

## GROWTH PERFORMANCE AND SERUM OXIDATIVE BIOMARKERS IN BROILER STARTER FED PHYTOADDITIVES-SUPPLEMENTED DIETS

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### ABSTRACT

Phyto-additives, such as pawpaw, neem, and bitter leaves, have been explored as alternatives to antibiotic growth promoters in enhancing the performance of animals. However, the influence of the combinations of the different phyto-additives on the growth and serum biomarkers of broiler chickens has not been elucidated. In a 14-day feeding trial, two hundred 14-day old Abor Acre broiler chickens were randomly assigned to 5 dietary treatments in a completely randomized design, with 5 replicates per treatment and 8 birds per replicate. Treatment 1 contained no phyto-additive supplementation. Treatment 2 was supplemented with 1.5%PL+0.5%BL. Treatment 3 was supplemented with 1.5%PL+0.5%NL. Treatment 4 was supplemented with 0.5%NL+0.5%BL. Treatment 5 was supplemented with 1.5%PL+0.5%NL+0.5%BL. Growth performance indices were measured, and blood samples were analyzed for serum antioxidant parameters. Data were subjected to descriptive statistics and ANOVA at  $\alpha 0.05$ . Significant ( $p < 0.05$ ) differences were observed in the birds' average daily weight gain (ADWG) and average daily feed intake (ADFI). Birds fed 1.5%PL+0.5%NL+0.5%BL diet had higher ADWG (32.55 g/bird) than those fed 1.5%PL+0.5%NL (22.76 g/bird) but similar to other treatment groups. Furthermore, birds fed 1.5%PL+0.5%NL+0.5%BL diet had higher ADFI (62.82 g/bird) than those fed 1.5%PL+0.5%NL (48.40 g/bird) but similar to other treatment groups. Birds fed control had lower malondialdehyde (1.08  $\mu\text{M}$ ) than other treatment groups but was similar to those fed 1.5%PL+0.5%NL (1.46  $\mu\text{M}$ ). Similarly, birds fed control had higher catalase (14.70 U/ml) than other treatment groups. In conclusion, phyto-additive supplementation slightly improves growth performance, and negatively impacted serum antioxidant parameters of the birds.

**Keywords:** Phyto-genic additives, Performance, Serum biomarkers, Oxidative stress, Poultry nutrition

### INTRODUCTION

Phyto-additives have garnered significant interest as promising alternatives to antibiotic growth promoters in livestock production due to their ability to improve growth performance, reduce disease incidence, and enhance overall animal welfare (Windisch *et al.*, 2008). Phytochemical analyses have revealed a rich diversity of bioactive compounds, including alkaloids, flavonoids, tannins, and terpenoids (Al-Yasiry and Kiczorowska, 2016). These compounds can enhance appetite and stimulate the secretion of digestive enzymes, contributing to improved growth of animals. During normal metabolic processes, reactive oxygen species are continuously generated, and their regulation through endogenous antioxidant enzymes like catalase superoxide dismutase, and glutathione peroxidase is critical in maintaining cellular equilibrium and overall animal health (Barbosa *et al.*, 2020). Phyto-additives, such as pawpaw, neem, and bitter leaves have been observed to exhibit growth-promoting, anti-inflammatory, and antioxidative effects in livestock due to the presence of bioactive compounds such as phenols and flavonoids (Omidwura *et al.*, 2017). However, the effects of the combinations of the different phyto-additives on performance of broiler chickens have not been elucidated. Hence, the aim of this study was to evaluate the influence of the different combinations of pawpaw, neem, and bitter leaves on growth performance and serum antioxidant parameters of broiler chickens.

### MATERIALS AND METHODS

#### Experimental site

The study was conducted at the Poultry Unit of the Teaching and Research Farm, University of Ibadan. The experiment was conducted in compliance with the Animal Care and Use Research Ethics of the University of Ibadan.

