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Effect of strain on growth performance, carcass and organ analysis of broiler chickens supplemented with aqueous extract of bitter leaf to drinking water

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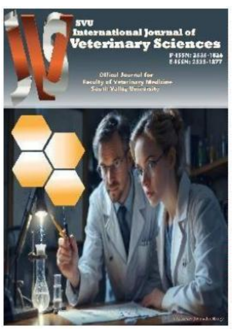
ABSTRACT



Investigating the impact of strain on the growth performance, carcass and organ parameters of broiler chickens supplemented with aqueous extract of bitter leaf to drinking water was the aim of this study. The poultry unit of the Department of Animal Production and Health's Teaching and Research Farm at Federal University Oye Ekiti in Ekiti State, Nigeria, served as the study's site. 153-day-old broiler chicks were purchased from a commercial hatchery (Mhido farms) (51 Cobb-500, 51 Ross-308, and 51 Arbor acres, respectively). These were raised in a 3 by 3 fully randomized design trial and given the same commercial feed along with an aqueous bitter leaf extract at a rate of 25 millilitres per litre of drinking water on an as-needed basis for eight weeks. The routine medication and vaccination program as outlined by the University Teaching and Research farm as well as ethical considerations were observed throughout the experimental period. Growth performance records were taken on weekly basis and organ and carcass analysis were carried out at the end of the study. Highest significant (p<0.05) weight gain was recorded by CBR with 2536.6g while AAR had the least mean value of 2359.5 g. Significant differences (p<0.05) were also observed on shank, back and drumstick weights across all the strains with CBR recording highest significant mean values of 114.2g and 319.5g in shank and drumstick and back weight of 376 g in RSR, respectively. The results revealed that the inclusion of bitter leaf extract in the diets of broiler chickens had a positive effect on growth performance, carcass and organ characteristics.

Keywords: *Bitter leaf, Broiler strains, Growth performance, Carcass and organ measurement, Phytoadditive*

INTRODUCTION

The supply of feed components and the ability to produce high-quality products at a fair price are two of the challenges facing the feed industry, according to Kumar et al. (2021). To maximise carcass quality and net returns, various feed additives are used for poultry (Alagawany et al., 2020). A feed ingredient's effect on the haematological traits of the chicken substantially aids in determining whether or not it will be used as poultry feed.

Animals' clinical and nutritional health can be assessed using a variety of haematological traits, such as haemoglobin, red blood cells, packed cell volume, and others, which can be connected to specific production attributes. For instance, a high proportion of white blood cells, especially lymphocytes, is associated with the chicken's ability to perform well under extreme stress, whereas a high packed cell volume (PCV) and haemoglobin content (Hb) are associated with a high feed conversion ratio (Oloruntola et al., 2022). The FAO (2020) defines feed additives as ingredients added to chicken diets to improve health, reduce morbidity, and boost production efficiency.

For many years, chicken farms have utilized antibiotics as a frequent feed element. Bans on the use of antibiotics as feed additives have prompted more research into natural alternative feed additives in animal agriculture (Ugbogu et al., 2021). When compared to synthetic antibiotics or inorganic chemicals, these plant-derived compounds have been demonstrated to be natural, less hazardous, residue-free, and suitable feed additives in feed animal production (Wang et al., 1998). Although there are many medicinal plant stores worldwide, Africa has the largest collection of classified species (Oloruntola et al., 2022).

According to Hassan et al. (2022), the use of medicinal herbs in Africa predates the introduction of antibiotics and other modern drugs. The bitter leaf (*Vernonia amygdalina*), a shrub or small tree, is one of the edible vegetables in Nigeria and other subregions of Africa. It has medicinal and nutritional uses (Adeyemi et al., 2022). Any plant that has substances in one or more of its organs that have therapeutic value or that act as building blocks for the creation of advantageous drugs is considered a medicinal plant, according to Kumar et al. (2021). It is frequently referred to as bitter leaf due to its numerous bitter components (Adebayo et al., 2021).

