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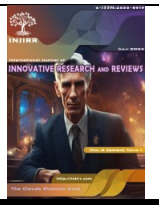

RESEARCH ARTICLE

Performance of broiler chicken fed diets supplemented with *Azanza garckeana* (snot apple)

Christie Oluwatosin RAIMI[1,*] Abubakar Olatunji JIMOH[1] Adenike Mary OYEYEMI[1]

[1] *Department of Agricultural Technology, School of Agriculture and Agricultural Technology, Federal Polytechnic, Ado-Ekiti, Nigeria*

* *Corresponding author E-mail: christosinr@gmail.com* *

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ABSTRACT

In this study, we evaluated the growth performance of broiler chicken fed diets supplemented with *Azanza garckeana* (snot apple). A total number of two hundred (200) broiler chickens were randomly allotted to 4 dietary treatments and replicated 10 times with 5 birds per replicates using a completely randomized design. Four dietary basal diets were formulated; Treatment 1 was with no Snot apple inclusion, Treatment with 2kg of Snot apple inclusion, Treatment 3 with 4kg of Snot apple inclusion and Treatment 4 with 6kg of Snot apple inclusion. The birds in each pen were weighed on weekly basis and feeding trials was recorded on daily basis. The results obtained showed that there were no significantly ($P>0.05$) difference in the initial weight and feed intake of birds on T1, T2, T3 and T4. Final live weight of broiler fed T1, T2 and T4 were significantly ($P<0.05$) high compared to T3. Likewise, Body weight gain of birds fed T1, T2 and T4 were significantly ($P<0.05$) high compared to T3. While Feed conversion ratio of birds fed T3 were significantly ($P<0.05$) high compared to T1, T2 and T4. It was concluded that the test ingredient (Snot Apple) did not have deleterious effect on the performance of the experimental birds. Higher inclusion level of Snot apple is recommended to check further the effect of snot apple on performance and it potential as growth promoting additive in broiler feed.

Contents

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1. Introduction

Broiler's has been reported to account for more than 90% of the total poultry population in the world [1]. It serves as a source of income and employment among people of Africa [2]. The considerable and increasing demand for animal protein is focusing attention on the sources of feed protein and their suitability, quality and safety for future supply. The production of poultry contributes significantly to the global economy by supplying food and wealth by producing jobs for the world's growing population [3]. However, the industry in the developing countries is facing some challenges; these challenges include high feed to gain ratio and increase in the cost of feed because of high prices of feed ingredients [4]. Using natural additives in broiler rations has become an important consideration to agricultural industries, including poultry production [5, 6]. Many countries have banned the use of antibiotics in poultry nutrition as a feed additive. Hence, there is a great demand to find an alternative to antibiotics. New preventive measures for enteric diseases have been researched as an alternative to antibiotic administration [6], which is encouraged by the World Health Organization [7].

In the face of the current resistance problem, medicinal plants are an enormous source of new bioactive molecules [8]. The bioactive molecules of some plants extract have been shown to possess antibacterial, antioxidant, digestive stimulant, hypolipidemic, growth promoter, immunomodulator, antimycotic, antiparasitic, antitoxigenic, antiviral, and insecticidal properties [9]. Numerous attempts have been made to overcome these challenges, and one of them involves the use of antibiotics in feed. Antibiotics have been utilized as growth promoters and to prevent outbreak of diseases [10]. The use of antimicrobial as growth promoting factors (AGP) in sub therapeutic doses for long periods resulted in the production of antimicrobial resistance to microorganisms.

The European countries banned the antimicrobial growth promoters because of the development of antimicrobial resistance and transference of resistance genes from animal to human beings. Growing concerns about antibiotic resistant bacteria and their transfer from birds to humans has led to the ban of AGPs and the subsequent quest for alternatives. The indiscriminate use of antibiotic growth promoters in the feed impacts a threat to the development of antibiotic resistance in the human beings. It has become an alarming problem in the broiler meat and egg marketing. Hence, scientists have moved their research towards non-antibiotic growth promoters in feed, especially of plant derived compounds or phytogenics [11].

