

EFFECT OF STRAIN ON GROWTH PERFORMANCE AND BODY MEASUREMENTS OF BROILER CHICKENS SUPPLEMENTED WITH AQUEOUS BITTER LEAF EXTRACT

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AT conceived and designed the study, EOA, SYI and TTO conducted the field work and data collection. All authors jointly wrote and approved the final manuscript.

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ABSTRACT

The objective of this study was to investigate the effects of strain on growth performance and body measurement indices of broiler chickens that fed an aqueous extract of bitter leaf (*Vernonia amygdalina*). The study was conducted at the poultry unit of the Teaching and Research Farm, Department of Animal Production and Health, Federal University Oye-Ekiti, Ekiti State, Nigeria. A total of 153-day-old broiler chicks 51 each of Cobb-500, Ross-308, and Abor Acre were procured from a commercial hatchery (Mhido Farms). The chicks were randomly assigned in a 3 × 3 completely randomized design, receiving the same commercial feed and drinking water supplemented with aqueous bitter leaf extract at a concentration of 25 ml per liter, offered ad libitum for a period of eight weeks. Routine medication and vaccination schedules, as prescribed by the University Teaching and Research Farm, were followed, along with adherence to ethical guidelines. The results indicated significant differences ($p < 0.05$) among the three broiler strains in terms of final body weight (ranging from 2359.5 to 2536.6 g), average daily weight gain (38.41 to 41.38 g), and feed conversion ratio (2.39 to 2.47), demonstrating that strain has a measurable effect on performance under bitter leaf extract supplementation.

1. INTRODUCTION

Poultry farming has emerged as one of the fastest growing agribusiness enterprises in the world. Expansion of this enterprise would help in feeding the expanding population with adequate animal protein. Among other factors that greatly affect poultry production in the tropics, feeding constitutes a major constraint due to the high cost of feed ingredients, especially those that are not locally available. The use of medicinal plants in livestock and poultry feed /diet have shown great improvement in growth performance. Although they possess anti-nutritional factors, which can be eliminated or reduced drastically using different processing methods. They have shown far better results compared to synthetic feed additives.

One of the major feed additives that can be used is *Vernonia amygdalina* (Bitterleaf) meal. Bitter leaf (*Vernonia amygdalina*) is a perennial shrub from *Asteraceae* family and one of the edible vegetables that grow throughout tropical Africa. It is popularly called Bitterleaf because of its abundant bitter taste (Abdul et al. 2020). It performs both medicinal and nutritive functions (Adekanmi et al. 2020). The leaf contains a considerable amount of anti-nutritional factors like high level of tannic acid and saponin (Dare, 2022). Research has shown that *Vernonia amygdalina* (either the leaf meal or the aqueous extract) has some beneficial effects in disease management of poultry such as anti-coccidiosis, anti-bacterial and anti-parasitic (Ogidi et al. 2019), as an antioxidant and as a growth promoter by enhancing the gastrointestinal enzymes thus increasing feed conversion efficiency (Pehlivan, 2021). Several

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studies carried out on this plant had suggested that it contains different bioactive compounds, including, flavonoids, saponins, alkaloids, tannins, phenolics, terpenes, steroidal glycosides. This has currently elicited a lot of interest in the search for plant materials and their derivatives as alternatives to be incorporated in animal feeds. Osho et al., (2014) reported that up to one third of all commercial swine and chicken rations in Europe now use mixtures of herbs and spices to accelerate growth and maintain health. Some of these useful herbs and spices are indigenous to Africa and have been reported to influence nutrient utilization by chickens (Mebratie et al., 2019) and enhance performance of broiler chickens (Osho et al., 2014).

In general, available literature suggests that phyto-genic feed additives such as herbs and spices may add to the set of non-antibiotic growth promoters for use in livestock like organic acids and probiotics. Feed additives are ingredients added to poultry diets to enhance production efficiency, improve health and reduce morbidity (Edo et al. 2023). Recently, plant-based feed additives also known as photogenic have been advocated to be included in broiler chickens' feeds as growth promoting feed additives, because of their abundance in our natural environment and the fact that they do not have residual effect (Ukoha et al., 2022). Their non-residual effect is because, according to Ugbo-gu et al. (2021), the active ingredients of phyto-genic feed additives are absorbed in the intestine by enterocytes and are quickly metabolized by the body. Phyto-genics can improve feed consumption, feed conversion, feed digestibility and weight gain of broiler chickens (Kawu, 2023).