Along with other anti-nutritive components, the leaves include high concentrations of tannic acid and saponin. Vernonia amygdalina Leaf Meal's (VALM) approximate chemical makeup is 527.83 ME kcal kgG. In addition to 86.40% DM, 21.50% CP, 13.10% CF, 6.80% EE, and 11.05% Ash, the mineral composition results indicate that V. amygdalina contains 3.85% Ca, 0.40% Mg, 0.03% P, 0.006% Fe, 0.33% K, and 0.05% Na (Adebayo et al., 2021). It is one of the natural feed additives used in the barbecue industry that can significantly affect both health and production.

To evaluate the effects of different doses of bitter leaf aqueous extract on the growth performance, carcass and organ quality, and blood parameters of grill chickens, numerous experiments have been carried out. The main objective of this study was to ascertain how strains affected the growth performance, carcass, and organ measures of broiler chickens that were given bitter leaf extracts (*Vernonia amygdalina*) as a phytoadditive.

MATERIALS AND METHODS

Location of the study

The poultry unit of the Department of Animal Production and Health's teaching and research farm at Federal University Oye Ekiti's Ikole campus served as the site of the experiment. State of Ekiti. Nigeria. Geographically, Ikole, a local government in Ekiti State, is located between latitudes 7.7979°C North and 5.326°C East. It experiences high humidity and an average annual temperature of 24.6°C.

Experimental Materials and Preparation

The Arbor Acres, Ross-308, and Cobb-500 experimental birds were purchased from a commercial hatchery. The Federal University of Oye-Ekiti's Teaching and Research farm (Crop Production Unit) is where the bitter leaves were collected.

The Federal University's Teaching and Research farm in Oye-Ekiti provided the plant material (V. amygdalina) for the experiment. The leaf materials were drained and given a gentle wash. After that, 50g of bitter leaves were weighed, infused in one litre of hot, boiled water for the whole night, and supplemented to drinking water for the birds without restriction for the duration of the experiment at a rate of 25ml per litre of drinking water.

Treatment and Experimental Design

The strain (three levels) served as the treatment, and the experiment was repeated three times. A total of 153 birds were included in the sample, with 17 birds per replication. Completely Randomised Design (CRD) is the experimental design.

Management of the Poultry House Prior to the Birds' Arrival

There were light sources available twenty-four hours a day. The experimental birds were kept on a deep litter system in an open-sided wall housing. Before the birds arrived, the enclosures were thoroughly cleaned with Izal ® solution, a disinfectant, and then scrubbed, cleaned, and debris and cobwebs were removed. To prevent heat loss, tarpaulin was appropriately placed over the enclosures' exterior wall. To aid with heat conservation, especially during the brooding stage, fresh wood shavings were sprinkled 5 cm deep. During the brooding phase, charcoal burners were utilized as heat sources, while locally produced and rechargeable lamps were employed for lighting. Other appliances such as drinkers and feeders were also provided.

The house was demarcated and divided into 9 units.

Management of Chicks and Experimental Layout

One hundred and fifty-three (153) day-old broiler chicks (51 Ross 300, 51 Arbor Acres and 51 Cobb 500) were purchased from a commercial hatchery (Mhido farms). The 153 chicks with average weight of 50g were randomly assigned into three treatments of strain levels; RSR (Ross 300), ABR (Arbor Acres) and CBR (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×1m). The birds under each treatment were fed the same commercial broiler starter (22% CP and 2900 kcal/g ME) and finisher (18% CP and 2900 kcal/kg ME) diets and allowed to consume the water with the same levels (25ml per liter) 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 considerations, was observed for the birds. The study lasted for 8 weeks.

Growth Performance

Feed intake, body weight gain, and feed conversion ratio are among the metrics that were assessed under growth performance.

Feed Intake

Every morning, a certain amount of feed was provided, and the following morning, the leftover amount was measured. Feed intake was defined as the difference between the feed that was provided and the feed that was left over.

The following formula was used to determine the average feed intake.

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

Body Weight Gain

By deducting the weight of the previous week from the weight of the current week, the body weight growth was calculated.

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).

