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Growth performance and hematological indices of finisher broilers fed varying levels of Bush Buck (*Gongronema latifolium)* leaf extract in drinking water

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***Target audience:** Researchers, Students, Poultry farmers*

Abstract

The study was conducted to investigate the effects and administration of Gongronema latifolium leaf extract (GLLE) on growth, carcass characteristics and hematological indices of broiler finisher birds in drinking water. A total of 270 Marshall Strain commercial finisher broilers were randomly selected and assigned to six experimental treatments namely: T_1 (GLLE 0g), T_2 (GLLE 5g), T_3 (GLLE 10g), T_4 (GLLE 15g), T_5 (GLLE 20g), and T_6 (GLLE 25g). Each treatment was replicated thrice with fifteen (15) birds in each replicate in a completely randomized design (CRD). At the end of 30 days, final body weight and daily weight gain were significantly ($P<0.05$) higher in birds fed GLLE 15g, followed by birds fed GLLE 10g, then GLLE 5g than those on GLLE 20g & 25g which were not significantly ($P >0.05$) different from the control. The feed conversion ratio though similar for GLLE 15g and 10g, was better ($P <0.05$) than GLLE 5g. The carcass weights of GLLE 15g, 10g and 5g were not significantly ($P >0.05$) different, however, they were significantly ($P< 0.05$) heavier than those of GLLE 20g, 25g and control. The hematological characteristics of the birds showed significant differences ($P < 0.05$) in favour of birds on GLLE 15g, GLLE 10g and GLLE 5g than GLLE 20g, 25g and control. It is therefore suggested that administering Gongronema latifolium leaf extract in drinking water improved performance of broiler finishers at 15g, 10g and 5g significantly ($P<0.05$) than birds fed without the leaf extract.

***Key words:** Broiler, Growth performance, Carcass characteristics, Hematological indices, Gongronema latifolium.*

Description of Problem

There are several recent research investigations into local means of improving animal production through the use of leafy vegetables like Bush buck (*Gongronema latifolium*) [1, 2]. Findings suggest that it can conveniently replace the use of some conventional sources of vitamins and mineral supplements in rural communities where these premixes are not readily available and affordable due to cost. In addition, [3, 4, 5] reported that Bush buck (*Gongronema latifolium*) contains high quality protein, mineral, vitamin with medicinal properties such as anti-bactericidal effect on poultry and rats [6, 7, 8, 9, 10, 11, 12, 13]. In this respect, [14, 15] posited that it is known to have anti-inflammatory, immune modulatory, cardiac

and cardiovascular stimulatory (tonic) properties important for smooth blood circulation and good health of animals [16. 17, 18].

In the light of its (*G' latifolium*) being locally available in Nigeria, [16, 17] worked on its usage in broiler production to replace other sources of minerals and vitamins to aid immunity and its antibacterial effect. However, they incorporated vitalyte as a flavouring in the *Gongronema latifolium* leaf extract (GLLE) at 30 mls GLLE and 60 mls GLLE per litre of drinking water and found improved performance in favour of birds on water + vitalyte, 30 mls and 60 mls over birds given drinking water alone. Their finding prompted [18] to study the effect of *Gongronema latifolium* leaf meal (GLLM) at inclusion levels of 0, 25g, 37.5g, 50g, 62.5g, and 75g per 25kg of feed. They found improved growth performance up to 75g (3g/kg) of feed without a definite trend. Their findings thus presented the challenge of determining g/kg of usage in feed formulation for the rural farmer.

Accordingly, the current study tries to investigate the simpler method of using *Gongronema latifolium* leaf extract through application in drinking water and the existence of a pattern or an optimum level of inclusion for broilers without flavouring which would be suitable for farming situations in rural areas.

Materials and Methods

Experimental Site

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm, Enugu State University of Science and Technology, Enugu State, Nigeria.

Experimental material

Fresh leaves of *G. latifolium* were purchased at Ogbete Main market, Enugu. The leaves were rinsed in clean water to remove dirt and sand. They were later air dried under room temperature for 10 days. The dried leaves were ground to powdery form and stored under room temperature in sealed plastic bottles for use. On daily basis a total of 75g of the powdery *G. latifoliium* leaves was soaked in 5 litres of warm water for 24 hours for proper mixing, then sieved for use every morning.

