Research Article **JHMR 2019, 4:36**

Journal of Herbal Medicine Research
(ISSN: 2474-106X)

GROWTH PERFORMANCE AND HEAMATO-BIOCHEMICAL PARAMETERS OF BROILERS CHICKEN FED DIFFERENT LEVELS OF *Pakia biglobosa* LEAF EXTRACTS

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ABSTRACT

This experiment was conducted to evaluate the growth performance and some hemato-biochemical parameters of broilers fed different levels of Pakia biglobosa leaf extract (BPE). Two hundred and fifty (250) one day old (Ross 308) broiler chicks were randomly assigned to five treatments with five replicate consisting of ten (10) bird each in a completely randomized design. Treatment 1 contained 0% BPE, Treatment 2, 3, 4 and 5 contained 5ml, 10ml, 15ml and 20ml per liter of water respectively. Clean feed and water were offered ad libitum throughout the experiment which lasted for 7 weeks during which data on performance, hematology and serum biochemical traits were collected. Results revealed that BPE had a significant (p<0.05) effect on final weight, feed conversion ratio and mortality rate. Birds given 20ml (T5) BPE recorded the highest weight gain (1846.1g) followed by 15ml (T4) with 1839.1g, 10ml (T3) with 1763.1, 5ml (T2) with 1757.1g and 0ml (T1) with 1679.0g respectively. BPE had no significant (p>0.05) on the feed intake of the birds. There was no significant (p>0.05) difference in PCV, Hb, RBC, MCV, MCH and MCHC values among the treatment. However, WBC and its differentials were significantly (p<0.05) influenced by BPE. Significant influences were not observed for albumin, globulin and total protein. Serum glutamic oxaloacetate transaminase (SGOT) and Serum glutamic pyruvic transaminase (SGPT) were significantly affected (P<0.05) as the level of BPE increased in the water of the animals. It was concluded BPE can be safely included in the water of birds at 15ml and 20ml without any deleterious effect on the performance and health of the animals.

Keywords: Growth performance; Pakia biglobosa leaf extract; hematology; serum biochemistry.

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How to cite this article:
Alagbe, J.O. GROWTH PERFORMANCE AND HEAMATO-BIOCHEMICAL PARAMETERS OF BROILERS CHICKEN FED DIFFERENT LEVELS OF Pakia biglobosa LEAF EXTRACTS. Journal of Herbal Medicine Research, 2019,4:36.

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Website: https://escipub.com/

INTRODUCTION

Pakia biglobosa Benth is a multipurpose fodder tree that belongs to the family Mimosaceae. It is widely distributed in savannah, sahelo-sudanian region and some parts in India (Adjanohoun *et al,* 1991). The leaves are alternate, dark green, bipinnate and about 8-30 mm × 1.5-8 mm in size with about 13-60 pairs of leaflets of distinct venation on a long rachis (Udobi and Onaolapo, 2009). The seeds can be locally fermented and used for cooking soup and its husk are used in feeding ruminants (Obizoba, 1998). According to Agroforest database (2008), the average weight of P.biglobosa seed is about 0.26g and it contains a hard testa. The leaves, seed and barks have been medicinally used in the treatment of pneumonia, severe cough, dermatitis, conjunctivitis, bilhaziosis, otitis, jaundice, piles, arterial hypertension, bronchitis, cough, zoster, hemorrhoids, ulcers and abscesses Arbonnier (2002); Sacande and Clethero (2007).

Phytochemical screening of *Pakia biglobosa* leaf leaved the presence of several bioactive chemicals or secondary metabolites such as tannins, flavonoids, saponin, oxalate, phytate, glycosides and alkaloids (Onyeike and Omubodede, 2002; Soetan *et al.,* 2014; Elemo *et al,* 2002). This bioactive chemicals confers them the ability to function as antifungal (Cakir *et al.,* 2004), antihyperglycemic (Udobi and Olaolapo, 2009; Okwuosa and Azubize, 2011), antibacterial (Ajaiyeoba, 2002), anthelminthic (Palaksha and Ravishankar, 2012) and antioxidant (Ujowundu *et al.,* 2010).