Carcass and Organ Measurements

Three birds per duplicate were chosen at random from each treatment at the conclusion of the experiment to be utilized for the measurements of the organs and carcasses. Before being weighed and killed the following morning, the birds were kept off-feed for the whole night to allow their stomachs to empty. The inner organ was removed and the birds were defeathered. The dressed weight and dressing % (carcass yield, which includes the dressed weight of the thigh, drumstick, shank, breast, upper back, lower back, wing, and head) were calculated after the birds were dressed. All of the cut-up components were weighed and reported as a percentage of the live weight. Each bird's visceral organs, including the liver, intestines, heart, spleen, kidney, lungs, pancreas, and entire gizzard, were also weighed and reported as a percentage of live weight.

Statistical Analysis

Using SPSS, a one-way analysis of variance (ANOVA) was performed on all gathered data. To compare the means, Duncan's Multiple Range Test (DMRT) was employed.

RESULTS

Effect of Strains on feed intake and body weight gain of Broiler supplemented with a Bitter leaf aqueous extract

Table 1 displays the findings of the strains' impact on feed intake in grill chickens given aqueous extracts of bitter leaf. The average feed intake of the experimental grill strains varied significantly ($p<0.05$). According to the data, AAR consumed the least amount of feed (5692.12g), while CBR consumed the most (5974.63g).

According to the findings, body weight gain varied significantly in all strains. AAR had the lowest mean value of 2359.5g, while CBR had the most significant ($p<0.05$) average final weight increase of 2536.6g.

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

PARAMETER	AAR	CBR	RSR	SEM	P - Values
Average Initial Weight (g)	55.0	57.5	56.4	0.262	0.645
Average Final Weight (g)	2359.5 ^{b}	2536.6 ^{a}	2464.7 ^{a}	93.64	0.035
Average Weight gain (g)	2304.5 ^{b}	2479.1 ^{a}	2464.6 ^{a}	100.81	0.028
Average Daily Weight gain (g)	38.41	41.32	41.08	0.6389	0.211
Average Feed Intake (g)	5692.12 ^{b}	5974.63 ^{a}	5890.39 ^{a}	115.55	0.025
Average daily feed intake (g)	95.20	100.21	98.50	14.16	0.580
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 acres broilers, CBR=Cobb- 500 broilers, RSR=Ross-308 broilers.

Effect of Strains on carcass characteristics of Broiler supplemented with aqueous extract of Bitter leaf

Table 2 displays the effects of strains on the carcass characteristics of grilled chickens supplemented with aqueous extract of bitter leaf. The findings showed that the weights of the drumsticks, shank, and back varied significantly among all strains. AAR and RSR had comparable statistical values in both metrics, whereas CBR had the largest significant ($p<0.05$) differences in shank and drumstick, measuring 114.2 and 319.5g, respectively. Across all strains, no discernible variation was seen in other metrics.

Table 2: Effect of Strains on carcass characteristics of Broiler supplemented with aqueous extract of Bitter leaf

Weight Parameters/g	Treatments			SEM±	P-value
	AAR	CBR	RSR		
Live Weight	2359.5	2536.6	2464.7	93.64	0.093
Slaughtered W.	2275.3	2475.3	2426.5	100.81	0.078
Defeathered W.	2201.8	2391.8	2296.5	99.26	0.088
Carcass	1767.3	1964.2	1886.5	149.25	0.230
Head	68.3	59.5	54.3	13.81	0.352
Neck	95.2	101.5	97.2	6.59	0.377
Shank	96.3^{b}	114.2^{a}	99.8^{b}	6.19	0.041
Back	334.3^{b}	354.3^{ab}	376^{a}	16.09	0.023
Breast	594.0	571.0	628.8	42.28	0.214
Thigh	299.8	319.2	305.8	13.25	0.186
Drumstick	239.7^{b}	319.5^{a}	264^{ab}	32.77	0.011

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

Effect of Strains on length of internal organs of Broiler supplemented with aqueous extract of Bitter leaf

Table 3 displays the findings of the strains' impact on the internal organs of grilled chickens supplemented with aqueous extract of bitter leaf. The mean liver values of the experimental grill chicken strains varied significantly (p<0.05), according to the data. RSR had a value of 43 cm, whereas AAR and CBR had values of 50.0 cm and 49.0 cm, respectively.

