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Responses of broiler chickens fed varying levels of dietary waterleaf *(Talinum triangulare*)

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ABSTRACT

This study was carried out to determine the responses of broiler chickens fed varying levels of dietary Waterleaf (Talinum trangulare). One hundred and twenty broiler chickens were used for this study. Waterleaf (Talinum trangulare) was introduced to the birds at four (4) weeks of age after they were randomly allotted into four (4) dietary treatments. Treatment 1, which was the control, had no Waterleaf (Talinum trangulare), Treatments 2, 3, and 4 had 100g, 200g and 300g of Waterleaf respectively, in a Completely Randomized Design (CRD). Water was given ad libitum. The data collected from this study showed that the final weight, weekly weight gain, weekly feed consumption and feed efficiency showed a significant difference (P<0.05) between the treatments, indicating a higher feed utilization by the birds in Treatment 4. However, the results obtained from the organ weights, showed significant effects (P<0.05) on the liver, with the highest value in treatment 4. The test on serum enzymes showed that Aspartate Amino Transferase (AST) and Alkaline Phosphate Transferase (ALP) showed significant differences (P<0.05) between the treatments, while the serum lipid profile indicated a significant difference (P<0.05) in the High Density Lipoproteins (HDL). The analysis of the Blood electrolytes and blood chemistry showed significant differences (P<0.05) in Potassium (k), Sodium (Na), Bicarbonate and Conjugated Bilirubin amongst the treatments. The Lymphocyte counts showed a significant difference (P<0.05) amongst the treatment in the haematological analysis. From the results, it can be concluded that Waterleaf (Talinum trangulare) improves feed utilization, stimulates appetite and a good source of electrolytes. It is, therefore, recommended to supplement broiler diets with Waterleaf (Talinum trangulare).

***Key Words**: Aspartate Amino Transferase, Feed Efficiency, High Density Lipoproteins, Lymphocytes and Potassium.*

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I. Introduction

Adequate nutrition is one of the ways to enhance the productivity of birds. Feeding in poultry production is based on the science of nutrition, in which the nutritional requirements are best known. However, the high cost of poultry feed has reduced these extraordinary advantages of poultry

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compared to other livestock species. The feed is the main cost of producing poultry, and 80% of the total cost of producing finished feed is the cost of raw materials (Longe, 2006). The use of local, cheap and easily available materials, especially those that are not directly used by humans, has been given special attention as the only viable alternative to the use of traditional feed (Akpodiete et al., 1997; Akande et al., 2007). High feed costs and shortage of necessary raw materials forced poultry farmers to look for systems that could help identify feed ingredients with lower costs and healthy biological values that could partially supplement conventional sources of protein and energy in broiler diets. The cost of feed from the total estimated price of poultry production is around 75% in Nigeria (Atteh, 2002).

In Nigeria and many other countries, it has been established that green leafy vegetables are inexpensive, surpluses and readily available sources of protein due to its ability to synthesize amino acids from a wide range of available primary raw materials (Fasuyi, 2006). It also contains vitamins; as pro-vitamin A (Mbaegbu, 2012). Waterleaf (*Talinum triangulare*) is an herbaceous annual and perennial plant with a wide, worldwide range. The crude waterleaf protein content is favorable compared to the cowpea, peanut, millet and cashew nut content (Ofusor et al., 2008). Waterleaf (*Talinum triangulare*) is a rich source of vitamin C, vitamin E, Omega-3 fatty acids, calcium, magnesium, soluble fibers (pectin), potassium, β-carotene, proteins and dietary fiber (Ezekwe et al., 2001). Diets with vitamins C and E, ingredients containing zinc and selenium can help protect animals from the damage of internal organs caused by free radicals.

II. Materials and Methods

The study was conducted at Chimezie's Farm, Obeama-Asa Oyigbo L.GA of Rivers State from 23rd July – 24th September, 2019 (8 weeks). Oyigbo lies between latitude 4.8869° N and longitude 7.1252°E. The Relative humidity is 71%. A total of one hundred and twenty (120) birds were used for the study. The birds were randomly assigned to four dietary treatments and repeated three (3) times with ten (10) birds per repetition in a completely random design (CRD).

Waterleaf (*Talinum triangulare)* was introduced to the birds at four (4) weeks of age. Treatment 1 was the control, with zero (0g) Waterleaf (*Talinum triangulare),* Treatments 2, 3 and 4 had 100g, 200g and 300g of Waterleaf (*Talinum triangulare*) respectively. Feeds were measured and measured daily, and water was given ad libitum. Aquarius (*Talinum triangulare*) was obtained from the local market in Oyigbo the day before bird feeding to allow wilting. It is chopped into small particles and mixed with commercially available poultry feed. This is to give bird's easy access to Waterleaf (*Talinum triangulare*) and to avoid waste.