According to Tamburawa *et al* (2017), reported that soaked and fermented African locust bean seed can be incorporated at 15% in the diet of broilers to performance and carcass quality. Similar result was obtained by Wada *et al* (2016) who recommended the dietary inclusion 15% *Pakia biglobosa* in concentrate diets of Yankasa rams. All the authors have result have proven that *Pakia biglobosa* can also serve as a multipurpose leaf because it contains several vitamins and minerals which play vital role in the body of human being and animals (Alalade *et al.,* 2016). However, to the best of my knowledge no research has been carried out to determine the effect of P. biglobosa leaf extract on the performance and blood profile of broilers. A timely evaluation of this test material will provide further information on the quantity to administer to birds.

It is in view of this, that this research was conducted to determine the effect of *Pakia biglobosa* leaf extract on the performance, hematology and serum biochemical parameters of broiler chickens.

MATERIALS AND METHODS

Site of the experiment

The experiment was carried out at Division of Animal Nutrition, Sumitra Research Farm, Gujarat, India during the month of January to March, 2018.

Collection and processing of Pakia biglobosa leaf extract

Fresh and healthy Pakia biglobosa leaf extract (PBL) were obtained from the farm premises in India. The plant was authenticated by Professor Xing Leu at Sumitra Research Institute at department of biological sciences with a voucher number PAK/19/90. Thereafter, the fresh leaves were thoroughly washed with running tap water to remove the debris and allowed to dry under shade for 12 days until a constant weight were obtained, the dried samples was blended into fine powder using an electric blender and stored in an air tight container. The extract was prepared by soaking 200grams of PBL in 1000 ml of ethyl alcohol (80% BDH). The mixture was agitated using electric blender (to enhance proper mixing of the solvent with the powder), sieved with WhatMan filter paper and then poured into air tight plastic container and the mixture kept in the refrigerator at 4^{o}C for 48 hours for further analysis.

Phytochemical analysis was carried out on the plants leaf extract using standard methods Sofowora (1993) and AOAC (2000). Percentage composition of flavonoids, saponin, phytate, tannin and oxalate were carried out according to procedures outlined by Harbone (1984) and Boham and Kocipai-Abyazan (1974), Trypsin inhibitor level in the sample was determined method outlined by Liener (1979). Mineral and vitamin analysis was carried out using Atomic Absorption Spectrophotometer (AAS) & Okwu and Josiah (2006) respectively. Proximate analysis of crude protein, ash, ether extract and crude fibre in the experimental diet were carried out in accordance with the Association of Official Analytical Chemists (AOAC, 2000).

Pre-experimental operations

A deep litter poultry house was used for the experiment, the pen was swept, cleaned and well disinfected, feed and water troughs were also washed. The electrical fittings (bulb) were properly fixed and a vaccination programme was designed before the commencement of the study.

Animal management and Experimental set - up

One day old 250 (Ross 308) broilers of mixed sex were obtained from a commercial hatchery in India. The chicks were weighed individually at the beginning of the experiment and wing banded. They were assigned into five treatments designated as T1, T2, T3, T4 and T5 each group was further divided into five replicates each of ten (10) birds. Anti-stress was added in the drinking water of the birds. The light (electric bulb) was continuous and the initial brooding temperature was 34^{o}C for the first week of age and it was gradually reduced by 2^{o}C per week to 22 ^{o} C. Vaccines were administered according to the prevailing vaccination schedule in the environment. Vitamins (Super vit) was added in water a day before and after each vaccination. Clean feed and water was provided unrestricted throughout the experimental period which lasted for 42 days.

Diets were formulated to meet the nutritional requirements of birds according to NRC (1994). BPL were given to the birds in their drinking water at 0ml, 5ml, 10ml, 15ml and 20ml/liter of water.

Blood analysis

At the end of the experiment, ten (10) birds were randomly selected from each treatment, two from each replicate for blood analysis. Blood was collected from the wing vein with a syringe and needle. Samples meant for hematology was put in tubes containing EDTA to prevent coagulation while those for serum biochemical parameters was put in bottles without EDTA. Hematological parameters covered pack cell volume (PCV), red blood cell (RBC), hemoglobin concentration (Hb), white blood cell (WBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC). Serum parameters included albumin, globulin, total protein, serum glutamic oxaloacetate transaminase (SGOT) and serum glutamic pyruvate transaminase (SGPT). PCV, RBC, Hb, MCV, MCHC, WBC and its differentials were determined using standard techniques as reported by Jain (1986). The serum total protein, Albumin and Globulin were computed according to (Doumas and Briggs, 1972), Glutamic oxaloacetate transaminase (SGOT), Glutamic phosphatase transaminase (SGPT) was determined according to Scott (1965).

