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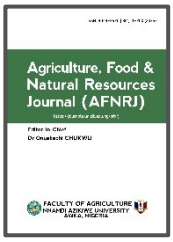

Original Article

Growth performance and immune response of broiler chickens to oral administration of *Parquetina nigrescens* leaf extracts

OPEN ACCESS

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ABSTRACT

The study was to determine the effect of Parquetina nigrescens leaf extract on the performance, health status and immunological response of broiler chickens. Fresh leaves of Parquetina nigrescens were harvested and blended, using 10 g of leaves in 200 ml of water, this was administered in the first 5 days in the starter and finisher phases. Two-hundred-day old Arbor acres plus strains of broilers were assigned to five dietary treatments, four replicates with forty birds per treatment. The treatments were as follows: treatment 1: positive control – commercial antibiotics was used, treatment 2: negative control without commercial antibiotics while treatments 3, 4, 5 birds were administered 0.2, 0.4 and 0.6 ml of Parquetina nigrescens leaf extract per bird respectively. The design of the experiment was completely randomized design (CRD). Performance, hematological, serum biochemical and immunological responses as well as the relative organ weights were investigated using standard procedures. Data were subjected to one-way Analysis of Variance while significant differences were determined using Duncan's multiple range tests. The results showed that there were significant differences ($p<0.05$) in the final weight and average feed intake of the birds administered with the leaf extract with T5 (0.6 ml) having the highest values (1.84 kg and 3.26 kg respectively) while T4 (0.4 ml) had the lowest value (1.58 kg and 2.97 kg respectively). However, there was no significant among the treatments for other parameters. The study concluded that Parquetina nigrescens leaf extract had no detrimental effect on growth performance and immune response of broiler.

KEYWORDS: *Antibiotics, Biochemical, Growth, Haematological, Serum*

INTRODUCTION

In Nigeria, poultry production is one of the most important animal industries. It is a source of income for farmers in the country who raise poultry birds. Poultry products are a good source of protein in the diet. Chicken meat consumption is growing faster than any other livestock, with feed accounting for roughly 70-80% of total poultry production costs (Adegbola, 1998).

Due to its high turnover rates and quick return on investment, broiler production is one of the most popular chicken industries. Broilers are specifically bred to produce meat. Very high growth rate is required in broiler chicken production if maximum productivity is to be achieved, which will reflect in the gross margin (Oluyemi & Roberts, 2000).

Antibiotic use is prohibited in many regions of the world. However, antibiotics and growth boosters are used to feed about 80 percent of all produced animals (Van *et al*., 2020).

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Antibiotics' growth-promoting impact was discovered in the 1940s, when it was revealed that animals fed dried Streptomyces aureofaciens mycelia containing chlortetracycline residues grew faster. Antibiotics' growth-promoting function is linked to interactions with the gut bacteria community (Dibner & Richards, 2005; Niewold, 2007). Because only antibiotics that are not absorbed in the digestive tract are approved as growth promoters, the chances of antibiotic residues in edible tissues and products causing allergic or harmful reactions in consumers are known to be small (Donoghue, 2003). The increased use of antibiotics as feed additives may eventually lead to the evolution of microbes resistant to antibiotics. If these bacteria with resistant genes are passed from person to person, they pose a risk to humans (Manyi-Loh *et al*., 2018). As a result, the World Health Organization (1997) and the European Union's Economic and Social Committee (1998) concluded that antimicrobial usage in food animals constituted a public health concern.

Herb extract has been utilized in place of growth boosters and antibiotics as an unconventional feed additive (Lee *et al.*, 2001; Olumide *et al.*, 2022). In the extensive livestock system, herbal extracts were employed to boost the general performance of the animals (Horton *et al*., 1991; Bakhiet & Adam, 1995; Skrabka *et al.*, 1997; Manzanilla *et al.*, 2001; William & Losa, 2001; Gill *et al.*, 2002; Abo Omar *et al.*, 2016). Medicinal plants and their products, such as plant extracts or essential oils, were added into broiler diets as phytogenic feed additives and their favorable effects were demonstrated (Bölkbaşi & Erhan, 2007; Soltan *et al.*, 2008; Dalkiliç & Guller, 2009; Olumide *et al.*, 2022). The maintenance of normal gut microbiota, the prevention of pathogen colonization (Tekeli *et al*., 2006), and the improvement of digestive enzyme synthesis and activity are the key effects of such substances on poultry productivity and health (Lee *et al.*, 2004).