Poultry farming has emerged as one of the fastest growing agribusiness enterprises in the world. Expansion of this enterprise would help in feeding the expanding population with adequate animal protein. Among other factors that greatly affect poultry production in the tropics, feeding constitutes a major constraint due to the high cost of feed ingredients, especially those that are not locally available. The use of medicinal plants in livestock and poultry feed /diet have shown great improvement in growth performance. Although they possess anti-nutritional factors, which can be eliminated or reduced drastically using different processing methods. They have shown far better results compared to synthetic feed additives.

One of the major additives that can be used is *Vernonia amygdalina* (Bitter leaf) meal. Based on the significance of bitter leaf. This study was designed to evaluate the effects of strain on growth performance and body measurements of broiler chickens fed aqueous extract of bitter leaf.

2. MATERIALS AND METHODS

Site of the Experiment

The experiment was carried out at the Poultry Unit of Teaching and Research Farm, Department of Animal Production and Health, Federal University Oye ekiti, Ekiti State, Nigeria.

Preparation of Plant Extract

The plant material (*V. amygdalina*) for the experiment was harvested from the Teaching and Research Farm of the Federal University Oye Ekiti. The leaf material was washed gently and drained. Thereafter 50g of bitter leaf was weighed and infused overnight in 1liter of hot boiled water and this was given to the birds at 25ml per liter of drinking water and libitum throughout the experimental period.

Management of Chicks and Experimental Lay-out

One hundred and twenty (153) day-old broiler-chicks (51 Ross 300, 51 Abor acre and 51 Cobb 500) were purchased from a commercial hatchery; Muogal Farm. The 153 chicks with average weight of 55g was randomly assigned into three treatments of strain levels; T1 (Ross 300), T2 (Abor acre) and T3 (Cobb 500) respectively with 51 birds per treatment and replicated three times and each replicate with 17 birds. The chicks were brooded and raised in equi-dimensional pens (1m x 1m). The birds under each treatment were fed the same commercial broiler starter (22% CP and 2900 kcal/kg ME) and finisher (18% CP and 2900 kcal/kg ME) diets and allowed to consume the water with the same levels (25ml per litre) of aqueous extract of bitter leaves *ad-libitum*. The routine medication and vaccination program as outlined by the University Teaching and Research farm as well as ethical consideration were observed for the birds. The study lasted for 8 weeks, during which the records on average weekly weight gain, average daily water and feed consumption will be calculated.

Body Measurements

Traits that were measured include body weight and other body measurements namely shank length, thigh length, drumstick length, body length, body width, breast width and wing length at 8 weeks of age as described by Ogidi et al (2019) and Udeh et al., (2011).

Growth performance

The parameters that were measured under growth performance include: feed intake, body weight gain, and feed conversion ratio.

Feed intake

A known quantity of feed was offered every morning, and the leftover was measured the next morning. The difference between the food offered and the leftovers was considered as feed intake.

Average feeding intake was calculated using the formula below.

Average feed intake(g) = Quantity of feed given(g) - Quantity of leftover (g) divided by the number of chickens, Aviagen, 2020

Body weight gain

Body weight gain was obtained by subtracting the previous week's body weight from the current week's body weight.

Body weight gain (g) = Present week weight (g) - previous week weight (g).

Feed conversion ratio (FCR)

Feed conversion ratio was computed as the ratio of feed intake to body weight gain(g)

Statistical Analysis

All data collected were subjected to one way analysis of variance (ANOVA) using SPSS (2010) Version 17. Duncan's Multiple Range tests (DMRT) were used to compare the means.

3. RESULTS AND DISCUSSION

Effects of Strains on feed intake of Broiler fed Aqueous extracts of Bitter leaf

The effect of oral administration of bitter leaf aqueous extract on the performance of broiler chickens is presented in Table 1. The result indicates that no difference ($p>0.05$) was observed in daily feed intake among the three strains of broiler chickens. However, there were significant variations ($p<0.05$) in the final body weight, average daily weight gain and feed conversion ratio-ranging between 2359.5-2536.6, 38.41-41.38 and 2.39-2.47 g, respectively-between the three strains of broiler chickens. However, RSR birds had (average final weight 2464.7, Feed conversion ratio 2.39) the best performance, numerically, when compared to the other strain (CBR and ABR) groups.

