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Effect of administration of aqueous extract of *Justicia carnea* (plume plant) on growth, carcass and blood profile of broiler chickens

[1*]Akinlade, O. O., Olorunsogbon, B. F.,[1] Sangosina, M. I.,[1] and Okusanya, P. O.[2]

[1]*Animal Production Technology Department;* [2]*Animal Health and Production Technology Department; The Federal Polytechnic, Ilaro*

***Corresponding author:** olamilekan.akinlade@federalpolyilaro.edu.ng

Abstract

The health and growth enhancing abilities of aqueous extracts of medicinal plants is currently gaining attention because of their easy application by poultry farmers in their production process. The usage of these plants will reduce the cost of medication, prevent antibiotic residual cases in human and enhance food safety. This experiment was carried out for six weeks to ascertain the effect of Justicia carnea aqueous extract on the feed intake (FI), weight gain (WG), feed conversion efficiency (FCR), carcass yield and haematological profile of broiler chickens. Justicia carnea leaves aqueous extract was administered to one hundred and twenty broiler chicks allotted to four treatment (T) groups of thirty birds in three replicates of ten birds each. T1 was administered water with synthetic antibiotic (control) while birds in T2, T3 and T4 consumed Justicia carnea aqueous extract for two, three and four consecutive days per week, respectively. Data WG, FI, FCR, carcass yield and haematobiochemical parameters were collected and subjected to one way analysis of variance. Treatment 2 had the highest WG (1719.72g), final weight (2104.44g), the best FCR (1.99) and breast percentage (38.70 %). However, T1 had the highest (P<0.05) park cell volume and haemglobin values (29.31 % and 9.80 g/dl) but statistically comparable with other groups. The red blood cell was increased in T2, T3 had the highest total protein value (114.72 g/L) while T4 had the highest aspartate aminotransferase and Albumin values (195.42 U/L and 76.86 g/dl), respectively. It was concluded that administration of Justicia carnea aqueous extract for two consecutive days in a week enhances the performance of broiler chicken without compromising their blood quality.

Keywords: *Justicia carnea,* broiler, blood, carcass

Running title: Growth promoting property of *Justicia carnea*

Effet de l'administration d'extrait aqueux de Justicia carnea (plante à plume) sur la croissance, le rendement en carcasse et le profil sanguin des poulets de chair

Résumé

L'utilisation d'extraits aqueux de plantes médicinales comme additifs alimentaires pour les volailles suscite un intérêt croissant en raison de leur facilité d'utilisation et de leur potentiel à réduire les coûts des médicaments, les résidus d'antibiotiques et à améliorer la sécurité alimentaire. Cette étude expérimentale de six semaines visait à évaluer l'effet de l'extrait aqueux de Justicia carnea sur l'ingestion d'aliment (IA), le gain de poids (GP), l'indice de conversion alimentaire (ICA), le rendement en carcasse et le profil hématologique des poulets de chair. Cent vingt poussins ont été répartis en quatre groupes de traitement (T) de trente oiseaux chacun, avec trois répétitions par groupe. Le groupe T1 (contrôle) a reçu de l'eau avec un antibiotique synthétique, tandis que les groupes T2, T3 et T4 ont consommé de l'extrait aqueux de Justicia carnea pendant deux, trois et quatre jours consécutifs par semaine, respectivement. L'IA, le GP, l'ICA, le rendement en carcasse et les paramètres hématobiochimiques ont été mesurés et analysés par une analyse de variance à une voie. Le groupe T2 a présenté le GP le plus élevé (1719,72 g), le poids final le plus élevé (2104,44 g), le meilleur ICA (1,99) et le pourcentage de poitrine le plus élevé (38,70 %). Le groupe T1 a présenté un volume cellulaire moyen (VCM) et une concentration d'hémoglobine (Hb) statistiquement supérieurs (P<0,05) par rapport aux autres groupes, bien que restant statistiquement

comparable. Le nombre de globules rouges a augmenté dans le groupe T2. Le groupe T3 a présenté la valeur la plus élevée de protéines totales (114,72 g/L), tandis que le groupe T4 a présenté les valeurs les plus élevées d'aspartate aminotransférase (AST) et d'albumine (195,42 U/L et 76,86 g/dl), respectivement. En conclusion, l'administration d'extrait aqueux de Justicia carnea pendant deux jours consécutifs par semaine améliore les performances des poulets de chair sans compromettre la qualité de leur sang.

