PERFORMANCE OF BROILERS ADMINISTERED AQUEOUS BAMBOO (BAMBUSA VULGARIS) LEAF EXTRACT IN DRINKING WATER

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ABSTRACT
This study investigated the effect of aqueous bamboo leaf extracts (BLE) in drinking water on performance of broiler chickens. A total of ninety-six (96) day-old broiler (Ross 308) chickens were used for the study. The birds were allotted into four treatments in a completely randomised design. The treatments were T1 (Control, which is ordinary water), T2 (antibiotics (Tetranor 5% at 5g per litre of watre)), T3 (50ml BLE per litre of water) and T4 (100mL BLE per litre of water). Each treatment was replicated four times with 6 birds in each replicate. Performance parameters were taken at the end of every week for the period of 8 weeks of the study. Data collected were subjected to one way analysis of variance using SAS (2009) while separation of means was done using Tukey's test. Result showed that the broiler given 100ml/L of aqueous BLE in drinking water had the highest (P<0.05) final weight and weight gain at both starter and finisher phase. Feed conversion ratio (FCR) (P<0.05) was best for broilers given 100ml/L of aqueous BLE in drinking water at both starter and finisher phase. Inclusion of aqueous BLE at both 50ml/L and 100ml/L had no significant (P>0.05) effect on feed intake of broiler at both starter and finisher phase. No mortality was recorded for the group of broilers given 100ml/L of aqueous BLE at finisher phase. It was concluded that inclusion of aqueous BLE at 100ml/L in drinking water improved the weight gain, FCR and reduced mortality of broilers.
KEY WORDS: Broilers, phytogenic plants, bamboo leaf extract, growth performance

INTRODUCTION

The problem with rise in antimicrobial-resistant bacteria due to consumption of poultry products arising from synthetic antibiotic treated birds has generated a great deal of opposition against the use of antibiotics in poultry production (Haque *et al*., 2020). The significant role broiler production plays in mitigating the negative impact of low protein intake in humans especially in developing countries cannot be over emphasised. Broilers are known to be fast growing birds with short rearing period of 6-8weeks and high feed conversion efficiency when properly managed (Odukoya *et al*., 2019) and its production stands as the fastest approach to meet the protein needs of the growing population (Voila *et al.,* 2015). However, the drawback is the poor immune system of the birds (CIWF, 2019) and its production can hardly be separated from the use of antibiotics which is strongly advocated against due to adverse residual effect (Diarra *et al*., 2010). In response to this menace, there has been an intensified search to suitable alternatives to antibiotics for broiler production.

Natural growth promoters such as herbs, roots and spices usually called phytogenics are recently used in poultry production due to their inherent bioactive compounds (Banerjee *et al*., 2011). Bamboo (*Bambusa vulgaris*) belongs to this category of plants which exhibit certain properties which could be beneficial in poultry production (Nirmala *et al*., 2018). The leaves of bamboo contain a large quantity of active constituents which include flavonoids, polyphenols and polysaccharides (Cheng *et al*., 2023). Bamboo leaf extract (BLE) is commonly used in cosmetics production, food and medicine (Shen *et al*., 2019). The use of BLE have been reported to exhibit important properties through the activity of constituent flavonoids such as immune modulatory and being active in reducing disease risk by functioning as an antioxidant thereby enhancing performance (Ni *et al.,* 2013). Other phytogenic plants have been investigated in broiler production for their suitability as alternative to antibiotics (Mishra and Singh, 2000; Franz *et al*., 2010), however, fewer studies exist on the investigation of BLE in broiler production. Therefore, this study was designed to investigate the inclusion of BLE in drinking water of broilers on performance.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Poultry Unit, Teaching and Research Farm, School of Agriculture, Epe Campus, Lagos State University. The climate of Epe is classified as the tropical climate. It has an average temperature of 26.30°C and precipitation or rainfall of about 1990mm per annum (https: //en.climate-data.org/africa/nigeria/lagos/epe-46640/). Epe also has its latitude and longitude as 6°35'2.83"N and 3°59'0.10"E respectively (https://latitude.to/map/ng/nigeria/cities/epe).

Collection and preparation of bamboo leaf extracts

The bamboo extracts were prepared from fresh bamboo leaves collected from the bamboo (*Bambusa vulgaris*) plants within the premises of Lagos State University, Epe Campus. They were air-dried at room temperature and chopped into pieces. Water was boiled and the chopped bamboo leaves were poured into the boiled water at the quantity of 15 grams to 1litres. It was allowed to cool and macerate for about 48 hours after which the extracts were filtered and the leaves particles removed. Then, the extracts were stored in bottles at room temperature prior to usage.