#### Experimental animals, diets, design, and management

A total of two hundred (200) one-day-old Abor acre unsexed broiler chicks were sourced from a reputable hatchery. The birds were weighed and randomly allotted to five dietary treatments, consisting of five replicates of eight birds per replicate in a completely randomized design. Treatment evaluated were as follows: Treatment 1 - Basal diet (control); Treatment 2 - Basal diet + 1.5% pawpaw leaf + 0.5% bitter leaf; Treatment 3 - Basal diet + 1.5% pawpaw leaf + 0.5% neem leaf; Treatment 4 - Basal diet + 0.5% neem leaf + 0.5% bitter leaf; Treatment 5 - Basal diet + 1.5% pawpaw leaf + 0.5% neem leaf + 0.5% bitter leaf. Feed and water were offered to the birds *ad libitum*.

**Data collection****Growth performance**

Feed intakes (FI), body weight gain (BWG), and feed conversion ratio (FCR) were calculated at weekly intervals from day 14 to day 28. The FI was obtained by subtracting leftover feed from the total feed offered, BWG was obtained by subtracting initial weight from final weight and FCR was calculated by dividing feed intake by weight gain.

**Serum Oxidative Biomarkers**

At day 28, blood samples were collected from 3 birds per treatment and collected into non-heparinised tubes. Samples were centrifuged at 3000rpm for 15 minutes at 24°C. Serum levels of superoxide dismutase (SOD), catalase (CAT) glutathione transferase (GST), and malondialdehyde (MDA) were quantified using commercially available enzyme kits (Ransel, RANDOX/RS-504; Randox Laboratories, Cruclin, United Kingdom).

**Statistical analysis**

Data were subjected to descriptive statistics and ANOVA using SPSS (2016). Treatment means were compared using Tukey's HSD test at  $P < 0.05$ .

**RESULTS AND DISCUSSION**

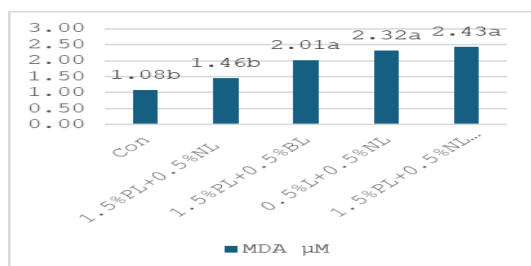
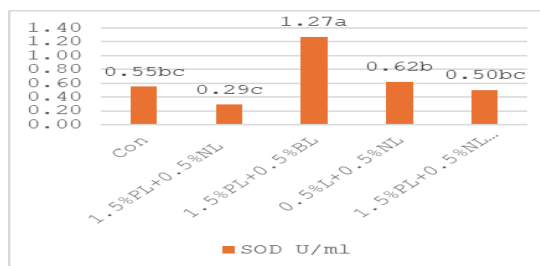
The growth performance of broiler chickens fed phyto-additives-supplemented diet is presented in Table 1. Significant ( $p < 0.05$ ) differences were observed in the birds' average daily weight gain (ADWG) and average daily feed intake (ADFI). Birds fed 1.5%PL+0.5%NL+0.5%BL diet had higher ADWG (32.55 g/bird) than those fed 1.5%PL+0.5%NL (22.76 g/bird) but similar to other treatment groups. Furthermore, birds fed BD+0.5%BL+0.5%NL diet had higher ADFI (62.82 g/bird) than those fed 1.5%PL+0.5%NL (48.40 g/bird) but similar to other treatment groups. However, the feed conversion ratio was comparable among the treatment groups.

**Table 1: Growth performance of broiler chickens fed phyto-additives supplemented diet**

Parameters	CON	1.5%PL +0.5%NL	1.5%PL +0.5%BL	0.5%BL +0.5%NL	1.5%PL+ 0.5%NL+ 0.5%BL	SEM	P Value
ADWG Starter	29.68 <sup>ab</sup>	22.76 <sup>b</sup>	27.50 <sup>ab</sup>	30.17 <sup>ab</sup>	32.55 <sup>a</sup>	1.01	0.015
ADFI Starter	59.79 <sup>ab</sup>	48.40 <sup>b</sup>	53.34 <sup>ab</sup>	62.82 <sup>a</sup>	58.67 <sup>ab</sup>	1.67	0.033
FCR Starter	2.02	2.17	1.95	2.10	1.80	0.05	0.121