Mots-clés : Justicia carnea, poulet de chair, profil sanguin, carcasse

Introduction

During the past 20 years, broiler production in the tropics has increased tremendously as a result of the growing human population and the ensuing rise in the demand for animal protein. To meet the nutritional need of this growing human population and ameliorate the low protein consumption and malnutrition incidence reported in Nigeria (FAO, 2007), there is a need for an equal or greater increase in food production especially broiler chickens (Oloruntola *et al*., 2023).

Poultry has been identified as one sector that has greatly contributed to the global supply of protein for humans in order to address the issue of low protein consumption and malnutrition, which is on the rise in Africa, including Nigeria (FAO, 2007, Kpomasse *et al.,* 2021). Increasing the amount of poultry raised domestically in Africa has been reported to have the potential to improve people's economic standing, expand access to high-quality protein sources, and protect the environment by encouraging biodiversity (Schonfeldt and Hall, 2012). This can be made possible by investing in broiler production because of its high turnover due to short production cycle and its acceptability by all and sundry without discrimination by any religion (Kataria *et al*., 2005).

However, the cost of production has been one of the militating factors facing broiler production, in order to reduce cost, the use of growth promoters such as phytobiotics has been on the increase due to its capability to enhance growth by increasing feed consumption, feed conversion ratio and promoting the gut morphometry without any or little side effects to poultry and human health (Aljumaah *et al*., 2020; Taer *et al.*, 2020). *Justicia carnea* a phytogenic plant is an evergreen, tall perennial shrub or herb with whole leaf margins that can reach a height of 12 meters. It has a bilabial corolla, two stamens, three lobes on the anterior lip, four seeded capsules, and pinkish blooms. It belongs to the largest genus of *Acanthaceae* family (Corrêa and Alcântara, 2012). Phytochemical study revealed that terpenoids, tannins, alkaloids, carbohydrates, flavonoids, saponins, phenols, reduced sugar, and glycosides are present in *Justicea carnea*. (Orjiakor *et al*., 2019). Onyeabo *et al*. (2017) also reported that the extract of *Justicia carnea* is rich in vitamins A, E and C. These constituents have been reported to have various beneficiary effect on the overall well been of both man and poultry. Oloruntola et al. (2023) reported that *Justicia carnea* powder enhance the growth of broiler chickens with higher PCV, RBC, and Hbc concentrations of the birds compared to the control group. Serum biochemistry and hematology are helpful clinical techniques for assessing the health of animals. Animal health management and disease diagnosis depend heavily on haematological and biochemical data (Baker *et al*., 2008).

Hence, this study evaluated effect of *Justicia carnea* aqueous extract on performance, carcass traits and haematobiochemical indices to ascertain its usefulness in promoting growth without any adverse effects on broiler chickens and human population at large.

Materials and methods

Experimental Site

The Teaching and Research Farm, Federal Polytechnic, Ilaro served as the research site. It is situated at 72.42 meters above sea level, has 30.85°C and 148.85 millimeters of temperature and precipitation respectively each year (Google Earth, 2024).

Experimental plant extract preparation

Justicia carnea leaves were harvested at the Federal Polytechnic, Ilaro, Teaching and Research Farm. 500g of the leaves was rinsed with distilled water to remove dirt, chopped into smaller pieces and soaked in 5L of water for 72 hours. It was stirred vigorously at 12 hours intervals. After 72 hours, it was filtered with a muslin cloth and the filtrate was stored in containers and used for the experiment.

Experimental birds

One hundred and twenty (120), 1-day old Cobb 500 broiler chicks were procured from a reputable hatchery and brooded for one week. Feed and water extract was provided *ad libitum.* All vaccinations were administered as at when due.