MCV, MCH and MCHC were calculated according to Jain (1986) method as shown below:

MCV (fl) = PCV (%) ×10/RBC (10^{6}/µL)

MCH (pg) = Hb (g/dl) × 10/RBC (10^{6}/µL)

MCHC (%) = Hb (g/dl) × 100/PCV (%)

Statistical Analysis

All data collected were analysed using Snedecor and Cochran (1978). The difference in treatment means were separated using Duncan's multiple range test as outlined by Obi (2002).

RESULT AND DISCUSSION

Table 1and 2 reveals the chemical composition of the experimental diets. The chemical analysis of broiler starter diet shows that it contained 92.45% dry matter, 92.02% organic matter, 23.20% crude protein, 3.97% crude fibre, 7.80% ash, 3.57% ether extract, 61.30% nitrogen free extract and 2988.9 MEkcal/kg energy while broiler finisher's diet contained 92.30%, 90.95%, 63.00%, 20.27%, 4.50%, 9.05%, 3.40% and 3071.4 MEkcal/kg for dry matter, organic matter, nitrogen free extract, crude protein, crude fibre, ash, ether extract and energy respectively. The nutritional value of the experimental diets is in line with the level recommended by NRC (1994).

Table 1 Percentage composition of experimental diets

Ingredients	Broiler Starter (0-4 weeks)	Broiler Finisher (5-8 weeks)
	Quantity (kg)	Quantity (kg)
Maize	52.0	60.0
Wheat offal	2.50	5.00
Soya meal	30.0	25.0
Groundnut cake	8.00	4.00
Fish meal (72%)	2.00	2.00
Limestone	1.50	1.20
Bone meal	3.00	3.30
Lysine	0.20	0.20
Methionine	0.20	0.20
Premix*	0.25	0.25
Salt	0.30	0.30
Toxin binder	0.10	0.10
Total	100.00	100.00
Calculated analysis		
Crude protein (%)	23.52	20.70
Crude fibre (%)	3.71	4.45
Ether extract (%)	3.12	3.50
Calcium (%)	1.51	1.61
Phosphorus (%)	0.84	0.71
Energy (MEkcal/kg)	3007.8	3100.8

* Premix supplied per kg diet :- Vit A, 10,000 I.U; Vit E, 5mg; Vit D3, 3000I.U, Vit K, 3mg; Vit B2, 5.5mg; Niacin, 25mg ; Vit B12, 16mg ; Choline chloride, 120mg ; Mn, 5.2mg ; Zn, 25mg ; Cu, 2.6g ; Folic acid, 2mg ; Fe, 5g ; Pantothenic acid, 10mg ; Biotin, 30.5g ; Antioxidant, 56mg

Table 2 Chemical analysis of experimental diet

Parameters	Starter (0-4weeks)	Finisher (5-7weeks)
Dry matter (%)	92.45	92.30
Organic matter (%)	92.20	90.95
Nitrogen free extract	61.30	63.00
Crude protein (%)	23.20	20.27
Crude fibre (%)	4.07	4.50
Ash (%)	7.80	9.05
Ether extract (%)	3.57	3.40
Energy (MEkcal/kg)	2988.9	3071.4

Table 3. Proximate composition of *Pakia biglobosa* leaf meal

Parameters	% Composition
Moisture content	11.67
Dry matter	88.33
Crude protein	18.06
Crude fiber	15.10
Ether extract	7.03
Ash	9.56

Table 4. Mineral composition of *Pakia biglobosa* leaf meal

Parameters	Composition
Calcium (%)	0.339
Potassium (%)	0.80
Phosphorus (%)	0.35
Magnesium (%)	0.31
Sodium (mg/g)	109.4
Copper (mg/g)	198.1
Iron (mg/g)	150.2
Zinc (mg/g)	161.1

Table 5. Phytochemical composition of BPL

Phytochemicals	% Composition	Safe recommended level
Tannins	2.86	31.20
Saponin	1.40	7.02
Phytate	0.60	11.33
Flavonoids	3.11	6.11
Oxalate	0.40	1.30
Trypsin inhibitor	0.21	16.90

Table 6. Vitamin composition of *Pakia biglobosa* leaf

Parameter	Composition (mg/100g)
Beta-carotene	9.10
Vitamin C	45.81
Riboflavin	0.010
Thiamine	0.13

