g/bird)	665.06^{c}	935.33^{b}	936.51^{b}	1075.7^{a}	1082.6^{a}	100.5
Cumulative Feed Intake (g/bird)	1405.1^{b}	1609.2^{a}	1620.3^{a}	1722.1^{a}	1725.6^{a}	141.2
Feed Conversion Ratio	2.11^{a}	1.72^{b}	1.73^{b}	1.58^{c}	1.59^{c}	0.001

In each row, means with different superscript letters are significantly different (P<0.05); SEM: standard error of mean

T1: Basal diet + Neomycin at 20 g/kg diet (Antibiotic control)
T2: Basal diet + Dried *C. micranthum* leaf powder at 20 g/kg diet
T3: Basal diet + Dried *C. micranthum* leaf powder at 40 g/kg diet
T4: Basal diet + Dried *C. micranthum* leaf powder at 60 g/kg diet
T5: Basal diet + Dried *C. micranthum* leaf powder at 80 g/kg diet

Table 4: Nutrient digestibility of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder

Constituents (%)	T1	T2	T3	T4	T5	SEM
Dry matter	69.18^{b}	74.17^{a}	73.16^{a}	75.85^{a}	76.09^{a}	0.86
Crude protein	70.84^{b}	78.96^{a}	79.11^{a}	80.07^{a}	81.13^{a}	1.12
Ether extract	66.81^{b}	75.72^{a}	77.86^{a}	78.04^{a}	78.55^{a}	0.91
Organic matter	70.13^{b}	78.57^{a}	78.94^{a}	79.06^{a}	79.14^{a}	0.89
Crude fibre	36.18^{b}	43.91^{a}	44.36^{a}	45.17^{a}	46.09^{a}	0.36
Ash	40.06^{b}	53.88^{a}	54.87^{a}	54.92^{a}	54.98^{a}	0.41

In each row, means with different superscript letters are significantly different (P<0.05); SEM: standard error of mean

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T4: Basal diet + Dried *C. micranthum* leaf powder at 60 g/kg diet
T5: Basal diet + Dried *C. micranthum* leaf powder at 80 g/kg diet

Table 5: Carcass characteristics of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder

Parameters	T1	T2	T3	T4	T5	SEM
Live weight (g)	509.1^{c}	756.9^{b}	794.2^{b}	907.5^{a}	910.3^{a}	79.21
Eviscerated weight (g)	370.7^{c}	591.0^{b}	615.0^{b}	782.0^{a}	785.0^{a}	65.98
Dressed weight (%)	72.81^{c}	78.08^{b}	77.43^{b}	86.17^{a}	86.23^{a}	0.07
Head (g)	21.49^{c}	25.66^{b}	25.71^{b}	26.02^{a}	26.17^{a}	0.04
Breast (g)	96.57^{c}	129.8^{b}	131.1^{b}	135.7^{a}	136.9^{a}	2.92
Neck (g)	27.88^{c}	31.17^{b}	31.55^{b}	32.08^{a}	32.17^{a}	0.03
Back (g)	76.66^{c}	105.4^{b}	106.8^{b}	107.1^{a}	107.8^{a}	1.86
Shank (g)	21.87^{c}	28.65^{b}	28.81^{b}	29.67^{a}	29.83^{a}	0.02
Wing (g)	48.12^{c}	55.76^{b}	55.91^{b}	56.09^{a}	56.17^{a}	0.05
Drumstick (g)	51.93^{c}	62.16^{b}	62.56^{b}	63.11^{a}	63.19^{a}	0.06
Thigh (g)	55.32^{c}	60.96^{b}	61.14^{b}	61.75^{a}	61.86^{a}	0.05

In each row, means with different superscript letters are significantly different (P<0.05); SEM: standard error of mean

T1: Basal diet + Neomycin at 20 g/kg diet (Antibiotic control)
T2: Basal diet + Dried *C. micranthum* leaf powder at 20 g/kg diet
T3: Basal diet + Dried *C. micranthum* leaf powder at 40 g/kg diet
T4: Basal diet + Dried *C. micranthum* leaf powder at 60 g/kg diet
T5: Basal diet + Dried *C. micranthum* leaf powder at 80 g/kg diet

Table 6: Haematological indices of Caribro Naked Neck Chicks fed diet supplemented with *Combretum micranthum* leaf powder

Parameters	T1	T2	T3	T4	T5	SEM
Pack cell volume (%)	29.87b	33.87a	33.96a	34.23^{a}	34.25^{a}	0.47
Red blood cell (10^{12}/L)	2.70b	3.01a	3.08a	3.12^{a}	3.15^{a}	0.02
Haemoglobin (g/dL)	9.76b	12.45a	12.58a	12.94^{a}	12.98^{a}	0.04
White blood cell (10^{9}/L)	11.85b	14.95a	15.06a	15.13a	15.15^{a}	0.21

T1: Basal diet + Neomycin at 20 g/kg diet (Antibiotic control)
T2: Basal diet + Dried *C. micranthum* leaf powder at 20 g/kg diet
T3: Basal diet + Dried *C. micranthum* leaf powder at 40 g/kg diet
T4: Basal diet + Dried *C. micranthum* leaf powder at 60 g/kg diet
T5: Basal diet + Dried *C. micranthum* leaf powder at 80 g/kg diet

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