Experimental Design

The chicks were divided into four treatment groups in a fully randomized manner. Thirty birds were allocated to each treatment which were further divided into three replicates comprising ten birds each. The experiment lasted six weeks. Chicks in each treatments were administered the extract as follows:

Treatment 1 (T1): water and synthetic antibiotics (neomycin sulphate)

T2: *Justicia carnea* aqueous extract (JCAE) as drinking water for two consecutive days/week.

T3: JCAE as drinking water for three consecutive days/week.

T4: JCAE as drinking water for four consecutive days/week.

Data Collection

Daily water intake and Daily Feed intake records were computed by deducting the amount of leftover from the total amount administered over a 24-hour period. Body weight was measured once the study started (starting weight) and then once a week after that (final weight). Weekly weight gain was calculated by deducting the initial starting weight from the end weight. To determine feed conversion, the entire amount of feed consumed was divided by the weight gained. At the end of the experiment, three birds from each replicate were randomly selected, weighed, fasted for 24 hours and sacrificed by jugular vein puncture. The sacrificed birds were dressed and eviscerated following the standard commercial procedures. The cut parts such as wing, thigh, drumstick, and breast were carefully removed and weighed using a sensitive scale. The weight of the cut parts was expressed as percentage of the live weight.

Data Analysis

Data were subjected to one-way Analysis of Variance (ANOVA) and then compare the treatment means using Duncan's Multiple Range Test using the SPSS software

Results

Effect of days of administration of Justicia carnea on the growth performance of broiler chickens

The effect of days of administration of *Justicia carnea* on the growth performance of broiler chickens is shown in Table 1. *Justicia carnea* had significant ($P<0.05$) influence on all of the growth parameters except for feed and water intake that shows similar effect. Birds administered *Justicia carnea* for two and four consecutive days per week had higher weight gain (1719.72 and 1711.11g respectively) and final weights (2104.44 and 2093.33g), though comparable to those administered control and three consecutive days per week. Effect of administration of *Justicia carnea* on the feed conversion ratio compared well among the treatment groups, however those administered the control treatment and the aqueous extract for three consecutive days per week had higher feed conversion ratio (2.12 and 2.21) when compared to T2 (1.99).

Table 1: Effect of **Frequency of *Justicia carnea* administration on the growth performance of broiler chicken**

Parameters	T1	T2	T3	T4	SEM	P-value
Initial weight (g/b)	381.94	384.72	380.55	382.22	0.51	0.07
Final weight (g/b)	1977.03^{ab}	2104.44^{a}	1960.74^{ab}	2093.33^{a}	19.71	0.02
Weight gain (g/b)	1595.09^{ab}	1719.72^{a}	1580.18^{ab}	1711.11^{a}	19.35	0.03
Feed intake (g/b)	3386.66	3429.33	3482.96	3588.56	22.76	0.11
FCR)	2.12^{a}	1.99^{ab}	2.21^{a}	2.09^{ab}	0.02	0.04
Water intake (mL/b)	6418.35	6741.65	6520.86	6384.27	42.05	0.22

^{abc} Means in the same column by factor with different superscripts are significantly (P<0.05) different

Effect of Frequency of Justicia carnea administration on carcass quality of broiler chickens

Table 2 shows the effect of days of administration of *Justicia carnea* aqueous extract on the carcass quality of broiler chickens. All carcass quality except the breast were not significantly (P>0.05) influenced by days of administration of *Justicia carnea* to the birds. The breast percentage ranges from 32.10 to 38.70 % as significantly (p<0.05) higher breast percentage was observed in T2.