Parquetina nigrescens is a shrub native to equatorial West Africa, and its leaves, roots, and latex have all been used in traditional medicine for millennia (Gill, 1992). Bullock is another name for it. It's a perennial with twinning stems and a woody base that taper to 10-15 cm in length and 6-8 cm in width, with a smooth long stem on the leaves. Bullock is a member of the Asclepiadaceae family. The leaf extract of *Parquetina nigrescens* has been demonstrated to help in hemorrhagic anemia (Agbor & Odetola, 2005). *Parquetina nigrescens* leaf extract has been shown to have analgesic, anti-inflammatory, and antipyretic properties (Owoyele *et al.*, 2009). Haematinic, antidiabetic, cardio tonic, anti-ulcerative, and antioxidant characteristics have been discovered in the plants (Datté & Ziegler, 2001; Saba *et al.*, 2010; Ozaslan, 2011; Ayoola *et al.*, 2011).

There is however paucity of information on the use of *Parquetina nigrescens* as it relates to animal health and livestock production. The study is therefore aimed at determining the growth performance, utilization and immunological response of broiler chickens to the administration of *Parquetina nigrescens* leaf extracts.

MATERIALS AND METHOD

The study was conducted at the poultry unit of Babcock University farmhouse, Ilishan-Remo, Ogun State, Nigeria. Ilishan Remo is in the rain forest zone of Nigeria with an annual rainfall of about 1500mm, a mean temperature of 27^0 Celsius.

Fresh leaves of *Parquetina nigrescens* were collected from Ibadan in Oyo State, Nigeria and identified by an agronomist in the Department of Agriculture and Industrial Technology, Babcock University, Ilishan-Remo, Ogun State, Nigeria. The harvested leaves were then washed with fresh water to remove debris and sands. Ten grams of the fresh leaves harvested were blended with 200 ml of water using a blender. The blended samples were well filtered using standard filter papers. The filtrates were then measured according to the treatment groups and administered orally to each bird.

Two-hundred-day-old broiler chicks were purchased from a commercial hatchery in Ibadan, Nigeria. The chicks were allotted in a completely randomized design (CRD) to five treatment groups designated as T1, T2, T3, T4 and T5 (0ml with antibiotics, 0ml without antibiotics, 2ml without antibiotics, 4ml without antibiotics and 6ml without antibiotics of the extract of *Parquetina nigrescens* leaf respectively). Each treatment group had four replicates with 10 chicks per replicate.

The extracts were administered in the first 5 days at the starter phase and first 5 days at the finisher phase.

The house was washed, disinfected and left to dry for two weeks before the arrival of the chicks. Drinkers and feeders were thoroughly washed and disinfected before the arrival of the chicks. On arrival, the initial weights of the birds were taken before they were randomly allotted to five treatments (T_1, T_2, T_3, T_4, and T5) with four (4) replicates of 10 birds each in a completely randomized design. Feed and water were supplied to the bird's *ad-libitum* throughout the experimental period which was 6 weeks.

Vitamins were administered from day one to six for all treatments. 1st Gumboro vaccination was administered orally at day 7 to birds in T1 and T2. 1st Lasota vaccination was administered orally at day 9 to birds in T1 and T2, 2nd Gumboro vaccination was administered at day 17 to birds in T1 and T2 and 2nd lasota vaccine was administered orally at day 19 to birds in T1 and T2

Data were collected on performance (feed intake, weight gain, feed conversion ratio (FCR) and livability), immunological response (serum biochemistry, haematology, and histopathology), relative organ weight (liver, kidney, heart,).

Feed intakes were calculated daily. This was done by deducting the amount of feed left in the feeders from feed given in the previous day as feed intake for the day.