The *Azanza garckeana* commonly known as Goron Tula, (kola of Tula) in Hausa, belong to the family Malvaceae. In Nigeria, it is grown only in Tula village of Gombe State. It is a multipurpose edible fruit of tropical Africa. It is an important medicinal and food plant commonly used in Northern Nigeria as herbal medicines [12]. Multiple classes of bioactive metabolites including amino acids, alkaloids, ascorbic acid, carotenoids, flavonoids, glucosides, phenols, lipids, tannins and saponins have been isolated from *Azanza garckeana* [13]. *Azanza garckeana* is a source of food, animal fodder, fuel (firewood), lumber, medicine (roots are taken orally for pain treatment, to treat cough and chest aches), and shelter, according to Ochokwu et al. [14]. Chemical composition and % dry matter of *Azanza garckeana* fruits are pH-5.96, Ascorbic acid -20.5, Crude protein - 12.0%, Fat - 1.1%, Fiber - 45.3%, Total carbohydrate - 35.2%, Energy value - 80010kj/100g, Phosphorus - 1476µg/g, Calcium - 95µg/g, Magnesium - 1453µg/g, Iron - 84µg/g, Potassium - 26190µg/g, Sodium - 202µg/g. Tannin, saponins, alkaloids, flavonoids, phenols, cyanogenic glucosides, and carotenoids are among the phytochemicals found in *Azanza garckeana* seeds. Due to their diverse roles in medicine, nutrition, and genetics, these anti-nutrients are crucial [15].

According to Ajayi [16], Tannins, Phenols, Saponins, Alkaloids, and Flavonoids have been linked or suggested to have antibacterial and antiviral activity. The various nutrient present in Goron Tula are essential nutrients such as vitamin C, vitamin B6, iron, magnesium, and antioxidants. If incorporated into the diet in an appropriate manner, it could potentially enhance the overall nutritional profile of broiler feed, promoting better health and growth. Goron Tula is rich in dietary fiber, including soluble fiber. Dietary fiber serves as a substrate for beneficial gut bacteria. When these bacteria ferment dietary fiber, they produce short-chain fatty acids (SCFAs), such as butyrate, acetate, and propionate, which are known to support gut health. Because of their properties (e.g., resistance to digestion by host enzymes and fermentability by intestinal microorganisms), DFs can impact the gut microbial ecosystem, modifying its composition in terms of taxa presence/absence, relative abundance, and metabolism. Reportedly, different microbes possess differentiated capability in metabolizing DFs, resulting in the production of different end-products [17]. DFs have heterogeneous physicochemical features and their metabolization requires an impressive array of carbohydrate-active enzymes (CAZymes) differently encoded among gut microorganisms [18].

The fruit is known as Snot Apple in English, African chewing gum, and goron tula in Hausa, the Northern part of Nigeria [19]. Snot apple is rich in anti-fungal, anti-bacterial, anti-oxidant, anti-malaria, anti-hyperglycemic and in absorbing iron [20]. The pulp and seeds are an important source of phytochemical and mineral components; ascorbic acid, Magnesium, Calcium, Sodium, Iron, Potassium, Phosphorus, crude fiber, Carotenoids, Tannins, Saponins. [20]. Snot Apple is a good source of protein, vitamin, fat, carbohydrate and fiber [21]. The use of antibiotic growth promoters has been criticized and banned by European Union due to its role in the occurrence of antimicrobial resistance in human and animal, this had led a lot of poultry and plant experts to think of alternative source to growth promoters and ways in which hematology indices of poultry birds can be improved, Considering the numerous phytoconstituents of Snot apple, it could serve as alternative source to growth promoters.

2. Materials and Methods

2.1. Experimental Site

A 6weeks completely randomized design (CRD) feeding trial was conducted at Agricultural Technology Department, Federal Polytechnic, Ado-Ekiti, Ekiti State, Nigeria. The state is located in south western part of the country, Ekiti

State covers a land area of 6,353km square (2453sqmi) with a population estimated in 2005 to be 2,737,186. It enjoys tropical climate with two distinct seasons, these are rainy season (April to October) and dry season (November to March). Ado-Ekiti has a temperature range between 21degree Celsius and 28 degrees Celsius with high humidity, the South westerly wind and the North east trade which blows in the raining season and dry (harmattan) season respectively, the tropical forest exist in the south of Ekiti State while savannah occupies the northern peripheries.

