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Effect of Aqueous *Gmelina arborea* Leaf Extract on the Performance Characteristics and Haematological indices of Broiler Chickens

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ABSTRACT
A six-week trial was conducted to evaluate the effect of aqueous *Gmelina arborea* leaf extract (AGALE) on the performance characteristics and haematological indices of broiler chickens. A total of 120 Arbor Acres broiler chicks were randomly assigned into four treatment groups of 30 birds each consisting of 10 birds per replicate in a completely randomized design. All birds were fed same diet while the treatment groups received daily oral administration of 0, 2.5, 5.0, or 7.5 mL AGALE through their drinking water. Data collected on growth performance and haematological indices were subjected to one-way analysis of variance at 5% level of significance. Results indicated that AGALE significantly ($P<0.05$) influence virtually all growth parameters of broiler chickens evaluated. Birds administered 2.5mL AGALE recorded the highest average daily weight gain (38.89 g/b/day) while the lowest (29.05 g/b/day) value was obtained in those receiving 5mL AGALE. The average daily feed intake values observed in this study varied significantly across the treatment groups in which birds on 0mL (91.03g/b/day), 2.5mL (91.51g/b/day) and 7.5 mL (89.92g/b/day) AGALE had similar values but significantly higher than those administered 5mL AGALE. Birds administered 2.5mL AGALE (2.37) recorded the best feed conversion ratio. With respect to haematological indices, AGALE had no significant effect ($P>0.05$) on most parameters, except the white blood cell (WBC) count and heterophil concentration. Birds supplemented with 2.5 mL AGALE recorded the highest WBC count ($27.85 \times 10^3/\mu L$), while the lowest value ($12.50 \times 10^3/\mu L$) was observed in the 7.5 mL group. Similarly, heterophil concentration was significantly ($P<0.05$) highest in birds administered 2.5 mL AGALE (53.50%), compared with birds on 0 mL (18.00%), 5 mL (20.00%), and 7.5 mL (18.00%) AGALE groups, which had statistically similar values. It can be concluded that broiler chickens administered 2.5 mL AGALE had enhanced growth performance and optimized immune function
Keywords: Medicine, *Gmelina arborea*, Extract, Herbs, Phytochemicals, Additives

Description of Problem

Herbal and spice-derived medicinal products have long been utilized as feed additives in livestock production (1). Plant-based feed additives are increasingly valued in poultry production as natural alternatives to synthetic compounds, owing to their ability to enhance growth, health, and overall productivity (2). *Gmelina arborea*, a widely distributed tropical multipurpose tree, contains leaves rich in protein, flavonoids, tannins, and phenolic compounds bioactive nutrients known to promote gut integrity and provide antioxidant benefits (3). Its aqueous leaf extract (AGALE) has demonstrated potential in enhancing nutrient utilization and improving health status across different animal species (4). Previous studies have reported positive effects of *G. arborea* components, such as leaf meal or seed meal, on animal performance in both ruminants and poultry (5). However, evidence regarding the specific impact of its aqueous leaf extract (AGALE) on broiler growth performance and haematological indices remains limited. This study therefore investigates the effects of AGALE supplementation via drinking water on broiler chickens, with the aim of assessing its potential as a natural growth promoter and immune modulator.

Materials and Methods

Experimental site and duration: The experiment was conducted at the Teaching and Research Farm, of the Federal College of Animal Health and Production Technology, Moor Plantation, Apata, Ibadan. The temperature and relative humidity ranges from 35 - 40°C and 76-

78% respectively. The experiment lasted for six (6) weeks,

Experimental animals, diet and design: A total of one hundred and twenty (120) day-old Arbor Acres broiler chicks were used for the study. The chicks were brooded for two weeks, after which they were randomly distributed into four treatment groups of 30 birds each. Each treatment was replicated three times, with 10 birds per replicate, in a completely randomized design (CRD). All treatment groups were fed the same diet throughout the experiment.