Table 7. Performance traits of the experimental animals

Parameters	T_1	T_2	T_3	T_4	T_5	SEM	p value
Breed: Ross 308							
Number of animals	50	50	50	50	50	-	
Initial body weight (g)	43.07	43.01	43.00	43.02	43.01	0.03	NS
Final body weight (g)	1722.1[c]	1800.1[b]	1806.1[b]	1882.1[a]	1900.0[a]	13.11	*
Body weight gain (g)	1679.0[c]	1757.1[b]	1763.1[b]	1839.1[a]	1846.7[a]	10.31	*
Av. weight gain (g/bird)	279.8	292.9	293.9	306.5	307.8	6.82	NS
Total feed intake (g/bird)	3321.2	3308.5	3301.2	3307.1	3308.3	5.77	NS
Feed conversion ratio	1.98[a]	1.88[b]	1.87[b]	1.78[c]	1.79[c]	0.27	*
Mortality	7/50	2/50	1/50	0/50	0/50	-	*

[abc] means different superscript along rows differs significantly at $p<0.05$

NS: Not significant

*: significantly different

Table 8: The effect of feeding different levels BPE on the haematology of broilers

Parameters	Treatment						
	T_1	T_2	T_3	T_4	T_5	SEM	p value
PCV (%)	31.23	31.45	31.63	31.82	31.92	1.25	NS
Hb (g/dl)	12.91	13.51	13.67	13.85	13.93	0.40	NS
RBC ×10^6/µL	2.54	2.60	2.68	2.81	2.88	0.05	NS
MCV (fl)	123.0	121.0	118.0	113.2	110.8	12.67	NS
MCH (pg)	50.83	51.96	51.00	49.29	48.37	2.13	NS
MCHC (%)	41.34	42.96	43.22	43.53	43.64	2.06	NS
WBC ×10^6/µL	29.03[c]	36.81[b]	36.93[b]	37.14[a]	38.08[a]	1.16	*
Differentials (10^3/µL)							
Lymphocytes	15.18[c]	16.01[b]	16.71[b]	17.03[a]	18.44[a]	0.81	*
Monocytes	1.23[c]	1.30[c]	1.31[b]	1.37[a]	1.38[a]	0.03	*
Heterophils	4.07[c]	6.06[b]	6.18[b]	6.05[b]	6.10[a]	0.45	*
Basophils	1.04[c]	2.08[b]	2.13[b]	2.19[a]	2.60[a]	0.02	*
Eosinophils	1.06[c]	1.40[b]	1.44[b]	1.47[b]	1.51[a]	0.05	*

[abc] means different superscript along rows differs significantly at $p<0.05$

NS: Not significant

*: significantly different

Table 9: The effect of feeding different levels BPE on some serum biochemical parameters of broilers

Parameters	Treatment						
	T_1	T_2	T_3	T_4	T_5	SEM	p value
Albumin (g/dl)	1.80	1.86	1.87	1.91	1.93	0.03	NS
Globulin (g/dl)	1.75	1.80	1.84	1.89	1.90	0.45	NS
Total protein (g/dl)	3.55	3.66	3.71	3.80	3.83	0.31	NS
SGPT (iu/l)	21.80^{c}	19.72^{b}	19.65^{b}	18.44^{a}	15.22^{a}	1.20	*
SGOT (iu/l)	126.18^{c}	106.01^{b}	105.86^{b}	104.11^{a}	104.03^{a}	11.05	*

SGPT: Serum glutamic pyruvate transaminase

SGOT: Serum glutamic oxaloacetate transaminase

^{abc} means different superscript along rows differs significantly at p<0.05

NS: Not significant

*: significantly different

Table 3 shows the proximate components of *Pakia biglobosa* leaf meal, the chemical analysis reveals that dry matter (88.33%), moisture content (11.67%), crude protein (18.88%), crude fibre (18.10%), ether extract (7.03%) and ash (9.56%). The result obtained is in agreement with previous reports by Kehinde *et al* (2014) but contrary to that of Alalade *et al* (2016) who reported a lower crude protein value of 17.97%, the nutrient variation might be attributed to differences in stage of the plant growth, plant parts, season, harvesting regime, topography and environmental conditions as reported by Norton (1994). According to Onwuka (2005), ash contents of plants indicates the amount of minerals in a sample.