Feed intake (g) = feed given (g) – feed left (g) (1)

Table 1: Gross composition of experimental starter and finisher diet (g/100g)

Ingredient (kg)	Broiler starter	Broiler finisher
Maize	52.0	58.00
Soya bean meal	38.00	27.00
Wheat offal	4.59	9.64
Palm oil	2.00	2.00
Dicalcium phosphate	1.50	1.50
Oyster shell	1.00	1.00
Salt	0.25	0.25
Broiler premix	0.25	0.25
Methionine	0.30	0.25
Lysine	0.05	0.05
Avatec	0.06	0.06
Total	**100.00**	**100.00**
Determined analysis		
Crude protein (%)	20.50	18.00
Crude fibre (%)	4.02	5.80
Ether extract (%)	3.00	4.50
Metabolizable energy (kcal kg)	2,962.29	2,911.63

The weights of all the birds in each replicate were taken. This was done on the day of arrival and was subsequently done weekly until the end of the experiment.

Feed Conversion Ratio (FCR) = feed intake (g) ÷ body weight (g) (2)

Mortalities were recorded against the respective replicates as and when they occurred throughout the experimental period. Percentage mortality was calculated as:

Percentage mortality = Number of dead birds ÷ Number of birds per treatment ×100 (3)

On the 42nd day, the birds were fasted prior to blood collection but water was provided *ad-libitum*. 4.0 ml blood was collected from the wing vein of birds (3 birds were randomly selected per replicate) into heparinized bottles to determine serum biochemical components: Total Protein (TP), Globulin, Albumin, Urea, Creatinine, Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) and labeled sterile universal bottles containing Ethylene Diamine Tetra Acetate (EDTA) as anticoagulant for the determination of haematological parameters. Red blood cells (RBC), white blood cells (WBC), platelet, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH), basophil, neutrophil, eosinophil, heamoglobin concentration (HB), packed cell volume (PCV), monocytes, lymphocytes and heterophils were determined according to the procedure of Howlett and Jamie (2008).

Fifteen birds were randomly selected from all the treatments, three (3) birds per treatment for relative organ weight at the end of the experiment. The selected birds were starved overnight and their live weight was recorded. The birds were de-feathered after scalding and their plucked weights were taken. The birds were eviscerated and the eviscerated weight was recorded. The organs were harvested and the following parameters were recorded; liver, heart, kidney, spleen. Relative organ weight is gotten by dividing each bird's organ weight by their body weight.

Blood samples were collected 24 hours after the vaccination days (3 samples/treatment) and at the end of the feeding trial to examine the immune response to Newcastle Disease Virus (NDV) and Infectious Bronchitis Virus (IBV) by measuring the titer values against these viruses using Hemagglutination-inhibition (HI) test and commercial Enzyme Linked Immunosorbent Assay Kits respectively

Data collected on performance, relative organ weight and immunological response were subjected to analysis of variance (ANOVA) (SAS Institute, 1999) and the treatment means were separated using Duncan Multiple range test where significant (Steel & Torries, 1990).

RESULTS AND DISCUSSION

As presented in Table 2, there was significant difference ($P<0.05$) in the final weight, weight gain and feed intake of birds administered the leaf extract. With T5 (0.6 ml) having the highest final weight, weight gain and feed intake; 1.882 kg, 1.844 kg and 3.256 kg respectively while the least values were obtained from T4 with 1.620 kg, 1.581 kg and 2.793 kg respectively. There was no significant difference in the FCR and mortality ($p>0.05$) however the feed conversion rate (FCR) values ranged from 1.697 - 1.771.

Table 3 showed that there was no significant difference ($P>0.05$) between the antibody titre value of the treatments when tested against IBD Gumboro and NDV lasota.

Table 4 showed the haematological response of the birds to the administration of *Parquetina nigrescens* leaf extract. The oral administration of *Parquetina nigrescens* leaf extracts did not have significant effects ($p>0.05$) on the haematological parameters of birds. The values obtained for packed cell volume ranged from 15.50 – 27.50% , haemoglobin ranged from 5.15-9.15 g/dl, the values obtained for total white blood cell ranged from 6250- 11250 mm^3, the value gotten for the red blood cell count ranged from 1.85- 3.20 (µ) *10^6 , platelets value ranged from 116000- 156000, MCH value ranged from 2.77- 2.86%, MCV ranged from 8.32-8.59%, MCHC ranged from 33.16-33.27%, lymphocytes ranged from 53.50-62.50%, heterophils ranged from 27.50 - 37.50%, monocytes ranged from 4.00-6.00%, eosinophils ranged from 0-1.5%, and basophils ranged from 0.50- 30%.

