GROWTH PERFORMANCE AND ECONOMY OF FEED CONVERSION OF BROILER CHICKEN ORALLY-ADMINISTERED *Aloe vera* AND *Vernonia amygdalina* LEAF EXTRACTS AS PHYTOMEDICINES

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ABSTRACT
This study evaluated the growth performance and economy of feed conversion of broiler chicken orally-administered Aloe vera and Vernonia amygdalina leaf extracts as phytomedicines. Using a completely randomized design (CRD) model, a total of 120 one-day-old Ross 308 broiler chicks were randomly assigned to four treatments. with three replicates having ten birds per replicate thus: T1 (control, vaccinated against Gumboro disease at the 1st and 3rd week of the experiment and against Newcastle disease at the 2nd and 4th week of the experiment); T2 (administered 100 g Aloe vera/4 litres of water); T3 (administered 100 g Aloe vera + 50 g Vernonia amygdalina/4 litres of water); and T4 (administered 100 g Aloe vera + 100 g Vernonia amygdalina/4 litres of water). The extracts were administered over four consecutive days per week followed by three days resting period, for five weeks. All groups were fed the same diet (single phase formulated diet) for eight weeks. Data collected for growth performance and economy of feed conversion were analysed using the SPSS statistical package (version 23, 2021). Results showed that although there were no significant differences (P>0.05) in growth performance across the treatments during the starter and finisher phases, T2 (100 g Aloe vera/4 litres of water) consistently showed better weight gain and lower FCR, indicating superior growth performance. In conclusion, Aloe vera and Vernonia amygdalina extracts did not negatively affect broiler growth performance, and T2 emerged as the optimal treatment, offering the best balance between growth performance and economic efficiency.
Keywords: Growth performance, Economy of feed conversion, Phytomedicines, Broiler chicken.

INTRODUCTION

Broiler chickens are a reliable source of animal protein due to their rapid growth rate, efficient feed conversion, and quick turnover time. Concern over the misuse of antibiotics in broiler production and its possible effects on human health, particularly the emergence of drug resistance and cross-resistance in pathogenic bacteria, has grown in recent years on a global scale (Osita *et al.,* 2019). Researchers' efforts to find safe and efficient antibiotic substitutes for animal husbandry have intensified as a result of this worry (Oleforuh-Okoleh *et al.,* 2015; Chiemela *et al.,* 2016; Ndelekwute *et al.,* 2017; Okunlolo *et al*., 2018). The utilization of medicinal plants, which have long been acknowledged for their therapeutic qualities in traditional medical practices, is one exciting field of study. *Aloe vera* and *Vernonia amygdalina* have drawn the most attention among the therapeutic plants being studied because of their possible uses in poultry farming and other aspects of animal production. It has been suggested that *Aloe vera*, which has anti-inflammatory, immunomodulatory, and antioxidant properties, is a multipurpose plant that could boost chicken growth, boost immunity, and reduce the risk of sickness (Olobatoke and Oloniruha, 2009). Comparatively, *Vernonia amygdalina*, also referred to as bitter leaf, has been found to have antibacterial qualities and may be used in place of antibiotics in the treatment of chicken diseases (Usunobun and Okolie, 2016). Nevertheless, no comprehensive investigation has been carried out till date to assess the synergistic effects of combining these two phytomedicines in broiler chicken diets. This study therefore aims to close the gap by assessing the growth performance, economy of feed conversion and possibly the total elimination of commercial vaccines in broiler chicken by being given a mixture of *Aloe vera* and *Vernonia amygdalina* leaf extracts orally.

MATERIALS AND METHODS

Experimental site

This study was conducted at the Poultry Unit of the Department of Animal Production Teaching and Research Farm, Gidan Kwano Campus, Minna. Minna is located within latitude 09° 36' 50"'N and longitude 06° 33' 25"E respectively. It has an attitude of 700 kilometers above sea level, and bounded by River Niger which runs through the North - Western part down to the South - Western part of the State. It falls within the Southern Guinea Savannah agro-ecological zone of the country. The average rainfall is 1209.7 mm (Minna, Niger Geography, 2004 - 2017).