Experimental birds, design and management

A total of two hundred and seventy 28-day old finisher broilers with average weight of 906.16g were used for the study. They were reared for thirty days (30 days) in a deep litter system. The 270 birds were randomly allotted into six treatments with each having 45 birds at 15 birds per replicate in a completely randomized design (CRD) experiment. The treatments contained varying levels of *G. latifolium* leaf extract (GLLE); treatment 1 (T_1), 0g; treatment 2 (T_2), 5g; treatment 3 (T_3), 10g; treatment 4 (T_4), 15g; treatment 5 (T_5), 20g and treatment 6 (T_6), 25g. The birds in T_1 were given water without *G. latifolium* leaf extract, while the birds in T_2, T_3, T_4, T_5 and T_6 were provided 5g, 10g, 15g, 20g and 25g of *G. latifolium* leaf extract mixed in 1 litre of warm water respectively and left overnight for proper mixing. This was done using a measuring container. Feed and water were supplied *ad libitum* during the experiment. Daily feed intake was recorded while the birds were weighed weekly. A day after thirtieth (30) day of the experiment, nine (9) broilers per treatment (three per replicate) were randomly picked and slaughtered for carcass and organ studies.

Proximate composition of *G. latifolium* for the finisher diets.

The constituent of the commercial Top feed usually used by farmers in the community and also used in this study to simulate the farmers' condition is shown in Table 1.

Table 1: Proximate composition of the Top Feed (commercial feed) used in the study.

COMPONENTS	% COMPOSITION
Crude protein	20.00
Fat/oil	6.00
Crude fibre	6.00
Calcium	1.00
Available phosphorus	0.40
Lysine	0.85
Methionine	0.55
Salt	0.30
Metabolized energy	3100kcal/kg
Net weight	25kg

Data collection and analysis

Data on daily feed intake, was collected, as total feed given minus left over feed. Weekly body weight gain as weight of bird minus initial weight. Food conversion ratio was determined by using the formula; feed intake divided by weight gain. At the end of the experiment, three birds per replicate were slaughtered for carcass parameters. The slaughtering was done by severing the jugular vein with sharp knife. The slaughtered chickens were scalded in warm water for a minute, de-feathered and eviscerated manually. The kidneys, liver, gizzard, heart, intestine, lungs, head and legs were removed and weighed using a sensitive scale. The two birds were disinfected by the wing and blood samples collected by allowing the blood to flow into labelled bottles containing ethylene di-ethyltrichloroacetate (EDTA), as anticoagulant for hematological analysis; Packed Cell Volume (PCV), Hemoglobin (Hb), Red Blood Cells (RBC), White Blood Cells (WBC), Lymphocytes. Monocytes. Neutrophils. Eosinophils. Basophils. These parameters were determined following standard procedures described by [19].

Statistical analysis

Data obtained were subjected to a one-way analysis of variance (ANOVA) and significantly different means were separated using Duncan multiple range test; with window's SPSS, Version 23.

Results and Discussion

Table 2 shows the effect of varying dietary levels of *Gongronema latifolium* leaf extract (GLLE) on the growth performance of broiler chicks.

Table 2: Growth performance of broiler finisher chickens fed varying levels of *Gongronema latifolium* extract (GLLE) in drinking water

	Treatment						
Parameter	T_1(0g)	T_2(5g)	T_3(10g)	T_4(15g)	T_5(20g)	T_6(25g)	SEM
Initial weight (g)	900	906.33	908	910.33	908.67	903.67	±2.02
Final weight (g)	2286.67^{d}	2746.67^{c}	2940.00^{b}	3087.00^{a}	2284.67^{d}	2261.33^{d}	±82.67
Daily gain (g)	46.22^{d}	61.34^{c}	67.73^{b}	72.55^{a}	45.87^{d}	45.25^{d}	±2.73
Daily feed intake (g)	160.83^{b}	172.92^{a}	167.42^{ab}	172.75^{a}	158.25^{b}	159.92^{b}	±1.65
Total feed intake (g)	4824.9^{b}	5187.6^{a}	5022.6^{ab}	5167.5^{a}	4747.5^{b}	4797.6^{b}	±6.59
Feed conversion	3.48^{c}	2.82^{b}	2.47^{a}	2.38^{a}	3.45^{c}	3.54^{c}	±2.77
Mortality	0	0	0	0	0	0	

a, b, c, d: Row means with different superscripts are statistically significantly different at($P<0.05$).