Source of Test Ingredient and its Preparation: Fresh *Gmelina arborea* leaves were collected from the premises of the Federal College of Animal Health and Production Technology. The leaves were thoroughly washed to remove sand and debris, then manually macerated to obtain the liquid extract. The aqueous *Gmelina arborea* leaf extract was stored in a transparent bottle at room temperature and administered daily to broiler chickens through their drinking water. Dosages were accurately measured using a syringe, with treatment groups receiving 0, 2.5, 5.0, and 7.5 mL of the extract, respectively.

Data Collection: Daily feed intake was determined as the difference between the feed offered and the leftovers each day. The initial body weights of the birds were recorded at the start of the trial and subsequently on a weekly basis, while final weights were measured at the end of the experiment. From these data, total weight gain, average daily weight gain, total feed intake, average daily feed intake, and feed conversion ratio (calculated as feed intake divided by weight gain) were determined.

On the 42nd day of the study, approximately 2.5 mL of blood was collected from two randomly selected birds per replicate using sterilized 5 mL syringes and needles via the jugular vein. The samples were transferred into sterilized bottles containing ethylene diamine tetraacetic acid (EDTA) as an anticoagulant and gently shake to ensure proper mixing and prevent clotting. The collected blood samples were analyzed for haematological indices. Haemoglobin (Hb) concentration was determined spectrophotometrically using an SP6-500 UV spectrophotometer, while red blood cell (RBC) and white blood cell (WBC) counts were estimated with a haemocytometer.

Chemical Analysis: The proximate analysis of the experimental diet was determined according to the procedures of (6).

Statistical Analysis: All data obtained were subjected to analysis of variance using statistical package; (7) and the means among the variables were separated using Duncan multiple range test of the same statistical package.

Table 1: Gross Composition of the Experimental Diet

Ingredients	**Starter**	**Finisher**
Maize	50.00	53.00
Soybean meal	31.55	24.50
Fishmeal	4.00	2.00
PKC	10.00	15.50
Palm oil	0.60	1.15
Bone meal	3.00	3.00
Salt	0.25	0.25
Premix	0.25	0.25
Methionine	0.25	0.25
Lysine	0.10	0.10
Calculated Analysis		
Energy (MJ/Kg)	11.92	10.68
Crude Protein (%)	21.96	20.22
Crude Fibre	4.20	5.98

Results and Discussion

Presented in Table 2 is the effect of aqueous *Gmelina arborea* leaf extract (AGALE) on the

growth performance of broiler chickens. AGALE significantly (P<0.05) influenced nearly all growth parameters assessed. Birds administered 2.5 mL AGALE recorded the highest average daily weight gain (38.89 g/bird/day), whereas the lowest values were observed in birds receiving 5 mL AGALE. Average daily feed intake varied significantly among the treatment groups, with birds on 0 mL (91.03 g/bird/day), 2.5 mL (91.51 g/bird/day), and 7.5 mL (89.92 g/bird/day) AGALE showing comparable values, all of which were significantly (P<0.05) higher than those on 5 mL AGALE administration. Additionally, the best feed conversion ratio (FCR) was recorded in birds administered 2.5 mL AGALE. Broilers supplemented with 2.5 mL AGALE showed improved feed intake, weight gain, and feed conversion efficiency, likely due to the hormetic effect of phytogenic additives, which at moderate levels stimulate appetite, support gut health, and enhance nutrient utilization (8). The bioactive compounds in *Gmelina arborea* including flavonoids, tannins, and phenolics may have further promoted digestive enzyme activity and gut integrity (9). Conversely, higher doses (5.0–7.5 mL) depressed performance, probably due to excess phytochemicals exerting anti-nutritional effects, such as reduced palatability, impaired nutrient absorption, and metabolic stress (10). This dose-dependent response agrees with earlier reports that phytogenic additives benefit poultry at optimal levels but become detrimental when oversupplied (11). Thus, 2.5 mL AGALE is the optimum supplementation level for enhancing broiler growth, while higher doses may compromise performance.