Table 2: Performance characteristics of broiler birds given *Parquetina nigrescens* leaf extract

Parameter (kg)	T1 (Positive control)	T2 (Negative control)	T3 (0.2ml/bird)	T4 (0.4ml/bird)	T5 (0.6ml/bird)
Initial weight	0.04 ± 0.00	0.04 ± 0.00	0.04 ± 0.00	0.04 ± 0.00	0.04 ± 0.00
Final weight	1.83 ± 0.05^{ab}	1.75 ± 0.07^{ab}	1.75 ± 0.05^{ab}	1.62 ± 0.11^{a}	1.88 ± 0.09^{b}
Weight gain	1.79 ± 0.05^{ab}	1.71 ±0.072^{ab}	1.72 ± 0.05^{ab}	1.51 ± 0.11^{a}	1.84 ± 0.09^{b}
Feed intake	3.10 ± 0.09^{ab}	2.91 ±0.18^{ab}	2.92 ± 0.12^{ab}	2.79± 0.19^{a}	3.26 ± 0.09^{b}
Mortality (%)	0.50 ± 0.29	1.50 ± 0.29	1.25 ± 0.48	0.75 ± 0.48	1.00 ± 0.63
FCR	1.73 ± 0.04	1.70 ± 0.04	1.70 ± 0.04	1.77 ±0.06	1.77 ± 0.04

a, b: Means along the same row with different superscript are significantly different (P<0.05). Group mean and standard error of samples (x±sem) shown, FCR – Feed Conversion Ratio

Table 3: Immunological response of broilers chickens given Parquetina nigrescens leaf extract

	T1 (Positive control)	T2 (Negative control)	T3 (0.2ml/bird)	T4 (0.4ml/bird)	T5 (0.6ml/bird)
IBD	234.38 ± 78.13	97.66 ± 58.59	332.03 ± 92.97	312.50 ± 89.00	29.30 ± 9.77
ND	175.78 ± 136.72	117.19 ± 39.06	468.75 ± 156.25	97.66 ± 58.59	117.188 ± 39.06

Group mean and standard error of samples (x±sem) shown, IBD – Infectious Bursa Disease, ND – Newcastle Disease

Table 4 Haematological response of broiler chickens given *Parquetina nigrescens* leaf extract

	T1 (Positive control)	T2 (Negative control)	T3 (0.2ml/bird)	T4 (0.4ml/bird)	T5 (0.6ml/bird)
PCV (%)	17.00 ± 7.00	23.00 ± 4.00	27.50 ± 2.50	26.00 ± 2.00	15.50 ± 6.50
HB (g/d)	5.65 ± 2.35	7.65 ± 1.35	9.15 ± 0.85	8.65 ± 0.65	5.15 ± 2.15
TWBC (mm3)	7950.00 ± 25.00	6250.00 ± 75.00	11250.00±25.00	8750.00±1.00	9050.00±55.00
RBC COUNT (µ) *10^6	2.00 ± 0.80	2.70 ± 0.50	3.20 ± 0.30	3.05 ± 0.25	1.85 ± 0.75
Platelet	125000.00 ± 20000.00	142000.00 ± 12000.00	156000.00 ± 9000.00	147500.00±7500.00	11600.00 ± 26000.00
MCH (%)	2.80 ± 0.05	2.84 ± 0.03	2.86 ± 0.00	2.84 ± 0.02	2.77 ± 0.04
MCV (%)	8.45 ± 0.12	8.54 ± 0.10	8.59 ± 0.03	8.53 ± 0.04	8.32 ± 0.14
MCHC (%)	33.16 ± 0.17	33.25 ± 0.09	33.26± 0.07	33.27± 0.06	33.25 ± 0.08
Lymphocytes (%)	53.50± 5.50	56.00 ± 6.00	59.00 ± 6.00	62.50 ± 7.50	58.50 ± 1.50
Heterophils (%)	37.50 ± 7.50	36.00 ± 4.00	34.50 ± 9.50	27.50 ± 2.50	35.00 ± 0.00
Monocytes (%)	6.00 ± 2.00	6.00 ± 1.00	5.00 ± 3.00	6.00 ± 2.00	4.00 ± 0.00
Eosinophils (%)	0.00 ± 0.00	1.50 ± 1.50	0.00 ± 0.00	1.50 ± 1.50	0.00 ± 0.00
Basophils (%)	3.00 ± 0.00	0.50 ± 0.50	1.50 ± 0.50	2.50 ± 1.50	2.50 ± 1.50