2.2. Site Preparation

The poultry house was thoroughly washed, fumigated with disinfectant. The poultry house was allowed to stay and dried for two weeks before the arrival of the experimental birds, proper weeding of the surrounding was carried out to prevent predators and pests.

2.3. Experimental Design

A total number of two hundred (200) broiler chickens were randomly allotted to 4 dietary treatments and replicated 10 times with 5 birds per replicates using a completely randomized design. Four dietary basal diets were formulated; Treatment 1 was with no Snot apple inclusion, Treatment with 2kg of Snot apple inclusion, Treatment 3 with 4kg of Snot apple inclusion and Treatment 4 with 6kg of Snot apple inclusion (Table 1 and Table 2). The birds in each pen were weighed on weekly basis and feeding trials was recorded on daily basis.

2.4. Test Ingredient

Fresh Snot apple (*Azanza garckeana*) was purchased from Northern part of Nigeria (Gombe), The fruits was oven dried with a temperature of about 150 °C for 24 hours and grounded using grinding machine, packed in a vacuum bag and stored in a plastic container with lid and then stored for further use in broilers feed formulation.

Table 1 Gross composition of experimental starter diets

Ingredient %	T1	T2	T3	T4
Maize	59.0	59.0	57.0	55.0
Groundnut Cake	9.8	9.8	9.8	9.8
Soybean meal	25	23	23	23
Fishmeal	3.1	3.1	3.1	3.1
Methionine	0.3	0.3	0.3	0.3
Lysine	0.3	0.3	0.3	0.3
Oyster shell	1.5	1.5	1.5	1.5
Limestone	1.1	1.1	1.1	1.1
Premix	0.3	0.3	0.3	0.3
Salt	0.3	0.3	0.3	0.3
Snot apple	0	2	4	6
Total	100	100	100	100
Calculated nutrient				
DM%	85.85	85.85	85.85	85.85
CP%	22.29	22.29	22.29	22.29
ME kcal/Kg	3031.27	3031.27	3031.27	3031.27
EE%	3.94	3.94	3.94	3.94
CF%	3.32	3.32	3.32	3.32
METH%	0.61	0.61	0.61	0.61
CA%	1.17	1.17	1.17	1.17

T1: 0kg of Snot Apple Powder, T2: 2kg of Snot Apple powder: T3: 4kg of Snot Apple powder, T4: 6kg of Snot Apple powder

Table 2 Gross composition of experimental Finisher diets

Ingredient %	T1	T2	T3	T4
Maize	66.5	64.5	62.5	60.5
Groundnut Cake	8.3	8.3	8.3	8.3
Soybean meal	19.5	19.5	19.5	19.5
Fishmeal	2.0	2.0	2.0	2.0
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Oyster shell	1.5	1.5	1.5	1.5
Limestone	1.2	1.2	1.2	1.2
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Snot apple	0	2	4	6
Total	100	100	100	100
Calculated nutrient				
DM%	85.85	85.85	85.85	85.85
CP%	22.29	22.29	22.29	22.29
ME kcal/Kg	3031.27	3031.27	3031.27	3031.27
EE%	3.94	3.94	3.94	3.94
CF%	3.32	3.32	3.32	3.32
CA%	1.17	1.17	1.17	1.17
P%	0.32	0.32	0.32	0.32

T1: 0kg Snot Apple Powder, T2: 2kg of Snot Apple powder: T3: 4kg of Snot Apple powder, T4: 6kg of Snot Apple powder

2.5. Data Collection

The birds in each pen were weighed on weekly basis and the feed intakes were recorded on daily basis to determine their growth performance.

2.6. Statistical analysis

Data were subjected to statistical analysis using windows-based SPSS (Version 20.0), based on analysis of variance (ANOVA) as prescribed for a completely randomized design (CRD). Mean separation was done using Duncan's New multiple range tests, and Level of significance was set at $P< 0.05$.

3. Results and Discussion

Table 3 below shows the performance of Broiler chicken fed diets supplemented with snot apple, initial weight and feed intake of birds T1, T2, T3 and T4 were significantly ($P<0.05$) the same. Final live weight of birds fed T1 (864.10g), was significantly ($P<0.05$) high compared to T2 (799.00g), T3 (705.12g) and T4 (764.72g). Body weight gain of birds fed T3 (665.45g/d) had significantly ($P<0.05$) low value compared to others. While, the Feed conversion ratio of birds fed T3 was significantly ($P<0.05$) high compared to T1, T2 and T4. It is generally accepted that feed costs represent about 70% of the cost of poultry production and this makes a bird's ability to use feed efficiently very important. Birds considered to have better feed efficiency typically have a lower proportion of feed intake to body weight gain.

