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Full Length Research Paper

Oral administration of *Gongronema latifolia* leaf meal: Implications on carcass and haematological profile of broiler finishers raised in the humid tropics

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An experiment was conducted to determine the effect of *Gongronema latifolia* leaf extract (GLLE) on carcass characteristics and haematological indices of broiler finisher birds. A total of 120 four weeks old Marshall Strain commercial broilers were randomly selected and assigned to four experimental treatments namely: W- water only, WV- water + vitalyte, GL30- water + 30 ml GLLE and GL60- water + 60 ml GLLE. At the end of four weeks, nine birds were randomly selected from each treatment and humanely slaughtered for carcass, organ evaluation and haematological studies. The live weight, dressed weight and the relative weights of the thigh, drumstick and breast of the birds were better (P < 0.05) for birds on the GLLE. The relative weights of the eviscerated carcass, head, neck and organs were not affected by the treatments. The haematological characteristics of the birds showed significant differences (P < 0.05) in packed cell volume, red blood cell counts and white blood cell counts in favour of birds on WV, GL30 and GL60. The study showed that GLLE had nutritional benefits on carcass and organ quality of birds in spite of its antinutritional content. Therefore, it can be used as a nutrient supplement in poultry production.

Keyword: *Gongronema latifolia*, carcass, organs, vitamins, minerals, strain, haematology.

INTRODUCTION

Gongronema latifolia Benth commonly called *'utazi'* and *'arokeke'* in south eastern and south western Nigeria, is of West African origin (Nielsen, 1965). It is abundantly available in virgin forests in many parts of sub Saharan Africa and some parts of China (Nielsen, 1965; Ying and Ping-tao, 1997). The crop can be propagated by seeds and stem cuttings (Agbo and Obi, 2006). It is used as a leafy vegetable and spice in south eastern Nigeria (Agbo et al., 2005). The crop has been identified to be nutritionally high in iron, zinc, vitamins, protein and amino acids (Agbo et al., 2009). Gamaniel and Akah (1996) reported that the leaf extracts contain five phytochemical compounds including alkaloids, saponins, tannins, flavonoids and glycosides, and suggested possible varied pharmacological effects. Similarly, the leaf extracts have been shown to possess anti-oxidative properties and are being utilized in management of diabetes mellitus and other tropical diseases (Agbo et al., 2005, Ugochukwu et al., 2003).

The high cost of supplementary sources of vitamins in broiler feed, motivated this research. This study was aimed at determining the beneficial inclusion of *G. latifolia* leaf extract (GLLE) as a supplementary source of vitamins and minerals on the carcass characteristics and the haematological implications of inclusion on broiler finisher birds.

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MATERIALS AND METHODS

The experiment was conducted at the poultry unit of the Department of Animal Science, Teaching and Research farm,

Table 1. Percentage and proximate composition of experimental diet

Ingredient	Composition (%)
Maize	30.06
Wheat offal	8.20
Cassava root meal	16.40
Groundnut cake	24.20
Palm kernel cake	12.10
Fish meal	4.04
Bone meal	4.00
Methionine	0.25
Lysine	0.25
Salt	0.25
Vit./Mineral premix	0.25
Total	100
Proximate	**Dry matter (%)**
Crude protein	22.05
Crude fibre	5.75
Ether extract	9.90
Ash	6.80

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Collection and preparation of *G. latifolia* leaf extracts

Fresh leaves of *G.* l*atifolia* were harvested from a selected clone, ENS-08-MBU from an established *G. Latifolia* Benth field in the Department of Crop Science, University of Nigeria, Nsukka. 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 later milled into tiny particles. A total of 1.25 kg of the milled *G. latifolia* leaves was soaked in 5 L of water for 24 h. The soaked leaves were then sieved and the supernatant collected were stored in a refrigerator maintained at 5°C and later used daily as GLLE. This protocol was repeated weekly in order to ensure the availability of fresh samples of the extract.