Group mean and standard error of samples (x±sem), packed cell volume (PCV), RBC (Red Blood Cells), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC)

From Table 5, it was observed that the administration of the leaf extracts of Parquetina nigrescens did not significantly influence (p>0.05) all the serum biochemical parameters measured. The parameters measured were alanine transaminase, aspartate transaminase, alanine phosphatase, creatinine, albumin, globulin, total protein and cholesterol. The values obtained for relative organ weight are shown in Table 6. The obtained values were not significantly influenced (P>0.05) by the administration of the leaf extracts of *Parquetina nigrescens.*

Table 5 Serum biochemical responses of broiler chickens given Parquetina nigrescens leaf extract

	T1 (Positive control)	T2 (Negative control)	T3 0.2ml/bird)	T4 0.4ml/bird)	T5 0.6ml/bird)
ALT (U/I)	62.00±10.00	68.50 ± 6.50	64.00± 10.00	65.00 ± 5.00	70.50 ± 6.50
AST (U/I)	67.00 ± 8.00	61.00 ± 6.00	71.50 ± 4.50	65.00 ± 9.00	69.00 ± 9.00
Creatinine (mg/dl)	0.16 ± 0.04	0.165 ± 0.08	0.18± 0.08	0.20 ± 0.15	0.23±0.17
Albumin (g/dl)	7.55 ± 0.65	7.55 ± 0.55	7.70 ± 0.50	7.45 ± 0.35	7.60±0.70
Globulin (g/dl)	5.05 ± 0.45	5.05 ± 0.35	5.10 ± 0.3	4.95 ± 0.25	5.10 ± 0.40
Urea (mg/dl)	56.50 ± 0.50	57.00 ±7.00	59.50 ± 7.50	55.00 ± 5.00	57.50±4.50
Total protein (g/dl)	12.60 ± 1.10	12.60 ± 0.90	12.80 ± 0.80	12.40 ± 0.60	12.70±1.10
ALP (U/I)	32.50 ± 4.50	32.50 ±7.50	37.50 ± 7.50	33.50 ± 1.50	29.00±4.00
Cholesterol (mg/dl)	367.00±23.00	357.00±37.00	360.00±20.00	348.00±30.00	353.00±29.00

Group mean and standard error of samples (x±sem), aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP)

Table 6 Organ Weights and Relative Organ Weights of Broiler Chickens Administered *Parquetina nigrescens* Leaf Extract

Organs (g)	T1 (Positive control)	T2 (Negative control)	T3 (0.2ml/bird)	T4 (0.4ml/bird)	T5 (0.6ml/bird)
Liver	34.00±0.03	31.00±1.00	31.00±2.00	33.00±2.00	33.00±2.00
Kidney	1.00±0.00	1.00±0.00	1.00±0.00	1.00±0.00	1.00±0.00
Heart	1.00±0.00	1.10±0.00	1.10±0.01	1.10±0.00	1.00±0.01
Spleen	2.00 ±0.01	1.00±0.01	1.00±0.01	1.00±0.01	2.00±0.01
Rel. Liver (%)	1.60±0.02	1.50±0.01	1.50±0.01	1.60±0.01	1.50±0.01
Rel. Kidney (%)	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Rel. Heart (%)	0.05±0.00	0.05±0.00	0.05±0.01	0.05±0.00	0.05±0.01
Rel. Spleen (%)	0.01±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.01±0.00