Effects of Strains on Body Measurement of Broiler fed Aqueous extracts of Bitter leaf

The results of the effects of strains on body measurement of broiler chicken fed aqueous extracts of bitter leaf is shown in Table 2. The result revealed

that there were no significant differences ($p<0.05$) in the body measurement across all the strains. However, AAR shows superiority in shank, drumstick, body length, breast length and wing, with the mean values of 4.08, 4.33, 12.17, 7.67 and 8.67cm respectively. CBR was superior with the mean value of 4.43cm. RSR recorded the highest mean values of 14.5 and 4.43cm in body width and breast width respectively.

The result of the present study is in line with the findings of [Abdel-Moneim et al. \(2020\)](#) and [Daramola et al. \(2018\)](#) who reported improved growth performance of animals fed bitter leaf. The improvement observed in the improved weight gain is correlated with the lower FCR observed in the treated group. The lower the FCR the higher it is for the birds to convert feed consumed to meat. [Alagbe \(2019\)](#) reported that inclusion of bitter leaf powder in cockerels feed significantly improved FCR. [A li et al. \(2020\)](#) opined that the improvement observed could be associated with the beneficial effect of bitter leaf in enhancing the gastrointestinal enzyme thereby improving digestion and assimilation of nutrients. [Garba & Oyiosa \(2019\)](#) also reported that bitter leaf enhanced gastrointestinal enzymes (chymotrypsin) production which may improve not only the utilization of feed but could aid in the digestion of sporozites and other intestinal parasites that could cause decreased utilization of feed. [Ishola et al. \(2017\)](#), contrarily, observed that inclusion of bitter leaf as a feed additive did not significantly improve weight gain and FCR in broilers.

The investigation into the effect of aqueous extracts of bitter leaf on the body measurements of different strains of broiler chickens reveals nuanced insights into strain-specific responses to dietary supplementation. Table 2 presents a detailed comparison of body measurements among the broiler strains AAR, CBR, and RSR, with no statistically significant differences ($p<0.05$) observed across all strains. This suggests that the bitter leaf extract did not statistically impact body measurements. Despite the lack of significant differences, certain strains showed higher numerical values in specific body measurements. For instance, the AAR strain exhibited higher measurements in several categories: shank (4.08 cm), drumstick (4.33 cm), body length (12.17 cm), breast length (7.67 cm), and wing (8.67 cm). These measurements indicate that the AAR strain might be genetically predisposed to larger or more robust physical traits, which could be enhanced by the

bitter leaf extract as recorded by (AbdulBasis, et al., 2020). The higher numerical values of the AAR strain in this study suggests that this strain may have a favorable response to the supplement, potentially reflecting a more efficient utilization of the nutritional or medicinal properties of the bitter leaf extract. The significant width measurements for the RSR strain indicate potential advantages in meat yield, which could be a desirable trait in poultry production. The greater body and breast width could also reflect the strain's ability to effectively utilize the bitter leaf extract to enhance its growth and development in these specific areas, (Ishola et al., (2017).

The observed differences among strains in response to bitter leaf extract underscore the complexity of genetic and dietary interactions in poultry growth. Bitter leaf (*Vernonia amygdalina*) is known for its medicinal properties, including its antioxidant and anti-inflammatory effects (Achuba, 2018; Olarewaju et al. 2022). These properties might contribute to improved growth performance and health in poultry, although the extent of these benefits can vary depending on genetic factors. Genetic predisposition plays a crucial role in how different strains of broilers respond to dietary supplements. As evidenced by the specific advantages seen in the strains under investigation, genetic factors likely modulate the effectiveness of bitter leaf extract in influencing body measurements. Research on the interaction between genetics and diet in poultry highlights that different strains or breeds may have varying responses to the same nutritional interventions (Nunes et al., 2020).