The Average weekly feed intake and weight gain were recorded. At the end of the experiment, one bird was randomly selected from each repeat and the organ weights (liver, heart, kidney, stomach and spleen) were recorded. Blood samples were also taken from each replicate to determine the hematological and biochemical parameters. Blood was collected through the jugular vein into an anticoagulant bottle (EDTA) to determine some hematological indicators that include; packed cell volume (PCV), hemoglobin (Hb), red blood cells (RCB), white blood cell count (WBC), platelets, Nuetrofil, lymphocytes, eosinophils and monocytes, as well as with a bottle other than EDTA to obtain serum. Serum from coagulated blood samples were used to determine some serological parameters, including serum lipids, enzymes and electrolytes. All collected data were subjected to one-way analysis of variance (ANOVA) and significantly different values were separated with Duncan's multiple range test, using SPSS statistical software (version 23).

III. Results and Discussion

The performance records, hematology, organ weights, serum enzymes and lipids, blood electrolytes and other blood biochemical results are presented in Tables 01- 05 respectively. On Table 01 the performance characteristics of broilers chicken fed varying levels of dietary water leaf (*Talinum triangulare*) showed that, the final weight gain, weekly weight gain, weekly feed consumption and feed efficiency showed significant difference ($P< 0.05$) amongst the treatments. The least feed efficiency of 39% was observed in Treatment 2, while the highest at 42% was observed in Treatment 4.

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Table 01. Performance of broilers fed varying levels of dietary waterleaf (*Talinum triangulare*)

Treatment/parameters	T1	T2	T3	T4
Initial weight (g)	506.67±24.04	523.33±13.33	530.00±5.77	516.67±3.33
Final weight (g)	3730.00^{c}±10.00	3760.00^{c}±5.77	3813.33^{b}±12.02	3893.33^{a}±8.82
Weekly weight gain (g)	402.92^{c}±2.3	404.58^{c}±2.3	410.42^{b}±0.83	422.08^{a}±1.10
Weekly feed consumption (g)	1013.24^{b}±8.12	1032.07^{a}±2.20	1021.65^{ab}±5.58	1016.52^{ab}±1.23
Feed efficiency (%)	40^{b}±0.60	39^{c}±0.45	40^{b}±0.59	42^{a}±0.67
Mortality	0.33±0.00	0.33±0.00	0.00±0.00	0.33±0.00

^{abc} : Means along the same row with different superscript were significantly different (P<0.05).

The results of the organ weight of broiler chicken fed varying levels of waterleaf are presented on Table 02, and show that the liver weight was significantly different (P<0.05) between the treatment groups. The weight of the gizzard (full), gizzard (empty), spleen and heart showed no significant difference (P>0.05).

Table 02. Organ weight of broiler chicken fed varying levels of dietary waterleaf (*Talinum triangulare*)

Parameters	T1	T2	T3	T4
Liver (g)	70.18^{a}±0.48	55.12^{b}±1.72	46.65^{b}±1.27	73.25^{a}±5.91
Gizzard Full (g)	50.35±1.14	44.94±9.32	49.04±8.50	62.08±4.35
Gizzard Empty (g)	65.13±3.31	65.47±8.78	62.16±5.49	82.40±6.95
Spleen (g)	3.50±0.51	2.85±0.86	9.03±6.55	4.58±0.52
Heart (g)	15.34±0.77	13.71±1.34	14.32±1.76	18.64±4.55

^{abc} : Means along the same row with different superscripts were significantly different (P<0.05).

Table 03, shows the serum enzymes and lipids of broiler chickens fed varying levels of dietary waterleaf (*Talinum triangulare*). It indicated significant difference (P<0.05) in the AST, ALT and HDL levels between the treatment groups.

Table 03. Serum enzymes and lipids of broiler chicken feed varying levels of dietary waterleaf (*Talinum triangulare*)

Parameters	T1	T2	T3	T4
ALP (µ/L)	174.33±12.57	164.33±1.20	149.00±7.57	155.33±6.49
AST (µ/L)	6.30^{ab}±1.61	10.60^{a}±0.95	8.67^{ab}±2.94	4.17^{b}±0.69
ALT (µ/L)	227.67^{b}±10.27	277.33^{a}±6.17	249.00^{ab}±11.02	241.67^{b}±9.33
Total cholesterol (mmol/L)	5.10±0.86	6.13±0.50	5.23±0.98	5.60±0.45
Triglyceride (mmol/L)	1.0±0.15	0.66±0.02	0.97±0.23	0.55±0.24
HDL (mmol/L)	2.19^{ab}±0.21	2.71^{a}±0.41	1.32^{b}±0.18	2.39^{ab}±0.43
LDL (mmol/L)	2.49±0.62	4.01±0.19	3.57±0.97	3.17±0.16