The mineral analysis of *Pakia biglobosa* leaf meal indicates that calcium (0.339%), potassium (0.80%), phosphorus (0.35%), magnesium (0.31%), sodium (109.4mg/g), copper (198.1mg/g), iron (150.2mg/g) and zinc (161.1mg/g). Soetan *et al* (2010) reported that minerals are inorganic nutrients, usually required in small amounts from less than 1 to 2500mg per day, depending on the mineral. Calcium, phosphorus, sodium and chloride are regarded as macro nutrients while zinc, copper, magnesium, iron, potassium, cobalt, iodine, iron, molybdenum, fluoride selenium, chromium and sulphur are regarded as micro nutrient (Eruvbetine, 2003). Lack of these minerals in enough quantity in an animal will result to a deficiency. Interrelationship also occurs between various minerals in the body, for instance, zinc, copper and magnesium deficiency could result in low birth rate, infertility and other reproductive abnormalities (Pathak and Kapil, 2004). Copper deficiency results in an increase in iron in the liver, sodium is an important intracellular cation involved in the regulation of acid base balance and muscle contraction (Akpanyung, 2005). Zinc helps in protecting the structure of the genetic material or the DNA chromatin in the sperm nucleus, a structure important for successful fertilization (Brown and Pentland, 2007). Ibrahim *et al* (2001) reported that calcium is vital in bone formation and development.

The phytochemical composition of BPL is presented in Table 5. The phytochemical components reveals that tannins (2.86%), saponin (1.40%), phytate (0.6%), flavonoids (3.11%), oxalate (0.40%) and trypsin inhibitor (0.21%). Similar reports was recorded by Alalade *et al* (2010). Millogo-Kone *et al* (2008); Bukar *et al* (2010) and Vidjinnangni Fifamê *et al* (2016) observed that *Pakia biglobosa* leaf extract (BPE) contained alkaloids, flavonoids, tannins, saponins, reducing sugar and steroids. However all values were within the safe recommended level reported by Kumar and Amit (2010); Alagbe, J.O (2019). Phytochemicals are bioactive chemicals of plants which protects against degenerative disease (Omale and Okafor, 2008) and exhibits several pharmacological effects on microorganisms (Dreosti, 2000). Flavonoids have been reported to have anti-inflammatory, antioxidant, antiviral and ant carcinogenic effects (Chen *et al.,* 2000), tannins possess antibacterial and antiviral activity (Adisa *et al,* 2010). Furthermore, Andjelkovic *et al.* (2006) submitted that phenolic compounds have a high antioxidant activity through three mechanisms: free-radical scavenging activity, transition-metal-chelating activity.), and/or singlet oxygen quenching capacity.

Vitamin composition of *Pakia biglobosa* leaf is presented in Table 6. The results revealed that *P. biglobosa* leaf contained beta-carotene (Vitamin A precursor) at 9.10mg/100g, vitamin C (45.81mg/100g), riboflavin (0.01mg/100g) and thiamine (0.13mg/100g). Kulisic *et al* (2004) reported that Vitamin C have antioxidant properties and also have a correlation with α-tocopherol, and ß-carotene Yeum *et al* (2009); Wright (2002). Vitamin A have also been reported to play a vital role in good sight and regulates gene expression (Bakare *et al,* 2010)

The performance traits of birds given different level of BPE is presented in Table 7. The final live weights of the birds ranged 1722.1 – 1900.0 grams. The results showed that BPE had a significant ($P<0.05$) effect on the final body weight, body weight gain, average weight gain and feed conversion ratio of the birds among the treatments. Birds in T_5 had the highest weight gain (1900.0grams) followed by T_4 (1882grams), T_3 (1806.1grams) and T_2 (1800.1grams). Birds in T_1 had the lowest final body weight (1722.1 grams). The improvement of body weight gain and feed conversion could be due to the several bioactive chemicals or secondary metabolites (tannins, phenols, saponins, flavonoids etc.) found in BPE causing greater efficiency in the utilization of feed, resulting in enhanced growth (Hasan *et al.,* 2016). The increase in the final body weight is in accordance to the findings of Galib *et al* (2011); Safa M.A Eltazi (2014) when broiler chicks were fed diets containing different mixture levels of garlic and ginger powder as natural feed additives.

Feed intake was not significantly ($P>0.05$) influenced by the treatments. Birds given T_1 (0% BPE) had the highest feed intake (3321.2 grams/bird) while the birds on T_3 (10ml/liter BPE) had the lowest feed intake (3308.5 grams/bird). This result is in line with the findings of Agbabiaka *et al* (2012) but contrary to the reports of Bolu *et al* (2014) on the effects of cold extracts of *Vitellaria paradoxa* bark on the performance of *Aspergillus* challenged broiler chicks. Feed conversion ratio and mortality rate were significantly ($P<0.05$) influenced by the treatments. Birds in T_1 recorded the highest mortality (7birds) followed by T_2 (2 birds) and T_3 (1 bird) respectively. No birds were recorded in T_4 and T_5.