Experimental procedure

A total of 150 day old Marshal Strain commercial broiler chicks were brooded for four weeks after which 120 birds were randomly selected and assigned to four experimental treatments in a complete randomised design (CRD). Each experimental treatment contained 30 birds made up of 3 replicates of 10 birds each. The treatments were W (water only), WV (water + Vitalyte®), GL30 (water + 30 ml GLLE) and GL60 (water + 60 ml GLLE). Birds in W treatment served as the control. Vitalyte® was administered to birds on WV treatment according to the manufacturers recommended dose of 5 g in a litre of drinking water. Birds in GL30 and GL60 were provided drinking water having 30 and 60 ml of GLLE per litre of drinking water, respectively. Feed and water were supplied *ad-libitum*, while other standard broiler management procedures were meticulously followed throughout the duration of the study. The compositions of the experimental diet are shown in Table 1.

Blood collection for analysis

At the age of 8 weeks, a total of 36 birds (3 birds per replicate per treatment) were randomly selected, weighed and slaughtered by severing the jugular vein. Procedures for slaughtering, blood collection and carcass handling were in line with approved guideline for humane treatment of animals (FASS, 1999). Blood samples were collected by allowing the blood to flow into labelled bottles containing ethylene di-ethyltrichloroacetate (EDTA), as anti-coagulant. The haematological parameters namely: packed cell volume (PCV), haemoglobin concentration (Hb), red blood cell count (RBC) and white blood cell count (WBC) were determined using standard laboratory methods (Jain, 1986). The mean cell haemoglobin concentration (MCHC), mean corpuscular haemo-globin (MCH) and the mean corpuscular volume (MCV) were calculated.

Carcass and organ evaluation

After slaughtering, the carcasses were scalded at 75°C in a water bath for about 30 s before defeathering, after which the dressed carcass was eviscerated, following the methods stipulated by Fasuyi (2007). Carcass traits measured were dressed weight, eviscerated weight, and the weights of the thigh, shank, drumstick, breast, head and neck of the birds. The organs measured were the heart, liver, lung, kidney, proventriculus, small and large intestine, crop, gizzard and spleen of the birds. Organ measurements were taken after gross inspection for any observed change. Data collected on the different parts and organs of the birds were expressed as percentage of the initial live weight of the birds.

Statistical analysis

Data were subjected to one-way analysis of variance (ANOVA) using SPSS 11.0 Computer statistical package in accordance with a completely randomized design (CRD). Significant difference found among the treatment means were separated using the Duncan multiple range test (Duncan, 1955) and accepted at 5 or 1% level of probability.

RESULTS

Some determined chemical constituents of the *G. latifolia* leaves used (Clone ENS-8-MBU) are shown in Table 2. The proximate composition of the clone show relatively high level of crude protein, fibre, ether extract and nitrogen free extract. The level of alkaloids, phenol, phytate and lycopene at 9%, 2.3 mg/100 g, 6.50 mg/100 g and 5.16 mg/100 g, respectively, in the crop species are relatively substantial. Cyanogenic glycosides were present at a low level, while haemagglutinin, known to agglutinate erythrocytes and leucocytes were absent. The levels of vitamins A, C, E and β-carotene in the crop species are relatively high, measuring 40.82 mg/100 g, 15 mg/100 g, 3.71 mg/100 g and 6.80 mg/100 g, respectively.

Carcass and organ weight evaluation

The results on the beneficial inclusion of GLLE on carcass

Table 2. Proximate composition, anti nutritional factors and vitamin profile of air-dried *G. latifolia* leaves.

Proximate	Composition (%)
Crude protein	26.99
Crude fibre	31.86
Ether extract	10.30
Ash	6.79
Carbohydrate	15.5
Moisture	8.56
Nitrogen free extract	24.18
Phytochemical (dried leaves)	
Alkaloid	9.10%
Phenol	2.23 mg/100 g
Tannin	2.54%
Phytate	6.5 mg/100 g
Haemagglutinin	0.00
Cyanogenic glycoside	0.02 mg/100 g
Lycopene	5.16 mg/100 g
Moisture	10.2%
Vitamins (fresh leaves)	
Beta carotene	6.80 mg/100 g
Vitamin E	3.71 mg/100 g
Vitamin C	15 mg/100 g
Vitamin A	40.82 mg/100 g