^{abc} : Means along the same row with different superscripts were significantly different (P<0.05). ALP-Alkaline Phosphate Transferase; LDL-Low Density Lipoproteins; AST-Aspertate Amino Transferase; HDL- High Density Lipoprotein; ALT-Alanine Amino Transferase

Table 04. Showing blood electrolytes and biochemicals of broiler chicken fed varying levels of dietary waterleaf (*Talinum triangulare*)

Treatment/parameters	T1	T2	T3	T4
Potassium(K) (mmol/L)	7.07^{ab}±0.81	5.37^{b}±0.42	6.43^{ab}±0.60	7.77^{a}±0.50
Sodium (Na) (mmol/L)	141.67^{ab}±7.80	125.00^{b}±5.13	135.67^{ab}±4.70	148.00^{a}±4.93
Urea (Ur) (mmol/L)	2.5±0.15	3.0±0.46	1.87±0.37	2.03±0.37
Creatinine (Cr) (mmol/L)	87.33±0.15	95.00±5.70	74.67±7.31	79.67±8.88
Chlorine (Cl) (mmol/L)	95.00±2.65	77.67±1.76	82.00±9.71	95.33±1.45
Bicarbonate(HCO_{3}) (mmol/L)	24.00^{b}±1.15	28.67^{a}±0.67	27.33^{ab}±1.33	24.67^{b}±0.66
Total Bilirubin (mg/L)	11.27±1.30	9.10±0.56	8.70±0.29	8.70±0.53
Conjugated Bilirubin (mg/L)	6.90^{a}±0.80	4.47^{b}±0.38	4.33^{b}±0.17	5.17^{b}±0.52
Total Protein (g/100ml)	57.67±2.19	54.67±1.76	53.67±1.20	50.33±3.17
Albumin (g/100ml)	23.33±2.40	21.67±0.67	22.00±0.58	20.00±1.15

^{abc} means along the same row with different superscripts were significantly different (p<0.05).

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Table 04, shows that supplementary waterleaf in the diets of broilers had no significant influence on the total protein, albumin, creatinine, urea and chlorine but showed significant difference (P<0.05) in the levels of potassium, sodium, bicarbonate and conjugated bilirubin.

Table 05, showed a significant difference (P<0.05) in the Lymphocyte counts across the treatment groups, while the PCV, Hb, RBC, WBC, Platelets, Neutrophils, Eosinophils and Monocytes showed no significant difference (P>0.05).

Table 05. Showing the Heamatological Profile of broiler chicken fed varying levels of dietary waterleaf (*Talinum triangulare*)

Parameters	T1	T2	T3	T4
Pack cell volume (PCV)(%)	29.00±1.00	26.00±1.53	27.00±1.15	25.33±2.4
Haemoglobin (Hb)(g/dl)	9.67±0.33	8.67±0.52	9.00±0.40	8.57±0.72
Red blood cell(RBC)($_X$ 10^{12}/L)	4.40±0.21	3.83±0.20	4.03±0.15	3.73±0.39
White blood cell(WBC)	14.23±0.43	12.00±0.87	14.13±0.92	13.00±1.15
Platelets	170.00±10.41	174.67±14.90	176.00±12.42	181.00±7.37
Neutrophils	31.67±4.41	32.33±1.45	41.00±2.08	40.67±2.96
Lymphocytes	57.33^{a}±3.71	55.67^{ab}±2.33	45.00^{b}±2.89	48.33^{ab}±3.53
Eosinophils	2.67±0.33	4.33±0.88	5.33±0.88	3.33±0.88
Monocytes	8.33±0.88	7.67±1.20	8.67±0.67	7.67±1.45

^{abc} means along the same row with different superscripts were significantly different (p<0.05).

IV. Discussion

The Final weight gain, feed conversion rate, weekly weight gain and weekly feed intake are best in treatment group 4 (0.42) and least in T2 (0.39), which is attributed to the high feeding efficiency of birds in T4. The final weight gain ranged from 3730.00 g in diet 1 to treatment 3893.33 g in T4, and this followed a similar trend in weekly weight gain recorded at 402.92 g for T1 and 422.08 for T4. The result of the action of broiler chicken fed on water leaves explains that water leaf is a fairly good protein supplement for broilers (Nworgu et al., 2015). According to Nworgu et al. (2007) an increase in leaf meal supplementation in the broiler diet reduced the available energy and protein in their diet, which was seen when broiler chickens were given an additive to the heat treated pumpkin leaf extract. This is contrary to the result of this study. The increased water leaf level has led to improved performance in terms of weight gain, and the increase in weight gain is attributed to the fact that this appetizing leaf has digestive properties, which increased growth efficiency, as in the case of Langhout (2000), Nworgu et al. (2014) and Sande (2015). The Waterleaf diet led to an increase in weekly weight gain, final weight gain and feed conversion efficiency, which is consistent with the report by Nworgu et al. (2007) and Sande (2015).