Hematological parameters of broilers given different levels of BPE is presented in Table 8. The PCV value ranged (31.23-31.92 %), Hb (12.91-13.93 g/dl), RBC 2.54-2.88 ($\times 10^6 \mu L$), MCV (110.8-123.0 fl), MCH (48.37-50.83 pg) and MCHC (41.34-43.64%). PCV, Hb, RBC, MCV, MCH and MCHC values were not significantly ($P>0.05$) influenced across the treatments. However all values recorded were within the physiological range described by Talebi *et al* (2005); Ibrahim Albokhadaim (2012). Hematological parameters are used to determine the health status animals (Bamorovat *et al.,* 2013) and indicators of stress due to nutritional, environmental and pathological factors (Dias *et al.,* 2010; Adili *et al.,* 2013). According to Etim *et al* (2014) Haemoglobin is an iron-containing conjugated protein that performs the physiological function of transporting oxygen and carbon dioxide. PCV, Hb and RBC is a toxicity index and are used in the diagnosis of anaemia (Peters *et al*., 2011).

Diets have been established to have a significant effect on blood components (Olabanji *et al.,* 2007). Changes in MCV, MCH and MCHC values are clear evidence of an animal's adaptation to an environment (Yaqub *et al.,* 2013) and they are also useful in monitoring feed toxicity especially with feed constituents that affect the blood as well as the health status of farm animals (Oyawoye and Ogunkunle, 2004)

White blood cell values ranged 29.03-38.08 (10^6µL), lymphocytes 15.88-18.44 (10^3µL), monocytes 1.27-1.38 (10^3µL), heterophils 4.07-6.10 (10^3µL), basophils 1.04-2.60 (10^3µL) and eosinophils 1.06 -1.51 (10^3µL). The white blood cell and its differentials were significantly ($P<0.05$) influenced across the treatment. However all values fall within the normal range reported by Kececi and Col (2011). Nse Abasi N. Etim (2014) posited that when WBC, neutrophils and lymphocytes fall within the normal range, it is an indication that the feeding pattern do not affect the immune system. Higher values of WBC can also be linked to malnutrition (Melillo, 2007).

The albumin values obtained are 1.80, 1.86, 1.87, 1.91 and 1.93 g/dl for T_1, T_2, T_3, T_4 and T_5 respectively while those of globulin are 1.75, 1.80, 1.84, 1.89 and 1.90 g/dl for T_1, T_2, T_3, T_4 and T_5 .There was no significant difference ($P>0.05$) among the treatment in terms of the albumin and globulin values. According to Olajide *et al* (2009) diets, disease and infections have measurable effects on blood components. Albumin content in the blood are easily influenced by protein shortage, the results obtained is an indication that the experimental diets contained enough protein to support the normal protein reserves across the group. Globulin protein consist of antibodies, enzymes and also play a vital role in blood clotting process, transport of hormones to different part of the body (Vivian *et al,* 2015). The values for all the parameters fall within the normal range values established for birds by Ibrahim Albokhadaim (2012).

The SGPT values obtained ranged 15.22-21.80 (iu/l) and SGOT 104.3-126.18 (iu/l). There SGPT and SGOT results were significantly ($P<0.05$) different among the treatment. According to Iyayi (1994) SGPT and SGOT values usually respond to the presence of toxic substances in the diet. It is a clear indication that the integrity of the internal organs are protected. Greaves (2007) noted that the liver detoxifies the substance that are harmful to the body while the kidney is responsible for homeostatis and removal of waste product. The results obtained agrees with the findings of Olabanji *et al* (2007); Alagbe, J.O (2019) but contrary to the reports of Iheukwuemere *et al* (2002) on the Physiological responses of broiler chickens to qualitative water restrictions: hematology and serum biochemistry.

CONCLUSION

It could be concluded that *Pakia biglobosa* leaf extract (BPE) leaf extract at 15ml and 20ml per liter of drinking water caused a significant improvement in weight gain, feed conversion ratio and low mortality. BPE have the ability to act as a natural growth promoter and as competitive exclusion i.e. physical blocking of opportunistic pathogen, thus maintaining a balanced gut microbial ecosystem.

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