Animal management, treatments and design

The day-old chicks were procured from a reputable hatchery and prior to the arrival of the birds, the brooding pens were cleaned, disinfected and heated to regulate the temperature of the day-old chicks. Wood shavings were provided as beddings on the floor, the feeders and drinkers were cleaned, disinfected and made available for feeding and providing water. The recommended vaccination schedules were also adhered to. A total of 96-day old broiler chicks were purchased and grouped into 4 treatments using a completely randomized design. Each treatment had 24 birds consisting of 4 replicates of 6 birds per replicate. The birds were raised for 8 weeks consisting of starter and finisher phases (4 weeks each). Diets were formulated at each phase (Table1) to meet the nutrient requirements of the birds according to NRC (1994) and the treatments are: bamboo leaf extracts free (ordinary water), antibiotics (Tetranor 5% at 5g per litre of water), 50ml of bamboo leaf extracts per litre of water and 100ml of bamboo leaf extracts per litre of water.

Table 1: Composition of experimental diets

Ingredients (%)	Starter (0-28 days)	Finisher (29-56 days)
Maize	51	60
Soya bean meal	19	19
Groundnut cake	14	10
Fish meal	2	1
Wheat offal	10	6
Oyster shell	1	1
Bone meal	2	2
Lysine	0.25	0.25
Methionine	0.25	0.25
Vitamin/Mineral Premix*	0.25	0.25
Common salt	0.25	0.25
Total	**100**	**100**
Calculated nutrients (%)		
Metabolizable energy (Kcal/Kg) **	2965.21	3067.24
Crude protein	22.65	19.42
Fat	4.10	3.89
Fiber	3.84	3.33
Calcium	1.30	1.22
Phosphorus	0.51	0.47
Lysine	1.29	1.13
Methionine	0.59	0.54
Ash	3.02	2.57

**Starter premix: vit. A10,000,000 IU, vit. D 32,500,000 IU, vit. E 23,000 mg, vit. K3 2,000 (mg), vit. B_1 1,800(mg), vit. B_2 5,500(mg), niacin 27,500 (mg), pantothenic acid 7,500 (mg), vit. D_6 3,000(mg), vit. B_{12} (15mg), folic acid (750mg), biotin H_2 60mg, chlorine chloride 300,000mg, cobalt 200mg, copper 3,000mg, iodine 1,000mg, iron 20,000mg, manganese 40,000mg, selenium 200mg, zinc 30,000mg.*

**Finisher phase: vit. 8,500,000 IU, vit. D_3 1,500,000 IU, vit. E 10,000 mg, Vit K_3 1,500 mg, vit. B_1 1,600 mg, vit. B_2 4,000 mg, niacin 20,000 mg, pantothenic acid 5,000 mg, vit. D_6 1,500 mg, vit. B_{12} 10mg, folic acid 500mg, biotin H_2 750mg, chlorine chloride 175,000mg, cobalt 200mg, copper 3,000mg, iodine 1,000mg, iron 20,000mg, manganese 40,000 mg, selenium 200 mg, zinc 30,000 mg.*

***Estimated using the Nutrient Requirement of Poultry, NRC (1994) formulae, ME = 26.7 (%Dry matter) + 77 (%Ether extract) − 51.22 (%Crude fibre)*

Growth performance

The initial live weight of the birds per pen (*n = 4 per treatment*) was measured and the weight was also measured weekly. The difference between initial weight (IW) and final weight (FW) was calculated to determine the weight gain (WG). The difference between the feed offered and leftovers was calculated to obtain the feed intake (FI). The feed consumed was divided with the weight gain to obtain the feed conversion ratio (FCR)

Statistical analysis

All data collected were subjected to one-way analysis of variance using SAS 2009. The significant means were separated using Tukey's test of the same software. Significant difference was considered at P<0.05