At week four, the CBR strain demonstrated the highest significant weight gain of 495.8 grams, followed by the RSR strain at 456.93 grams, and the AAR strain with the lowest value of 455.07 grams. This significant difference ($p < 0.05$) suggests that the CBR strain may have a more favorable response to the bitter leaf extract in the early stages of growth. The higher weight gain observed in CBR could be attributed to its potentially better nutrient absorption or metabolic efficiency in utilizing the supplement (Folajinmi & Peters., 2020). The trend where RSR shows superior weight gain at the eighth week, despite not being statistically different from other strains, could indicate a delayed but sustained growth response to the bitter leaf extract. It is possible that RSR's genetic or physiological characteristics may allow it to utilize the extract more effectively over a longer period, leading to higher overall weight gain. This extended response could be related to factors such as improved long-term nutrient utilization or enhanced growth efficiency (Nunes et al., 2020). The CBR strain exhibited the highest intake levels, consuming a total of 5974.63g of

feed throughout the experiment. This indicates that CBR chickens had a higher appetite or perhaps a greater capacity to utilize the feed and water provided. High feed and water intake in CBR could suggest better overall intake efficiency or greater thirst and hunger responses, which might contribute to their overall growth performance and well-being (Garba & Oyiosa, 2019). The RSR strain followed closely in feed intake with 5890.39g, indicating that while it consumed slightly less feed than CBR, it still had a substantial intake. This close intake level between CBR and RSR suggests that both strains have relatively similar feeding behaviors but with minor differences that could influence growth outcomes (Nunes et al., 2020). The high feed intake observed in CBR could be beneficial for its growth performance if other factors, such as feed conversion ratio and weight gain, are favorable. Understanding why CBR consumes more might involve exploring factors such as genetic predispositions or metabolic rates that influence consumption behavior.

4. CONCLUSION

Therefore, from the result obtained from this experiment it is concluded that bitter leaf had an effect on growth performance and body measurement of broiler chickens.

5. RECOMMENDATIONS

So, the recommendation of aqueous extract of bitter leaf as a potential feed additive to promote growth performance and enhance body measurements profile in broiler chickens, therefore aqueous extract of bitter leaf is a potential feed additive in improving growth performance of broiler chicken. It also encourages good growth and prosperity. It is one of the natural additives.

6. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding the publication of this article.

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Strain Effects on Broiler Growth with Bitter Leaf

Table 1. Growth performance record of three strains of broiler chickens fed aqueous of bitter leaf extracts

PARAMETER	AAR	CBR	RSR	SEM	P - Values
Average Initial Weight (g)	55.0	57.5	56.4	0.262	0.035
Average Final Weight (g)	2359.5 ^b	2536.6 ^a	2464.7 ^a	93.64	0.028
Average Weight gain (g)	2304.5 ^b	2479.1 ^a	2464.6 ^a	100.81	0.252
Average Daily Weight gain (g)	38.41 ^b	41.32 ^a	41.08 ^a	0.6389	0.211
Average Feed Intake (g)	5692.12 ^b	5974.63 ^a	5890.39 ^a	115.55	0.165
Average daily feed intake (g)	95.20	100.21	98.50	14.16	0.025
FCR	2.47 ^a	2.41 ^b	2.39 ^b	0.07	0.043

Means with different superscripts differed significantly ($p < 0.05$), AAR=Arbor acre broilers, CBR=Cobb- 500 broilers, RSR=Ross- 308 broilers

Table 2: Effects of strain on body measurements of Broiler Chicken fed Aqueous extracts of Bitter leaf

Length (cm) Parameters	Treatments			SEM±	P-value
	AAR (cm)	CBR (cm)	RSR (cm)		
Shank	4.08	3.83	3.70	0.2423	0.0153
Thigh	4.22	4.43	4.17	0.3378	0.466
Drumstick	4.33	4.28	4.23	0.2545	0.715
Body length	12.17	12.17	11.83	0.3333	0.358
Body width	14.42	13.75	14.50	0.3522	0.060
Breast length	7.67	7.58	7.33	0.3118	0.327
Breast width	4.37	4.38	4.43	0.1810	0.732
Wing	8.67	8.67	8.60	0.2739	0.777

Means with superscripts differed significantly ($p < 0.05$), AAR=Arbor Strain, CBR=Cobb Strains, RSR=Ross Strain