Preparation of the leaf extracts

Fresh bitter leaves *(Vernonia amygdalina)* were obtained within Minna and its environs. The leaves were dried under room temperature for a few days, to a moisture level of about 10 %, while retaining its greenish colouration, and then ground into a meal. One litre of boiling hot water was used to soak 100 g of ground bitter leaf meal for

12 hours in order to produce the leaf extract. This was filtered, and the experimental treatments applied based on the measured amount of filtrate. Also, fresh *Aloe vera* was gathered within Minna and its surroundings. After giving the leaves a thorough cleaning with salt water, the Aloe gel was peeled off the leaves. After the leaves' latex was extracted, the gel was gathered and placed in a container. One litre of hot distilled water and 100 grams of fresh gel was combined to create a powerful infusion. An electronic blender was used to blend the *Aloe vera* gel before it was transferred into a jar. After that, the jar holding the *Aloe vera* gel mixture was filled with hot, distilled water. To ensure full mixing, the jar was shaken for two minutes and then left for six to eight hours at room temperature before use. According to the inclusion level of the experimental treatments, both *Aloe vera* and *Vernonia amygdalina* were administered into fresh and clean drinking water and served to birds. The treatment was administered for four consecutive days per week.

Experimental diets

The birds were fed a compounded feed (single phase diet), which was mixed at the feed mill around the experimental site. The feed was compounded to contain 22.28 % crude protein and 3006.60 Kcal/kgME (metabolizable energy). The composition of the experimental diets is shown in Table 1. These diets were fed to the experimental birds for eight weeks.

Source and management of the experimental birds

120 one-day-old Ross 308 broiler chicks were purchased from Agrited Hatchery, Ibadan, Oyo State, Nigeria. For one week, the birds were raised in a deep litter system with sawdust as the litter material. They were served fresh water administered with antibiotics and a self-formulated feed for the first week. The poultry pens were completely cleaned and treated with disinfectant before the birds arrived. The pens were well-segmented and the floor areas was spread with sawdust to absorb wastes from the birds. Pots with charcoal was made accessible for the birds to use as a heat source. Strict adherence to all other management procedures was also maintained. Antibiotics, multivitamins, and glucose was added to the drinking water of the birds on the day of their arrival as sources of energy, prophylactic medicine, and anti-stress agents, respectively. For four weeks, a standard vaccination schedule was adhered to (only treatment 1 was vaccinated); in the first week, the infectious bursal disease vaccine (Gumboro vaccine) was given; in the second week, the Newcastle disease vaccine (Lasota vaccine) was given; and in the third and fourth weeks, respectively, the same procedure was repeated. In order to make the birds thirsty and expedite the vaccination, drinkers were removed the night before the vaccination day, and administering the vaccine the following morning. This was done to make sure the birds had the vaccination before being given food and drink.

Table 1: Ingredient composition of the experimental diets at both starter and finisher phases (single phase diet)

Ingredients	**T1 (%)**	**T2 (%)**	**T3 (%)**	**T3 (%)**
Maize	50.00	50.00	50.00	50.00
Wheat offal	1.00	1.00	1.00	1.00
Soya cake	6.00	6.00	6.00	6.00
Full fat soya	35.00	35.00	35.00	35.00
Fish meal	1.50	1.50	1.50	1.50
Lime stone	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25
Lysine	0.50	0.50	0.50	0.50
Methionine	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis	**T1**	**T2**	**T3**	**T4**
Crude protein (%)	22.80	22.80	22.80	22.80
Energy (kcal/kgME)	3006.60	3006.60	3006.60	3006.60
Crude fibre (%)	3.89	3.89	3.89	3.89
Ether extract (%)	8.85	8.85	8.85	8.85
Calcium (%)	1.68	1.68	1.68	1.68
Phosphorus (%)	0.78	0.78	0.78	0.78
Methionine (%)	1.33	1.33	1.33	1.33
Lysine (%)	1.66	1.66	1.66	1.66