Results showed that final body weight, daily weight gain, and daily feed intake were significantly (P<0.05) higher for birds on GLLE 15g, followed by GLLE 10g and GLLE 5g, while the control (GLLE 0g) was not significantly (P>0.05) different from GLLE 20g and 25g. The feed conversion ratio of birds on GLLE 15g (2.37), GLLE 10g (2.47) were similar (P>0.05) but better than birds on GLLE 5g (2.82) and birds on control (3.48), GLLE 20g (3.45) and GLLE 25g (3.54) which did not differ (P>0.05) from each other. There was no mortality. The increasing weight gain with increasing level up to GLLE 15g and thereafter decreasing weight gain from GLLE 20g to 25g was contrary to the works of [16, 17] and [18] who found increases in weight gain up to 60 mls and 75g inclusion level of *Gongronema latifolium* respectively. The finisher birds at higher level of inclusion in this experiment consumed less and had lower feed conversion ratio which may be indicative of rejection of the feed because of the sour taste of the *G. latifolium* in the water. However, the superior growth of the birds on GLLE 5g, 10g and 15g over the control and GLLE 20g and 25g may indicate that the inclusion of *G. latifolium* in the broiler diet was quite beneficial at moderate levels. The birds tend to drink less at higher levels thus preventing them from eating more and according to [20], the growth and carcass yield of birds is an indication of the quality and utilization of the ration. The superior feed intake and conversion of birds in treatments 5g, 10g and 15g indicated the better utilization of the high-quality *G. latifolium* by birds in these categories. Earlier, [3, 5, 6] had reported that *G. latifolium is* one of the most available sources of important proteins, vitamins, minerals and essential amino acids that can boost the physiological status of birds and promote their growth. The absence of mortality tended to corroborate the report of [11] that *G. latifolium* is known to contain important compounds that can strengthen the immune system and serve as antibiotics for the treatment of common pathogenic strains in birds. [2, 6, 8, 9, 10] had reported that *G. latifolium* can be used in the prevention and treatment of many diseases that can cause death in farm animals. This supports the report of [16, 18] that the inclusion of *G. latifolium* in the broiler diet might have resulted in better gut and overall health status, more efficient nutrient utilization, normal development and better growth response of these birds over the control. It does appear therefore, that *G. latifolium* can be included in broiler diets as an additive to prevent, reduce or manage the incidence of disease-causing organisms in growing chicks.

The results of GLLE treatment as regards weight of the prime cuts of the broilers are presented in Table 3.

Looking at the results, the drumstick, thigh, and wing were significantly ($P < 0.05$) heaviest in T_4. Also, breast weight considered as prime cut was heaviest in both T_4 and T_3. However, T_5 had the lowest ($P < 0.05$) in these prime cuts. Summarily, T_4 and T_3 had significantly ($P < 0.05$) heavier weights in all the prime cuts than T_1, T_2, T_5 and T_6 which however did not differ significantly ($P > 0.05$) from each other.

Table 3: Prime cuts of broiler finisher chickens fed varying levels of *Gongronema latifolium* extract (GLLE) in drinking water

Parameters	Treatment						
	T_1(0g)	T_2(5g)	T_3(10g)	T_4(15g)	T_5(20g)	T_6(25g)	SEM
Live weight (g)	2286.67^{d}	2746.67^{c}	2940.00^{b}	3087.00^{a}	2284.67^{d}	2261.33^{d}	±82.67
Carcass weight (g)	1825.67^{b}	2253.33^{a}	2388.67^{a}	2501.00^{a}	1806.33^{b}	1825.67^{b}	±74.43
Dressing %	79.84^{c}	82.04^{a}	81.25^{a}	81.02^{a}	79.06^{c}	80.73^{b}	±1.63
Head (g)	46.23^{b}	57.75^{a}	60.44^{a}	61.36^{a}	40.11^{c}	46.56^{b}	±1.99
Neck (g)	87.81^{d}	112.77^{c}	122.34^{b}	124.61^{a}	85.75^{e}	87.82^{d}	±4.08
Breast (g)	359.72^{b}	434.16^{b}	479.12^{a}	501.74^{a}	310.80^{c}	379.72^{b}	±16.67
Wing (g)	74.10^{d}	92.92^{c}	102.02^{b}	113.17^{a}	79.42^{c}	70.59^{e}	±3.37
Drumstick (g)	106.17^{d}	144.14^{c}	172.90^{b}	201.25^{b}	103.05^{d}	101.67^{d}	±9.30
Thigh (g)	102.41^{d}	145.50^{c}	176.89^{b}	202.67^{a}	103.07^{d}	101.91^{d}	±9.67
Shank (g)	30.28^{e}	36.09^{c}	43.44^{b}	45.46^{a}	32.42^{d}	28.78^{f}	±1.54
Back (g)	255.84^{d}	308.84^{c}	323.52^{b}	336.27^{a}	245.40^{d}	219.17^{e}	±10.60

a, b, c, d, e, f: Row means with different superscripts are statistically significantly different at (P<0.05).