RESULTS AND DISCUSSION

Performance of broiler chicken administered aqueous BLE in drinking water

Table 2 shows the performance of broilers given aqueous BLE in drinking water. At stater phase, the FW, WG, mortality and FCR were significantly (P<0.05) affected by the inclusion of BLE in drinking water of broiler chickens. Broilers given water containing 100ml BLE had higher (P<0.05) FW (1078.20g) and WG (1029.19g) than other treatments. The increased FW and WG observed for this group of broilers could be due to the presence of flavonoids in the extract. It has been observed that flavonoids act as growth hormone due to their hydroxyl groups of aglycone (Havsteen, 2002). Li *et al.* (2017) also reported increased body weight of broilers by 17.60% when fed diet supplemented with 2.5g/kg of bamboo leaf flavonoids (BLFs). The result obtained in this study is similar to the report of Shen *et al.* (2019) who also discovered linear and quadratic increase in final body weight of broiler chickens fed diets supplemented BLE. There was no significant (P>0.05) difference in the FI of the broiler chickens across treatment. Although, the birds given water with the inclusion of aqueous BLE at 50ml/L and 100ml/L in drinking water consumed slightly more feed than the birds in the control and antibiotic groups at the end of the starter phase. The slight increase in feed intake could be due to the influence of phytochemical constituent of BLE which stimulates feed intake. Wang *et al*. (2017) reported that flavonoid and polyphenol content of marigold and broccoli extract improves feed palatability which promotes FI resulting in better performance. The FCR was best for broilers given 100ml/L of BLE but was worst for broilers given 50ml/L of BLE. It has been reported that the bioactive compounds of BLE is capable of increasing the activities of digestive enzyme resulting in improved nutrient utilisation (Dhama *et al.*, 2015). The poor FCR observed for the group of broilers given 50ml/L BLE could be due to the lower quantity of BLE with low concentration of flavonoids which could not elicit improved digestion. Reduced mortality observed for the group of broilers given 100mL/L BLE suggests that BLE could serve as immune booster. The constituent secondary metabolite of BLE which include tannins, flavonoids, and saponins are potent antioxidants that reduces risk of disease development (Abbas *et al*., 2017).

At the finisher phase, broilers given 100ml/L of BLE had increased (P<0.05) FW. This is similar to the report of Oloruntola *et al*. (2018) who observed increased weight for broilers fed diet containing bamboo leaf meal and composite leaf mix (bamboo, neem and pawpaw) than those fed control diet at day 42. The FI was not significantly (P>0.05) affected but FCR was improved (P<0.05) for broilers given 100ml/L BLE as observed at the starter phase. The better FCR obtained for the group of broilers given 100ml/L of BLE is due to the positive effect of bioactive compounds in BLE. Imasuen *et al.* (2014) also observed improved FCR for broilers given heat treated pumpkin leaves extract as supplement due to the positive effect of bioactive compounds. No mortality was observed for broilers given 100ml/L of BLE however, mortality was higher (P<0.05) for broilers given 50ml/L BLE. This observation indicates that inclusion of BLE in the drinking water of broilers at 50ml/L was not sufficient to support increased immunity against disease infection. It is therefore pertinent to state the ability of phyto-additives to exhibit their inherent attribute is a function of the inclusion levels.

Table 2: Performance of broilers fed diet supplemented with Ethiopian pepper, cloves, and their composite.

Parameters (g)	Control	Antibiotics	50ml BLE	100ml BLE	SEM	P-value
Initial weight	50.13	50.05	50.03	49.73	0.10	0.177
Day 28						
live weight	801.91^{b}	744.20^{b}	751.20^{b}	1078.20^{a}	43.94	0.004
Weight gain	751.78^{b}	694.15^{b}	701.70^{b}	1029.19^{a}	43.96	0.004
Feed intake	1296.30	1353.65	1424.06	1423.83	32.92	0.491
FCR (g/g)	1.72^{ab}	1.97^{ab}	2.13^{a}	1.39^{b}	0.09	0.013
Mortality (%)	0.25^{b}	1.75^{ab}	2.50^{a}	0.25^{b}	0.25	0.014
Day 56						
live weight	1672.95^{b}	1961.00^{ab}	2082.67^{ab}	2695.42^{a}	142.53	0.055
Weight gain	871.04	1216.80	1331.47	1616.55	110.25	0.103
Feed intake	4235.62	4437.86	4770.50	4390.20	100.44	0.307
FCR (g/g)	5.31^{a}	3.99^{ab}	3.96^{ab}	2.69b	0.37	0.072
Mortality (%)	0.50^{b}	0.25^{b}	2.25^{a}	0.00^{b}	0.28	0.004

^{ab}Means on the same row with differing superscripts are significantly different (P<0.05) FCR= Feed conversion ratio
SEM= Pooled standard error of mean

CONCLUSION

The inclusion of BLE in the drinking water of broilers at 100ml/L resulted in increased FW, WG and reduced mortality at starter and finisher phase. The feed intake was not significantly affected by treatment at both phases however, the FCR was improved with inclusion of 100ml/L of BLE. Therefore, 100ml/L BLE can be included in drinking water of broilers to replace antibiotics for improved performance.

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