Table 2: Effect of **Frequency of *Justicia carnea* administration on carcass quality of broiler chicken**

Parameters	**T1**	**T2**	**T3**	**T4**	**SEM**	**P-Value**
Live Weight	2225	2350	2325	2350	36.15	0.42
Dressing %	73.58	74.52	73.13	75	0.75	0.82
Breast %	32.10^{b}	38.70^{a}	33.74^{b}	32.88^{b}	0.88	0.01
Neck %	4.67	5.18	4.83	4.19	0.15	0.35
Thighs %	12.97	14.68	14.2	13.7	0.22	0.41
Back %	15.92	16.71	15.91	18.43	0.4	0.49
Drum Sticks %	11.38	11.78	12.11	12.28	0.2	0.36
Wings %	10.39	10.09	10.2	9.16	0.24	0.33

^{a,b,c} Means in the same column by factor with different superscripts are significantly (P<0.05) different

Effect of Frequency of Justicia carnea administration on haematological parameters of broiler chicken

Table 3 shows the haematological parameters of broiler chickens as influenced by administration of *Justicia carnea* aqueous extract. The result revealed that the packed cell volume (PCV), haemoglobin (Hb), red blood cell (RBC) and heterophils (HETE) were statistically (P<0.05) influenced by the number of days *Justicia carnea* was administered to the birds while other heamatological parameters were similar across the treatment groups. Birds administered antibiotics and those administered *Justicia carnea* for two consecutive days in a week had higher PCV and Hb. RBC was increased in birds administered *Justicia carnea* aqueous extract for two consecutive days per week while the least was observed in the control group. Bird administered aqueous extract of *Justicia carnea* have higher percentage of heterophils than those administered antibiotics.

Table 3: Effect of frequency of *Justicia carnea* administration on haematological parameters of broiler chicken

Parameters	1	2	3	4	SEM	P-Value
PCV (%)	29.31[a]	28.27[a]	26.03[ab]	25.83[ab]	0.46	0.03
Hb (g/dL)	9.80[a]	9.45[a]	8.71[ab]	8.64[ab]	0.19	0.06
WBC (µ/L x 10^{-3})	9.23.37	9.22.37	9.23.73	9.22.07	0.12	0.1
RBC (µ/L x 10^{-6})	1.59.00[c]	2.05.00[a]	1.67.00[b]	1.62.00[b]	5.60.80	0.02
LYM (%)	46.81	33.98	37	35.32	1.52	0.12
MONO (%)	3.5	4.5	3	3	0.28	0.11
HETE (%)	45.68[b]	56.00[a]	54.00[a]	54.50[a]	1.23	0.04
BASO (%)	1.5	2.39	3.01	2.4	0.23	0.06
ESIN (%)	2.5	3	3	4.74	0.35	0.06

[a,b,c] Means in the same column by factor with different superscripts are significantly (P<0.05) different. PCV: Park cell volume, Hb: haemogobin, WBC: white blood cells, RBC: red blood cells

Effect of frequency of Justicia carnea administration on serum biochemistry of broiler chickens

Table 4 shows the effect of *Justicia carnea* aqueous extract administration on broiler chicken's serum biochemistry. The total protein, AST and albumin were significantly (P>0.05) different.

T3 has the highest total protein value (114.72 g/L), T4 has the highest AST and Albumin value (195.42 U/L and 76.86 g/dl) respectively while those administered antibiotics had the least values for the aforementioned parameters. Other serum biochemical parameters measured were not significantly (P>0.05) affected across all treatment groups. As the number of administration days increased, a numerical increase in the albumin and ALT values was seen. On the other hand, a drop in the ALP and Creatinine values was observed.

Table 4: Effects of frequency of *Justicia carnea* administration on serum biochemistry of broiler chickens

Parameters	T1	T2	T3	T4	SEM	P-Value
Total protein (g/L)	33.58[c]	97.17[a]	114.72[a]	53.21[b]	9.83	0.02
AST (U/L)	166.21[b]	194[a]	174[b]	195.42[a]	3.8	0.01
Albumin (g/dL)	27.74[c]	58.25[b]	66.16[b]	76.86[a]	5.5	0.03
ALT (U/L)	26.17	16.64	17.87	24.28	1.22	0.33
ALP (U/L)	381.84	421.82	399.77	391.49	4.45	0.13
CREAT(µmol/L)	66.37	95.87	77.44	71.17	3.37	0.21