**2.5 kg of premix contains: Vit. A= 12500.00 U.I, Vit. D_3 = 2500000.00 U.I, Vit. E = 40000.00 mg, Vit. K_3 = 2000.00 mg, Vit. B_1 = 3000.00 mg, Vit. B_2 = 5500.00 mg, Niacin = 55000.00 mg, Calcium panthonate = 115000.00 mg, Vit. B_6 = 5000.00 mg, Vit. B_{12} = 25.00 mg, Choline chloride = 500.000.00 mg, Folic acid =*

1000.00 mg, Biotin = 80000.00 mg, Iron = 100000.00 mg, Manganese = 120000.00 mg, Zinc = 80000.00 mg, Copper = 8500.00 mg, Iodine = 1500.00 mg, Cobalt = 300.00 mg, Selenium = 120.00 mg, Antioxidant = 120000.00 mg.

T1 = Control (0 g of *Aloe vera* and *Vernonia amygdalina*) with complete vaccination
T2 = 100 g of *Aloe vera* per 4 litres of water (no vaccination)
T3 = 100 g of *Aloe vera* and 50 g of *Vernonia amygdalina* 4 litres of water (no vaccination)
T4 = 100 g of *Aloe vera* and 100 g of *Vernonia amygdalina* 4 litres of water (no vaccination)

Data collection and analysis
Data were collected on growth performance (feed intake, weight gain, feed conversion ratio and mortality) and economy of feed conversion (cost of feed/kg, total cost of feed intake and cost of feed/kg weight gain). Using the Statistical Package for Social Sciences (SPSS 2021, version 23), all data collected were subjected to a one-way analysis of variance (ANOVA) based on a completely randomized design (CRD) model. Where differences existed among the treatments, they were separated using the Duncan's Multiple Range Test (DMRT), as contained in the SPSS package.

RESULTS AND DISCUSSION
The proximate composition of the experimental diet is presented in Table 2. The diet is composed of 91.6 % dry matter, 15.5 % ether extract, 14.5 % ash, 4.5 % crude fibre 21.13 % crude protein, and 35.97 % nitrogen-free extract. The experimental diet appears to be well-balanced, including a good amount of energy, lipids, proteins, and vital minerals. This makes it suitable for promoting growth and improving the health and performance of broiler chicken, based on the recommendation of Olomu (2011).

Table 2: Proximate composition of the basal experimental diet (single phase diet)

	Treatments			
Parameter (%)	**T1**	**T2**	**T3**	**T4**
Dry matter	91.60	91.60	91.60	91.60
Crude protein	21.13	21.13	21.13	21.13
Ether extract	15.50	15.50	15.50	15.50
Crude fibre	4.50	4.50	4.50	4.50
Ash	14.50	14.50	14.50	14.50
Nitrogen free extract	35.97	35.97	35.97	35.97

T1 = Control (0 g of *Aloe vera* and *Vernonia amygdalina*) with complete vaccination
T2 = 100 g of *Aloe vera* per 4 litres of water (no vaccination)
T3 = 100 g of *Aloe vera* and 50 g of *Vernonia amygdalina* 4 litres of water (no vaccination)
T4 = 100 g of *Aloe vera* and 100 g of *Vernonia amygdalina* 4 litres of water (no vaccination)

Table 3: Overall growth performance of broiler chicken orally-administered *Aloe vera* and *Vernonia amygdalina* leaf extracts as phytomedicines

	Treatments						
Parameters	**T1**	**T2**	**T3**	**T4**	**SEM**	**LOS**	**P-Value**
IBW (g/bird)	155.07	153.80	153.43	149.87	2.08	NS	0.88
TBWG (g/bird)	1710.73	1749.79	1662.92	1478.99	74.24	NS	0.65
FBW (g/bird)	1865.79	1903.59	1890.46	1628.86	75.34	NS	0.59
TFI (g/bird)	4348.85	4440.39	4585.36	4736.20	104.81	NS	0.64
TWI (ml/bird)	7188.55	7242.25	7604.47	7010.50	149.03	NS	0.62
FCR	2.58	2.54	2.79	3.34	0.16	NS	0.30
Mortality (%)	3.61	7.63	7.84	11.06	1.85	NS	0.63

Values are means of triplicate determinations.
IBW = Initial Body Weight;TFI = Total Feed Intake; FBW = Final Body Weight; TWI = Total Water Intake; TBWG = Total Body Weight Gain; FCR = Feed Conversion Ratio; LOS = Level of Significance; SEM = Standard Error Mean; P-Value = Probability Value; NS = Not significantly different

The growth performance of broiler chicken orally-administered *Aloe vera* and *Vernonia amygdalina* leaf extracts is presented in Table 3. The study revealed that *Aloe vera* and *Vernonia amygdalina* leaf extracts did not significantly enhance the growth performance of broilers. This is consistent with the findings of Ghazalah *et al*.