Table 2: Effect of Aqueous *Gmelina arborea* Leaf Extract on the Growth Performance of Broiler Chickens

	AGALE (mL)					P value
Parameters	**0**	**2.5**	**5**	**7.5**	**SEM**	
Initial Weight (g/b)	400.00	400.00	400.00	420.00	14.43	0.09
Final Weight (g/b)	1876.67^{ab}	2033.33^{a}	1620.00^{c}	1760.00^{bc}	50.27	0.01
Weight gain (g/b)	1476.67^{ab}	1633.33^{a}	1220.00^{c}	1340.00^{bc}	50.98	0.02
ADWG (g/b/d)	35.16^{ab}	38.89^{a}	29.05^{c}	31.91^{bc}	1.21	0.02
Feed Intake (g/b)	3823.33^{a}	3843.33^{a}	3420.00^{b}	3776.67^{a}	54.70	0.01
ADFI (g/b/d)	91.03^{a}	91.51^{a}	81.43^{b}	89.92^{a}	1.30	0.02
FCR	2.59^{ab}	2.37^{b}	2.81^{a}	2.82^{a}	0.07	0.04

^{a,b,c} means along the same row with different superscripts are significantly different (p<0.05). ADWG: Average Daily Weight Gain, ADFI: Average Daily Feed Intake, FCR: Feed Conversion Ratio, AGALE: Aqueous *Gmelina arborea* Leaf Extract

Indicated in Table 3 is the effect of aqueous *Gmelina arborea* leaf extract (AGALE) on the haematological indices of broiler chickens. AGALE had no significant effect (P>0.05) on most of the haematological parameters, except the white blood cell (WBC) count and heterophil concentration. The WBC values varied significantly (P<0.05) across the treatment groups, with birds administered 2.5 mL AGALE recording the highest count (27.85×10^3/ uL), while those given 7.5 mL AGALE had the lowest value (12.50×10^3/ uL). Similarly, heterophil concentration was highest in birds receiving 2.5 mL AGALE (53.50%), compared to birds on 0 mL (18.00%), 5 mL (20.00%), and 7.5 mL (18.00%) AGALE groups, which showed statistically similar values. The elevated WBC count and heterophil proportion observed in broilers administered 2.5 mL AGALE may be linked to an enhanced innate immune response, likely stimulated by the bioactive compounds in the extract. White blood cells play a vital role in the prevention of disease or infection, thus animals with low WBC level stand a risk of disease infections. Birds on 2.5mL AGALE with high WBC are capable of generating antibodies and have a high degree of resistance to diseases (12). In contrast, higher doses (5.0–7.5 mL) appeared to suppress leukocyte activity. This supports recent reports that phytogenic feed additives exert hormetic effects promoting health

and immunity at moderate levels but becoming detrimental when administered in excess (11).

Table 3: Effect of Aqueous *Gmelina arborea* Leaf Extract on the Haematological indices of Broiler Chickens

Parameters	AGALE (mL)				SEM	P value
	0	2.5	5	7.5		
PCV (%)	25.00	25.00	23.50	24.50	0.38	0.55
Hb (mg/dL)	8.05	8.60	7.30	7.15	0.28	0.24
RBC ($\times10^{12}$/L)	2.33	2.26	2.16	2.06	0.05	0.24
WBC ($\times10^{3}$/ uL)	20.70^{ab}	27.85^{a}	14.13^{bc}	12.50^{c}	2.42	0.02
Platelets ($\times10^{4}$/L)	24.90	31.40	29.90	30.5	2.95	0.92
Heterophils (%)	18.00^{b}	53.50^{a}	20.00^{b}	18.00^{b}	6.02	0.02
Lymphocytes (%)	68.00	35.50	65.00	50.00	6.18	0.22
Eosinophil (%)	2.50	30.00	3.00	2.00	0.26	0.58
Monocytes (%)	11.50	7.50	2.50	7.00	2.07	0.61
Basophils (%)	0.00	0.50	0.50	0.50	0.18	0.80

^{a,b,c} Means along the same row with different superscripts are significantly different ($p<0.05$). PCV: Packed Cell Volume, Hb: Hemoglobin RBC: Red Blood Cell.WBC: White Blood Cell.

Conclusion and Application

It can therefore be concluded that AGALE administered at 2.5mL improved weight gain, feed efficiency and immune response of broiler chickens as it enhanced WBC and heterophil counts observed in this study.Future studies should investigate the bioactive compounds responsible for these effects, as well as the long-term safety and economic implications of AGALE supplementation in poultry nutrition.

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