Further in Table 4, the organ weights of the broiler chickens are presented.

Table 4: Organ characteristics of broiler finisher chickens fed varying levels of *Gongronema latifolium* extract (GLLE) in drinking water

Parameters	Treatment						
	T_1(0g)	T_2(5g)	T_3(10g)	T_4(15g)	T_5(20g)	T_6(25g)	SEM
Live weight (g)	2286.67^{d}	2746.67^{c}	2940.00^{b}	3087.00^{a}	2284.67^{d}	2261.33^{d}	±82.67
Carcass weight (g)	1825.67^{b}	2253.33^{a}	2388.67^{a}	2501.00^{a}	1806.33^{b}	1825.67^{b}	±74.43
Dressing %	79.84^{c}	82.04^{a}	81.25^{a}	81.02^{a}	79.06^{c}	80.73^{b}	±1.63
Gizzard (g)	38.25^{d}	45.77^{c}	48.61^{b}	50.55^{a}	37.88^{d}	35.25^{e}	±1.42
Heart (g)	9.00^{c}	11.78^{b}	12.60^{a}	13.41^{a}	9.55^{e}	8.00^{d}	±0.49
Kidney (g)	3.28^{b}	4.55^{a}	4.73^{a}	4.88^{a}	2.21^{c}	2.29^{c}	±0.28
Liver (g)	40.34^{c}	44.81^{a}	44.41^{a}	45.53^{a}	41.02^{c}	42.67^{b}	±0.32
Lungs (g)	8.03^{c}	8.29^{bc}	8.89^{ab}	9.33^{a}	8.03^{c}	8.82^{ab}	±0.13

a, b, c, d, e, f: Row means with different superscripts are statistically significantly different at (P<0.05).

The gizzard was significantly (P< 0.05) heaviest in T_4 (15g GLLE), followed by T_3 (10g GLLE), T_1 (0g GLLE) and T_5 (20g GLLE), which were similar, then T_6 (25g GLLE) had the lowest. The weights of the hearts of T_4 and T_3 were not significantly (P > 0.05) different, however they were significantly (P < 0.05) heavier than the other treatments with T_6 having the lowest. The kidney of T_4, T_3, and T_2 did not differ significantly (P > 0.05), but differed significantly (P <0.05) from T_1 which in turn differed significantly (P < 0.05) from T_6 and T_5 that had the lowest weights. This trend was repeated with liver. In the case of the lungs, T_6 did not differ significantly (P > 0.05) from T_4

and T_3 but had heavier ($P < 0.05$) weights over T_2, T_1 and T_5. The values shown in Tables 3 and 4 revealed superior carcass weight (confirmed from dressing percentage), heart, drumstick, thigh, and wings in favour of GLLE fed broilers at levels of 5g, 10g and 15g over the control. [21] had earlier reported on the positive effect of leafy vegetables like *Amarantus cruentus* on growth promotion, body weight gains and consequently carcass characteristics in broilers because of their protein, vitamin and mineral content. This reflects the impressive performance of birds fed *Gongronema latifolium* leaf extract at 5g, 10g and 15g over those which were not fed (control) and could be related to the higher feed intake and conversion of these birds as reported by [16, 17, 18] in agreement to the explanation of [20] that the growth and carcass yield of poultry birds is related to the quality and utilization of the feed.

The significant differences ($p<0.05$) observed in organ weights of gizzard, heart, kidney, liver and lungs of birds fed on GLLE 10g and 15g over the control suggests that *Gongronema latifium* inclusion promoted the development of organ weights up to 15g and decreased from 20g – 25g. This trend draws from the higher live and carcass weights of birds in T_4 and T_3 over T_1, T_2, T_5 and T_6. It agrees with reports of [16, 17] and [18] that lower carcass weight, dressed percentage and organs weight of broilers depends on their live weight, since the surface area determine the number of visceral organs required respectively. Furthermore, the higher heart weight in the test group T_4, T_3 and T_2 over the control and T_1 may be in response to the need for increased cardiac output to meet the circulatory needs of the bigger birds from these test groups as reported by [22]. This was also observed with the weight of gizzard of T_4, T_3, and T_2 which were heavier ($P < 0.05$) over the control and T_1. The bigger size of gizzard may be in response to amount of work required by the muscular walls of the organs to grind feed particles; in this case that the more feed consumed by the treated birds was required to maintain the heavier live weights of these birds.