DISCUSSION

Administration at the highest dose (0.6ml) improved body weight gains and feed intake but no significant difference was observed in FCR. The performance results, on the other hand, were in contrast to those of Arslan *et al.* (2017), who looked at the effects of turmeric (*Curcuma longa*) supplementation on broiler development, immunological response, carcass features, and cholesterol profile. Supplementation at a rate of 0.5 percent improved FCR and reduced feed consumption, but comparable findings were made in the current investigation, with birds receiving the highest percentage of the supplement having the best ultimate live weight and body weight gain. Al-Jaleel (2012) showed enhanced body weight gain at the maximum turmeric dosage without affecting feed consumption, which is similar to these findings. The feed conversion ratio (FCR) ranged from 1.697 to 1.771, which is within the broiler industry's acceptable range. The results were higher than the optimum value of 2.0 reported for broilers by Prakbakaran (2003). This indicates that giving the birds *Parquetina nigrescens* leaf extract had no negative impact on their diet intake. Also, the mortalities rate, were not significantly different (P>0.05) among treatments and fall within the best ranges for mortalities in well managed birds especially less than 3% as reported by Atteh (2015).

Furthermore, Olumide *et al.* (2022) discovered that the administration of *Ocimum gratissimum* leaf extracts had no effect on the feed conversion ratio. The findings are also consistent with Basit *et al.* (2020) study on the effects of different doses of *Pericardia odorata* leaf meal (POLM) in broiler chicken feed on biochemical and haematological blood markers, as well as liver histomorphological changes. They concluded that supplementing broiler chicks with POLM improved their growth performance. They also discovered that the phytobiotics greatly increased body weight, but that dietary supplementation with POLM had no effect on feed intake or FCR. The findings are also consistent with the findings of Aroche *et al.* (2018), who found that adding phytobiotics to the diet in the form of a 0.5 percent mixed powder of *Morinda citrifolia*, *Psidium guajava* and *Ageratina occidentalis* boosted feed efficiency and body weight gain. Nouzarian *et al.* (2011) found better FCR at 1.0 percent supplementation, contrary to the findings of this study. Variations in this study could be attributed to the varied test ingredients employed.

Other investigations have discovered that probiotic bacteria have no effect on the amount of serum immunoglobulins Y, IgM, or IgA, and the immunological parameters revealed no significant difference (Balevi *et al.*, 2001; Mountzouris *et al.*, 2010; Talebi *et al.*, 2015). When turmeric was added at 0.33, 0.66, and 1.0 percent to the diet of broiler chickens, Nouzarian *et al.* (2011) found no significant effect on the titer against ND. When turmeric was supplemented at the rates of 1.0, 1.2, 1.8, and 2.0 percent, Qasem *et al.* (2015) found no favorable results on IBD titer, which is consistent with the current investigation.

Animals' physiological status can be determined by haematological measures (Khan & Zafar, 2005; Akintunde *et al.*, 2019). The status of animals exposed to toxicants and other situations is reflected in their blood (Olafedehan *et al.*, 2010; Oloruntola *et al.*, 2016). According to Isaac *et al.* (2013), animals with a healthy blood composition are more likely to perform well. Isaac *et al.* (2013) further reported that packed cell volume has a role in oxygen and nutrient absorption. Increased packed cell volume indicates improved transportation, preventing anemia (Coles, 1986). This finding is consistent with the findings of Chineke *et al.* (2006), who found that packed cell volume can easily indicate an increase in the number of red blood cells or a decrease in the volume of circulating plasma. Toxic chemicals in feed have been shown to decrease haemopoietic tissues, resulting in lower white blood cell production (Fakunle, 2021).