(2011), who reported minimal impact on body weight when *Aloe vera* was used to supplement the diets of broiler chicken. However, Darabighane *et al*. (2011) observed a moderate improvement in growth performance when *Aloe vera* gel was added to drinking water, indicating that the formulation and dosage might play a crucial role in its effectiveness. Similarly, Yim *et al*. (2011) found improved feed efficiency and moderate weight gain with *Aloe vera* powder, though the results were not significant enough to affect early-stage growth.

Table 4: Economy of feed conversion of broiler chicken orally-administered *Aloe vera* and *Vernonia amygdalina* leaf extracts as phytomedicines at both starter and finisher phases

	Treatments						
Parameters	**T1**	**T2**	**T3**	**T4**	**SEM**	**LOS**	**p-Value**
FC/Kg (₦)	297.56	240.90	249.23	262.23	6.52	_	_
TCFI (₦)	1294.04	1069.69	1142.81	1241.97	35.79	NS	0.09
FC/KgWG (₦)	768.69	611.08	694.52	875.85	45.56	NS	0.21

Values are means of triplicate determinations.
FC/Kg = Feed cost per kg NS = Not significantly different TCFI = Total cost of feed intake SEM = Standard Error of mean FC/KgWG = Feed cost per kilogram weight gain LOS = Level of significance

T1 = Control (0 g of *Aloe vera* and *Vernonia amygdalina*) with complete vaccination
T2 = 100 g of *Aloe vera* per 4 litres of water (no vaccination)
T3 = 100 g of *Aloe vera* and 50 g of *Vernonia amygdalina* 4 litres of water (no vaccination)
T4 = 100 g of *Aloe vera* and 100 g of *Vernonia amygdalina* 4 litres of water (no vaccination)

Water intake and feed intake also remained consistent across treatments, suggesting that *Aloe vera* and *Vernonia amygdalina* did not promote feed intake nor discourage drinking behaviour in broilers. This is an important finding, as reduced water intake could compromise hydration, feed consumption, and overall growth performance. Hassanbeigy-Lakeh *et al*. (2012) also found no significant effect of *Aloe vera* on water intake, reinforcing that these phytomedicines are safe for use in broiler production without negatively affecting feed intake and water consumption. On the other hand, Sinurat *et al*. (2002) showed improved feed conversion ratios (FCR) with *Aloe vera* gel in feed, indicating that the plant's benefits may stem from improved feed efficiency rather than increased feed consumption.

The overall economy of feed conversion of broiler chicken orally-administered *Aloe vera* and *Vernonia amygdalina* leaf extracts as phytomedicines at both starter and finisher phase is shown in Table 4. There was no significant difference (P>0.05) among all the parameters measured across the treatments; though the feed cost/kg weight gain was lowest for birds administered 100 g of *Aloe vera* per 4 litres of water (with no vaccination).

CONCLUSION AND RECOMMENDATIONS

The growth performance parameters of broiler chicken were not significantly affected by the oral administration of *Aloe vera* and *Vernonia amygdalina* leaf extracts. The extracts had no detrimental effects on feed intake, water consumption, or feed conversion efficiency, even though it did not show any effects that would promote growth. T2 (100g of *Aloe vera* per 4 liters of water) is recommended as the optimal treatment for improving economy of feed conversion and reducing feed costs in broiler production. It provides the best economic outcome, without compromising the health or growth performance of the broiler chicken. Hence, it is recommended to poultry farmers, animal nutritionists and animal scientists generally to orally administer this extract to broiler chicken for optimum performance.

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