[a,b,c] Means in the same column by factor with different superscripts are significantly (P<0.05) different. T. PRO: total protein, AST: aspartate aminotransferase, ALT: alanine aminotransferase, ALP: Alkaline phosphate, CREAT: creatinine

Discussion

Justicia carnea and its embedded phytochemicals offer promising prospects for enhancing animal performance, carcass quality, and haematological and serum constituents (Onyeabo *et al*., 2017). Phytochemicals present in *Justicia carnea*, such as flavonoids and alkaloids, have been reported to possess adaptogenic and antioxidant properties. These compounds may contribute to improving overall health and vitality in animals, leading to enhanced performance metrics such as weight gain, feed conversion efficiency, and disease

resistance. Studies have shown that certain phytochemicals can positively influence physiological processes, including metabolism, immune function, and stress response, thereby promoting better performance outcomes in livestock and poultry (Kamboh *et al*., 2015; Lillehoj *et al*., 2018).

The result of growth performance in this present study is similar to the work of Oloruntola *et al*. (2023) and Oko *et al*. (2022) who fed *Justicia carnea* leaf powder and 0.75 g/L aqueous of *Justicia secunda* leaf-extract respectively and reported an increased weight. The observed increase can be attributed to the embedded flavonoids and alkaloids which has the capacity to improve the overall health (leading to enhanced performance) of the animals and thus, growth. (Lillehoj *et al*., 2018). According to Oloruntola *et al*. (2023), the bioactive ingredient in the dietary supplement may have preferentially reduced the population of unfavorable gut microbes in favour of the beneficial ones, thereby improving the overall performance shown in the birds.

Growth in broiler chickens is closely linked to breast weight, as it reflects the cumulative effects of genetic potential, nutritional management, environmental conditions, and health status on muscle development (Griffin, 2017). This further justify the essentiality and positive action of flavonoids and other constituents of *Justicia carnea.* This also goes in line with the increased breast weight observed for animal administered *Justicia carnea* for two consecutive days per week. Contrary to this research, study by Nasir and Grashorn (2010) and Amouzmehr *et al.* (2012) showed that supplementation of phytogenic extracts did not affect carcass characteristics including carcass yield, breast, thigh and abdominal fat. On the other hand, it corresponds to the work of Puvača *et al.* (2015) who observed an increase in breast muscle of broilers when fed garlic and other spices.

Evaluation of the blood profile of the chicks showed that PCV, Hb, RBC, heterophil count, TP, AST and Albumin were the parameters affected by aqueous extract of *Justicia* carnea. Mean PCV value observed in this study was within the range of 22-35% reported by Bounous and Stedman (2000) and Odunitan-Wayas *et al*. (2018). Hb on the other hand was within the range 7-13 g/dL by Bounous and Stedman, (2000) for clinically healthy birds. The normal level of park cell volume and haemoglobin reflect the importance of antioxidants present in *Justicia carnea* to influence the overall health of the birds while maintaining immune system and the oxygen carrying capacity of the blood to prevent the incidence of anaemia. Examining the blood for their constituents is necessary for disease monitoring and prognosis evaluation in animals (Oloruntola *et al*., 2023) since nutrition plays a critical role in shaping the blood profile of animals, influencing overall health, immunity, and physiological function. Increased heterophils of birds administered *Justicia carnea* extract maybe due to the immune-stimulatory effect of Justicia (Oloruntola *et al*., 2023). Flavonoids can also restrain enzymes that are responsible for producing superoxide (such as xanthine oxidase) and also play an important role in oxygen metabolism by chelating rare metals and preventing the onset of lipoxygenase reaction (Onyeabo *et al*., 2017).

Conclusion and Recommendation

In conclusion, administration of *Justicia carnea* aqueous extract for two consecutive days per week gave the highest weight gain in broiler chicken followed by four consecutive days in a week respectively with values that are statistically comparable with the control group. This means that administration of justicia aqueous extract in broiler chicken production can produce similar result as the conventional antibiotic growth promoters.

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