Table 3: Length of internal organs of Broiler supplemented with aqueous extract of Bitter leaf

Length Parameters/cm	Treatments			SEM±	P-value
	AAR	CBR	RSR		
Heart	10.0	10.33	9.50	0.647	0.240
Liver	50.0^{a}	49.0^{a}	43.0^{b}	1.520	0.042
Lungs	12.5	13.2	12.2	1.127	0.414
Gizzard	71.5	72.8	65.7	4.857	0.181
Spleen	2.33	2.17	2.0	0.475	0.517
Intestine	129.8	127.0	132.0	11.59	0.689

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

DISCUSSION

The impact of bitter leaf on the growth performance of grilled chicken. The Arbor Acres fowl consumed the least amount of feed out of the three strains. This might have happened because the feed was less appetising due to the bitter leaf. This is in line with the results of Ahaotu et al. (2013), who fed rabbits raw bitter leaf and discovered that the test diet rabbits ate less feed. Ahaotu et al. (2013) have also established the presence of bitter triterpenoids. Additionally, the observed decrease in feed consumption could be due to anti-nutritional components in the test ingredient.

This agree the outcomes of Melesse et al. (2009), who discovered that chickens ate less feed when fed different leaf diets that were known to have anti-nutritional qualities. The results of this study's feed conversion ratio are in line with those of Olobotoke and Oloniruha (2009), who discovered that feeding cockerels bitter leaves significantly raised the ratio. This might have to do with its capacity to enhance gastrointestinal enzymes, which enhances digestion and feed absorption (Adaramoye et al., 2008).

Furthermore, Windisch (2007) discovered that animals fed bitter leaves grew more effectively. Additionally, Mohammed and Zakariya's (2012) publication supported the results of the current investigation. However, the current outcome runs counter to Mohammed and Zakariya's (2012) findings about the improvement of grill weight increase and FCR. The inclusion levels of bitter leaf in the interaction of diet, genotype, and environment may account for the variance, as the trials are conducted on different strains.

However, Mohammed and Zakariya (2012) discovered that neither weight gain nor FCR was significantly increased by the addition of bitter leaf to grilled chicken. The results demonstrated that all strains had substantial differences in the weights of the drumsticks, shank, and back. While CBR had the biggest significant ($p<0.05$) variances in the shank and drumstick, measuring 114.2 and 319.5g, respectively, AAR and RSR exhibited similar statistical values in both measurements. The data showed that the experimental grill chicken strains' mean liver values varied considerably ($p<0.05$). AAR and CBR had values of 50.0 cm and 49.0 cm, respectively, while RSR had a value of 43 cm. Such variations in the literature might be attributed to the type of chicken strain used, the method of ration formulation and the environment in which birds were tested.

The results of the present investigation align with those of Abubakar et al. (2010), who observed variations in the carcass characteristics of grill chickens fed varying quantities of garlic. Shank, back, and drumstick weight values were significantly higher for the CBR, RSR, and CBR birds, respectively. The dressing percentage values discovered in this investigation are comparable to those reported by Nweze and Nwankwagu (2010) for broilers fed diets containing *Tetrepleura tetraptera*. The thighs, drumsticks, wings, gizzard, and hearts of birds fed olive leaf extract did not exhibit any appreciable modifications, according to Tarek et al. (2013). This can be the effect of using different shrub leaf extracts. The live weight of the birds in all treatments varied ($p>0.05$), but the strain groups in shank, back, and drumstick also differed significantly ($p<0.05$) from one another (Table 2).

According to Javed et al. (2009), broiler chicks' dressing percentage dramatically rose after being treated with an aqueous extract of a plant mixture. When broiler chicks were fed ground ginger and garlic, their belly fat significantly decreased (Oleforuh-Okoleh et al., 2014). It is believed that the improved FCR led to increased muscle development in the treated groups, which is what produced the observation. Furthermore, the hypolipidemic effect of bitter leaves might have promoted the evolution of thinner meat.

CONCLUSION

The results revealed that the inclusion of bitter leaf extract in the diets of broiler chickens had a positive effect on growth performance, carcass and organ characteristics.

RECOMMENDATIONS

It is therefore recommended to be a part of the grill diet, especially for the Cobb 500 strain, which did better than the other two strains that were being studied in terms of growth performance, carcass, and organ examination. In order to determine the percentage inclusion level of bitter leaf extract required for optimal performance of each strain of grilled chicken, further research is necessary.

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