and organ characteristics of broiler finisher birds are presented in Table 3. Results showed that administration of GLLE to finisher broilers significantly ($P < 0.01$) affected most of the carcass and organ characteristics of the birds. Live weight (2425 g) and dressed weight (93.37%) of birds on WV, GL30 and GL60 were signify-cantly ($P < 0.05$) higher than those of the control birds. Dressed weight of birds on WV, GL30 and GL60 were similar ($P > 0.05$) but significantly higher ($P < 0.05$) than the 89.24% reported for the control birds (W). Highly significant ($P < 0.01$) differences in the relative weights of the thigh, drumstick and breast of the birds were recorded in favour of birds on WV and GL30. Thigh weight measurements of birds on WV and GL30 were highly different ($P < 0.01$) from values recorded for birds on W and GL60. The relative weight of the drumstick measurement of birds on GL30 was higher and differed significantly ($P < 0.01$) from those of birds in the other treatments (W, WV and GL60). A highly significant difference ($P < 0.01$) in shank weights of the birds was obtained between WV and W, GL30, and GL60. Birds on GL60 recorded the least value of shank weight. Results also showed that breast weights of birds on GLLE (GL30 and GL60) were higher and differed from relative breast weight of birds on W and WV.

Results of the organs measured showed significant differences in the relative weights of the crop, intestine, heart, proventriculus and spleen. The relative percent weights of the crop were higher for birds on W (control) and WV. Their values, however, differed significantly ($P < 0.05$) from those of birds on GLLE (GL30 and GL60). Average relative weights of the small and large intestines of the birds were least for birds on GL30. Birds on GL60 recorded the highest percentage relative heart weight which differed significantly ($P < 0.05$) from those of birds on W, WV and GL30. Birds on WV and GL30 did not differ ($P > 0.05$) in their relative heart weights. The relative weights of the proventriculus for birds on WV, GL30 and GL60 were statistically similar but highly differed ($P < 0.01$) from those of the control birds (W). The percentage relative weights of spleen of birds on GLLE (GL30 and GL60) differed significantly ($P < 0.01$) from those of birds on W and WV. The relative weights of the head and neck of birds among the treatments were similar ($P > 0.05$).

Haematological indices

Results of the haematological implications of the inclusion of GLLE on broiler finisher birds are shown in Table 4. The oral administration of GLLE to finishing broilers influenced the PCV, Hb, RBC, WBC, MCHC, MCH and MCV indices of the birds' blood. The PCV and Hb of the birds on GL30 differed significantly ($P < 0.05$)

Table 3. The effect of administration of GLLE on carcass and organ characteristic of broiler finisher birds.

++Parameter (%)	Treatment				SEM
	W	WV	GL30	GL60	
Live body weight (g)	1715^{c}	1910^{bc}	2425^{a}	2050^{b}	62.54**
Dressed weight	89.24^{b}	91.42^{a}	93.37^{a}	91.86^{a}	0.64
Eviscerated weight	72.03	74.03	75.19	73.32	0.70^{NS}
Head weight	3.21	3.26	3.52	3.17	0.19^{NS}
Neck weight	4.38	4.47	4.35	4.91	0.20^{NS}
Thigh weight	5.55^{bc}	6.86^{a}	6.40^{ab}	4.75^{c}	0.24**
Drumstick weight	5.54^{b}	5.87^{b}	6.40^{a}	5.62^{b}	0.14**
Shank weight	2.33^{ab}	2.72^{a}	2.26^{b}	1.93^{b}	2.40**
Organs					
Breast weight	15.67^{b}	16.23^{b}	18.94^{a}	17.44^{ab}	0.48**
Liver weight	2.12	2.15	2.35	2.43	0.06^{NS}
Heart weight	0.35^{c}	0.41^{b}	0.39^{b}	0.44^{a}	0.01*
Kidney weight	0.12	0.11	0.16	0.16	0.01^{NS}
Lung weight	0.51	0.56	0.48	0.54	0.02^{NS}
Gizzard weight	2.25	2.02	2.14	2.37	0.05^{NS}
Crop weight	0.58^{a}	0.45^{ab}	0.39^{b}	0.57^{b}	0.03*
SI weight	2.40^{a}	2.06^{a}	1.35^{b}	1.98^{a}	0.11**
LI weight	1.61^{a}	1.29^{b}	1.07^{b}	1.63^{a}	0.07**
Prv. weight	0.56^{a}	0.49^{b}	0.50^{b}	0.47^{b}	0.01**
Spleen wt. (%)	0.20^{b}	0.20^{b}	0.23^{a}	0.24^{a}	0.01**