This finding suggests that the extract helped haemopoietic tissue produce enough white blood cells. Because white blood cells serve largely as a defensive system in the body (Eroschenko, 2000), this result showed that the birds' immune systems were not affected. In this investigation, the haematological blood markers were found to be within normal ranges (Thrall *et al*., 2012). The broiler hens administered *P. nigrescens* leaf extracts had normal blood haematology values, indicating adequate nutrition and improved immunological condition. However, the current study findings contrasted with those of Basit *et al.* (2020), who found significant increases in RBC and WBC counts, as well as Hb and PCV values. Reis *et al.* (2018) found that adding phytobiotics like cinnamic aldehyde, thymol, and carvacrol to broiler chicks dramatically boosted erythrocyte counts and haemoglobin in comparison to the control. Krauze *et al.* (2020) demonstrated improvements in the immune system and parameters including RBCs and Hb after feeding probiotic *Bacillus subtilis* (0.25 g/L), *Enterococcus faecium* (0.25 g/L), and phytobiotics with cinnamon oil (0.25 mL/L) to broiler chickens. Gilani *et al.* (2018) investigated the efficacy of organic acids and phytobiotics (including flavonoids) in poultry feed as alternatives to AGPs, finding substantial increases in RBC, WBC, and PCV in broiler chickens. Contrarily, broiler chicks fed Garden cress (*Lepidium satvium*) seed powder (Shawle *et al.*, 2016), cayenne pepper (*Capsicum frutescens*) and turmeric (*Curcuma longa*) powders (Adegoke *et al.*, 2018), and pawpaw leaf and seed meal (Oloruntola, 2019) had higher Hb, PCV, and RBC values.

The current findings were consistent with those of Basit *et al.* (2020), who found no significant differences in MCV, MCH, or MCHC in experimental broiler chicks fed POLM supplements. These findings were also consistent with those of Oghenebrorhie & Oghenesuvwe (2016), who found no significant differences in MCV, MCH, or MCHC among broilers fed *Moringa oleifera* leaf meal (MOLM). Finally, the lack of significance of haematological markers in broiler hens administered *Parquetina nigrescens* leaf extracts suggests that dietary nutrients are effectively utilized.

Serum biochemical parameters depict nutrient metabolism in the body and highlight potential alterations caused by intrinsic and external causes (Liu *et al.*, 2015; Hu *et al.*, 2016; Akintunde *et al.*, 2021). The liver is one of the largest and most important organs in living creatures, and it is responsible for detoxification, metabolism, and removal of both endogenous and foreign chemicals (Paul *et al.*, 2016). Alkaline phosphatase (ALP), aspartate transaminase (AST), and alanine transaminase (ALT) activity levels are regarded diagnostic measures that can be used to assess hepatotoxicity (Króliczewska, 2016). Any clinical manifestation or toxicity causes an increase in AST and ALT activity (Toghyani *et al.*, 2011). Furthermore, their levels of activity are thought to be specific indications of liver injury or impairment (Alhidary *et al.*, 2016). The current study found no significant differences in all serum biochemical parameters, in contrast to Basit *et al.* (2020), who found that increasing the *Pericardia odorata* Leaf Meal (POLM) supplementation dosage decreased serum activity of AST and ALT, but in agreement with Basit *et al.* (2020), who found that serum activity of ALP was not influenced by *Pericardia odorata* Leaf Meal (POLM) supplementation in experimental animals. The lack of importance of ALT and AST indicated that the extracts of *Parquetina nigrescens* were better utilized without affecting the birds' liver function. The findings of this study contrasted with those of Odetola *et al.* (2019), who found that graded supplementation of *Petiveria alliacea* root meal in broiler chicks significantly reduced AST activity. In a recent study, Oloruntola *et al.* (2018) discovered that feeding pawpaw and bamboo leaf meal to broiler hens reduced ALT activity considerably. The liver produces the majority of serum proteins, and their concentrations reflect the health of hepatocytes. Hepatic insufficiency, malnutrition, and active inflammation, which can be caused by recurrent infections and immunological deficiencies, can all cause a drop in blood protein levels (TP, albumin, and globulin) (Tothova *et al.*, 2016). Furthermore, the levels of serum protein in birds are key indications for determining their health status. Broiler chickens have a relatively short fattening stage, and there is a rapid buildup of building proteins in the body tissues, which may have a major impact on protein quantities and composition in the blood (Scanes, 2014). This rapid development pattern necessitates extensive erythropoiesis and haemoglobin synthesis, which might lead to increased globulin production, potentially altering blood protein concentrations in growing chickens (Roman *et al.*, 2009; Tothova *et al.*, 2019). In contrast to Akintunde *et al.* (2021a) for *Moringa oleifera* seed inclusion and Akintunde *et*