Table 5: H**ematological parameters of broiler finisher chickens fed varying levels of *Gongronema latifolium* extract (GLLE) in drinking water**

	Treatment						
Parameters	T_1(0g)	T_2(5g)	T_3(10g)	T_4(15g)	T_5(20g)	T_6(25g)	SEM
PCV (%)	25^{b}	26^{ab}	26^{ab}	27^{a}	23^{d}	24^{c}	±0.33
Hb (g/dl)	8^{c}	8.77^{b}	8^{c}	9^{a}	7.77^{d}	8.13^{c}	±0.11
RBC (x10^{12}cells/L)	2.52^{b}	2.54^{b}	2.45^{bc}	2.72^{a}	2.36^{c}	2.46^{bc}	±0.03
WBC (x10^{9}cells/L)	5.21^{b}	5.68^{a}	5.19^{b}	5.73^{a}	5.06^{c}	5.28^{b}	±0.06
Lymphocytes (%)	57.70^{d}	73.60^{a}	53.60^{e}	68.40^{b}	61.53^{c}	57.50^{d}	±1.67
Monocytes (%)	5.20^{b}	2.23^{e}	4.12^{c}	0.70^{f}	3.17^{d}	5.80^{a}	± 0.42
Neutrophils (%)	36.60^{b}	23.53^{f}	40.57^{a}	30.20^{e}	32.43^{d}	35.57^{c}	±1.31
Eosinophils (%)	0.80^{e}	0.93^{d}	1.53^{b}	0.70^{f}	2.57^{a}	1.20^{c}	±0.15

a, b, c, d, e, f: Row means with different superscripts are statistically significantly different at ($P<0.05$).

In Table 5, the result showed that the PCV of the birds on GLLE 15g, 10g and 5g differed significantly ($P < 0.05$) from those of birds on GLLE 20g and 25g. However, PCV of birds in control (0g) did not differ ($P>0.05$) from those of GLLE 15g, 10g and 5g. The Hb was

significantly (P< 0.05) higher in birds on GLLE 15g followed by birds on GLLE 5g and 20g which in turn had higher significant (P < 0.05) values than birds on GLLE 25g and 0g. This trend was repeated with RBC. The observed results for Hemoglobin concentration agree with the work of [16] and [18] and may be as observed by [10, 21] that the high mineral and vitamins content of plant food materials like the leaves stimulate the synthesis of hemoglobin leading to their increase in the blood. The WBC count was significantly (P < 0.05) higher in broilers on GLLE 15g and 5g followed by birds on GLLE 25g, 10g and 0g which differed significantly (P < 0.05) from those on GLLE 20g. There were no Basophil in all the treatments. Lymphocytes was significantly (P < 0.05) highest with birds on GLLE 5g, then GLLE 15g, followed by GLLE 20g while GLLE 25g and zero did not differ significantly (P > 0.05). Birds on GLLE 10g had the least value. The above inconsistent trend was repeated in Monocytes, Neutrophils and Eosinophils. A look at the high values for lymphocytes in most of the treated birds over the control may indicate that *G. latifolium* may have some anti-oxidative property. Earlier, [22] reported that the presence of high levels of vitamin A, C, and E (tocopherol), β-carotene and phytate confer some antioxidative properties useful in maintaining good health in birds by protecting the lymphocytes from being destroyed in the blood and thus increasing their counts in the body. Generally, regarding the hematological parameters, the results showed no definite trend except in very few cases. This inconsistency, [4] and [8] reported could be due to administration of varying doses of *G. latifolium* extracts to rats, for instance, the increases observed in WBC count above the value for the control at the levels of GLLE 10g, GLLE 15g and GLLE 20g could be the effect of the various doses or levels of administration. Furthermore, it could be in response to the presence of anti-nutritional factors in *G. latifolium* [4, 10. 13, 16] as more feed was consumed by them compared to the reduced water and consequently feed consumed by birds in control, T_5 (20g GLLE) and T_6 (25g GLLE).

Conclusions and Application

1. The study presents a simple method of processing *Gongronema latifolium* extract within the technological skill of the farmer and administration through drinking water by rural farmers for improved broiler production. This removes the complex method of using ml or supplementing in feed for the less skilled farmers.
2. It revealed that up to 15g of *Gongronema latifolium* leaf extract can be included in broiler finisher drinking water to enhance growth performance, carcass yield and would not be detrimental to the health status of the chickens.
3. It also showed that without flavourings, locally available leafy vegetables like *Gongronema latifolium* can serve as cheap source of feed additives for improved poultry production at levels of 5g, 10g and 15g per litre in drinking water of broiler chickens.

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