$^{a, b, c}$: Row means with different superscripts are statistically significantly different at 1% (** P < 0.01) or 5% (*P < 0.05); NS, not significant; SI, small intestine; LI, large intestine; Prv, proventiculus; $^{++}$ percentage (%) of initial live weight of bird.

Table 4. The effect of administration of GLLE on haematological indices of broiler finisher birds.

*Parameter	Treatment				
	W	WV	GL30	GL60	SEM
PCV (%)	17.50^{c}	20.00^{b}	21.75^{a}	20.02^{b}	0.77*
Hb (g/dl)	7.13^{c}	7.70^{b}	9.69^{a}	8.28^{b}	0.33**
RBC (x 10^{6}/mm^{3})	3.72^{ab}	3.05^{b}	4.01^{a}	3.31^{ab}	3.13*
WBC (x 10^{3}/mm^{3})	13.73^{b}	20.05^{a}	19.63^{a}	18.10^{a}	0.69**
MCHC (%)	36.57^{b}	40.99^{b}	49.06^{a}	36.49^{b}	1.36**
MCH (pg)	20.92^{b}	23.60^{a}	24.18^{a}	22.01^{b}	0.37**
MCV (fl)	58.37^{a}	58.34^{a}	49.84^{b}	56.42^{ab}	1.42*

$^{a, b, c}$: Row means with different superscripts are statistically significantly different at 1% (**P < 0.01) or 5% (*P < 0.05). PCV-packed cell volume; Hb, haemoglobin, RBC, red blood cells; WBC, white Blood cells; MCHC, mean cell haemoglobin concentration; MCH, mean corpuscular haemoglobin, MCV, mean corpuscular volume

from those of birds on W, WV and GL60. There was no significant difference (P > 0.05) between the PCV and Hb values of birds on WV and GL60. The mean RBC content of the blood of birds on W and GL30 were similar (P > 0.05). However, their values differed (P < 0.05) from those of birds on WV and GL60. The mean WBC content of the blood of birds on vitalyte (WV), and GLLE (GL30, and GL60) did not differ significantly (P > 0.05). However, their values were significantly higher (P < 0.05) than that of the control birds (W). Average MCHC and MCH values for birds on GL30 were significantly higher (P < 0.01) than those of birds on W, WV and GL60. On the other

hand, mean MCV values of birds on W and WV were significantly different ($P < 0.05$) from those of birds on GL30. The average MCV of birds on GL60 compared favourably with those of birds on GL30.

DISCUSSIONS

According to Bamgbose and Niba (1998), carcass yield is an indication of the quality and utilization of the ration. Thus, it may be pertinent to infer that the addition of vitalyte (WV) and GLLE extracts increased the ability of the birds to utilize available nutrients in the feed coupled with nutrient supplement from the GLLE. The protein level of 26.99% obtained in the *G. latifola* leaves fed to the broiler birds was relatively high. The protein value of the crop species has been suggested to be of high biological value because of the presence of high essential and non-essential amino acids (Agbo et al., 2009). This may have led to a significantly higher dressed weights recorded for birds on those treatments as compared to the control. The relative percentage shank weight was significantly higher ($P < 0.01$) for birds on W and WV when compared with values recorded for birds given GLLE (GL30 and GL60). Fasuyi (2007) reported that a significant increase in relative weight of the shank is an indication of poor growth and performance. The eviscerated weight, head weight and neck weight of birds in the various treatments were similar ($P > 0.05$).