al. (2021b) for *Chromolaena odorata* leaf meal, the current investigation found that administration of *Parquetina nigrescens* leaf extract had no significant effect on TP, albumin, or globulin levels. The current findings contrast with those of George *et al.* (2015), who found greater blood TP levels in broilers fed a ginger-powder-supplemented diet at both the beginning and end of their lives. In contrast to the current investigation, Abudabos *et al.* (2018) showed serum TP and globulin trends for broilers given anise and thyme essential oils. The typical range of serum glucose in birds is 200 to 500 mg/dL. (Thrall *et al.*, 2012). The present investigation found that oral administration of *Parquetina nigrescens* leaf extracts had no effect on serum glucose concentrations, which is consistent with Basit *et al.* (2020) findings on POLM supplementation in broiler chickens. The current findings are consistent with those of Abudabos *et al.* (2018), who found that serum glucose levels in experimental broilers treated with phytogenic feed additives did not differ significantly. Cholesterol and triglyceride levels in the blood are thought to be indications of lipid metabolism (He *et al.*, 2015; Akintunde *et al.*, 2021a). The current investigation found that administering *Parquetina nigrescens* leaf extracts had no effect on serum triglyceride and cholesterol levels. Similar findings have been documented in other investigations (Amad *et al.*, 2011). The kidneys are the second organ that might be harmed as a result of metabolic problems. Kidney function is crucial in determining the potential toxicity of any compound. The increase or decrease in serum levels of urea and creatinine can be used to assess kidney function (Akintunde, 2018). Reduced glomerular filtration results in higher creatinine levels, which suggests kidney damage (Rhiouani *et al.*, 2008), but an elevated serum urea level indicates cardiac and renal tissue injury. The current investigation found that the ingestion of the test components had no significant effect on serum creatinine and urea levels. These findings suggested that the test substances had no negative impact on kidney function when administered. These findings showed that giving *Parquetina nigrescens* leaf extracts to broiler chickens improved liver and kidney function and was safe up to 0.6 ml.

The relative internal organ weights were used as a predictor of animal reactions to any harmful substance in the feed that could cause a rise or reduction in internal organ weights (Ayodele *et al.*, 2016; Akintunde *et al.*, 2021a). There were no macroscopic changes in any internal organs in the current investigation, such as hypertrophy or atrophy, damage, or swelling. Furthermore, administration of *Parquetina nigrescens* leaf extracts had no effect on relative organ weights in experimental broiler chickens, which was consistent with Baist *et al.* (2020) findings. The findings of this study correspond with those of Oloruntola (2019), who found that the inclusion of seed meal and pawpaw leaf meal had no effect on the relative internal organ weights of broilers. Similar findings were reported by Rubio *et al.* (2019) and Vispute *et al.* (2019), who found that adding phytobiotics to the diet had no effect on the relative organ weights of broiler chickens. Finally, the stable relative internal organ weights of the broilers throughout experimental groups revealed that administration of *Parquetina nigrescens* leaf extracts had no negative impact on the internal organs of the broiler chickens.

CONCLUSION AND RECOMMENDATION

The findings of this study indicate that oral administration of *Parquetina nigrescens* leaf extract at 0.6 ml per bird resulted in enhanced feed intake, weight gain, and body weight. The administration of *Parquetina nigrescens* leaf extract up to 0.6 ml did not have any deleterious effect on the health, immunology and general wellbeing of broiler chickens. For enhanced productivity, *Parquetina nigrescens* leaf extract could be administered to broiler chickens up to 0.6 ml per bird.

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Authors Contributions

Authors LCN, AOA, TO and IO: Management of experimental animals, data collection. LCN, AOA and MDO: Conceptualization, design of the experiments, data management, data analysis, visualization, manuscript review and final approval of manuscript.

Ethical Statement

Not Applicable.

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