SEM= Standard Error of Mean, CON = control, PL = Pawpaw Leaf, NL = Neem Leaf, and BL = Bitter leaf, Means on the same row with different superscripts are significantly ( $P < 0.05$ ) different. ADWG: Average Daily Weight Gain; ADFI: Average Daily Feed Intake; FCR: Feed Conversion Ratio

The serum biomarkers of broiler chickens fed phyto-additive-supplemented diets are presented in Figures 1-4. Significant ( $p < 0.05$ ) differences were observed in the serum oxidative biomarkers analysed. Birds fed control had lower malondialdehyde (1.08  $\mu\text{M}$ ) than other treatment groups but were similar to those fed 1.5%PL+0.5%NL (1.46  $\mu\text{M}$ ). Furthermore, birds fed +1.5%PL+0.5%BL had higher superoxide dismutase (1.27 U/ml) than other treatment groups. Birds fed control had higher catalase (14.70 U/ml) than other treatment groups. Catalase aids in the regulation of reactive oxygen species levels in animals' system by converting oxygen radicals into molecular oxygen and water (Surai, 2016). Although phyto-additives have been reported to exhibit antioxidative effects in birds due to the presence of flavonoids and phenols which scavenge free radicals. However, the supplementation of the different phyto-additive mixtures decreased catalase levels of the birds. The observed effects could be attributed to interference in the absorption of the phytochemicals in the phyto-additives, since they exert their antioxidative activity via the same mechanism. Similar observation was made as supplementation of the different phyto-additives increased malondialdehyde levels of the birds. Malondialdehyde is a marker of lipid peroxidation which indicates the extent to which muscle is oxidized (Ma et al., 2010).

**Serum biomarker of broiler chickens fed phyto-additives supplemented diet.****Fig. 1: MDA of broiler starter fed phyto-additives****Fig. 2: SOD of broiler starter fed phyto-additives**

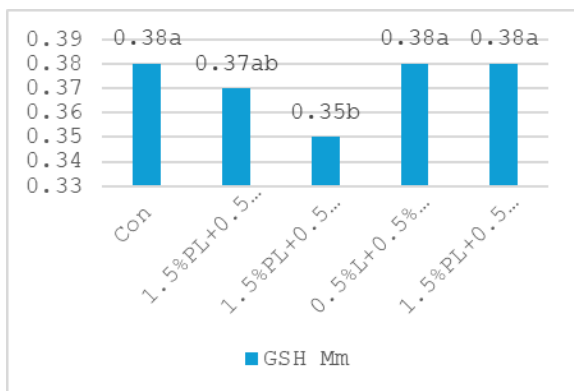


Fig. 3: GSH of broiler starter fed phyto-additives

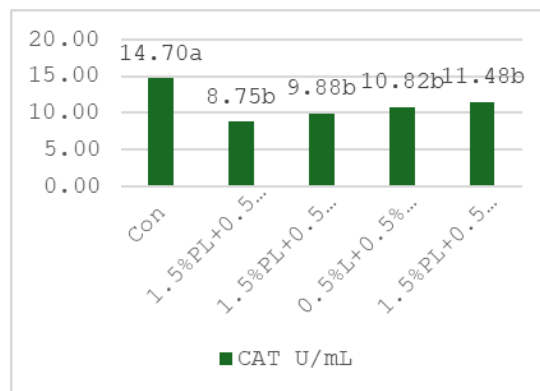


Fig. 4: CAT of broiler starter fed phyto-additives

### CONCLUSION AND RECOMMENDATION

In conclusion, the supplementation of the different combinations of pawpaw leaf, neem leaf, and bitter leaf in the diets of broiler chickens slightly improve the growth performance of the birds. Furthermore, the serum antioxidant parameters of the birds were impaired, suggesting that the mixtures exerted antagonistic effects on the birds. Further research should explore combining the phyto-additives at different inclusion levels to determine optimum levels that would enhance animals' performance.

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