There were no significant differences ($P > 0.05$) in the relative weights of the gizzard, liver, kidney and lungs of the birds among the treatments. This is an indication that the level of GLLE used in this study had nutritional benefits without any deleterious effects on the organs concerned, despite its anti-nutritional content. Hence, the physiological activities of these organs were normal. Iweala and Obidoa (2009) reported that *G. latifolia* is not toxic to the liver, but rather, had hepatoprotective effect because of its ability to reduce the level of liver enzymes in the blood. According to Perrisoud (1986), this hepatoprotective effect of GLLE may be due to its flavonoid content. The author noted that flavonoids exert a membrane-stabilizing action that protects the liver cells from injury.

The relative weights of the proventriculus, crop, small and large intestines were significantly higher ($P < 0.01$) for birds on the control group (W). This may be due to the greater volume of the digester staying in the gastrointestinal tract during enzymatic digestion (Ander, 1992). Although, slightly higher values were reported for the relative weight of the heart and spleen for bird on GLLE extract, this may be due to slightly higher physiological activities by these organs. Fasuyi (2007) reported that the presence of antinutritional factors in the diets of birds may trigger or induce an increase in the activities of the heart and spleen leading to an increase in the weights of these organs. Results of the haematological indices of the birds showed significant difference ($P < 0.05$) in packed cell volume, haemoglobin concentration, red blood cell count, white blood cell count, MCHC, MCH and MCV values. Haematological values of the birds reported were within normal ranges for birds (Fasuyi, 2007). Packed cell volume of the birds on WV, GL30 and GL60 were significantly different ($P < 0.05$) from that of the control (W) birds. Haemoglobin concentration of the birds on GL30 (9.69 g/dl) was significantly higher ($P < 0.01$) when compared to values recorded for birds on W (7.13 g/dl), WV (7.70 g/dl) and GL60 (8.28 g/dl). Haemoglobin concentration of birds on WV and GL60 were similar ($P > 0.05$). The observed increase in haemoglobin concentration of birds on these treatments may be due to the high mineral and vitamin content of vitalyte and GLLE. Iweala and Obidoa (2009) observed that the high mineral and vitamins content of plant foods materials like the leaves stimulate the synthesis of haemoglobin leading to their increase in the blood. White blood cell count of birds on WV, GL30 and GL60 were higher ($P < 0.05$) than that of the control. The higher WBC of birds on GLLE extract may be due to the presence of some antinutritional factors in the extract (Antai et al., 2009). According to Iweala and Obidoa (2009), phytosterols and flavonoids in *G. latifolia* leaves possibly interferes with the process of WBC synthesis resulting to increased presence of WBC in the blood. In addition, Duthie et al. (1996) reported that antioxidant phytochemicals play a protective role on the lymphocytes and also decrease their destruction in the blood. The presence of high levels of vitamin A (40.82 mg/100 g), vitamin C (15 mg/100 g), vitamin E (tocopherol) (3.71 mg/100 g), β-carotene (6.80 mg/100 g) and phytate (6.5 mg/100 g) that have been indicated to have antioxidative properties (Traber and Atkinson, 2007) and useful in maintaining good health, may suggest the result of birds fed with lower level of *G. latifolia* being healthier by having significantly higher haemoglobin and white blood cell values. Furthermore, the absence of haemaglutinin which agglutinates red blood cells in mammals may have caused significantly higher red blood cells count recorded for birds on the GLLE. Variations in the haematological indices of animals may occur due to breed and genotype differences, age, physiological condition and nutrition (Machebe et al., 2009).

Conclusion

This study has brought to the fore, the possible beneficial use of *G. latifolia* leaves in poultry since this review of literature produced no documented report of its use in poultry production. It is concluded that GLLE can possibly reduce the use of synthetic vitamins and minerals products in poultry production, especially in rural communities where these plants are readily available. This is particularly important today when emphasis is on

increasing local content in production.

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