This current study showed that there were increase in body weight gain in control diet, without snot apple T1 (864.10g), which was in agreement with Ochokwu et al. [14] who recorded increase in the body weight gain of Clarias gariepinus Male Broodstocks in the control diet and in female the highest weight gain was in Diet with 5% A. garckeana pulp (snot apple). The reason for variations in growth performance could be attributed to high fibre content

in A. garckeana pulp. The significant similar value gotten in feed intake across various level of snot apple in the diet suggested that there might have been some traces of residual anti-nutritional substances still present in the snot apple.

The administration of Snot apple as an additive on broiler chickens feed stuff had no significant effect (P>0.05) on feed intake. These observations are similar to the ones reported by Tekeli et al. [22]indicating that antibiotics or plant extract supplementation in a broiler experiment did not influence body weight gain, feed intake and feed conversion efficiency of the chickens. Similarly, there are other research findings showing that ration supplemented with plant extract and propolis additives did not have significant effect on the improvement of feed conversion efficiency of poultry [23]. The differences in the results of these studies can be attributed to several factors such as the botanical source, the concentration and the duration of supply of the active compounds, the feed composition, and the experimental challenging conditions, animal age and health status [24]. The study agreed with Folorunso, O.R and Onibi, G.E. [25], also observed no differences on initial weight and feed intake of broilers when fed diets contained different levels of protein, reason being due to varying dietary protein levels showing that the birds were able to consume at fairly the same level regardless of the quantity of protein in the diet.

Table 3 Performance of Broiler Chicken Fed Diets Supplemented with Snot Apple

Parameter	T1	T2	T3	T4	±SEM	P-value
Initial weight (g)	49.42	49.58	48.64	50.68	0.50	0.56
Final live weight (g)	864.10^{a}	799.00^{ab}	705.12^{c}	764.72^{bc}	17.08	0.01
Body weight gain (g/d)	811.15^{a}	746.72^{ab}	665.45^{b}	714.04^{b}	16.79	0.01
Feed intake	2942.40	2854.10	3309.10	2848.90	108.01	0.40
FCR	3.84^{b}	3.89^{b}	5.24^{a}	4.00^{b}	0.18	0.01

^{abcde}= means within the same row with different superscripts are significantly (P<0.05) different.
SEM: standard error of the mean, T1: With no snot apple inclusion, T2: 2kg of snot apple inclusion, T3: 4kg of snot apple inclusion, T4: 6kg of Snot apple inclusion.

4. Conclusion

Based on the findings of this research, it could be inferred that *Azanza garckeana* (snot apple) is very rich in fiber; have significant effects on the growth performance of the birds (P<0.05) and did not have any adverse effect of the performance of the experimental birds.

Overall, the present study has provided promising data for the *Azanza garckeana* (snot apple) meal as an additive in broiler feed. The results of the study also suggest that 6kg inclusion level of snot apple powder could be used in broiler diets to improve growth performance and economic output of broiler chickens. The study also reveals that snot apple powder can conveniently supplement expensive sources of protein in broiler diet without compromising performance and favoring production cost positively. Hence, poultry farmers are encouraged to patronize the use of snot apple powder as feed source for their broiler. In addition, further research is necessary to determine how to increase the nutritive value of the snot apple powder for broilers and layer chickens in view of its cheapness and abundance.

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Ethics approval

The authors confirm that the ethical policies of the journal, as noted in the journal authors guide lines, have been adhered to. Approval to perform the research and use of animals was obtained from the Ethics Committee of the University of Ilorin, Kwara State, Nigeria.

Authors' Contributions

C.O.R., A.O.J. and A.M.O. conceived and planned the experiments. All the authors participated in design and coordination. All the authors performed the experiments, contributed to sample preparation, interpreted the results, and took the lead in writing the manuscript. C.O.R. and A.M.O. provided critical feedback, shape the research, analyze and write the manuscript.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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