All internal organ weights shown in Table 02 show that there are no significant (P> 0.05) differences in all internal organs except the liver, which was (P <0.05) significantly lower in T2 and T3 compared to other treatment groups. This was expected because the liver was the only organ closely related to the gastrointestinal tract in broilers. It may also mean that the inclusion of the waterleaf did not cause any toxicity or abnormal effects on the organ system and is therefore safe for use in the production of broiler feeds. The organ mass values are in accordance with the findings of Akpodiete et al. (1997) and Fanimo et al. (2005) who did not observe a clear morphological manifestation in the organs of birds fed with food composed of various feed components. This discovery also agrees with earlier studies of Uni and Ferket, (2004), when they reported that cells of various organs of gastrointestinal morphology tend to multiply because they were more actively used at an early stage of growth.

The mean recorded liver weight was lower than the values reported by Etela et al. (2007). The organ mass result reflected the anatomical response of birds to the type of diet consumed (Atteh, 2002). The weight of the gizzard (full), gizzard (empty), spleen and heart was not statistically significant. Total serum protein and albumin were generally similar in all dietary treatments in the present study. The Values obtained for serum metabolites were generally similar without significant differences (P> 0.05) and are comparable with many other reports (Igene, 1999; Adeyemi et al., 2000). Supplementary waterleaf in broiler diets had no significant (P> 0.05) effects on albumin, creatinine, urea and chlorine,

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which was consistent with that given by Nworgu et al. (2015), but was significant (P <0.05) in potassium and bicarbonate (HCO3).

In nutritional studies, the most frequently studied hematological parameters include the volume of packed cells, red blood cells, hemoglobin concentration, average hemoglobin concentration, average blood cell volume and clotting time (Aletor and Egberongbe, 1992; Olorode and Longe, 2000; Adeyemi et al., 2000). Hematologic data suggest that the water leaf had no effect on hematological values; it's like the report by Nworgu et al. (2015). The birds did not differ significantly in PVC. All PVC values were in the normal range of 25 to 45% reported by Ross et al. (1978) and 26.1–29.5% reported by Imasuen and Gene (2008), suggesting that regardless of the processing effect, the diets were nutritionally adequate, providing a healthy plane of nutrition. PCV values are the same as for chickens fed winged beans and full-fat jatropha seeds (Igene, 1999; Adeyemi et al., 2000). Occidentalis leaf meal as a dietary supplement, PCV and Hb values are between 35-39% and 11, respectively, 2-13.7 g / dl, which are high compared to the values from this study.

The Hemoglobin concentration (Hb) values obtained in this study fall within the acceptable range of 7.0 - 13.0 (g/dl) for broiler chickens (Swensen, 1999). This also indicates that all birds were more prone to counteracting respiratory stress because Hb, which is transmitted to RBC, is an oxygen-carrying pigment, as previously observed by Muhammad and Oloyede (2009). RBC values are higher than 3.3x106 mm3 reported by Afolabi et al. (2011). WBC showed no significant (P> 0.05) difference between the different groups. Champe et al. (2008) observed that neutrophils and microphages (monocytes) are components of WBC that are involved in both oxygen-independent and oxygen-dependent mechanism for controlling viral, killing and absorbing bacteria. A higher number than normal may mean that the birds' immune system can fight the infection, as previously reported by Frandson (1986). The highest and lowest values 57.33 and 45.00% were recorded for lymphocytes. These values exceed 40 to 48% reported by Bhatti et al. (2002), although T3 and T4 are in the range of 45.00% and 48.33% respectively. This meant that all study groups had adequate immune response status. Serum creatinine values, which ranged from 74.67-95.00 µmol / L, did not differ significantly (P> 0.05) between treatment groups. All observed values were in the normal range 44 to 135 mmol / L higher than usual indicating renal dysfunction (Champe et al., 2008). The hematological responses of broilers show that all animals were in good health because all blood parameters were in the normal range, as reported by other authors (Imasuen and Gene, 2008; Banerjee, 2008; Onu, 2012).

V. Conclusion

The results show that waterleaf is a rich source of high quality protein, minerals and vitamins and can be used as a feed additive in broiler production because it improves weight gain in broilers. It is rich in potassium and sodium which adds to the succulence of feed, stimulates appetite and improves digestion that leads to an increase in the profit margin of broiler production. Waterleaf should be supplemented at 30g per bird in broiler diets for maximum performance.

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